



**TWSA BOARD MEETING PACKET for 6/7/2023**

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**TWSA Board Meeting - Quarter 2**  
**Wed., June 7, 2023 1:00 PM - 4:00 PM (PST)**

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### **AGENDA**

- A. Introductions**
- B. Public Comment** Conducted in accordance with Nevada Revised Statute (NRS) Chapter 214.020 and limited to a maximum of 3 minutes in duration.
- C. Presentations: None scheduled**
- D. Approval of Agenda** for the June 7, 2023 TWSA Board Meeting
- E. Approval of Minutes** for the March 1, 2023 TWSA Board Meeting
- F. Reports**
  - a. **Staff Reports**
  - b. **Budget** - see enclosed information for current expense details.  
Open Gov. link for current budget and expenses: <https://bit.ly/3wxURUA>
  - c. **TWSA Chair Report**
- G. General Business** (verbal updates/discussion/for possible action):
  - a. TKPOA Control Methods Test
  - b. Tahoe Water for Fire Suppression Partnership
  - c. South Tahoe PUD Recycled Water Plan update
  - d. DRINK TAHOE TAP® refill grant program
  - e. Goals review
- H. Purveyor Updates**
- I. Public Comment**
- J. Adjournment**

**Lahontan / TRPA - TKPOA Control Methods Test**

Final project and environmental documents: <https://tahoekeysweeds.org>

**2023 TWSA Board Meetings**

First Wednesdays, quarterly, held from 1 to 4 pm; virtual until further notice.

**Meeting dates:**

**March 1, 2023 / June 7, 2023 / September 6, 2023 / December 6, 2023**

**TWSA Board of Directors**

Suzi Gibbons (Chair)	North Tahoe Public Utility District
Andrew Hickman	Round Hill General Improvement District
Richard Robilliard; Tom White (alt.)	Douglas County Systems
Patrick McKay; Mike McKee (alt.)	Edgewood Water Company
Cameron McKay	Glenbrook Water Cooperative
Brad Underwood	Incline Village General Improvement District
Mitch Dion (vice-chair); Brandon Garden (alt.)	Kingsbury General Improvement District
Nakia Foskett	Lakeside Park Association
Kim Boyd; Tony Laliotis (alt.)	Tahoe City Public Utility District
Shelly Thomsen	South Tahoe Public Utility District

For more information, please contact: Madonna Dunbar, TWSA Executive Director  
 1220 Sweetwater Road, Incline Village, Nevada 89451  
 (775) 832-1212 office / (775) 354-5086 cell /email: mod@ivgid.org

Certification of posting of agenda = Online posting and email delivery of notice provided one week ahead of meeting.  
 Public comment is allowed and the public is welcome to make their public comment either via e-mail (please send your comments to mod@ivgid.org by 5 p.m. on Tuesday, June 6, 2023 or via telephone (775-354-5086) on the day of the meeting.

By, Madonna Dunbar, Executive Director, TWSA

Notes: Items on the agenda may be taken out of order; combined with other items; removed from the agenda; moved to the agenda of another meeting; moved to or from the Consent Calendar section; or may be voted on in a block. Items with a specific time designation will not be heard prior to the stated time, but may be heard later. Members of the public who are disabled and require special accommodations or assistance at the meeting are requested to call IVGID at 832-1212 at least 24 hours prior to the meeting.

TWSA agenda packets are available at the TWSA website [www.TahoeH2O.org](http://www.TahoeH2O.org) or the TWSA office at 1220 Sweetwater Road, Incline Village, Nevada 89451.

**TWSA Board Meeting**  
**Wednesday, March 1, 2023 – 1:00 pm to 3:00 pm**  
**Results Agenda**

**A. Introductions**

Kate Senft, staff research associate, Tahoe Environmental Research Center.

**B. Public Comment**

No public comments were given.

**C. Presentations**

Kate Senft presented *“To Sink or Swim: A Snapshot Evaluation of the Fate and Types of Microplastics in Lake Tahoe.”*

**Roll Call of Members in Attendance**

Suzi Gibbons (NTPUD), Cameron McKay (Glenbrook, Edgewood), Mitch Dion (KGID), Andrew Hickman (RHGID, LPA), Kim Boyd (TCPUD), Tom White (Douglas County), Brad B. Underwood (IVGID), Shelly Thomsen (STPUD).

