

Managing Cyanobacteria Blooms in East Bay Regional Park District Waters

Hal MacLean
Water Management Supervisor
East Bay Regional Park District
10/25/16

Healthy Parks 
Healthy People

Overview

- Blooms in the District
- District Bloom Response
- District Strategies to Manage Blooms



EBRPD Bloom History

- Annual Blooms
- 2008 first testing at Anza
- 2010 testing at Anza
- July 2014 first HAB at Temescal



HABs in District Waters Since 2014

Lake Temescal - July 2014

Lake Chabot - Sept 2014

3 dog deaths 2015

Morgan Territory
dog death April 2015

Quarry Lakes – May 2015

Lake Temescal - June 2015

Lake Anza – Sept 2015

Big Break - October 2015

Sunol - Nov 2015 dog illness

Del Valle – Dec 2015

Quarry Lakes – Feb 2016

Temescal – May 2016

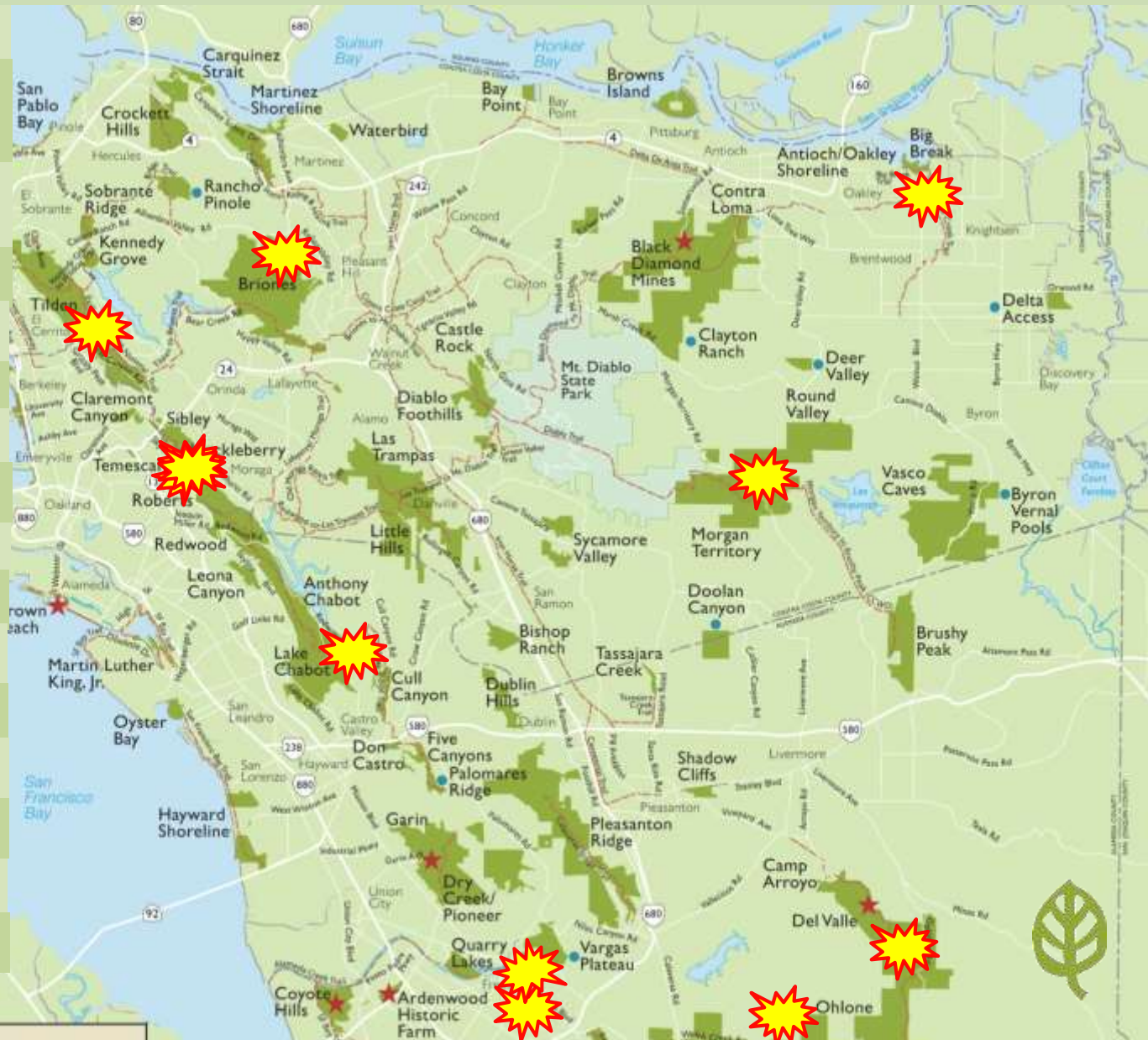
Big Break– July 2016

Anza – Aug 2016

Briones– Aug 2016

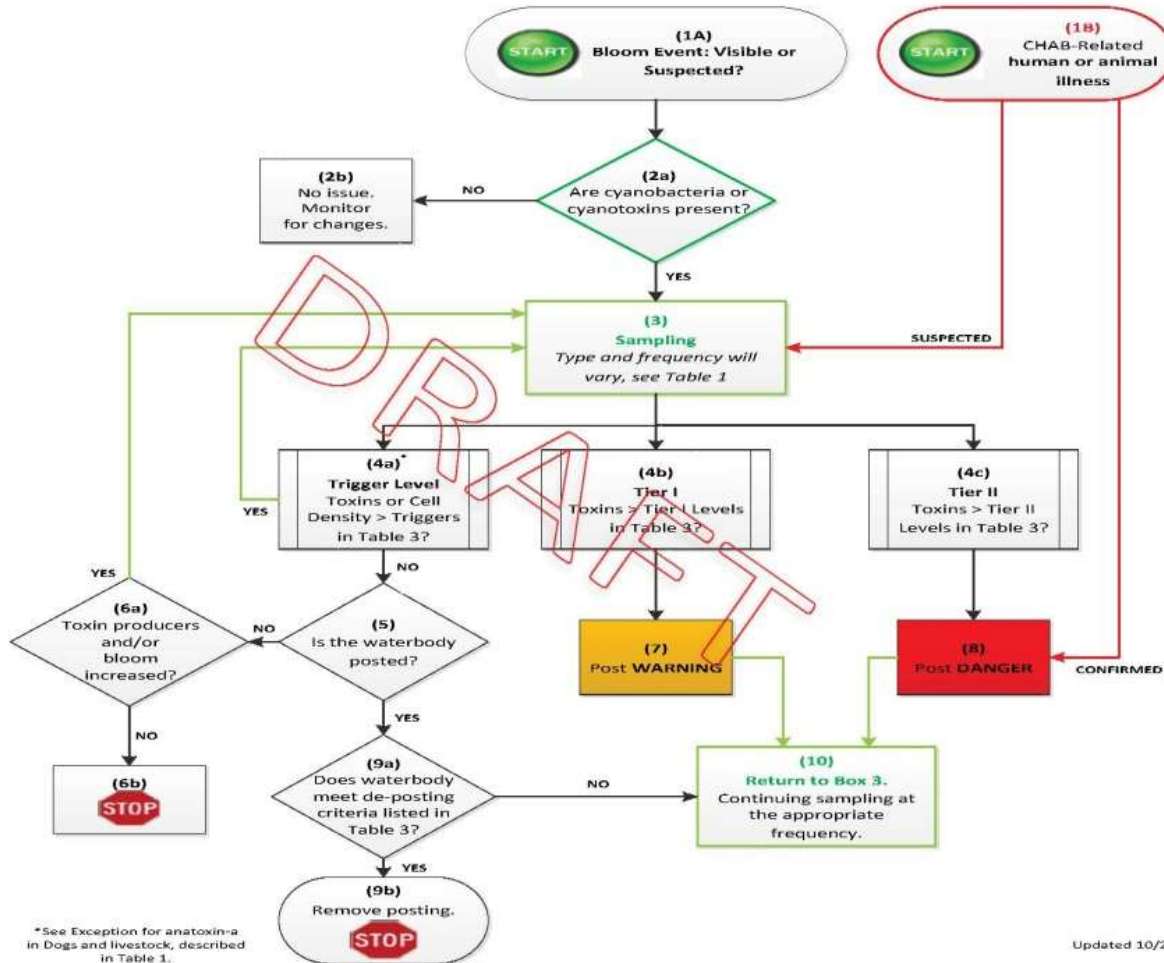
Temescal – Oct 2016

Quarry Lakes – Oct 2016



2016 HAB Monitoring Program

Proposed changes to consider for Voluntary CHAB Guidance. (Confidential- DO NOT CIRCULATE)
 Figure 1. Draft Decision Tree for Posing and Lifting Health Advisories for CyanoHABs



2016 HAB Monitoring Program

- Weekly Visual During Recreation Sampling
(DV, SC, QL, Tem, Anza)
- Park Staff Outreach
- Interns Monitor Trouble Spots and Strategic Areas
- Abraxis Toxin Kit Helps Initial Evaluation
- CAAS or Certified Lab Confirmation
- Staff and Health Dept. Coordination & Notifications
- Public Notification, Education and Outreach
- Remediation Actions
- Strategic Planning



Typical EBRPD Monitoring

Visual ID

Cyanobacteria?





