Attachment E – Notice of Intent

WATER QUALITY ORDER NO. 2013-0002-DWQ
GENERAL PERMIT NO. CAG990005

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

I. NOTICE OF INTENT STATUS (see Instructions)

Mark only one item	A. New Applicator	B. ☑ Change of Information: WDID# **3 440206022**
	C. ☐ Change of ownership or responsibility: WDID# _____	

II. DISCHARGER INFORMATION

A. Name **City of Santa Cruz, Water Department**			
B. Mailing Address **715 Graham Hill Road**			
C. City **Santa Cruz**	D. County **Santa Cruz**	E. State **CA**	F. Zip **95060**
G. Contact Person **Lindsay Neun**	H. E-mail address lneun@cityofsantacruz.com	I. Title **Water Quality Manager**	J. Phone **831-420-5486**

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

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

IV. RECEIVING WATER INFORMATION

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

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

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

V. ALGAECIDE AND AQUATIC HERBICIDE APPLICATION INFORMATION

A. Target Organisms: **Algae**

B. Algaecide and Aquatic Herbicide Used: List Name and Active ingredients
Copper (Algimycin® PWF)
Hydrogen Peroxide/Dioxide (GreenClean Liquid 5.0®)
Peroxyacetic Acid (GreenClean Liquid 5.0®)
Sodium Carbonate Peroxyhydrate (PAK®27)

Note: Product names listed in parentheses are examples only and may change.

C. Period of Application: Start Date: **January 1** End date: **December 31, for the life of the permit**

D. Types of Adjuvants Used: **Aquatic labeled adjuvants such as Cygnet Plus®, as needed**

VI. AQUATIC PESTICIDE APPLICATION PLAN

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

If not, when will it be prepared? _____

VII. NOTIFICATION

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

VIII. FEE

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

IX. CERTIFICATION

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

A. Printed Name: Chris Coburn

B. Signature: _____ **Date:** 3/19/21

C. Title: Deputy Director

XI. FOR STATE WATER BOARD STAFF USE ONLY

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

City of Santa Cruz

WDID # 3 440206022

Aquatic Pesticide Application Plan (APAP)

For the

Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications

Water Quality Order No. 2013-0002-DWQ

General Permit # CAG990005

Revised March 1, 2021

Prepared for:
City of Santa Cruz
Water Department
715 Graham Hill Road
Santa Cruz, 95060
Contact: Lindsay Neun
(831) 420-5486

Prepared by:
Blankinship & Associates, Inc.
1615 5th Street, Suite A
Davis, CA 95616
Contact: Stephen Burkholder
(530) 757-0941

Submitted to:
State Water Resources Control Board
Attn: NPDES Wastewater Unit
1001 I Street, 15th Floor
Sacramento, CA 95814
Contact: Gurgan Chand
(916) 341-5780

Certification

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

Signed and Agreed:

Chris Coburn
Deputy Director
Water Department
City of Santa Cruz

Stephen Burkholder
Pest Control Adviser # 153644
Senior Biologist
Blankinship & Associates, Inc.

Michael S. Blankinship
Licensed Professional Engineer (Civil) # 64112
Pest Control Adviser # 75890
Blankinship & Associates, Inc.

Limitations

The services used to prepare this document were performed consistent with the agreement with the City of Santa Cruz and were rendered in a manner consistent with generally accepted professional consulting principles and practices using the level of care and skill ordinarily exercised by other professional consultants under similar circumstances at the same time the services were performed. No warranty, express or implied, is included. This document is solely for the use of our client. Any use or reliance on this document by a third party is not authorized and is at such party's sole risk.

City of Santa Cruz
Aquatic Pesticide Application Plan

Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications
Water Quality Order No. 2013-0002-DWQ
General Permit # CAG990005
WDID # 3 440206022

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Aquatic Pesticide Application Plan

In March 2001, the State Water Resources Control Board (SWRCB) prepared Water Quality Order # 2001-12-DWQ which created Statewide General National Pollutant Discharge Elimination System (NPDES) Permit # CAG990003 for the discharges of aquatic herbicides to waters of the United States. The purpose of Order # 2001-12-DWQ was to minimize the areal extent and duration of adverse impacts to beneficial uses of water bodies treated with aquatic herbicides. The purpose of the general permit was to substantially reduce the potential discharger liability incurred for releasing water treated with aquatic herbicides into waters of the United States. The general permit expired January 31, 2004.

On May 20, 2004, the SWRCB adopted the statewide general NPDES Permit for Discharge of Aquatic Pesticides for Aquatic Weed Control in Waters of the United States # CAG990005. Dischargers were required to have coverage under the general permit to perform aquatic herbicide applications. In May 2009, the general permit expired, but was administratively continued until November 30, 2013.

The Statewide General NPDES Permit for Residual Aquatic Pesticide Discharges to Waters of the United States from Algae and Aquatic Weed Control Applications (herein referred to as the "Permit") was adopted on March 5, 2013 and became active on December 1, 2013 (SWRCB 2013). The Permit has been revised four times by Water Quality Orders since it was originally adopted by the SWRCB. The Permit expired on November 30, 2018 and has been administratively continued to allow dischargers to maintain coverage until a new permit is adopted. As such, the Permit is still active and enforceable. The Permit requires compliance with the following:

- The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries in California, a.k.a. the State Implementation Plan, or SIP (SWRCB 2005)
- The California Toxics Rule (CTR) (CTR 2000)
- Applicable Water Quality Objectives (WQOs) in the Regional Water Quality Control Board (RWQCB) Central Coastal Basin Plan (CCRWQCB 2019)

Coverage under the Permit is available to single dischargers and potentially to regional dischargers for releases of potential and/or actual pollutants to waters of the United States. Dischargers eligible for coverage under the Permit include public entities that conduct resource or pest management control measures, such as local, state, and federal agencies responsible for control of algae, aquatic weeds, and other organisms that adversely impact operation and use of drinking water reservoirs, water conveyance facilities, irrigation canals, flood control channels, detention basins and/or natural water bodies.

The Permit does not cover indirect or non-point source discharges, whether from agricultural or other applications of pesticides to land, that may be conveyed in storm water or irrigation runoff. The Permit only covers algaecides and aquatic herbicides that are applied according to label directions and that are registered for use on aquatic sites by the California Department of Pesticide Regulation (DPR).

The City of Santa Cruz Water Department (herein referred to as the "City") serves a suburban population of nearly 100,000 people situated in and around the City of Santa Cruz. The City of Santa Cruz is located on the Central-Northern California coast, south of San Francisco in Santa Cruz County and has a Mediterranean climate featuring wet, mild winters and warm, dry summers. The City's primary objective is to provide a safe, clean, and continuous supply of water for municipal and fire protection purposes to Santa Cruz and to the unincorporated surrounding areas.

The City owns and/or manages approximately 3,880 acres of land in the Santa Cruz Mountains around the Loch Lomond Reservoir, an impoundment of the Newell Creek Drainage. Refer to **Figure 1** and **Figure 2**. The reservoir is located 9 miles north of Santa Cruz, is about 2.5 miles long and has a maximum width of approximately 1,500 feet. It is fed by the Newell Creek drainage basin, which includes Newell Creek, extending three miles upstream of the reservoir and 2 miles downstream of the Newell Creek Dam to the San Lorenzo River. Loch Lomond Recreation Area was originally developed as a nature preserve and recreation area in the 1950's, and the reservoir was opened for public recreation in 1963 after the completion of the Newell Creek Dam two years earlier. The reservoir has been used as a source of water supply for the City of Santa Cruz since 1961. As part of the City's agreement for the completion of a dam, the entire area was open to the community for limited recreational activity, including hiking, boating, and fishing.

The Loch Lomond Reservoir has a surface area of approximately 175 acres and is up to 150 feet deep. The reservoir is situated in a largely undeveloped watershed. The reservoir experiences algae blooms during the late spring and summer months due to available nutrients, warm water temperatures, and abundant sunlight.

Blue-green algae, also known as cyanobacteria, can trigger complaints of adverse taste and/or odor in treated drinking water delivered to City customers when significant algae blooms are occurring in the reservoir. Additional complaints may be received regarding the appearance and adverse odor of water in Loch Lomond from reservoir users such as boaters or picnickers. Certain genera of cyanobacteria produce 2-methylisoborneol (MIB) and geosmin, which are taste and odor causing compounds that are difficult to remove from water during the treatment process.