TWSA Staff in attendance: Madonna Dunbar and Sarah Vidra

Guests: Reggie Lang (NDEP), Kate Senft (TECR)

**D. Approval of Agenda** for the March 1, 2023, TWSA Board Meeting

Motion to approve the agenda as submitted, approved unanimously.

**E. Approval of Minutes** for the December 7, 2022, TWSA Board Meeting

Minutes from December 7, 2022, were approved unanimously as submitted.

**F. Reports**

a. Staff Reports

Verbal update provided.

b. Current Budget

\$175K in reserve and \$60K in operating for FY22-23.

c. TWSA Chair Report

Verbal update provided.

**G. General Business** (for possible action):

a. 2023-24 Proposed Budget

Motion to approve the 2023-2024 budget as presented made by Andrew Hickman, second by Mitch Dion, motion carried unanimously.

b. TKPOA Control Methods Test

Verbal update was provided, no action was taken.

c. Tahoe Water for Fire Suppression Partnership

Verbal update provided, no action was taken.

- d. TERC Microplastics sampling summary report  
Board discussion on the presentation and continued research support. No action taken
- e. DRINK TAHOE TAP® refill grant program  
Motion to amend the refill grant program effective April 1, 2023, to incentivize refill station installation by providing 50% reimbursement for equipment up to \$2,500. With a \$30K maximum for the 2023-2024 fiscal year. Motion made by Brad Underwood, Second by Cam McKay, motion carried unanimously.
- f. TRPA mooring/buoy field/pier notifications (Suzi)  
Verbal update provided
- g. Mutual Aid - lead operations contact list (Brad)  
Request for Mutual Aid contact list for TWSA members. No action was taken.
- h. Exterior fire suppression sprinkler systems (Brad)  
Board Discussion on technology and required permitting for system installation. No action was taken.

**H. Purveyor Updates**

Verbal updates are provided.

**I. Public Comment**

No public comments were given.

**J. Adjournment**

Meeting adjourned at 3:34 pm.

**TWSA Board Meeting**  
**Wednesday, March 1, 2023 – 1:00 pm to 3:00 pm**  
**Minutes**

**C. Introductions**

Kate Senft, staff research associate, Tahoe Environmental Research Center.

**D. Public Comment**

No public comments were given.

**K. Presentations**

Kate Senft presented "*To Sink or Swim: A Snapshot Evaluation of the Fate and Types of Microplastics in Lake Tahoe.*"

**Roll Call of Members in Attendance**

Suzi Gibbons (NTPUD), Cameron McKay (Glenbrook, Edgewood), Mitch Dion (KGID), Andrew Hickman (RHGID, LPA), Kim Boyd (TCPUD), Tom White (Douglas County), Brad B. Underwood (IVGID), Shelly Thomsen (STPUD).

TWSA Staff in attendance: Madonna Dunbar and Sarah Vidra

Guests: Reggie Lang (NDEP), Kate Senft (TECR)

**L. Approval of Agenda** for the March 1, 2023, TWSA Board Meeting

Motion to approve the agenda, made by Mitch Dion, second by Andrew Hickman, all in favor; motion carried.

**M. Approval of Minutes** for the December 7, 2022, TWSA Board Meeting

Motion to approve the minutes from December 7, 2022, made by Cameron McKay, second by Kim Boyd, all in favor; motion carried.

**N. Reports**

a. Staff Reports

Staff highlighted several activities from the quarter; a full activity report is available in the Board Packet.

- The 2022 TWSA Watershed Control Annual Report was submitted. NDEP's letter of completion and acceptance was received on March 20, 2023. The water quality data shows production of excellent water well within regulatory limits when the Lake Tahoe basin sustained impacts by severe weather, wildfire, and drought within the reporting year. The narrative continues to show our evolving participation throughout the region, from programs to policy implementation.
- TWSA staff are preparing for the spring outreach season. Events will include:
  - Earth Day, North and South Shore events
  - Wild and Scenic Film Festival, South Lake Tahoe.
  - TERC Science Expo, North, and South Shore events.
  - 23<sup>rd</sup> annual snapshot day citizen science watershed monitoring event.