Typical EBRPD Monitoring

*Visual ID
Cyanobacteria?*

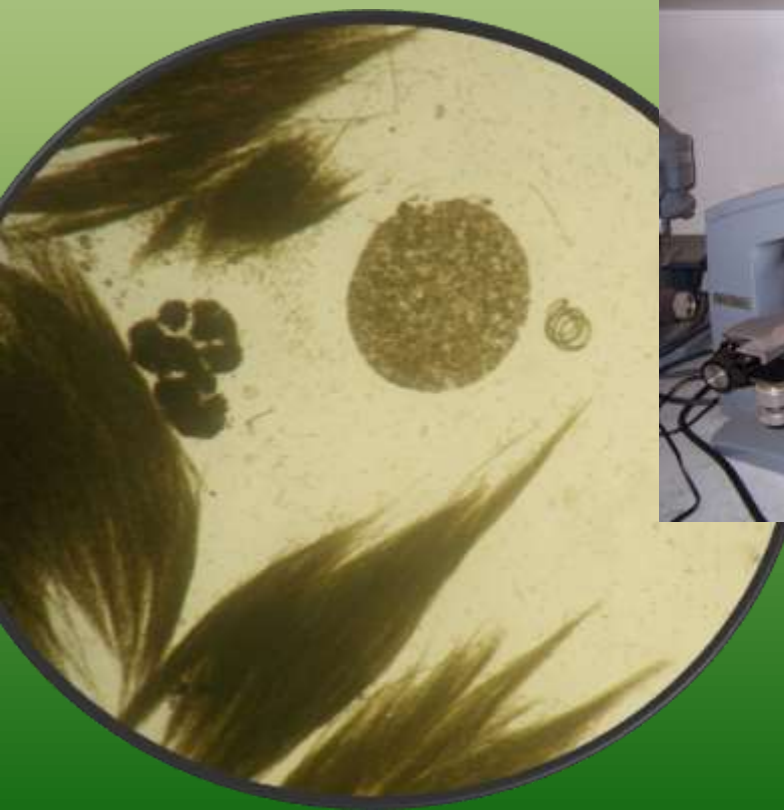
Got Toxins?

You need to test to know



Typical EBRPD Monitoring

- Identify Cyanobacteria
- Collect & ID Samples

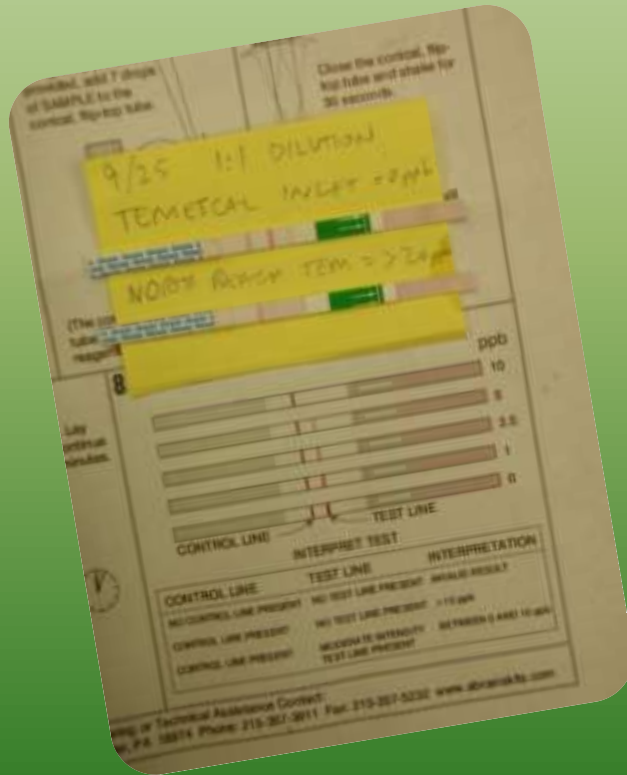


Cyanobacteria Genera	Hepatotoxins		Neurotoxins					Dermatotoxins	
	CYN	MC	NOD	ATX	BMAA	NEO	SAX	LYN	LPS
Anabaena (Dolichospermum) ★	X	X		X	X	X	X		X
Anabaenopsis		X							X
Aphanizomenon ★	X	X		X	X	X	X		X
Aphanocapsa		X							X
Coelosphaerium (Woronichinia)		X							
Cylindrospermopsis	X	X		X	X		X		X
Gloeotrichia		X							
Limnothrix		X							
Lyngbya ★	X	X		X	X		X	X	
Microcystis ★		X			X				X
Nodularia			X		X				X
Nostoc		X	X		X				
Oscillatoria (Planktothrix) ★	X	X		X	X		X	X	X
Phormidium		X		X	X				
Planktolyngbya							X	X	
Pseudanabaena		X		X					X
Raphidiopsis	X			X					X
Synechococcus		X			X				X
Synechocystis		X			X				X
Woronichinia		X		X					



Typical EBRPD Monitoring

- Test samples



Other Options

- Certified Lab Testing



United States Environmental Protection Agency Region 9 Laboratory

1337 S. 48th Street, Building 201, Richmond, CA 94804
Phone: (510) 412-2300 Fax: (510) 412-2302

Project Manager: Susan Keydel
Project Number: R16W02
Project: FY2016 Cyanotoxins for California Lakes Waters

Watershed: Section
75 Hawthorne Street
San Francisco CA, 94105

SDG: 16201A
Reported: 07/27/16 16:14

Sample Results

Analyte	Reanalysis / Extract	Result	Qualifier / Comment	Quantitation Limit	Units	Batch	Prepared	Analyzed	Method
Microcystin		ND	U	0.15	ug/L	B16G091	07/20/16	07/20/16	Water - Sampled: 07/18/16 10:30 Microcystin by ELISA
Microcystin		ND	U	0.15	ug/L	B16G082	07/19/16	07/19/16	Water - Sampled: 07/18/16 10:45 Microcystin by ELISA
Microcystin		ND	U	0.15	ug/L	B16G091	07/20/16	07/20/16	Water - Sampled: 07/18/16 10:20 Microcystin by ELISA
Microcystin		ND	U	0.15	ug/L	B16G091	07/20/16	07/20/16	Water - Sampled: 07/18/16 10:25 Microcystin by ELISA
Microcystin		ND	U	0.15	ug/L	B16G082	07/19/16	07/19/16	Water - Sampled: 07/18/16 13:25 Microcystin by ELISA
Microcystin		ND	U	0.15	ug/L	B16G091	07/20/16	07/20/16	Water - Sampled: 07/18/16 13:30 Microcystin by ELISA
Microcystin		ND	U	0.15	ug/L	B16G091	07/20/16	07/20/16	Water - Sampled: 07/18/16 13:00 Microcystin by ELISA
Microcystin		ND	U	0.15	ug/L	B16G091	07/20/16	07/20/16	Water - Sampled: 07/18/16 09:16 Microcystin by ELISA

@greenwaterlab.com
@greenwaterlab.com



Bay Regional Park District PERFORMAN RESULTS

Final Dilution Factor	Avg. LFM Recovery	Avg. LPM Recovery	Final Concentration (ug/L)	Average (ug/L)
1	82%	—	<0.10 <0.10	ND
2	82%	99%	<0.10 <0.10	ND
4	92%	—	<0.10 <0.10	ND

Submitted to:
Hal Madras
East Bay Regional Park District
2650 Redita Oaks CT
Oakland CA 94608
(510) 544-2328
HMACLEAN@ESPARKS.ORG



Typical EBRPD Response

- Notification/Posting

Table 1. CyanoHAB Trigger Levels for Human Health

DRAFT

	Caution Action Trigger	Warning TIER I	Danger TIER II
Primary Triggers^a			
Total Microcystins^b	0.8 µg/L	6 µg/L	20 µg/L
Anatoxin-a	Detection ^c	20 µg/L	90 µg/L
Cylindrospermopsin	1 µg/L	4 µg/L	17 µg/L
Secondary Triggers			
Cell Density (Toxin producers)	4,000 cells/mL	--	--
Site Specific Indicators of Cyanobacteria	Blooms, scums, mats, etc.	--	--

a. The primary triggers are met when ANY toxin exceeds criteria

b. Microcystins refers to the sum of all measured microcystin variants. (See Box 3)

c. Must use an analytical method that detects ≤ 1 µg/L Anatoxin-a

CAUTION

WA

Toxins from
harmful



DO NOT
green scum.

Fish caught here, throw away guts and clean fillet with tap water or bottled water before eating.