Toxins produced by some cyanobacteria can be harmful to humans, fish, and other animals. Observation of toxin production has increased globally and in California. Some species identified in Loch Lomond have been known to produce toxins under some environmental conditions or in response to stressors. The factors that may influence toxin production in some cyanobacteria include algal density, temperature stress, nutrient availability, light availability or competition, and predation.

Metabolic products released by the algae react with chlorine during the treatment process to produce potentially carcinogenic disinfection by-products (DBPs). When a large algae population dies off the decomposition can deplete the available oxygen and lead to a fish kill, further damaging water quality. In order to prevent these problems and to provide customers with drinking water that meets State and Federal drinking water standards, routine monitoring of Loch Lomond is conducted to evaluate water quality and algal populations.

The City staff conducts routine water quality sampling in the reservoir to assess overall algae population status when blooms may occur. Species present at the surface and various water intake depths are generally identified and counted, and samples may be analyzed for chlorophyll-*a*. When populations of known nuisance genera (i.e., *Dolichospermum*, *Anabaena, Woronichinia, Lyngbya*, *Microcystis*, *Aphanizomenon*, etc.) are observed to be increasing, sampling frequency is increased. If algae counts and chlorophyll-*a* values show exponential growth, indicating that a bloom is imminent or occurring, an algaecide may be applied to prevent or lessen the impact of a cyanobacteria bloom.

The City has previously applied algaecides and aquatic herbicides using the SWRCB's 2004 Permit and the current 2013 Permit. Consistent with existing Permit requirements, the City has completed a Notice of

Intent (NOI) and prepared an Aquatic Pesticide Application Plan (APAP), and a Notice of Applicability (NOA) has been received. Sampling and analysis has been performed and annual reports have been submitted to the SWRCB and Central Coast RWQCB. The revisions to the City's APAP are intended to better describe how the City approaches monitoring and reporting related to their use of algaecides to mitigate the impact of cyanobacteria blooms on drinking water customers and reservoir users.

Using Integrated Pest Management (IPM) techniques, the City intends to apply algaecides identified in the NOI submitted to the RWQCB. For the purposes of complying with the Permit, the City has created this APAP.

This APAP is a comprehensive plan developed by the City that describes the project, the need for the project, what may be done to reduce water quality impacts, and how those impacts will be monitored. Specifically, this APAP contains the following eleven (11) elements.

1. Description of the water system to which algaecides and aquatic herbicides are being applied;
2. Description of the treatment area in the water system;
3. Description of types of weed(s) and algae that are being controlled and why;
4. Algaecide and aquatic herbicide products or types of algaecides and aquatic herbicides expected to be used and if known their degradation byproducts, the method in which they are applied, and if applicable, the adjuvants and surfactants used;
5. Discussion of the factors influencing the decision to select algaecide and aquatic herbicide applications for algae and weed control;
6. If applicable, list the gates or control structures to be used to control the extent of receiving waters potentially affected by algaecide and aquatic herbicide application and provide an inspection schedule of those gates or control structures to ensure they are not leaking;
7. If the Discharger has been granted a short-term or seasonal exception under State Water Board Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Policy) section 5.3 from meeting acrolein and copper receiving water limitations, provide the beginning and ending dates of the exception period, and justification for the needed time for the exception. If algaecide and aquatic herbicide applications occur outside of the exception period, describe plans to ensure that receiving water criteria are not exceeded because the Dischargers must comply with the acrolein and copper receiving water limitations for all applications that occur outside of the exception period;
8. Description of monitoring program;
9. Description of procedures used to prevent sample contamination from persons, equipment, and vehicles associated with algaecide and aquatic herbicide application;
10. Description of the Best Management Practices (BMPs) to be implemented. The BMPs shall include, at the minimum:

    10.1. Measures to prevent algaecide and aquatic herbicide spill and for spill containment during the event of a spill;

10.2. Measures to ensure that only an appropriate rate of application consistent with product label requirements is applied for the targeted weeds or algae;

10.3. The Discharger's plan in educating its staff and algaecide and aquatic herbicide applicators on how to avoid any potential adverse effects from the algaecide and aquatic herbicide applications;

10.4. Discussion on planning and coordination with nearby farmers and agencies with water rights diversion so that beneficial uses of the water (irrigation, drinking water supply, domestic stock water, etc.) are not impacted during the treatment period; and

10.5. A description of measures that will be used for preventing fish kill when algaecides and aquatic herbicides will be used for algae and aquatic weed controls.

11. Examination of Possible Alternatives. Dischargers should examine the alternatives to algaecide and aquatic herbicide use to reduce the need for applying algaecides and herbicides. Such methods include:

    11.1. Evaluating the following management options, in which the impact to water quality, impact to non-target organisms including plants, algaecide and aquatic herbicide resistance, feasibility, and cost effectiveness should be considered:

        11.1.1. No action;

        11.1.2. Prevention;

        11.1.3. Mechanical or physical methods;

        11.1.4. Cultural methods;

        11.1.5. Biological control agents; and

        11.1.6. Algaecides and aquatic herbicides;

        If there are no alternatives to algaecides and aquatic herbicides, Dischargers shall use the minimum amount of algaecides and aquatic herbicides that is necessary to have an effective control program and is consistent with the algaecide and aquatic herbicide product label requirements.

    11.2. Using the least intrusive method of algaecide and aquatic herbicide application; and

    11.3. Applying a decision matrix concept to the choice of the most appropriate formulation.

This APAP is organized to address the aforementioned 1 through 11 elements.

	032621		M.Z.
	DATE	DESCRIPTION	INIT.

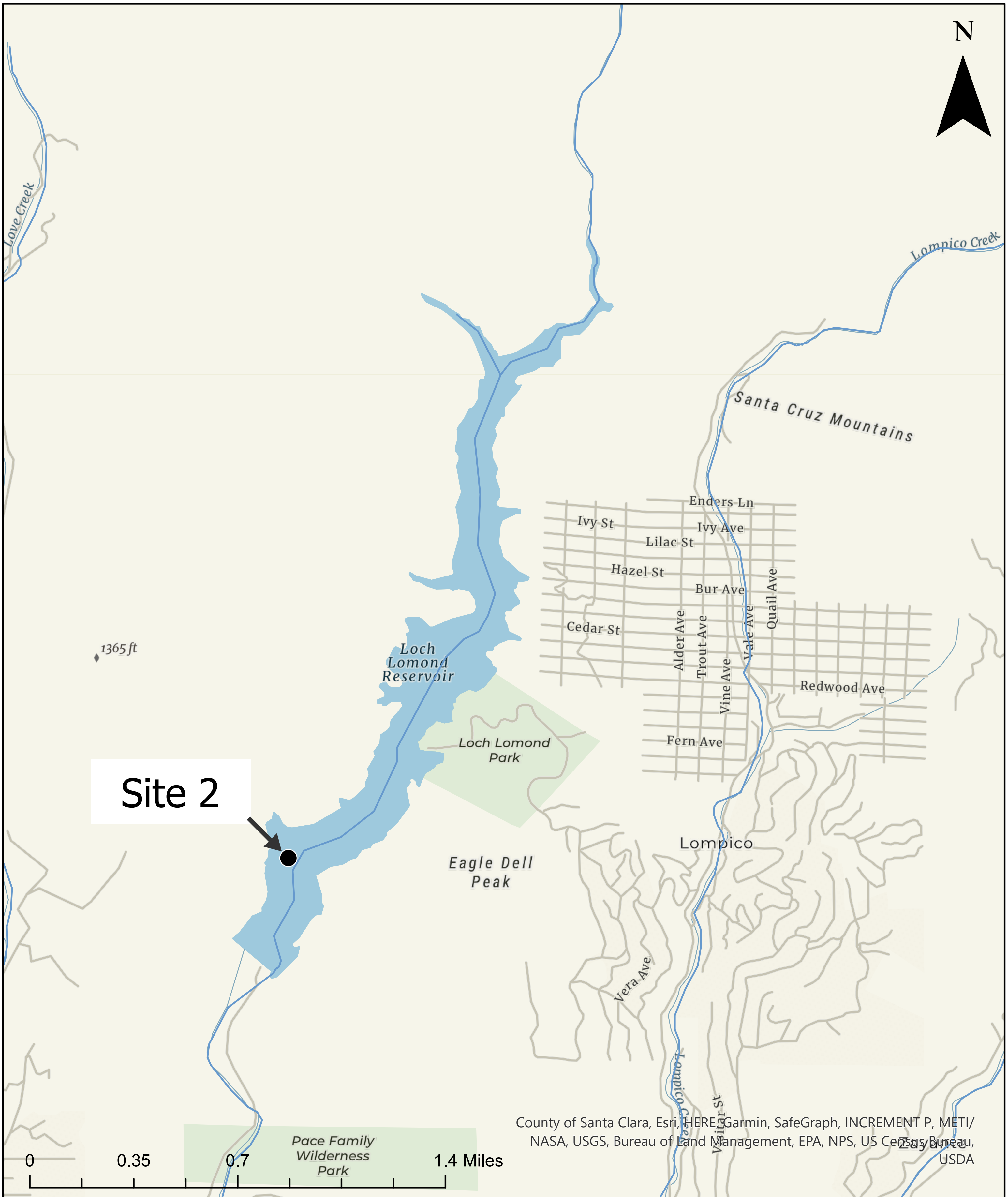
BLANKINSHIP & ASSOCIATES, Inc.
Ag & Environmental Science & Engineering
1615 5th St
Suite A
Davis, CA 95616
www.h2osci.com
(530) 757 -0941