- Snapshot Day 2023 will be held on Saturday, May 20, 2023. TWSA will be leading the North Lake Tahoe event. Members who would like tributaries in their District sampled are encouraged to participate. The North Lake Tahoe Event will be staged out of Tahoe Watemans Landing in Carnelian Bay, CA. This is the first year post covid that the event will have the outreach component and volunteer appreciation lunch.

b. Current Budget  
\$175K in reserve and \$60K in operating for FY22-23.

c. TWSA Chair Report  
No update was provided.

**O. General Business** (for possible action):

- a. 2023-24 Proposed Budget  
Changes to FY 23-24 budget from FY 22-23  
Increase labor by \$10K. The actual labor cost for two staff members for 40% of their FTEs is \$107K. The FY 23-24 budget has \$100K for labor. The Executive Director will move the remaining \$7K from the reserve to cover labor or water bottles, whichever is needed, by the end of the year.

The budget is lean due to the reserve budget to tap if actual costs exceed the proposed budget. Additionally, there is no building of the reserve budget built into the FY 23-24 budget.

There is a central service cost for IVGID administrative support including; IT, Payroll, and Fleet. The central service cost is \$900 a month.

The budget formula includes shared costs and dependent costs, including each member's water production. The FY 23-24 dues have increased for all members but not significantly. The associate membership of \$3k for STPUD was deducted from the shared cost.

**Board Questions and Discussion:**

In the operating budget, under the water fill station rebate program, what does the *existing budget rollover/reserve* mean?

The couple thousand in the rebate program would have come from the reserve budget if the total budget had gone to zero.

Where are items like funding the microplastic report? Do we have discretionary funding for these projects?

The ED will approach the board with requests to fund from the reserve for projects like the microplastic report.

Does it make sense to have approved items in the budget?

It would be a separate transfer rather than presenting in operating. It would be a project-specific allocation from the reserve.

Is the reserve budget have its own tracking, where the reductions are tracked with the year and amount?

There will be documentation with an allocation and actual cost.

The FY 24-25 budget should include the entire labor cost. Funding the \$7K difference from the reserve is fine for FY 23-24, but continued use for fixed labor costs will eventually zero out the reserve funds.

**Motion:**

Motion to approve the 2023-2024 budget as presented made by Andrew Hickman, second by Mitch Dion, motion carried unanimously.

b. TKPOA Control Methods Test

Staff discussed the preliminary results provided by the TKPOA on February 10, 2023. Highlights included the extended herbicide degradation time interfering with the UV-C combo sites, the additional cost associated with monitoring, and the plant biovolume results provided in the report. No action was taken.

- The herbicide application took longer than anticipated due to turbidity.
- Combination pieces were not conducted because the boat barrier couldn't be removed until the herbicide degraded to 5ppb for Endothall and 1ppb for Triclopyr. This would constitute a test failure because the proposed tests were not conducted due to the influence of the herbicide.
- All the monitoring was conducted, but the cost was higher than anticipated.
- Endothall, the contact herbicide, was effective on the Eurasian watermilfoil as expected. The consequence was increased Curlyleaf pondweed biomass in the Endothall treated sites.
- The Laminar Flow Aeration System was not operated throughout the CMT. The project team goes to great lengths to explain that the LFA system test runs in parallel but can not be looked at with the same plant knockback potential as the other Group A methods.

TWSA staff's primary critique on the CMT year 1 is: If you're going to test these things, you have to have quality control or an invalid test.

There was no board discussion, and no action was taken.

c. Tahoe Water for Fire Suppression Partnership

The partnership has ranked the projects using the FY 23-24 Lake Tahoe Restoration Act (LTRA) funds. The funding will come through region five of the US forest service, and the appropriation amount is up to \$10M. Currently, there is no set allocation to water projects from the funding source.

STPUD, NTPUD, and TCPUD will send delegates to Washington in March to meet with federal representatives to lobby for funding, proper allocation of appropriated funds, and the importance of the water-for-fire partnership in the Lake Tahoe Basin.

d. TERC Microplastics sampling summary report

Board discussion on the presentation and continued research support. No action taken  
The compelling action of the report is a refinement to answer questions. There are some assumptions about variants of the variables out there. It may be worth asking for a



proposal from the TERC research group on refining to watch the upcoming potential threat to drinking water.

The Nevada regulatory environment focuses on Lead & Copper, Microbial and Disinfection Byproducts Rules, Lithium, and Unregulated Contaminate Monitoring Rule 5 contaminants. Microplastics are not an issue on the horizon.