For fish caught here, throw away guts and clean fillet with tap water or bottled water before eating.

esent

cup of toxin
are safe,
your fam

cum

water or

g.

eat

Typical EBRPD Response

- Web Home Page

The screenshot shows the website's header with navigation links for Home, Print, Subscribe, and Share, along with a search bar and a 'I WANT TO' dropdown menu. The main banner features a group of people holding corn cobs and the East Bay Regional Park District logo. Below the banner is a 'Healthy Parks Healthy People' section with a list of notices. On the left, a 'SEE AND DO!' sidebar lists various park activities, with red arrows pointing to 'Employment' and 'Park Planning'. On the right, there are sections for 'Features' (Regional Park Finder), 'News' (Register Now! Activities Events Programs, Sunol 2016 Hootenanny), and 'Calendar' (Trails Challenge 2016, Fire Safety).

SEE AND DO!

- Parks / Trails
- Activities
- Reservations / Registration
- About Us
- Employment
- Kids
- I Want To...
- Volunteer / Get Involved
- Park Planning

Healthy Parks Healthy People

Notices

- > General Manager Responds to Questions about Vargas Plateau
- > East Bay Park District Board Approves Parking Project for Mission Peak
- > Newt Migration Closes So. Park Drive, Tilden: Nov 1
- > Quarry Lakes, Temescal, Lake Anza CLOSED to Swimming
- > Coyote Hills: Limited Running Water
- > Nike Base Road and Parking Closure
- > Reservations Department Phones Closures
- > Chabot Gun Club CLOSED: Sept. 5, 2016
- > Toxic Blue-Green Algae: Lake Closure Updates

Features

- REGIONAL Park FINDER

News

- Register Now! Activities Events Programs
- Sunol 2016 Hootenanny: Sat, Nov 5, Sunol

Calendar

- Trails Challenge 2016: A Free Program
- Fire Safety

Typical EBRPD Response

- Web Toxic Algae Updates page

SEE AND DO!


- Parks / Trails
- Activities
- Reservations / Registration
- About Us
- Employment
- Kids
- I Want To...
- Volunteer / Get Involved
- Park Planning
- Stewardship / Resources
- News
- Public Meetings / Notices

Select Language ▼

> [East Bay Regional Park District](#) | [Embrace Life!](#) > [Features](#) > Toxic Algae Update


Toxic Algae Update

Due to the drought and unusually warm weather conditions, toxic blooms of blue-green algae and other water-quality issues are occurring more frequently in the East Bay Regional Park District and elsewhere. We monitor our lakes and shorelines regularly, and post warnings and closures when appropriate. Here's a current update of which lakes and shorelines are affected:



- > Temescal beach at [Lake Temescal](#) is **CLOSED** to swimming and water contact due to toxins related to the blue green algae. Fishing is not currently affected and fishing access will remain open. Please keep your dogs out of the water for their safety.
- > [Quarry Lakes](#) is **CLOSED** to swimming and water contact due to toxins related to the blue green algae. Fishing is not currently affected and fishing access will remain open. Please keep your dogs out of the water for their safety.
- > [Lake Anza](#) contains toxic blue-green algae and is **CLOSED** to swimming. Avoid any contact with the water and keep dogs away from the water.
- > [Big Break Regional Shoreline](#) contains toxic blue-green algae. Avoid contact with the water and keep dogs away from the water.
- > Swimming is allowed, but keep dogs away from the water.
- > [Lake Del Valle](#) contains blue-green algae but toxin levels are very low. Swimming is allowed, but keep dogs away from the water.
- > [Lake Chabot](#) contains toxic blue-green algae and swimming is never permitted. Avoid any contact with the water and keep dogs away from the lake.
- > [Shinn Pond](#) contains toxic blue-green algae. Avoid contact with the water and keep dogs away from the water.

The Park District encourages visitors who wish to enjoy water activities to visit these other:



Typical EBRPD Response

- Web Parks Closures and Notices page

> [East Bay Regional Park District | Embrace Life!](#) > [Park Closures and Notices](#)

Park Closures and Notices

Fire Warnings and Weather Related Information

> [Fire Warning Information and Weather Related Information](#)

Park & Trail Closure Information - Listed by Facility

- > Antioch/Oakley Regional Shoreline
- > Alameda Creek Regional Trail
- > Alamo Canal Trail
- > Anthony Chabot Regional Park
- > Big Break Regional Shoreline
- > Briones to Mt. Diablo Regional Trail
- > Briones Regional Park
- > Black Diamond Mines Regional Park
- > Carquinez Strait Regional Shoreline
- > Castle Rock Regional Recreation Area
- > Contra Costa Canal Trail
- > Claremont Canyon Regional Preserve
- > Contra Loma Regional Park
- > Coyote Hills Regional Park
- > Las Trampas Regional Wilderness
- > Marsh Creek Regional Trail
- > Martin Luther King Jr. Regional Shoreline Park
- > Martinez Regional Shoreline
- > Miller/Knox Regional Shoreline
- > Mission Peak Regional Preserve
- > Morgan Territory Regional Preserve
- > Old Moraga Ranch Trail
- > Oyster Bay Regional Shoreline
- > Pleasanton Ridge Regional Park
- > Point Isabel Regional Shoreline
- > Point Pinole Regional Shoreline
- > Quarry Lakes Regional Recreation Area
- > Redwood Regional Park

Select Language | ▼



Typical EBRPD Response

- Web Parks Pages


The screenshot displays the website for Quarry Lakes Regional Recreation Area. On the left is a navigation menu with categories like 'SEE AND DO!', 'Parks / Trails', and 'Activities'. The main content area features a breadcrumb trail, a title, a notice about watercraft inspections, a list of links, a photo of a pier, and a 'Notice' section. On the right, a sidebar provides 'Park Info' including address, entrances, phone numbers, and local weather.

> [East Bay Regional Park District](#) | [Embrace Life!](#) > [Parks](#) > [Quarry Lakes Regional Recreation Area](#)

Quarry Lakes Regional Recreation Area

Watercraft Owners - Please Help Keep Invasive Mussels Out of Our Water.
> [Read more about mandatory watercraft inspections and the Invasive Mussel...](#)

- > [About The Park](#)
- > [History](#)
- > [Park Features](#)
- > [Park Activities](#)
- > [Park Accessibility](#)
- > [To Reach The Park](#)
- > [Trail Map](#)
- > [Interpretative Panels](#)



Notice

Quarry Lakes is now closed to swimming and water contact due to toxins related to the blue green algae. Fishing is not currently effected and fishing access will remain open. Please keep your dogs out of the water for their safety.

ACWD work along the Alameda Creek Flood Control Channel will have temporary impacts on recreation along the Alameda Creek Trail and at Quarry Lakes Regional Recreation Area. For

Select a Park or Trail...


Park Info

Address
[2100 Isherwood Way](#)
Fremont, CA 94536

Park Entrances
> [Quarry Lakes Main Entrance](#)
> [Niles Beach](#)
> [Boat Launch](#)
> [ADA Fishing Pier](#)

Phone Numbers
Toll Free: 888-EBPARKS (888-327-2757), option 3, extension 4552

Local Weather



Weather Forecast

Typical EBRPD Response

- Swim Beach Water Quality pages

NOTICE

Blue Green Algae is Present in Horseshoe Lake

During summer and fall, the presence of blue green algae in lakes can result in a buildup of toxins. While near-water activities such as picnicking, biking, and hiking are safe, take the following precautions to help protect yourself, your family (including pets), and your friends:

- **No bodily contact with the water. Supervise children and pets at all times—they are particularly vulnerable.**
- **Skin in contact with blue green algae should be rinsed with tap water.**
- **Fish may be consumed after removing guts and liver, and rinsing fillets in tap water.**
- **Keep pets, especially dogs, out of the water.**

East Bay Regional Park District at Health online

Del Valle Water Quality Status

Red Light: Beach is Closed. No Swimming, wading or water contact. There is a Water Quality Hazard.

Yellow Light: Beach is Open. There is an increased health risk for swimming and wading. Bacteria results do NOT meet State Health Standards.

Green Light: Beach is Open. Low health risk for water contact. Bacteria results are within State Health Limits.

Be advised, there is always some risk with beach water contact. Beach water contact may cause illness. Do not swallow water. Shower and towel dry after water contact. Water quality conditions can change at any time.

Tenga en cuenta, siempre hay cierto riesgo al entrar en contacto con el agua de la playa. El contacto con el agua de la playa puede provocar enfermedades. No trague el agua. Séquese y séquese con una toalla después de haber estado en contacto con el agua. La calidad del agua puede cambiar en cualquier momento.

Current Site Conditions*

EAST BEACH Low Risk - Green Light		NORTH	SOUTH
Sample Date		E. coli	E. coli
October 18 th		83	74
October 12 th		10	20
October 4 th		10	63
September 27 th		<10	10
September 20 th		<10	21
30-Day Geometric Mean		27	25

WEST BEACH Low Risk - Green Light		NORTH	SOUTH
Sample Date		E. coli	E. coli
October 18 th		83	E. coli
October 12 th		10	21
October 4 th		10	10
September 27 th		<10	<10
September 20 th		10	<10
30-Day Geometric Mean		17	10

State Water Quality Bacteria Levels:
Daily Maximum Level for E. coli: 235
30 Day Geometric Mean Maximum for E. coli: 120

All results expressed as bacterial density (Colony Forming Units or Most Probable Number) per 100 mL.