PROJECT: City of Santa Cruz APAP

FIGURE: 1

DESCRIPTION: Project Location Map

DATE: Mar. 26, 2021



	DATE	DESCRIPTION	INIT.
	032621		M.Z.

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Ag & Environmental Science & Engineering

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PROJECT:

FIGURE: 2

DESCRIPTION: Project Detail Map

DATE: Mar. 26, 2021

Element 1: Description of the Water System

The City owns, operates, and maintains Loch Lomond, a reservoir that supplies drinking water to the City of Santa Cruz. Loch Lomond is an impoundment of Newell Creek with a surface area of approximately 175 acres. Water flows into Loch Lomond from the surrounding watershed or is diverted from the San Lorenzo River and pumped into the reservoir via the Newell Creek Pipeline. Inflows fill the reservoir during winter months. During wet years, water may spill over the dam's spillway into Newell Creek; drought years may not result in sufficient rainfall to cause the reservoir to spill. The City delivers a minimum flow of 1 cubic foot per second (CFS) to Newell Creek throughout the year.

The water intake gates allow the City to select the depth from which water will be withdrawn from the reservoir and delivered to the Graham Hill Water Treatment Plant or released downstream to Newell Creek to meet the 1 CFS flow requirement. Maximum water surface elevation in the reservoir is 577.5 feet above mean sea level (AMSL). Intake depths are at 550 feet, 530 feet, 510 feet, 490 feet and 470 feet AMSL. The intake gates on the dam allow the City to take advantage of differences in water quality due to stratification and variable lake elevations. The intake depth used for water going to the treatment plant or downstream to Newell Creek is typically selected to maximize water quality going to the treatment plant and maintain cold water temperature in Newell Creek for native fish species. If the taste and odor issues are localized within a stratum of the reservoir, the City may be able to selectively withdraw water from a depth of the reservoir that is less impacted.

Refer to **Figure 1** and **Figure 2**.

Element 2: Description of the Treatment Area

The City may apply algaecides to Loch Lomond if treatment thresholds are met.

Element 3: Description of Weeds and Algae

Nuisance algae found in the reservoir include, but are not limited to: *Aphanizomenon*, *Anabaena, Woronichina, Dolichospermum*, *Lyngbya*, *Microcystis*, and *Oscillatoria*. The City routinely monitors for the types of algae present in the reservoir. Of the algae identified, some may produce MIB and geosmin, which are taste and odor causing compounds. The City may receive complaints of nuisance tastes and odors if blooms are not addressed early in growth cycle. Additionally, certain genus and species of algae identified in Loch Lomond have been known to produce toxins under some environmental conditions or in response to stressors.

The presence of algae in Loch Lomond may reduce water quality, create nuisance tastes and odors, and adversely impact drinking water treatment facilities.

Element 4: Algaecides and Aquatic Herbicides Used, Known Degradation Byproducts, Application Methods and Adjuvants

Table 1 summarizes the algaecides that may be used by the City.

Table 1: Algaecides That May be Used

Herbicide	Application Method(s)	Adjuvant	Degradation Byproducts
Copper – Chelated	Handgun, boom sprayer, injection	As Needed	None, persists as various speciations of copper[1]
Copper Sulfate	Slug application, spreader, or via submersed burlap sack	Not Applicable	None, persists as various speciations of copper[1]
Hydrogen Peroxide[2]	Handgun, boom sprayer, injection	As Needed	O_2, H_2O
Peroxyacetic Acid	Handgun, boom sprayer, injection	As Needed	CO_2, O_2, H_2O
Sodium Carbonate Peroxyhydrate	Handgun, boom sprayer (liquid), or spreader (granules)	Not Applicable	CO_2, O_2, H_2O

[1] - USEPA 2009
[2] - Hydrogen Dioxide is a synonym for Hydrogen Peroxide and shares the same CAS number (CAS No. 772-84-1).

Historically, the City has not used adjuvants. As additional research on improved efficacy from use of aquatic-labeled adjuvants is published, the City may elect to use a penetrant to enhance algae control.

Algaecides may be applied to the reservoir using methods that target shallow littoral zones along shorelines, and/or the water column throughout the reservoir where, depending on where cyanobacteria are observed. An effective approach to treat algae blooms in Loch Lomond has been to apply algaecide throughout the surface area of the lake accessible by application boats, targeting the upper 10, 15, or 20 feet of the water column. Factors that influence the depth that will be treated include algae density, stage in bloom cycle, presence of known or suspected toxin producing algae, time of year, water temperature, wind, and thermal stratification of the reservoir.

All algaecide applications are made in accordance with the product label. For example, an application of liquid copper to Loch Lomond may be made by lowering weighted drop hoses into the water column and delivering a known amount of product to the application area to achieve the target concentration.

Element 5: Discussion of Factors Influencing Herbicide Use

Treatment of algae in Loch Lomond by the City is guided by the application of IPM. The IPM program and policy were recently reviewed and revised, and staff are familiar with the City's Pesticide Use Policy. One of the primary operational goals of the IPM program is to establish a general and reasonable set of control measures that not only aid in managing algae populations, but also address public health & safety, economic, legal, regulatory, and aesthetic requirements. An action threshold level is the point at which action should be taken to control algae before the water treatment plant's ability to produce high quality drinking water is significantly impacted; moreover, established action threshold levels may change based

on public expectations. A central feature of IPM is to determine when control action is absolutely necessary and when it is not. The presence of some algae in the reservoir may be a sign of a well-balanced, flourishing ecosystem. City staff regularly conducts site scouting of the reservoir through water quality monitoring and evaluating algae populations throughout the year. Analytes and trends monitored related to algae treatment thresholds include temperature and dissolved oxygen, pH, turbidity, algae quantification and identification, chlorophyll-*a* and secchi depth.

Examples of when or how thresholds are met are when algae causes complaints of taste and odor issues in drinking water, potential toxins that could enter drinking water or expose reservoir users, or creates a nuisance to the public. Typical challenges associated with algae blooms are adverse impacts to water quality and nuisance tastes and odors.

If the population of algae in Loch Lomond equals or exceeds a threshold, a control method is implemented. Control methods considered include mechanical, cultural controls, biological, and/or chemical, consistent with the City's IPM techniques. Algaecide use may or may not be employed as a last resort control method and is considered a critical part of the IPM program. For algal blooms that are in progress and have exceeded a threshold, algaecides offer the most effective control.

Alternatively, the City's monitoring may indicate that algae populations are stable or naturally declining; in this case, no action would be taken. The City is not interested in stopping all algal growth or blooms, rather the focus is on preventing the production of taste and odor compounds, and algal toxins. The presence of non-problem algae may be beneficial as they are likely occupying an overlapping niche and directly competing with the problem algae species.

Algaecide application may also be made prior to threshold exceedance. For example, based on City's staff knowledge and observation of ambient quality conditions (e.g., nutrients, warming epilimnion, etc.) or algal density and predicted growth rate. The identification of some species of algae may reasonably be predicted to cause future problems. Accordingly, algae may be treated soon after detection and observation of significant increase in population numbers. Even though algae may not be an immediate problem at this phase, treating them before the bloom enters an exponential growth phase prevents their populations from reaching densities where adverse effects, like the production of MIB, geosmin or toxin would occur. An additional benefit from the application of IPM is that the total amount of algaecide needed is reduced. Generally, treating algae earlier in the growth cycle results in fewer controls needed and less total herbicide used. Selection of appropriate algaecide(s), adjuvant and rate of application is done based on the identification of the algae, its growth stage and the inclusion of that type of algae on the product label.