TWSA Board Member Discussion Highlights:

- Microplastics are part of the PFA and UCMR 5 sampling to be conducted in 2023-2024 by some TWSA member agencies.
- This is a catch-22 situation. It's good information because it's a question we've been asking for years. We didn't know if there were microplastics, is it in the drinking water. Is there a concern for filtration exemption?
- The organization should continue to get data. Exemption loss is more likely to be from a lack of data on what is present in the source water. We have this data from two sample points, but do we understand what's happening in the full system?
- Wait to see what happens as the regulatory environment matures. Don't lose sight of the group was proactive, asked a good questions, and hired the local scientist to get the answers. Now we need to dive into what it really means to us.
- There's enough data to suggest that microplastics are pretty prevalent.
- The group should continue to look into the impacts on drinking water.
- What additional data are the TERC scientists looking for? The water providers understand the impacts to drinking water.
  
- Getting ahead of the issue is more important than waiting for the State(s) to tell us what to do.
- What is the outreach piece? Yes, there are microplastics. The data from our study shows one microplastic particle in 23 liters of water. That equals one microplastic particle every seven days. Plastic packaged water show thousands of particles per bottle, add the citation.
- This study supports the pollution prevention projects that the TWSA champions, like removing litter and saying no to single-use plastics. As well as the primary message of Dirnk Tahoe Tap®.
- Don't yell fire at Earth Day. Wait for the question to be asked. The summary table shows 3x the plastic particles in Lake Tahoe than in the other Lake studies in the literature review. The chart should be downplayed. Don't yell fire without seeing smoke.
- The Executive Director will have talking points ready for Earth Day.
- Lake Tahoe doesn't have wastewater input. The microplastic particles in Lake Tahoe are more tourism related.
- Brainstorm results for increased concentration of microplastic particles in Lake Tahoe:
  - Additional Particle Sizes Counted
  - Vigor in Data Collection
  - Sampling Date, newer technology used for sampling.
  - Residence time
  - Comparisons are not straight across

e. DRINK TAHOE TAP® refill grant program

Motion to amend the refill grant program effective April 1, 2023, to incentivize refill station installation by providing 50% reimbursement for equipment up to \$2,500. With a \$30K maximum for the 2023-2024 fiscal year.

**Motion:**

Motion made by Brad Underwood, Second by Cam McKay, motion carried unanimously.

f. TRPA mooring/buoy field/pier notifications (Suzi)

TWSA staff monitors the TRPA Interagency Shoreline Coordination Group meeting. The project review meeting focuses on shoreline projects that include moorings and piers. TWSA staff monitor projects to ensure notification is within a quarter mile of surface water intakes. TWSA members are concerned that notifications are not being received at distances greater than the ¼ mile requirement, and by association, all water intake owners are not being notified of shoreline projects.

The TRPA provides notifications to County Agencies (Washoe, Carson, Douglas, El Dorado, and Placer). The County Agency then notifies smaller jurisdictions.

The chair posed the following question to the board. Does the process of County notification meet the requirements of the TRPA shoreline plan for water purveyor notification?

TWSA Board Member Discussion Highlights:

- NTPUD receives weekly Placer County notifications about projects that involve Building, Plumbing, and electrical.
- NTPUD does not receive Land use or Mooring permit notifications from Placer County.
- KGID is not a subsidiary agency of Douglas County, and the TRPA notification policy does not meet the requirements of purveyor notification without direct communication with the District.
- Douglas County only receives TRPA shoreline notifications for projects within the ZWUD and Cave Rock/Skyland service areas.
- Glenbrook does not receive shoreline notifications from Douglas County.
- Notifying purveyors of shoreline projects is outside of the TWSA mission. The TRPA is the only organization responsible for purveyor notification.
- A Permit Tracking Portal is available in Douglas County.
- The TWSA was an integral part of the notification requirement in the TRPA shoreline Plan.

**Conclusion:**

TWSA staff will discuss with TRPA Shoreline planners that the communication strategy for notifying any water intake owner is the responsibility of the TRPA. The burden of responsibility for notification is not on the Tahoe Water Supplier Association or the County in which the surface water intake resides.