FOR FURTHER INFORMATION CONTACT THE EAST BAY REGIONAL PARK DISTRICT
WATER MANAGEMENT DEPARTMENT AT: (510) 544-2224

* To ensure you are viewing the most current version of the Water Quality Conditions Test Results PDF file please note the following procedure:
Once the PDF is open in your browser, perform one of the key combinations listed below (based on your operating system). This will force your browser to reload the most current version of the PDF file. If the PDF opens outside of the browser in a separate Adobe Acrobat application window, this operation will not be necessary.

Windows: **Ctrl + F5** | Mac/Linux: **Apple + R** or **Command + R** | Linux: **F5**

CAUTION

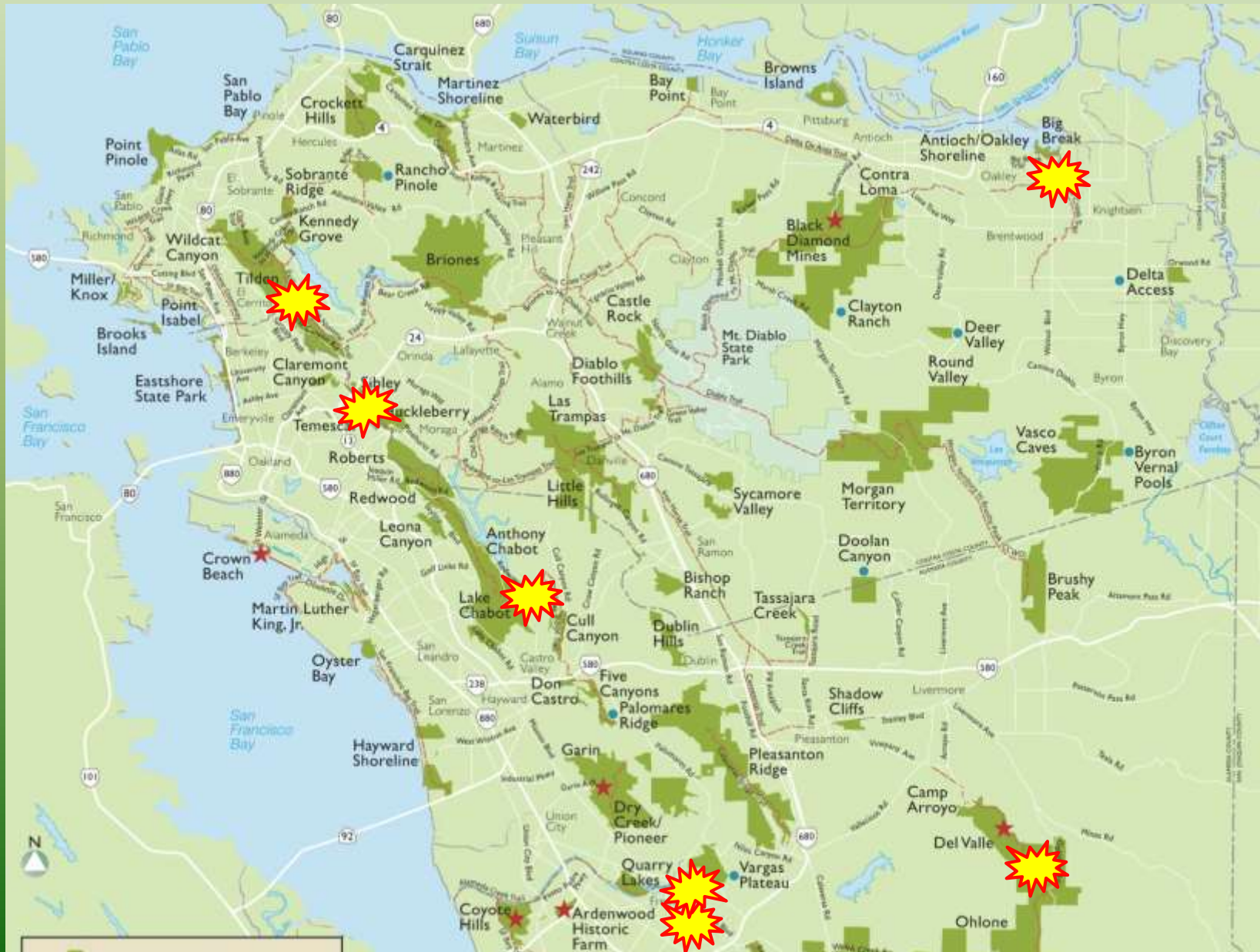
During summer and fall, the presence of blue green algae in lakes can result in a buildup of toxins. While near-water activities such as picnicking, biking, and hiking are safe, take the following precautions in the water to help protect yourself, your family (including pets), and your friends:

For your safety:

- DO NOT SWIM OR WADE near algae or scum
- KEEP CHILDREN AWAY from algae in the water or on the shore.
- DO NOT use this water for drinking or cooking



Specific Lake Monitoring



Lake Temescal Monitoring



DECONTAMINATION!

- Between Bodies of Water



Lake Anza Monitoring



DECONTAMINATION!

- Between Bodies of Water



Shadow Cliffs Monitoring

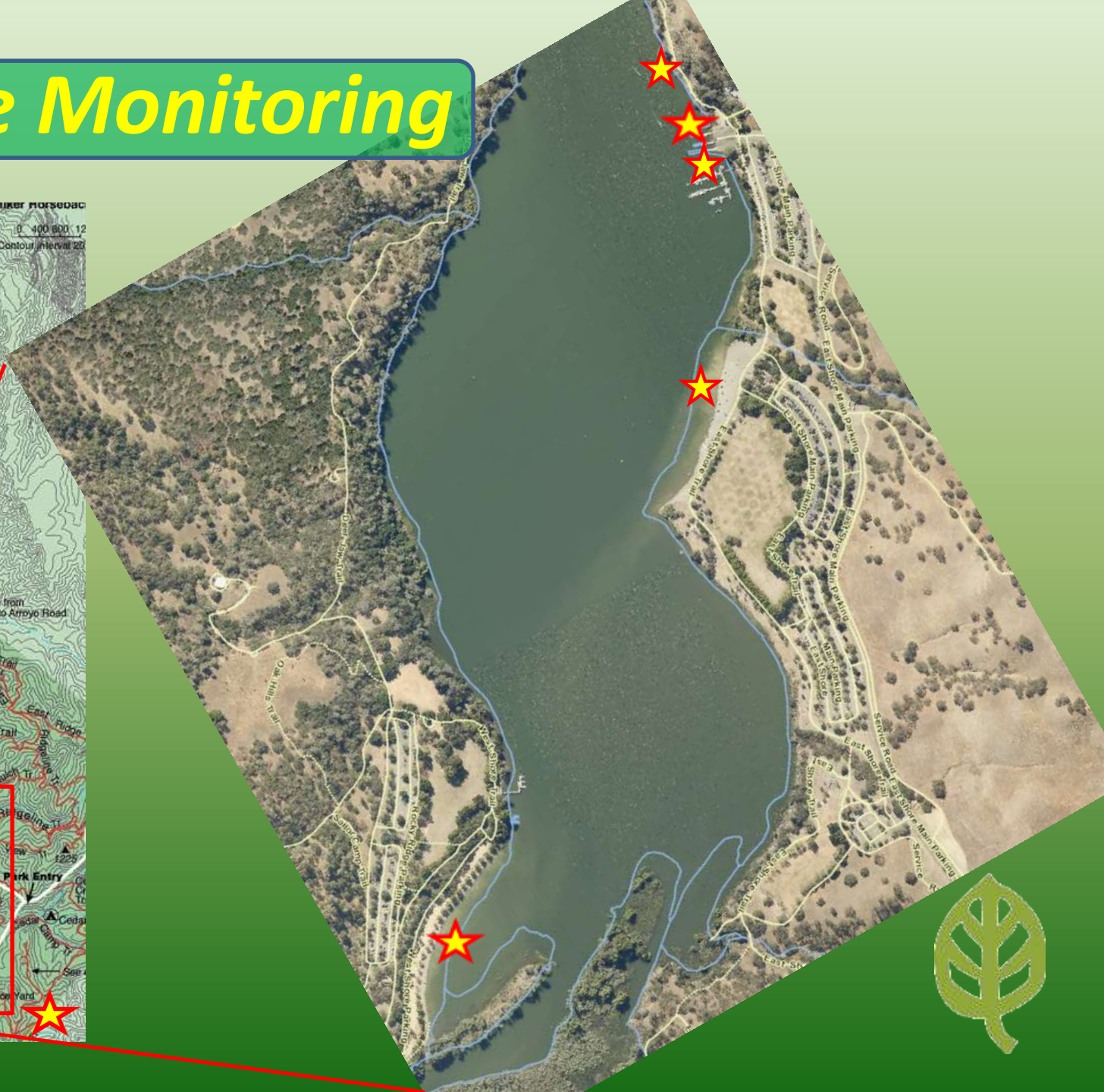


DECONTAMINATION!