The selection of and decision to use an algaecide is based on the recommendation of a DPR-licensed Pest Control Adviser (PCA). The PCA considers a variety of control options that may include mechanical and/or cultural techniques that alone or in combination with algaecide use are the most efficacious and protective of the environment.

Evaluating alternative control techniques is part of the City's IPM approach; therefore, an alternative treatment may be selected. If appropriate, the City may elect to test new approaches as part of a test or pilot program. Examples of alternative control techniques include mechanical removal, and prevention of nutrient loading. A more detailed description of each of these is presented in **Element 10** and **Element 11** of this document. In general, alternative control techniques are more expensive, labor intensive, and less effective; however, they may be implemented as feasible.

Element 6: Gates and Control Structures

Loch Lomond is an impoundment of Newell Creek formed by Newell Creek Dam. The dam has a fixed elevation spillway that can discharge water from Loch Lomond. The City has an array of intake gates on the dam used to bring water to the water treatment plant or for releases downstream to Newell Creek. The intake gates are at depths of 550 feet, 530 feet, 510 feet, 490 feet and 470 feet AMSL. On-going capital improvement projects at the reservoir include replacement and enhancement of the City's ability to draw water from specific elevations within the reservoir. This project is expected to be complete sometime in 2021-2022. The gates are subject to routine inspection, testing and maintenance to meet regulatory safety requirements.

The City uses Aquatic Herbicide Application Logs, as seen in **Figure 3**, to document conditions prior to and during applications of algaecides.

Element 7: State Implementation Policy (SIP) Section 5.3 Exception

The City has applied for and been granted a SIP Section 5.3 Exception for the use of copper. The City's exception period for applications of copper-containing algaecides is from April through September. These may be used on an as-needed basis during the exception period to control algae with the goal of minimizing taste and odor issues, and reducing impact of algal toxins in drinking water resulting from the presence of nuisance algae or aquatic vegetation in the City's reservoir.

The City does not anticipate using copper-containing products outside of the exception period.

Consistent with SIP exception requirements, after completion of copper applications for the year, a qualified biologist certifies that beneficial uses of receiving waters have been restored.

Element 8: Description of Monitoring Program

Attachment C of the Permit presents the Monitoring and Reporting Program (MRP). The MRP addresses two key questions:

> Question No. 1: Does the discharge of residual algaecides and aquatic herbicides cause an exceedance of the receiving water limitations?
>
> Question No. 2: Does the discharge of residual algaecides and aquatic herbicides, including active ingredients, inert ingredients, and degradation byproducts, in any combination cause or contribute to an exceedance of the "no toxics in toxic amount" narrative toxicity objective?

Attachment C of the Permit provides MRP guidelines that the City will use to meet the aforementioned goals.

Figure 3: Aquatic Herbicide Application Log

CLEAN LAKES, INC.

AQUATIC WEED CONTROL
NPDES AQUATIC PESTICIDE APPLICATION LOG

Date of Application:	**Location:**		**App. Start Time:** **App. Stop Time:**	
Applicator Name:		**APAP Certification:**		
Discharge Gates or Control Structures				
Name	**Date Closed**	**Time Closed**	**Date Opened**	**Time Opened**
1.				
Calculations to Determine Opening and Closures:				

Application Details					
Plot Number	**Area (ac. or sq. ft.)**	**Average Depth**	**Product**	**Product Quantity**	**Concentration or Rate**

Figure 4: Aquatic Herbicide Field Monitoring & Sampling Form

City of Santa Cruz Water Quality Laboratory

CALIFORNIA WATER BOARDS State Water Resources Control Board, ELAP Cert. No. 1875
NPDES/APAP Aquatic Herbicide Field Monitoring & Sampling Form

DE:	NPDES/ APAP
AV:	
SV:	

Sample Type:	☐ Background	☐ Event Monitoring	☐ Post-Event Monitoring	**Date of Application:**	**Weather:**
Login Record File:				**Herbicide Applied:**	
				Event #:	

Date Collected/Rec'd	**Time Rec'd**	**Sampler**	**Location/GPS Coordinates**	**Thermometer ID/Cal.Date/ Correction Factor (°C)**

DO Meter *(select one)*	☐ **YSI 550A SN:**	
	☐ **YSI ProSolo ODO SN:**	*(Perform required Barometric Conversion below for instrument calibration)*
	Station Pressure: _____ inHg x 25.4= True Barometric Pressure: _____ mmHg per inHg	

Field Observations		
Location Conditions (*Please give a brief description if condition is present)*		
Condition	**Absent**	**Present**
Water flowing		
Floating or suspended matter		
Discoloration		
Bottom Deposits		
Aquatic Life		
Visible films, sheens, or coatings		
Fungi, slimes or objectionable growths		
Potential nuisance conditions		
Comments:		

Water Quality Samples Collected *(Please circle)*			
Dissolved Copper	General Physical	Hardness	Other:

Water Quality Characteristics

		Field Analysis		Date Analyzed:						
				Analyst(s):						
Standard Methods Reference		SM2550B		SM4500-H^+ B	SM2510B	SM2130B	SM2340C	SM2320B	SM2120B	SM2150B
TIME	**LOCATION**	**Temp (°C)**	**DO (mg/L)**	**pH (S.U.)**	**COND (µS/cm)**	**TURB (NTU)**	**HARD (mg/L)**	**ALK (mg/L)**	**COLOR (CU)**	**ODOR (TON)**

Chem Analyst Review:

Figure 4: Aquatic Herbicide Field Monitoring & Sampling Form

City of Santa Cruz Water Quality Laboratory

CALIFORNIA WATER BOARDS State Water Resources Control Board, ELAP Cert. No. 1875
NPDES/APAP Aquatic Herbicide Field Monitoring & Sampling Form

DE:	NPDES/ APAP
AV:	
SV:	

Definitions
Floating or suspended matter: Presence of floating and/or suspended material in concentrations that cause nuisance or adversely affect beneficial uses.
Discoloration: Presence of coloration that causes nuisance or adversely affects beneficial uses.
Bottom Deposits: Presence of bottom deposits in amounts that cause nuisance or adversely affect beneficial uses.
Aquatic Life: Presence of aquatic communities and populations, including vertebrates, invertebrates, and non-target plant species to be degraded.
Visible films, sheens, or coatings: Presence of oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water that cause nuisance, or that otherwise adversely affect beneficial uses.
Fungi, slimes or objectionable growths: Presence of fungi, slimes, or objectionable growth in concentrations that cause nuisance or otherwise adversely affect beneficial uses.
Potential nuisance conditions: Presence of an observed condition not listed (e.g. odor) that can potentially adversely affect beneficial uses.

8.2 Monitoring Locations and Frequency

For application of copper-containing algaecides or aquatic herbicides, the City will collect samples from a minimum of six application events for each active ingredient in each environmental setting per year. If there are less than six application events in a year for an active ingredient, the City will collect samples for each application event in each environmental setting (e.g., flowing water and non-flowing water).

Water quality sampling is required for applications of products that contain sodium carbonate peroxyhydrate, peroxyacetic acid, and/or hydrogen peroxide, however, no chemical analysis for the hydrogen peroxide class of active ingredients is needed. If applications of sodium carbonate peroxyhydrate, peroxyacetic acid, and/or hydrogen peroxide are made, the City will collect samples and complete sampling forms consistent with permit requirements. Samples will be analyzed for field parameters including pH, dissolved oxygen, temperature, turbidity and electrical conductivity.

If the results from six consecutive sampling events show concentrations that are less than the applicable receiving water limitation/trigger in an environmental setting, the City will reduce the sampling frequency for that active ingredient to one per year in that environmental setting (e.g., in the non-flowing water setting of Loch Lomond). If the annual sampling shows exceedances of the applicable receiving water limitation/trigger, the City will be required to return to sampling six applications the next year, and until sampling may be reduced again.

The City generally makes applications to treat pervasive planktonic algae blooms where the entire lake is the treatment area. Background and Post-Event monitoring samples are collected from the location identified as “Site 2” on **Figure 2**. After application, no treated water is expected to be discharged from the lake. No water is expected to be spilling over the spillway to Newell Creek, and water discharged from the fish release is below the thermocline, therefore the algaecide treated water should not leave the lake. As such, downstream receiving water samples, referred to as Event monitoring samples, may not be required.