- g. Mutual Aid - lead operations contact list (Brad)  
IVGID requested a contact list for Mutual Aid assistance. The contact person provided needs to be able to execute mutual aid, someone who will be responsive to a phone call. TWSA staff will circulate a contact list and the updated agreement.
- h. Exterior fire suppression sprinkler systems (Brad)  
Board Discussion on technology and required permitting for system installation. Highlights of the discussion are below.
- When these technologies were brought up in the past, the request was sent to the Waterboard in CA.
  - Water quality management issue in NV.
  - Should not be allowed in the watershed due to PFA's.
  - Cross connection control issue, Douglas County is against the idea.
  - The water Purveyor will be invoiced in the plumbing permit.
  - Concerns about water runoff into the system, DeMinimis discharge issue.

The chair posed the question: Is the TWSA interested in drafting a standard position letter about these technologies?

No action was taken.

**P. Purveyor Updates**

KGID – NV legislature has a PFAs workgroup, which recommends following the federal EPA recommendations. The legislature would like to put the regulation in front of the science and has provided SB 76 PFAS regulatory structure.

The waterline project in KGID is moving forward. The award for materials was finalized, and they were told no delays on supplies.

**Q. Public Comment**

No public comments were given.

**R. Adjournment**

Meeting adjourned at 3:34 pm.

## TWSA Staff Report Q 2 2023

### **New Projects:**

The City of South Lake Tahoe has enacted a single-use water bottle ban to phase in over 2023-24. TWSA staff are providing a support role on implementation.

<https://www.kolotv.com/2022/10/04/south-lake-tahoe-bans-single-use-plastic-water-bottles/>  
<https://www.tahodailytribune.com/news/south-lake-tahoe-bans-single-use-plastic-water-bottles/>

The Town of Truckee discussed a single use water bottle ban at their 5/23/2023 Truckee Town Council meeting. The Council directed ToT staff to return with draft ordinance language and to implement a “Drink Truckee Tap” education, outreach and refill station program. TWSA Staff provided comment supporting the expansion of refill options and offered resource support to town staff for the initiative.

Vail Corporation is requesting possible co-branding water bottles with Drink Tahoe Tap in 2023/24 winter season for Heavenly and Kirkwood. The resorts will be installing bottle fill stations. The TWSA ED met with Brand Geek (trademark attorney) to discuss next steps.

The TWSA board has expanded the current water bottle refill station incentive program to include larger individual grant amounts (up to \$2500 per unit) with a total funding allocation of \$30,000 approved at the 3/1/2023 TWSA Board meeting. Grant Program Information is posted at:

[https://www.yourtahoeplace.com/uploads/pdf-ivgid/Water\\_Bottle\\_Filling\\_Station\\_Updated\\_amounts\\_TWSA\\_TF\\_GRANT\\_Program\\_-\\_whole\\_packet\\_UPDATED\\_for\\_2023-24\\_\(with\\_bitly\\_shortcut\).pdf](https://www.yourtahoeplace.com/uploads/pdf-ivgid/Water_Bottle_Filling_Station_Updated_amounts_TWSA_TF_GRANT_Program_-_whole_packet_UPDATED_for_2023-24_(with_bitly_shortcut).pdf)

A Take Care funded billboard is featured along westbound Interstate 80 near Gold Ranch/Nevada for 6 months, summer 2023.



Expanded TWSA messaging on Drink Tahoe Tap and dog waste collection are being further developed in the Take Care partnership workgroup for use on the Take Care and TWSA outreach platforms.

#### IVGID Water Quality Monitoring Beach and Creek

Staff continues to take bi-monthly water quality monitoring samples at IVGID publicly accessible beaches and creeks. This sampling now contains a database of more than 20 years of site specific sampling records.



Staff responded to a reported oil spill at Ski Beach. The report came from a concerned citizen to NDEP about black sand on the beach that smelled like petroleum. Staff conducted field observations and collected samples. The sand was magnetic in nature, with no odor, and is commonly found in this location.

Village Green Sampling Project: Staff has an IVGID approved project to conduct additional water quality monitoring of Incline Creek and Third Creek. The study will include additional monitoring locations on the two creeks to be analyzed standard parameters and nutrients, similar to the Snapshot Day analysis.