- Between Bodies of Water



Del Valle Monitoring



Aerial Monitoring!



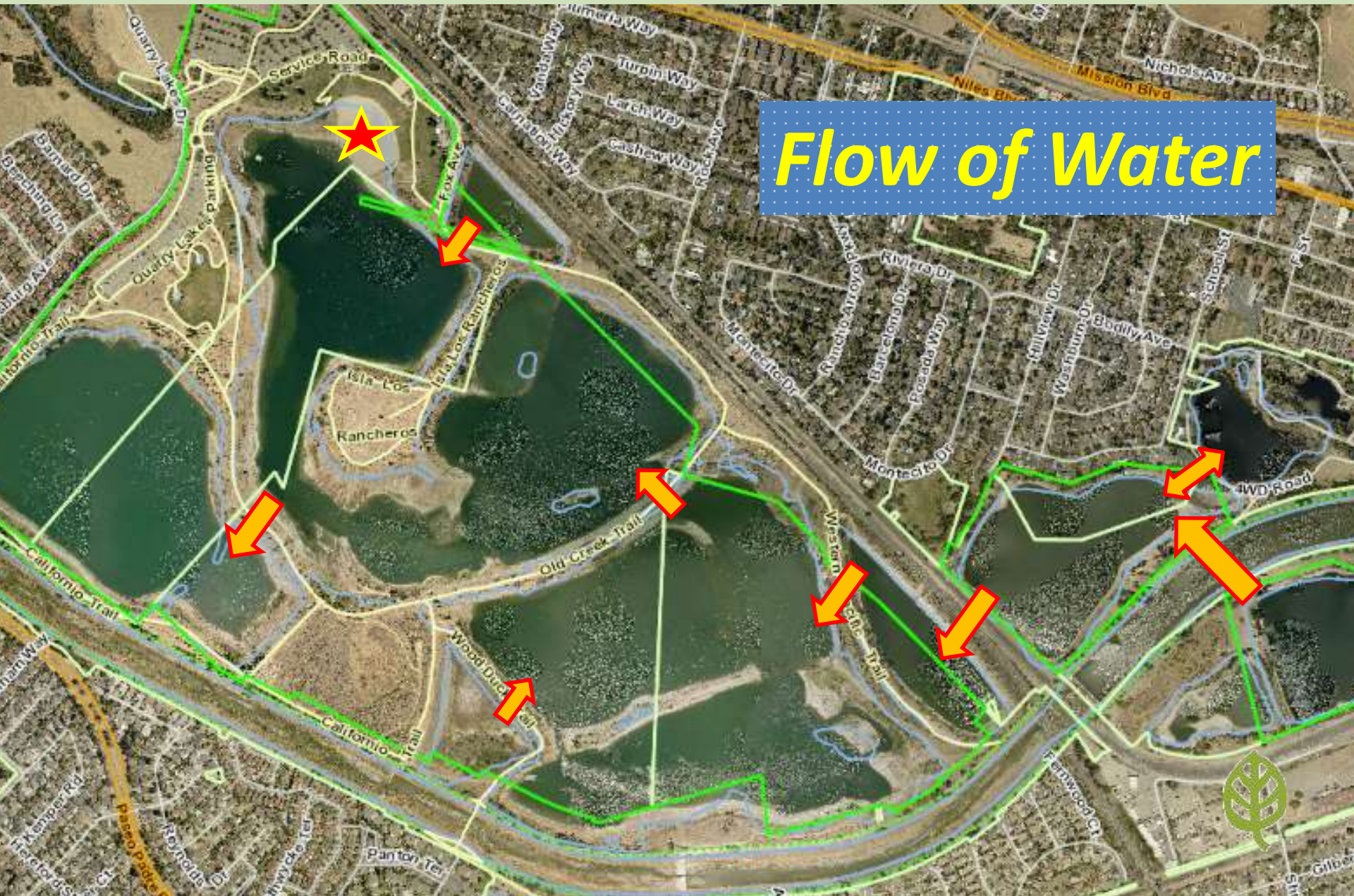
DECONTAMINATION!

- Between Bodies of Water



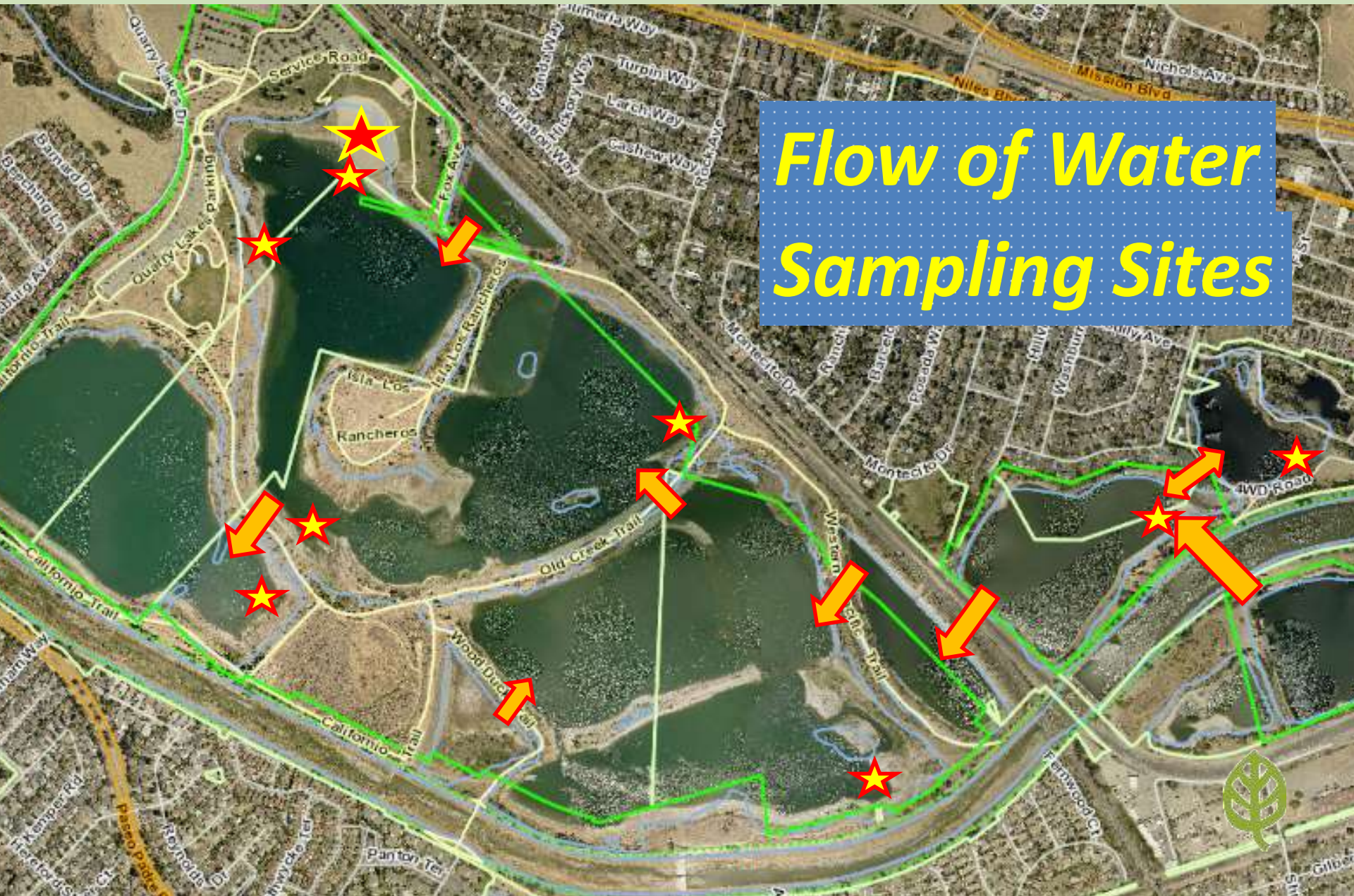
Quarry Lakes Monitoring Challenge

Flow of Water



Quarry Lakes Monitoring Challenge

*Flow of Water
Sampling Sites*



Aerial Monitoring!



DECONTAMINATION!

- Between Bodies of Water



Lake Chabot Monitoring



DECONTAMINATION!