If a partial lake application is made, sites will be chosen to represent the variations in treatment that occur, including algaecide or aquatic herbicide use, hydrology, and environmental setting, location of application, wind influence, water movement within the reservoir, and seasonal variations. The exact location(s) of sample site(s) will be determined after site scouting and a decision to make an aquatic herbicide application are made. **Figure 3** is the form used to document sampling.

8.2.1 Sample Locations

Sampling will include Background, Event, and Post-event monitoring as follows:

Background Monitoring: In static water, the background (BG) sample is collected in the treatment area, within 24 hours prior to the start of the application.

Event Monitoring: The Event sample for **non-flowing (static)** water is collected immediately outside the treatment area immediately after the application event, but after sufficient time has elapsed such that treated water would have exited the treatment area.

The location and timing for the collection of the Event sample may be based on a number of factors including, but not limited to algae and aquatic weed density and type, flow rates, size of the treatment area and duration of treatment.

Post-event Monitoring: The post-event monitoring (Post) sample is collected within the treatment area within one week after the application, or when the treatment is deemed complete.

One full set of three samples (e.g., BG, Event and Post) will be collected during each treatment from the representative site(s) treated within the City according to the monitoring frequency and locations described earlier.

The Background and Post-Event Monitoring samples during a full lake treatment are anticipated to be collected from Site 2, located at approximately 37.10642°, -122.07142°.

See **Figure 3** for the field sampling form used.

8.3 Sample Collection

If the water depth is 6 feet or greater, the sample will be collected at a depth of 3 feet. If the water depth is less than 6 feet, the sample will be collected at the approximate mid-depth. As necessary, an intermediary sampling device (e.g., Van Dorn-style sampler or long-handled sampling pole) will be used. Sample scoopers are used to collect samples at the approximate desired sampling depth and used to fill clean sample bottles. Appropriate cleaning technique is discussed in Section 8.8.4.

8.4 Field Measurements

In conjunction with sample collection, temperature and dissolved oxygen will be measured in the field. Turbidity, electrical conductivity, and pH, are analyzed in the laboratory. Turbidity, pH, and conductivity meters are calibrated according to manufacturer's specifications and according to the City of Santa Cruz Water Quality Laboratory Quality Assurance Manual and Standard Operating Procedures. Meters undergo maintenance and/or calibration at the recommended frequency, and checked with a secondary standard prior to each use. Quarterly, dissolved oxygen meters are verified against a Winkler titration to demonstrate accuracy. Calibration and/or maintenance logs are maintained for all instruments.

8.5 Sample Preservation and Transportation

Samples may be collected directly into preserved containers, or collected in unpreserved containers, and preserved at the laboratory upon receipt if the analytical method requires preservation. Once a sample is collected and labeled it will immediately be placed in a dark, cold (~4° C) environment, typically a cooler with ice. Samples will be delivered to the laboratory as soon as practicable after sample collection.

8.6 Sample Analysis

Table 2 shows the constituents that each sample must be analyzed for.

Table 2: Required Sample Analysis

Analyte	Method of Analysis	Reporting Limit	Hold Time (Days)	Container	Chemical Preservative
Temperature[1]	N/A	N/A	N/A	N/A	N/A
Dissolved Oxygen[1]	ASTM D888-09 (C)	N/A	1	N/A	N/A
Turbidity[2]	SM2130B	N/A	2	500/1000 mL HDPE	None
Electrical Conductivity[2]	SM2510B	N/A	28	500/1000 mL HDPE	None
pH[2]	SM4500-H+B	1-14	15 Minutes	500/1000 mL HDPE	None
Hardness[3]	SM2340C	4 mg $CaCO_3$/L	1 Day if unpreserved; 180 Days if preserved	250 mL HDPE	HNO_3
*Copper (dissolved)[3,4]	200.8	2.0 µg/L	1 Day if unpreserved; 180 Days if preserved	250 mL HDPE	HNO_3

Notes:
* Signifies algaecide or aquatic herbicide active ingredient. Chemical analysis is only required for the active ingredient(s) used in treatment.
Active ingredient analysis not required for algaecides and aquatic herbicides containing sodium carbonate peroxyhydrate, peroxyacetic acid, and/or hydrogen peroxide; field parameters must be measured and reported.
[1]Field measured.
[2]May be field or laboratory measured.
[3]Required for copper applications only.
[4]Per EPA 200.8, samples for dissolved copper should be filtered with a 0.45µm filter at the time of collection or as soon thereafter as practically possible.

8.7 Reporting Procedures

An annual report for each reporting period, from January 1 to December 31 will be prepared by March 1 of the following year and will be submitted to the Central Coast RWQCB and SWRCB. In years when no algaecides or aquatic herbicides are used, a letter stating no applications will be sent to the Central Coast RWQCB and SWRCB in lieu of an annual report.

The annual report will contain the following information as described in Attachment C of the Permit:

1. An Executive Summary discussing compliance or violation of the Permit and the effectiveness of the APAP; and
2. A summary of monitoring data, including the identification of water quality improvements or degradation as a result of algaecide or aquatic herbicide application.

The City will collect and retain all information on the previous reporting year. When requested by the Deputy Director or Executive Officer of the Central Coast RWQCB, the City will submit the annual information collected, including:

1. An Executive Summary discussing compliance or violation of the Permit and the effectiveness of the APAP to reduce or prevent the discharge of pollutants associated with herbicide applications;
2. A summary of monitoring data, including the identification of water quality improvements or degradation as a result of algaecide or aquatic herbicide application, if appropriate, and recommendations for improvement to the APAP (including proposed BMPs) and monitoring program based on the monitoring results. All receiving water monitoring data shall be compared to applicable receiving water limitations and receiving water monitoring triggers;
3. Identification of BMPs and a discussion of their effectiveness in meeting the Permit requirements;
4. A discussion of BMP modifications addressing violations of the Permit;
5. A map showing the location of each treatment area;
6. Types and amounts of aquatic herbicides used at each application event during each application
7. Information on surface area and/or volume of treatment area and any other information used to calculate dosage, concentration, and quantity of each aquatic herbicide used;
8. Sampling results shall indicate the name of the sampling agency or organization, detailed sampling location information (including latitude and longitude or township/range/section if available), detailed map or description of each sampling area (address, cross roads, etc.), collection date, name of constituent/parameter and its concentration detected, minimum levels, method detection limits for each constituent analysis, name or description of water body sampled, and a comparison with applicable water quality standards, description of analytical QA/quality control plan. Sampling results shall be tabulated so that they are readily discernible; and
9. Summary of Aquatic Herbicide Application Logs (AHALs, **Figure 2**).

The City will report to the Central Coast RWQCB and SWRCB any noncompliance, including any unexpected or unintended effect of an algaecide or aquatic herbicide that may endanger health or the environment. The Twenty-Four Hour Report will be provided orally, by way of a phone call, to the SWRCB and Central Coast RWQCB within 24 hours from the time the City becomes aware of any noncompliance. The Twenty-Four Hour Report will include the following information:

1. The caller's name and telephone number;
2. Applicator name and mailing address;
3. Waste Discharge Identification (WDID) number;
4. How and when the City became aware of the noncompliance;
5. Description of the location of the noncompliance;
6. Description of the noncompliance identified and the USEPA pesticide registration number for each product the City or its contractor applied in the area of the noncompliance; and
7. Description of the steps that the City has taken or will take to correct, repair, remedy, cleanup, or otherwise address any adverse effects.

If the City is unable to notify the RWQCB and SWRCB within 24 hours, the City will do so as soon as possible and provide a rationale for why the City was unable to provide notification of noncompliance within 24 hours.