- Between Bodies of Water



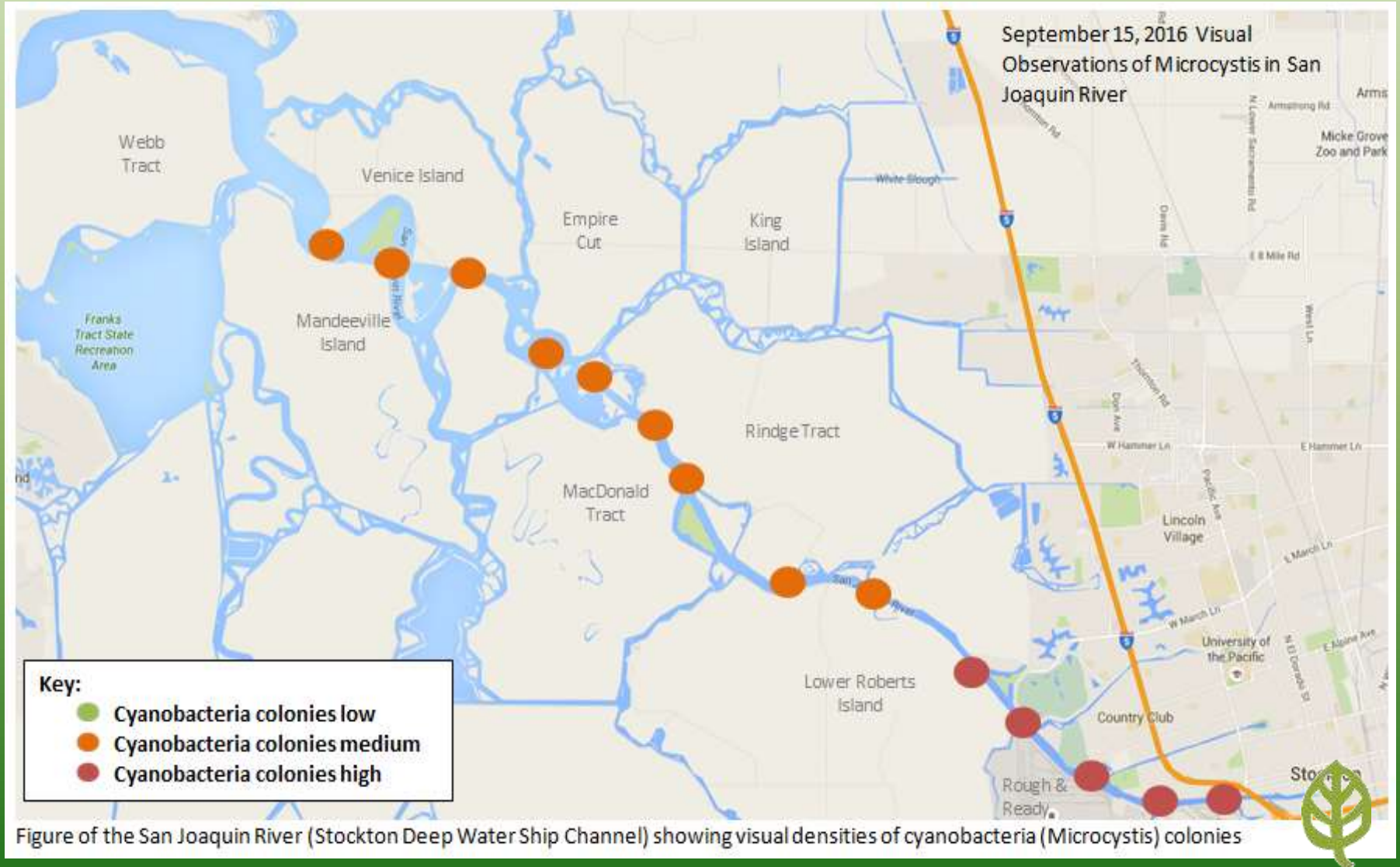
Big Break Monitoring



BIG BREAK



Big Break Monitoring



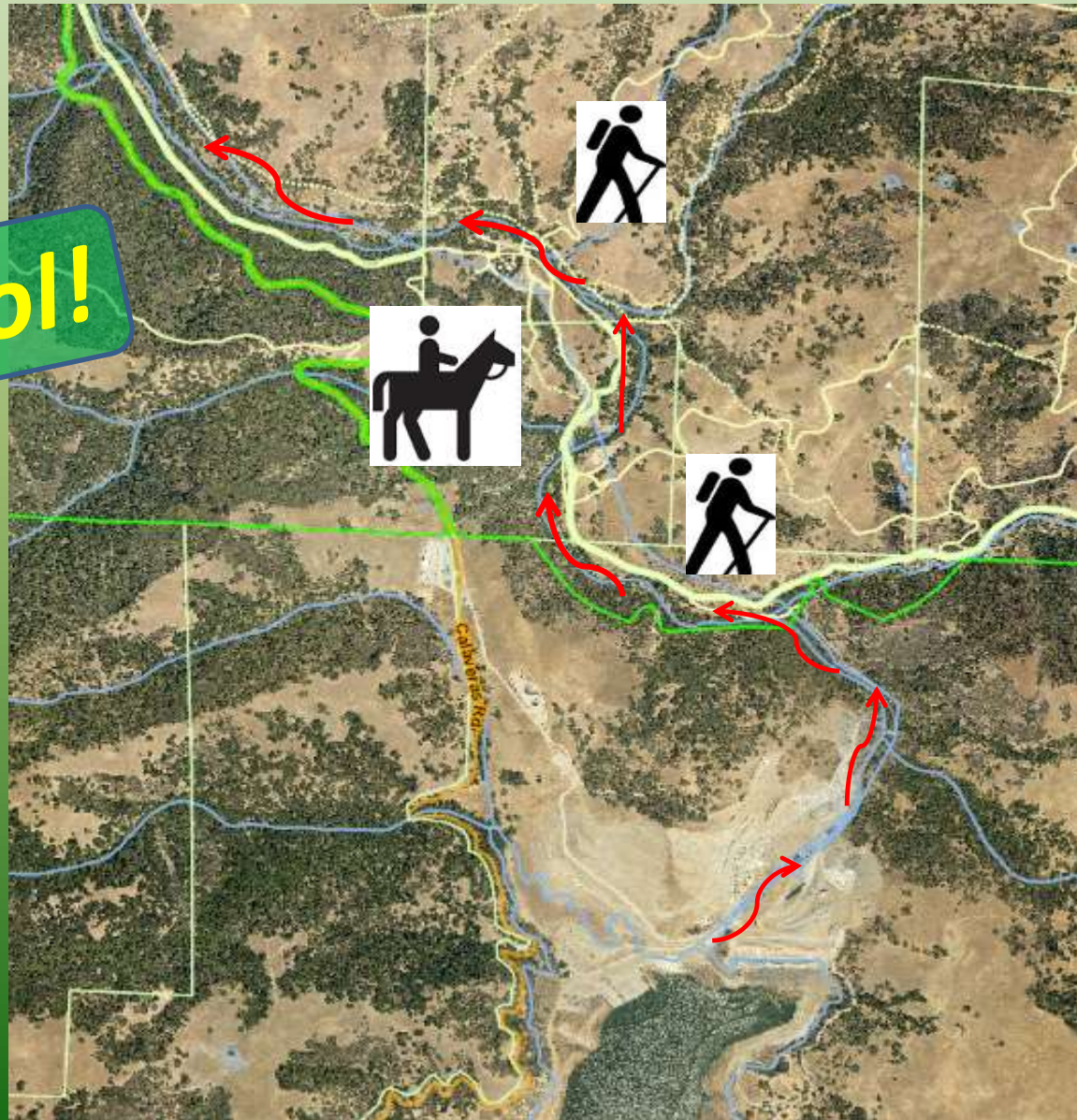
DECONTAMINATION!

- Between Bodies of Water



Alameda Creek Monitoring

Sunol!



Alameda Creek Monitoring



Calaveras Reservoir August 29, 2016



Summary: The HOS is on with the rate increased to 50 cfm per line on August 17, 2016. Dissolved oxygen concentrations are above saturation in the relatively warm epilimnion and have slightly increased at the thermocline, but remain less than 2 mg/L near the bottom. The total plankton concentration has increased by 191% (from 5,791,000 to 16,877,000 NU/m³) since the previous August 16, 2016 survey, exceeding both Level I (weekly monitoring) and Level II (treatment) action triggers. The phytoplankton community is dominated by the blue-green alga *Lyngbya* (50% of the total) with high numbers of the diatom *Fragilaria* and the blue-green alga *Anabaena* (30% and 12% of the total, respectively). pH is elevated in the upper 15 feet of the water column. Turbidity is elevated at the surface and likely due to floating algae. The next survey will be conducted during the week of September 5th.