In addition to the Twenty-Four Hour Report, the City will provide a written submission within five (5) days of the time the City becomes aware of the noncompliance if not waived by the RWRCB or SWRCB. The Five-Day Written Report will contain the following information:

1. Date and time the City contacted the State Water Board and the appropriate Regional Water Board notifying of the noncompliance and any instructions received from the State and/or Regional Water Board; information required to be provided in Section D.1 (24-Hour Reporting);
2. A description of the noncompliance and its cause, including exact date and time and species affected, estimated number of individual and approximate size of dead or distressed organisms (other than the pests to be eliminated);
3. Location of incident, including the names of any waters affected and appearance of those waters (sheen, color, clarity, etc.);
4. Magnitude and scope of the affected area (e.g. aquatic square area or total stream distance affected);
5. Algaecide and aquatic herbicide application rate, intended use site (e.g., banks, above, or direct to water), method of application, and name of algaecide and herbicide product, description of algaecide and herbicide ingredients, and U.S. EPA registration number;
6. Description of the habitat and the circumstances under which the noncompliance activity occurred (including any available ambient water data for aquatic algaecides and aquatic herbicides applied);
7. Laboratory tests performed, if any, and timing of tests. Provide a summary of the test results within five days after they become available;
8. If applicable, explain why the City believes the noncompliance could not have been caused by exposure to the algaecides or aquatic herbicides from the application; and
9. Actions to be taken to prevent recurrence of adverse incidents.

The Five-Day Written Report will be submitted within five (5) days of the time the City becomes aware of the noncompliance unless SWRCB staff or RWQCB staff waive the above described report if an oral report has been received within 24 hours.

8.8 Sampling Methods and Guidelines

The purpose of this section is to present methods and guidelines for the collection and analysis of samples necessary to meet the APAP objective of assessing adverse impacts, if any, to beneficial uses of water bodies treated with algaecides and aquatic herbicides.

This section describes the techniques, equipment, analytical methods, and quality assurance and quality control procedures for sample collection and analysis. Guidance for the preparation of this chapter included: NPDES Storm Water Sampling Guidance Document (USEPA 1992); Guidelines and Specifications for Preparing Quality Assurance Project Plans (USEPA 1980); Standard Methods for the Examination of Water and Wastewater, 22nd Edition (APHA 2012); and U.S. Geological Survey, National Field Manual for the Collection of Water Quality Data (USGS 1995).

8.8.1 Sampling Techniques

City staff conduct routine monitoring consistent with the City of Santa Cruz Water Quality Laboratory Standard Operating Procedures (SOP) for all water quality monitoring conducted at Loch Lomond. The SOP is updated regularly to reflect new methods or techniques. As discussed in Section 8.3, if the water depth is 6 feet or greater the sample will be collected at a depth of 3 feet, if the water depth is less than 6 feet the sample will be collected at the approximate mid-depth. As necessary, an intermediary sampling device (e.g., Van Dorn-style sampler, sample scooper or long-handled sampling pole) will be used for locations that are difficult to access. Appropriate cleaning technique is discussed in Section 8.8.4.

During collection, the samples will be collected in a manner that minimizes the amount of suspended sediment and debris in the sample. Samples will be collected directly by the sample container or by an intermediary container in the event that the sample container cannot be adequately or safely used. Intermediary samplers will be polyethylene (plastic/HDPE), stainless steel or glass. Any container that will be reused between sites will be triple rinsed before collection of the next sample, see Section 8.8.4. Alternatively, disposable poly or glass intermediary sample containers can be used.

8.8.2 Sample Containers

Clean, empty sample containers with caps will be transported in ice chests. The containers will be certified clean by either the laboratory or the container supplier. To ensure data quality control, the sampler will utilize the appropriate sample container as specified by the laboratory for each sample type. Sample container type, holding time, and appropriate preservatives are listed in **Table 2**. Each container will be affixed with a label indicating a discrete sample number for each sample location.

8.8.3 Sample Preservation and Filtering

Samples may either be collected with bottles containing the correct preservative(s), or collected in unpreserved bottles and preserved upon receipt at the analytical lab. If filtration is required, it must be done prior to sample preservation. After collection, samples will be stored in a cooler with ice and transported to the analytical laboratory. Once at the laboratory samples will be analyzed or refrigerated at ≤ six (6) degrees Celsius. Samples requiring filtration (dissolved copper) are sent over night to a subcontracting laboratory for filtration and preservation. Refer to **Table 2** for details on method bottle requirements, filtration and hold times.

8.8.4 Sampling Equipment Cleaning

The City typically conducts water quality monitoring at multiple locations in Loch Lomond before, during and after application. Field parameter meters and sample collection equipment (e.g., Van Dorn-sampler) will be triple-rinsed with distilled water, and then rinsed once with the water being sampled prior to its first use at a new sample collection location.

8.8.5 Sample Packing and Shipping

In general, pH, electrical conductivity and hardness will be analyzed in the City's Water Quality Laboratory (WQL) California Environmental Laboratory accreditation Program (CA-ELAP) Certificate # 1875. Dissolved copper samples will be analyzed by a CA-ELAP accredited subcontracting laboratory. All samples to be shipped or delivered to a subcontracting laboratory are to be packed and transported as soon as possible after collection to provide ample time for samples to be prepared and analyzed within the required holding time.

Ice will be included in coolers containing samples that require temperature control. Samples will be packaged for transport in the following manner:

1. Sample container labels will be checked for secure attachment to each sample container.
2. The sample containers will be placed in the cooler. If shipping glass bottles, place bubble-wrap, between sample containers to protect the sample containers from breakage during shipment and handling.
3. The Chain of Custody (COC) will be placed inside a plastic bag and placed inside the cooler. The COC will be filled out consistent with Section 8.9.4 with unique sample name, time and location, the sample collector, matrix type, the required analysis, number of containers, turn-around-time, and person(s) to which data will be reported.
4. The cooler will then be readied for pick-up by a courier.

8.9 Field Sampling Operations

8.9.1 Field Logbook

Datasheets/field forms must be maintained by to provide a record of sample location, significant events, observations, and measurements taken during sampling. Sample records are intended to provide sufficient data and observations to enable project team members to reconstruct events that occurred during the sampling and must be legible, factual, detailed, and objective. As appropriate and at the discretion of City staff, observations and measurements can be supplemented with pictures of site conditions at the time of sampling.

When recording observations in the field book, the sampling team will note the presence or absence of:

1. Floating or suspended matter;
2. Discoloration;
3. Bottom deposits;
4. Aquatic life;
5. Visible films, sheens, or coatings;
6. Fungi, slimes, or objectionable growths; and
7. Potential nuisance conditions.

See **Figure 4** for the forms to be used to record relevant field data when sampling.

8.9.2 Alteration of Sampling Techniques

It is possible that actual field conditions may require a modification of the procedures outlined herein. Specifically, water levels, weather, other environmental parameters and/or safety hazards including stream flow in Newell Creek, rainfall, and potential presence of cyanotoxins may pose challenges to completion of monitoring. In such instances, variations from standard procedures and planned sampling locations and frequencies will be documented by means of appropriate entry onto the datasheets/field forms.

8.9.3 Flow Estimation

Flow estimation is generally not applicable to sampling in Loch Lomond. If required due to site conditions or for sampling that may need to be conducted in Newell Creek, the City will collect flow estimation measurements. City staff can retrieve discharge data and determine flows to and within the creek. If necessary, a flow meter calibrated according to the manufacturer's directions may be placed as close to the center of the creek or waterbody as possible and a reading taken in feet per second (ft/sec). Alternatively, a common floating object (ball, branch, leaf, etc.) may be placed as close to the center of the conveyance as possible and the time it travels a known distance will be estimated and represented in ft/sec. A minimum travel distance of approximately 25 feet or a travel time of up to 30 seconds will be used.

8.9.4 Chain-of-Custody (COC)

The COC record will be employed as physical evidence of sample custody. The sampler will complete a COC record to accompany each sample from the field to the laboratory. The COC will specify: time, date, location of sample collection, container type and total number, requested analysis, sampler name, required turn-around-time (if applicable), time and date of sample transaction between field and laboratory staff, preservative and filtration, if any, and name of receiving party at the laboratory.

Corrections to the COC will be made by drawing a line through, initialing, and dating the error, indicating the reason and entering the correct information. Erasures are not permitted.

Upon receipt of the samples, laboratory personnel will check to confirm that there is evidence of cooling and upon verification of the number and type of samples and the requested analysis, a laboratory representative will sign the COC, indicating receipt of the samples.

Upon sample delivery, the original copy will be left with the laboratory and a copy will be kept by the sampler, three-hole punched, and placed in the field logbook.

8.9.5 Sample Label

The label will contain information on the specific project (e.g., City of Santa Cruz), the unique individual sample ID, the location (e.g., Loch Lomond Site #2 3' – BG), and the date and time the sample was collected.

Prior to sampling, a waterproof label will be filled out completely with indelible ink and will be affixed to the appropriate container.

8.9.6 Corrections to Documentation

Documents will not be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement or correction. If an error is made on a document used by an individual, that individual will make corrections by making a line through the error, date, initial and give reason for error and entering the correct information. The erroneous information will not be obliterated.

8.9.7 Document Control

A central file location will be established and used to store documentation such as the filed logbook and laboratory data. Staff tasked with monitoring or other Permit-related compliance work will familiarize themselves with the field forms, logbook and location of relevant documents like calibration logs and monitoring SOPs.

8.9.8 Sample Kit

Prior to departing to the field to collect samples, the following equipment will be prepared for use:

- Laboratory-supplied sampling bottles (one set for each sample to be collected plus spares, plus QA/QC samples, if applicable)
- Sample labels (one for each sample to be collected plus spares)
- Sharpie-type pen or other permanent, waterproof ink marker (indelible ink)
- Chain of Custody forms
- Dissolved Oxygen Meter
- Field logbook with field forms
- Deionized or distilled water
- blue ice packs
- Cooler for samples
- Intermediary sampling device (e.g., Van Dorn or sample scooper)
- Latex or nitrile gloves
- Rubber boots
- Camera/Smartphone

8.10 Quality Assurance and Quality Control (QA/QC)

The purpose of quality assurance and quality control (QA/QC) is to assure and control the quality of data generated during sample collection and analysis as described earlier in this document. Quality assurance and quality control are measured in a variety of ways, as described below.

Refer to the City of Santa Cruz Water Quality Laboratory Quality Assurance Manual and method-specific standard operating procedures. The QA/QC manual contains detailed quality control parameters followed by City staff.

8.10.1 Data Reporting

The results of sampling and analysis will be summarized in the Annual Report. The data will be tabulated so that they are readily discernible.

Element 9: Procedures to Prevent Sample Contamination

Sample collection will not be done in close proximity to application equipment and preferably upwind. Sampling will be done in a manner that prevents contact with algaecide application equipment, containers, or personal protective equipment (PPE). Care will be taken by samplers to minimize contact with any treated water, vegetation, or application equipment.

In the event that sampling equipment will be used in more than one location, the equipment will be thoroughly cleaned, triple-rinsed uncontaminated water, and then rinsed once with the water being sampled prior to its first use at a new sample collection location, as described in Section 8.8.4. Gloves will be changed between sites.

Element 10: Description of BMPs

The City employs the following BMPs to ensure the safe, efficient and efficacious use of algaecides and aquatic herbicides.

10.1 Measures to Prevent Spills and Spill Containment in the Event of a Spill

Applicators take care when mixing and loading algaecides and adjuvants. All label language is followed to ensure safe handling and loading of algaecides. Application equipment is regularly checked and maintained to identify and minimize the likelihood of leaks developing or failure that would lead to a spill. Applications to Loch Lomond are made using boats; mixing and loading occurs at the boat launch with closed system when possible and if compatible with the product being applied. Spill and cleanup equipment will be kept in good working order and readily available at the mixing and loading site.

If algaecides are spilled, they will be prevented from entering any waterbodies to the extent practicable. City and application contractor staff are trained to contain any spilled material and are familiar with the use of absorbent materials such as kitty litter, “pigs” and “pillows”. Spills will be cleaned up according to label instructions, and all equipment used to remove spills will be properly contained and disposed of or decontaminated, as appropriate. Applicators will report spills as required by City, county, state or federal policy and in a manner consistent with local, state and federal requirements.

10.2 Measures to Ensure Appropriate Use Rate

The following BMPs help ensure the appropriate algaecide and aquatic herbicide application rate is used.

10.2.1 Site Scouting

Prior to treatment, the City conducts extensive monitoring of water quality and algae in the reservoir. The City’s PCA and/or qualified City staff scout the reservoir to evaluate the extent to which algae thresholds have been exceeded. Thresholds are described in Element 5 and are generally based on complaints of taste and odor issues in drinking water, potential toxins that could enter drinking water or expose reservoir users, or creates a nuisance to the public.

If the reservoir is deemed to have exceeded a threshold, or a given algae population is anticipated to exceed a threshold based on known water quality, algal density, weather conditions, or other information, an algaecide application is considered. If the application can be made without negatively impacting the water quality, then an application is made.

10.2.2 Written Recommendations Prepared by PCA

Prior to application, a PCA licensed by DPR and/or qualified City staff scout the area(s) to be treated, makes a positive identification of pest(s) present, checks applicable product label(s) for control efficacy, and the PCA prepares a written recommendation, including rates of application, and any warnings or conditions that limit the application so that non-target flora and fauna are not adversely impacted. Licensed PCAs must complete 40 hours of continuing education every 2 years to stay licensed, and therefore are up-to-date on the latest techniques for pest control.

10.2.3 Applications Made According to Label

All algaecide applications are made according to the product label in accordance with regulations of the U.S. EPA, CalEPA, Cal OSHA, DPR, and the local Agricultural Commissioner. The City’s PCA and DPR-licensed Qualified Applicator Certificate (QAC) or Qualified Applicator License (QAL) holders regularly monitor updates and amendments to the label so that applications are in accordance with label directions. Licensed QALs and QACs must complete 20 hours of continuing education every 2 years to stay licensed, and therefore are up to date on the latest techniques for pest control.

10.2.4 Applications Made by Qualified Personnel

As appropriate, consistent with applicable regulations, the City or its application contractor will utilize QALs, QACs or staff under the supervision of QALs or QACs to make applications or supervise applications recommended by the PCA. The City's application contractor has knowledge of proper equipment loading, nozzle selection, calibration, and operation so that spills are minimized, precise application rates are made according to the label, and only target plants are treated.

10.3 The Discharger's plan in educating its staff and herbicide applicators on how to avoid any potential adverse effects from the herbicide applications

See information above on the continuing education requirements of City or application contractor staff responsible for selection and application of algaecides and aquatic herbicides.

10.4 Application Coordination to Minimize Impact of Application on Water Users

At least 15 days prior to the first algaecide application of each year, the City will deliver a notification letter to the Santa Cruz Agricultural Commissioner, the California Department of Fish and Wildlife Bay-Delta Region, the US Fish and Wildlife Service, and the National Marine Fisheries Service. Any other affected public agencies or individuals will be added to the notification letter distribution list as they are identified. If required by the algaecide product label, water users potentially affected by any water use restrictions will be notified prior to an application being made. No farmers receive water directly from any of the potentially treated waterbodies.

10.5 Description of Measures to Prevent Fish Kills

It is important to acknowledge that the use of algaecides, even when used according to label instructions, may result in unavoidable fish kills. Nonetheless, measures will be taken to reduce the likelihood of fish kills as described below. Generally speaking, the concentration of residual algaecides (i.e., the concentration of the algaecide present after the treatment is complete) is not sufficiently high to result in fish kills. Low dissolved oxygen due to decomposition of decaying algae can adversely affect non-target species like fish.

10.5.1 Applications Made According to Label

All algaecide applications are made according to the product label in accordance with regulations of the USEPA, CalEPA, DPR, Cal OSHA and the local Agricultural Commissioner. Precautions on the product label to prevent fish kills will be followed. For example, limitations on the total water volume treated will be followed to prevent dead algae from accumulating and then decaying and subsequently depressing the dissolved oxygen (DO) level. Depressed DO may adversely impact fish populations.

10.5.2 Written Recommendations Prepared by PCA

Prior to application, a PCA licensed by DPR, City and/or application contractor staff scouts the area to be treated, makes a positive identification of pest(s) present, checks applicable product label(s) for control efficacy, and in collaboration with City staff, the PCA prepares a written recommendation, including rates of application, and any warnings or conditions that limit the application so that fish are not adversely impacted.

10.5.3 Applications Made by Qualified Personnel

As appropriate, consistent with applicable regulations, the City and/or application contractor will utilize QALs, QACs or staff under the supervision of QALs or QACs to make applications or supervise applications recommended by the PCA. The City and/or application contractor have knowledge of proper equipment loading, calibration, and operation so that spills are minimized, precise product use rates are applied according to the label, and appropriate water concentration is achieved to control the target algae being treated.

Element 11: Examination of Possible Alternatives

11.1 Evaluation of Other Management Options

Evaluating alternative control techniques is part of the City's IPM approach and therefore alternative treatment measures are considered as part of the management options for algae control in Loch Lomond. Prior to making the decision to control algae with an algaecide, the City evaluates other available management options. These options are considered based on the impact to water quality, impact to non-targeted organisms like plants, fish or reptiles, potential efficacy, feasibility, and cost effectiveness. In general, alternative control techniques can be expensive, labor intensive, less effective, and cause temporary water quality degradation.