Gauge Height (ft): 701.8

Secchi (ft): 3.8

Conditions: clear and calm

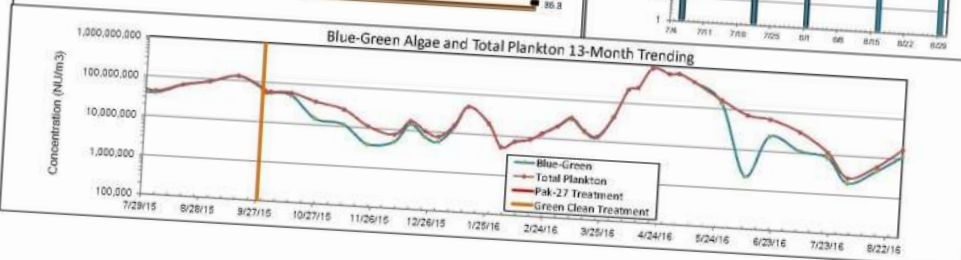
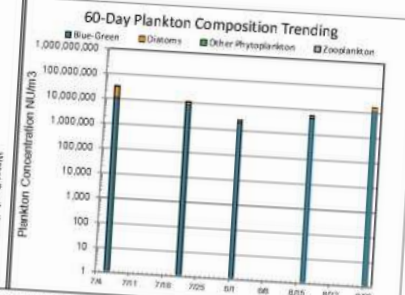
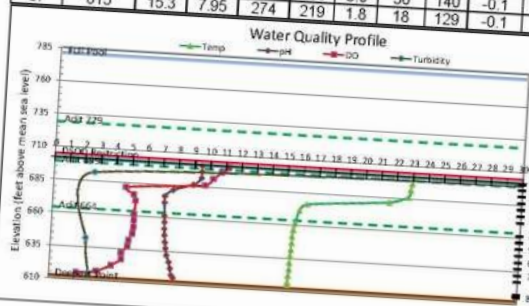
Biologist(s): A. Irons (assisted by K. Ritchie)

Sonde: EXO2

Starlims Folder#:

Depth feet	Elevation ft AMSL	Temp °C	pH pH units	Cond us/cm	TDS mg/L	DO mg/L	DO % sat	ORP mV	Chl-a Ref. Units	Phyco. Ref. Units	Turbidity NTU
1	701	23.1	9.46	285	192	11.2	131	121	0.8	0.3	52.4
5	697	23.0	9.44	285	193	10.7	125	122	0.9	0.1	
10	692	22.9	9.44	285	193	10.2	119	121	0.9	0.1	
15	687	22.7	8.95	286	194	9.7	113	116	0.8	-0.3	2.6
20	682	21.5	7.69	295	205	4.7	53	127	0.0	-0.5	
25	677	16.3	7.17	269	210	5.2	53	159	0.0	-0.5	
30	672	15.8	7.16	265	209	5.3	54	159	0.0	-0.5	
40	662	15.6	7.20	262	208	5.2	53	157	0.0	-0.5	
45	657	15.5	7.23	261	208	5.3	53	158	-0.1	-0.5	
50	652	15.4	7.25	261	208	5.3	53	157	0.0	-0.5	
55	647	15.4	7.28	261	207	5.2	52	156	-0.1	-0.5	
60	642	15.4	7.32	260	207	5.0	50	155	0.0	-0.5	
65	637	15.4	7.39	260	207	4.9	49	155	-0.1	-0.5	2.3
70	632	15.4	7.47	260	207	4.6	46	152	0.0	-0.5	
75	627	15.4	7.63	260	207	4.6	46	149	0.0	-0.5	
80	622	15.3	7.75	260	207	4.0	40	145	-0.1	-0.5	
85	617	15.3	7.83	258	206	3.0	30	140	-0.1	-0.5	
87	615	15.3	7.95	274	219	1.8	18	129	-0.1	-0.5	2.5

Phytoplankton	Natural Unit/m ³
<i>Lyngbya</i>	8,400,000
<i>Fragilaria</i>	5,000,000
<i>Anabaena</i>	2,000,000
<i>Aphanizomenon</i>	650,000
<i>Ceratium</i>	350,000
<i>Staurostrum</i>	260,000
<i>Microcystis</i>	130,000
Phytoplankton Total	16,790,000
Zooplankton Total	87,000
Plankton Grand Total	16,877,000

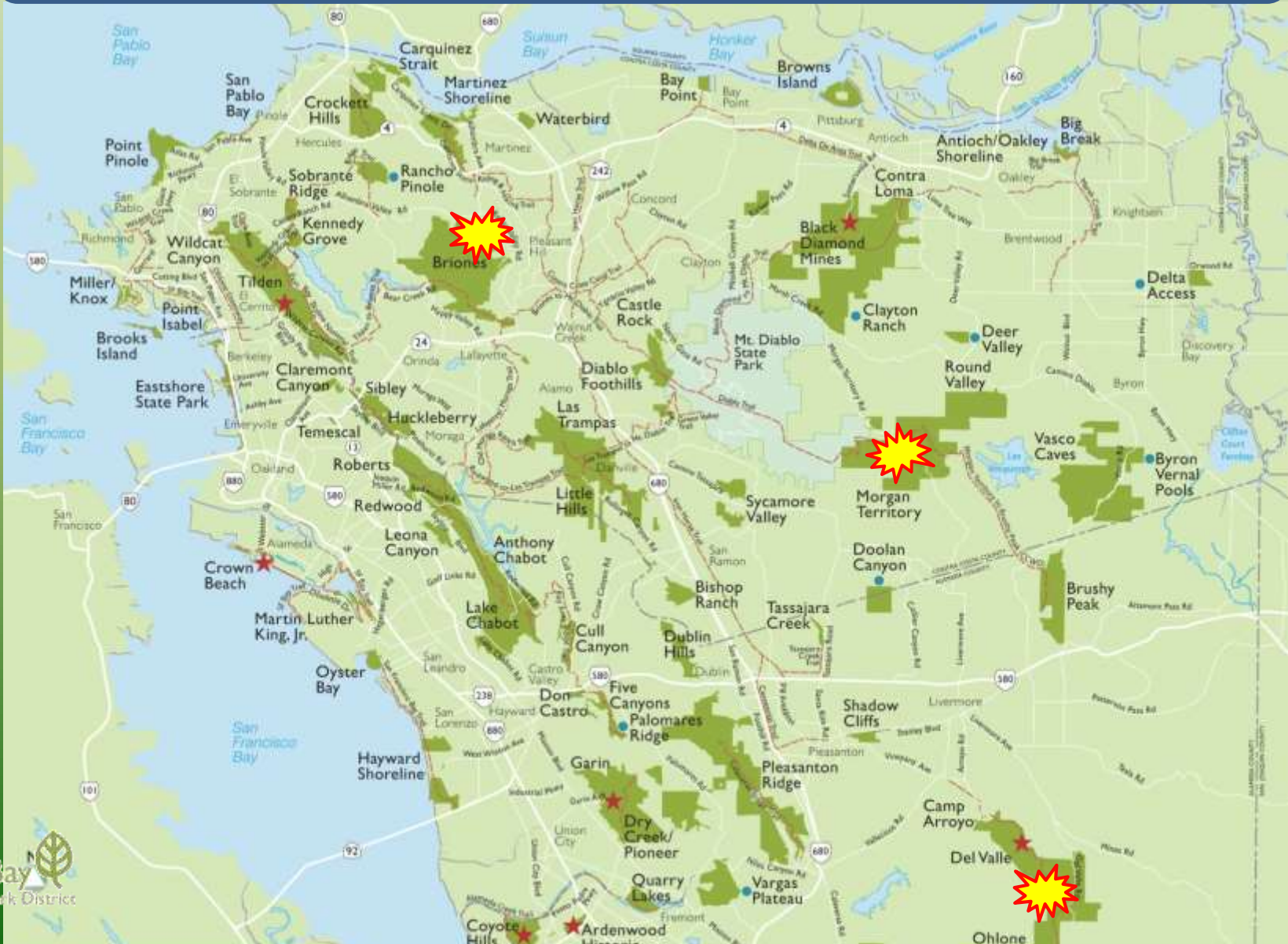


DECONTAMINATION!

- Between Bodies of Water



Cattle Ponds and Water Troughs



Solutions

- Dredging is the best long term option
- Wetlands
- Aeration
- Short Term Solutions
 - Alum/Phoslock
 - Pak 27



Progress

- Dredging Sedimentation Ponds at Temescal
- Consultant
 - Wayne Carmichael
- Pak 27 Treatments
 - Temescal (2014-15)
 - Lake Chabot Marina
- Removal
 - Temescal Inlet
 - Lake Chabot Marina
- Phosphorus Study
- Swim Beach Maintenance



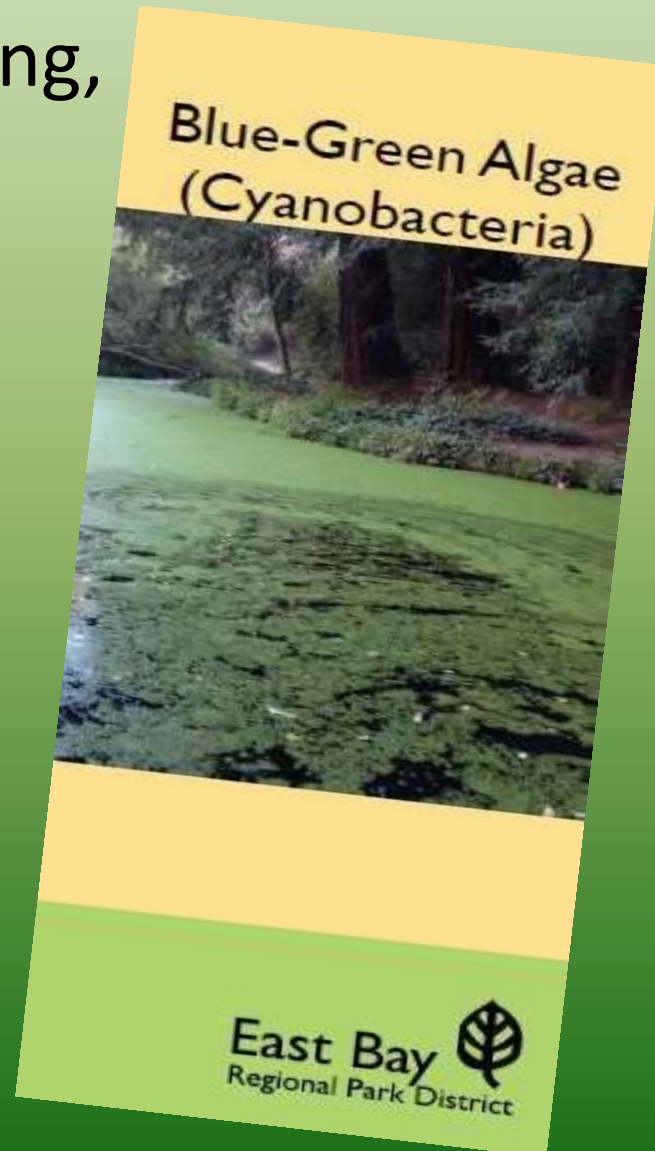
Future Plans

- Continued Commitment with CSUEB and Nutrient Source Study



Future Plans

- Continued Networking, Communication, Coordination and Outreach & HAB Brochure



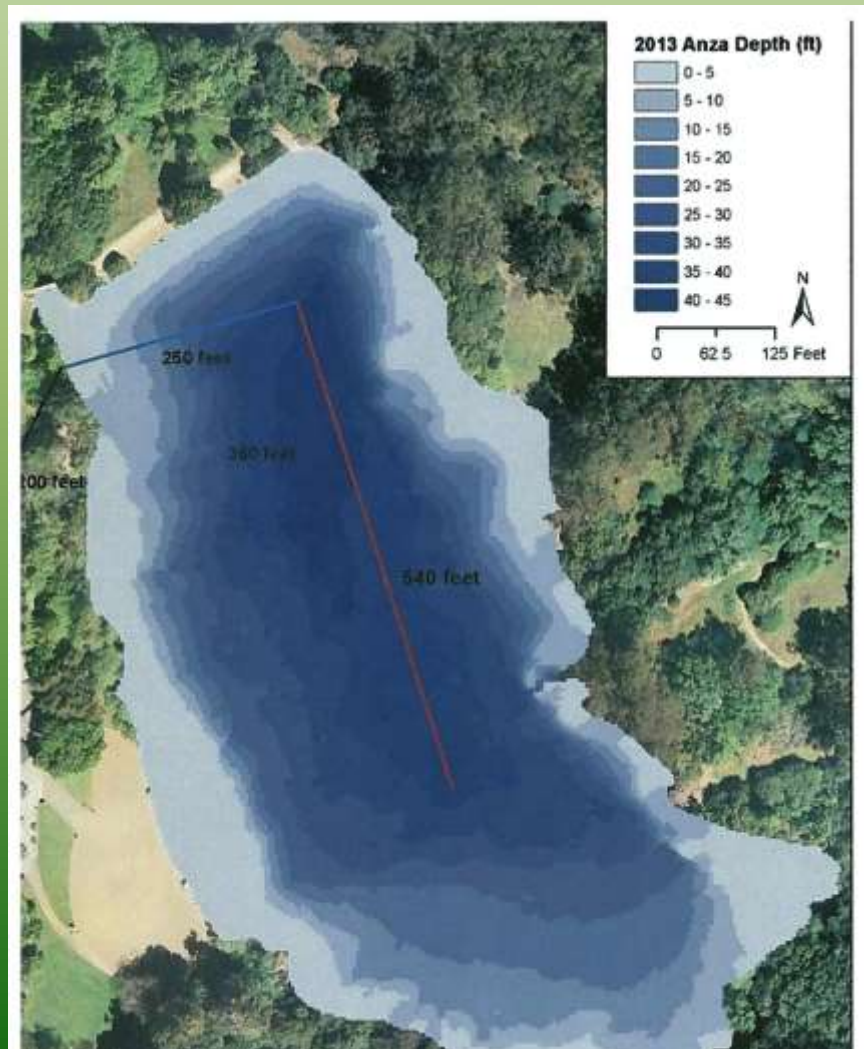
Future Plans

- Floating Island for Temescal



Future Plans

- Aeration System for System Lake Anza



Future Plans

- Continue to strategize solutions for larger lakes



Future Plans

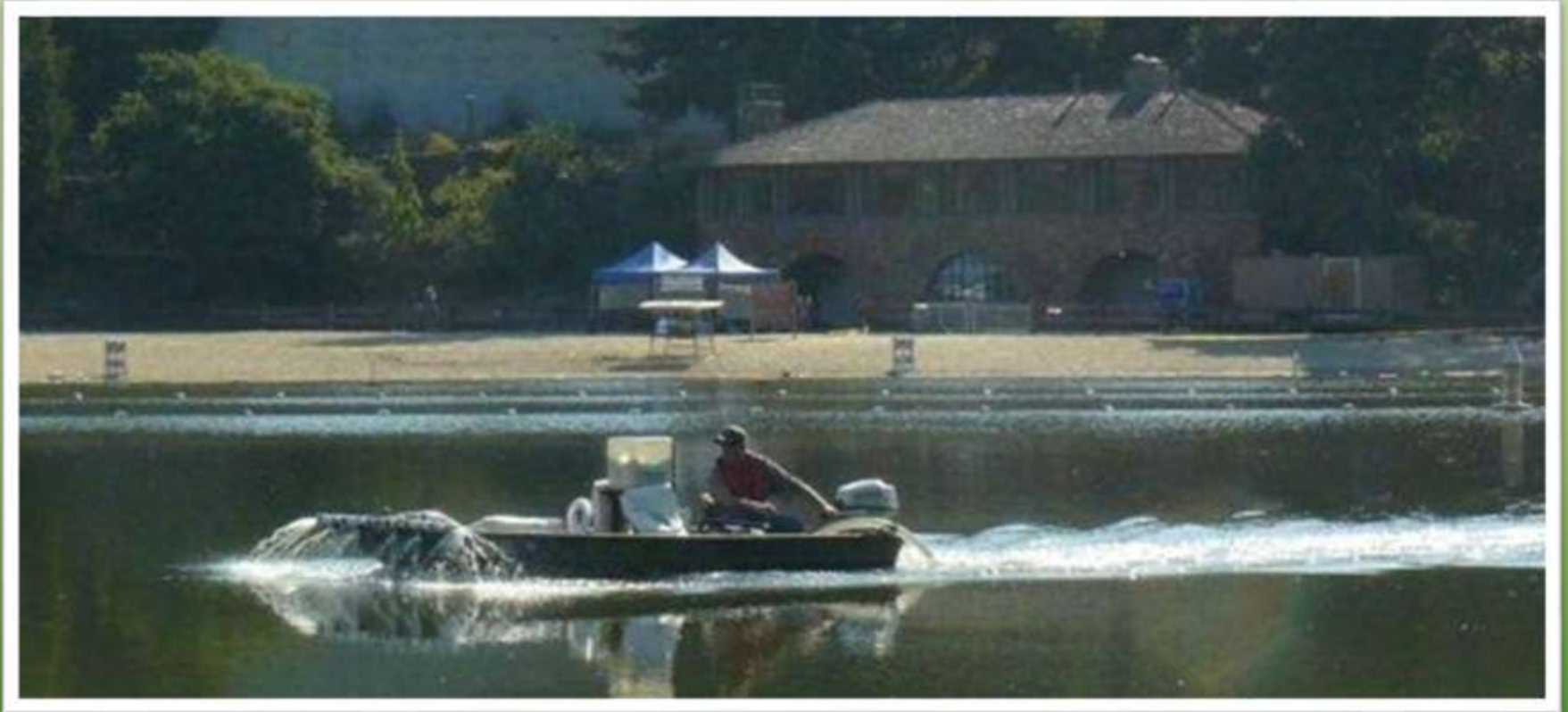
- Dredging smaller lakes?



Acknowledgement of Partners

- EBRPD Staff
- SF Bay Regional Water Quality Control Board
- US EPA Region 9 Laboratory and Staff
- Alameda Co. Dept. of Environmental Health
- UC Davis Veterinary Laboratory
- CA Department of Public Health
- CA Department of Public Health Lab
- CA State Water Resources Control Board

Questions?



Thank You