When the population of aquatic weeds equals or exceeds a threshold that could adversely affect drinking water quality or clog filters at treatment plants, management options are evaluated. Possible options that are considered may include additional sampling or investigation of the problem, implementing operational, mechanical, or cultural controls consistent with the City's IPM techniques.

11.1.1 No Action

As feasible, this technique is used. While no control action may be taken at this time, City staff conducts routine monitoring of the reservoir. The regular surveillance of conditions in Loch Lomond allow the City to monitor algae populations and inform decisions regarding thresholds where a control action may be needed. Prior to reaching a threshold, no control is considered.

The City is not interested in stopping all algal growth or blooms, but to focus on preventing the production of taste and odor compounds, or algal toxins. The presence of non-problem algae may be a benefit as they are likely occupying an overlapping niche and directly competing with the problem algae species.

11.1.2 Prevention

Habitat Modification

Habitat modifying techniques that the City may consider include dredging, oxygenation or aeration, shading with dyes, and water mixing. In areas where sedimentation has significantly impacted the capacity of the water body, dredging can increase the water volume, reduce organic matter generated in the water body, and remove nutrient-containing sediment. Dredging would not provide a substantial benefit to reduced internal nutrient loading. It will be considered in the future for select areas if removal of sediment accumulation may help prevent nutrients available to fuel algal growth.

Aeration, oxygenation and mixing are methods that can mechanically add oxygen directly to the water, and can result in the reduction of nuisance algal growth. Aeration is currently used to reduce anoxia in the hypolimnion of Loch Lomond and provide water movement to discourage algal growth. The current compressor-based aeration system is scheduled to be upgraded to a hypolimnetic oxygenation diffuser system.

Another habitat modification technique that can be considered is shading the water column using non-toxic, inert dyes. The use of dyes works on algae by limiting their ability to photosynthesize when the dye is present but is not a long-term solution and is not typically feasible or applicable to waterbodies like Loch Lomond.

The City installed Solar Bees® in the reservoir to circulate water and reduce algal growth habitat as a trial from 2003 to 2005. The Solar Bees® are intended to prevent the water column from stratifying, increase flow within the lake, and suppress algal blooms. After years of hoping for success, City staff determined that the units were not effective at mitigating algal blooms in Loch Lomond. It was thought that the depth of narrow shape of the reservoir prevented the City from seeing a reduction in algal blooms or populations.

Native Species Establishment

No appropriate native plants or acceptable algae species are available that could be put in Loch Lomond to out-compete nuisance algae for nutrients in the water column without creating similar challenges.

11.1.3 Mechanical or Physical Methods

Mechanical Removal

Mechanical removal of algae in the City's reservoir is not feasible. While floating mats of filamentous algae or submersed aquatic weeds can be removed from the water column using methods like hand-pulling, use of motor-driven aquatic harvesters to pull up and remove vegetation or algal mats, aquatic weed-whacking or mowing, non-matted algae is too small to be controlled by mechanical removal. Mechanical harvesting can be used for minimal removal of algae but is only practical when there is a thick algal scum. Thick algal blooms are not likely in City's reservoir, and if they did occur, the drinking use would likely

already be impaired. Additionally, this method has only been employed successfully in relatively small water bodies or in coves and embayments. Lastly, mechanical harvesting cannot be used for benthic algae, which are often the source of taste and odor compounds in the reservoir.

Reservoir covers limit algal production by limiting the light that is necessary for algal growth. Covering the City's reservoir with available technology is infeasible for many reasons, including its size and shape, ecosystem services and habitat benefits it provides, and to continue providing recreational opportunities to the community.

Alum, gypsum and lanthanum-modified bentonite have been used in some reservoirs, primarily in the Midwest and East, to limit algal growth by inactivating phosphorus, which is frequently the limiting nutrient. The City studied the use of these chemicals to help limit algal growth in its reservoir, but did not reach conclusive results regarding the effectiveness of either alum or gypsum. The City will continue to evaluate options to sequester nutrients.

Controlled Burns

This option is most suitable for some types of emergent and terrestrial weeds, and is not appropriate for control of algae. Additionally, controlled burns create air quality and significant wildfire concerns given the setting of Loch Lomond.

Grazing

This option is most suitable for emergent and terrestrial weeds, and is not suitable for algae. Impacts to water quality from animal feces, increases in turbidity, nutrients, and bank erosion, and impacts to desirable species make this option infeasible in some cases. The cost of hiring grazing animals is also generally more costly than chemical control alternatives. This option is not a suitable alternative control for algae within the reservoir.

Tilling or Discing

This option is not suitable for the control of aquatic or riparian vegetation because tilling or discing exposes erodible soils. This option is not a suitable alternative control within the reservoir.

Ultrasonic Control

Devices that emit ultrasonic waves at certain frequency to disrupt and/or kill algae cells. The City tested a unit from One SonicSolutions in 2011. The unit was mounted to a boat dock in a cover where algae was growing in the reservoir. The trial showed no significant difference in the test cove compared to other, untested coves. Therefore, the unit was removed after one trial season.

11.1.4 Cultural Methods

Non-herbicide cultural controls the City implements include withdrawing water from reservoir at varying depths at intake structures, or blending reservoir water with alternate water sources until taste and odor

causing algae are no longer impacting the water. If these strategies are unavailable, an algaecide application may be necessary.

Cultural methods used to reduce the amount of algaecides used include modifying the timing of algaecide and non-chemical controls. The City may make algaecide applications before the density of algae is high enough to require higher algaecide application rates, amounts or additional applications to maintain target algae populations below threshold levels.

11.1.5 Biological Control Agents

There are no known biological control agents that can reliably and effectively control significant algal blooms. The option of introducing herbivorous fish such as triploid grass carp is not permitted by California Department of Fish and Wildlife, and these fish prefer to eat submersed aquatic plants, not algae.

Bio-manipulation utilizes various natural mechanisms that can reduce algae and involves modifying the ratio of prey and predator species present to increase predation on algae in the reservoir. The biological controls are typically done by top-down or bottom-up changes to the food-web structure aimed at increasing populations of algae-consuming zooplankton. Bio-manipulation may be more efficient when used in conjunction with other habitat modification methods. However, this technique is also very difficult to institute and maintain in large reservoirs. Additional challenges with environmental permitting and impacts to special status species make biomanipulation infeasible to implement in Loch Lomond.

11.1.6 Algaecides and Aquatic Herbicides;

After other alternatives have been evaluated, the application of algaecides and aquatic herbicides may be a viable option available in order to prevent an algal bloom from adversely affecting drinking water quality, or creating a nuisance to the public. Applications may be necessary when a population of aquatic weeds equals or exceeds a threshold under the IPM program. At Loch Lomond, copper-containing algaecides have proven to be very effective at reducing the target algae without adverse effects on non-target organisms. The City anticipates additional trials with the hydrogen peroxide and peroxyacetic acid-containing products.

In order to reduce the amount and impact, an algaecide application may also be made prior to reaching a threshold exceedance, as discussed in Element 5. Even though algae may not be an immediate problem at this phase, treating certain species before a significant bloom is underway reduces the amount of algaecide needed because the lower density of algae is easier to control, and there is less biomass to target. If an algaecide is selected as the control measure, the rate of application is calculated based on the identification of the algae, volume of water to be treated, and the appearance of that type of algae on the product label. The application may also include other control techniques that alone or in combination with chemical controls are the most efficacious and protective of the environment.

11.2 Using the Least Intrusive Method of Aquatic Herbicide Application

The City may use a variety of application equipment, but applications are generally made using one to three boats. Boats may be used to apply algaecides by making broadcast applications using a spreader, handgun or submersed boom to apply granules or liquids. Combined with the need to hold, safely transport and properly apply algaecides, the methods used to apply algaecides to Loch Lomond are the least intrusive, feasible option.

Please refer to **Table 1** for application methods.

11.3 Applying a Decision Matrix Concept to the Choice of the Most Appropriate Formulation

As previously stated, a PCA and/or qualified City staff scout the area(s) to be treated, identifies the target algae(s) present, checks appropriate algaecide product label(s) for efficacy information, and then the PCA prepares a written recommendation. The written recommendation includes rates of application, and any warnings or conditions that limit the application.

The PCA may also recommend that an adjuvant be used to enhance the efficacy of the algaecide.

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