#### Tahoe-Truckee Snapshot Day 2023

Staff hosted with regional partners - the 23<sup>rd</sup> annual Snapshot Day (the Tahoe to Pyramid Lake Citizen Science monitoring event on May 20, 2023 along with the League to Save Lake Tahoe and Truckee Watershed Council. This is one of the longest running citizen science events in the nation. The north shore portion of the event was held at Tahoe Waterman's Landing with 25 volunteers conducting grab sampling and record site conditions at 19 locations. This event requires a large amount of preparation: participant training, preparing sampling kits (calibration/testing/organization), assigning sampling locations to teams; coordination of sample deliveries, lab runs and final consolidation of results for the 2023 report.



The 2022 Tahoe Truckee Snapshot Day report is published to the event website: [www.tahoetruckeesnapshotday.org](http://www.tahoetruckeesnapshotday.org) and is included at the end of this packet.

#### Aquatic Invasive Species (AIS):

Staff continues to monitor the progress of the TKPOA Control Methods Test (CMT). Staff reviewed the TKPOA Year 1 test reports, attended the TKPOA working group meetings in April and May, and monitored the Control Methods Test Public Webinar on 5/18/2023. <https://tahoekeweeds.org/> Excerpts are included at end of this packet.

#### TWSA Watershed Control Program Annual Report

The 2022 TWSA Annual Report is posted at: [https://www.yourtahoepace.com/uploads/pdf-public-works/2022\\_TWSA\\_Annual\\_Report\\_without\\_maps\\_or\\_CCRs\\_\(smallest\).pdf](https://www.yourtahoepace.com/uploads/pdf-public-works/2022_TWSA_Annual_Report_without_maps_or_CCRs_(smallest).pdf)

#### Outreach:

Staff was very busy with 2023 Earth Month outreach events; offering the TWSA booth at:

- Sierra Nevada Alliance's Wild and Scenic Film Festival on April 1, 2023
- Staff tabling on Fridays at Diamond Peak
- Outreach and Tabling at Tahoe Truckee Earth Day & South Lake Tahoe Earth Day
- Tahoe Truckee Earth Day @ Palisades 3/15/23:  
500 refillable pouches, stickers, dog roll holders, and refill bags.  
Taste Test Results: 349 participants  
TCPUD – 87  
Bottled – 101  
Glenbrook – 161
- South Lake Tahoe Earth Day @ Lake Tahoe Community College 3/22/23:  
160 glass mini-bottles, stickers, dog roll holders, and refill bags.  
Taste Test Results: 306 participants  
Bottled – 62  
STPUD – 73  
IVGID – 171
- May 6, staff attended the Washoe Tribe Earth Day event with 100 refillable bottles distributed.

#### Lakewide Microplastics Research Partnerships:

The most comprehensive characterization of microplastics in the Lake Tahoe Basin to date is occurring. Two TWSA Nevada members are participating with raw water samples for microplastics analysis by TERC researchers. TWSA's sponsored Manta Trawl been used in lake wide sampling for more than two years now. The draft report is available upon request.

#### Raley's / Drink Tahoe Tap Collaboration

The TWSA has procured more Drink Tahoe Tap bottles from Raley's.

The Raley's stores produced, funded and stocked custom 11,000 bottles for this campaign.

Extensive details are provided in earlier Board reports.

In 2022, Raley's and Tahoe Fund collaborated with Pixlbank on a social media & photography crowd-source platform in 2022.

<https://www.ilovetahoe.org/drink-tahoe-tap>



#### Water Bottle Refill Stations:

Grants: The TWSA/Tahoe Fund Water Bottle Filling Station Grant Program Phase 1: completed with 18 grants issued (\$13000. ) New signage has been developed for the refill stations. <https://www.yourtahoeplace.com/news/twsa-water-bottle-refill-station-grant-program>

Find a Fill Station: fill station locations are presently logged on the TAP APP: <https://findtap.com>

Tahoe Citizen Science App: TERC'S 2022 Tahoe Citizen Science App is now active with a DRINK TAHOE TAP refill station feature: <https://citizensciencetahoe.org/home>

#### Mobile Water Stations:

12 units are in circulation; 2 new units were built spring 2023. Reservation requests are extremely robust for 2023. Below is current RSVP summary:

- Tahoe Truckee Earth Day
- South Lake Tahoe Earth Day
- Washoe Tribe Earth Day
- Winter WonderGrass
- Golden Road Gathering
- Teddy Bear Picnic
- Strawberry Music Festival
- BackCountry Music Festival
- Truckee Day
- Tahoe City C Wine and Food Classic
- Tahoe City Joy Festival
- Rock Tahoe Half Marathon
- SLT Lakeside Concerts
- Truckee Roundhouse Maker Fair
- Truckee Air Races
- IVGID Beaches
- High Sierra Music Festival
- Lake Tahoe Shakespeare Festival
- Tahoe Celebrity Golf Classic
- Reno-Tahoe Open Foundation Barracuda Classic
- Lake Tahoe Reggae Festival (signage only)



- Truckee BrewFest
- Tahoe BrewFest at SLT Ski Run Blvd
- Celtic Festival
- Sugar Pine Festival
- Music on the Beach
- Music at Commons Beach

#### Administration (TWSA)

- Staff attended the *2023 Lake Tahoe Trash Summit* hosted by Clean Up The Lake (CUTL 72 mile lake-wide cleanup non-profit). 50 agency and non-profit personnel attended, all focused on solutions to litter as a watershed contaminant.
- Staff attended the Town of Truckee Council meeting on single use water bottle policy on 5/23/23.
- Staff is providing ancillary support to regional partners on their bottled water bans.
- Staff monitors monthly TRPA Shorezone Project Review Committee Project Review meetings.
- DRINK TAHOE TAP<sup>®</sup>; and I DRINK TAHOE TAP<sup>®</sup> trademarks are valid to 2026.
- Staff is in discussion on a co-branding opportunity 2023-24 with Vail/ Heavenly/Kirkwood and BrandGeek, the TWSA trademark attorney.
- Staff attends the Nearshore Aquatic Weeds Working Group (NAAWG) monthly.
- Staff facilitated the March 1 TWSA board meeting and follow-up on action items.
- We continue to collaborate with the Tahoe Environmental Research Center (TERC) and Sierra Watershed Education Partnership (SWEP) on regional student education efforts.
- Staff gave support to Science Expo (South Lake Tahoe) & Trout in the Classroom egg deliveries.
- DRINK TAHOE TAP<sup>®</sup> ads are running year-round: Tahoe.com print publication and website.

#### **Professional Development/Other:**

N/A



Account Trial Balance



2023 Period 1 to 12  
Expense Accounts

Accounts	Description	Organization	Beginning Bal	Debits	Credits	Net Change	Ending Balance
<b>200 Utility Fund</b>			<b>0.00</b>	<b>138,543.84</b>	<b>6,130.49</b>	<b>132,413.35</b>	<b>132,413.35</b>
<a href="#">20002899 5010</a>	Salary	20002899	0.00	44,173.72	0.00	44,173.72	44,173.72
<a href="#">20002899 5012</a>	Hourly	20002899	0.00	9,595.74	0.00	9,595.74	9,595.74
<a href="#">20002899 5013</a>	Other Earnings	20002899	0.00	446.96	0.00	446.96	446.96
<a href="#">20002899 5014</a>	Overtime	20002899	0.00	36.67	0.00	36.67	36.67
<a href="#">20002899 5020</a>	Other Earnings	20002899	0.00	132.48	0.00	132.48	132.48
<a href="#">20002899 5050</a>	Taxes	20002899	0.00	4,099.07	0.00	4,099.07	4,099.07
<a href="#">20002899 5100</a>	Retirement Fringe Ben	20002899	0.00	9,396.53	0.00	9,396.53	9,396.53
<a href="#">20002899 5200</a>	Medical Fringe Ben	20002899	0.00	9,696.02	281.78	9,414.24	9,414.24
<a href="#">20002899 5250</a>	Dental Fringe Ben	20002899	0.00	761.65	17.83	743.82	743.82
<a href="#">20002899 5300</a>	Vision Fringe Ben	20002899	0.00	85.90	1.12	84.78	84.78
<a href="#">20002899 5400</a>	Life Ins Fringe Ben	20002899	0.00	114.40	0.00	114.40	114.40
<a href="#">20002899 5500</a>	Disability Fringe Ben	20002899	0.00	170.96	0.00	170.96	170.96
<a href="#">20002899 5800</a>	Unemployment Fringe Ben	20002899	0.00	831.17	0.00	831.17	831.17
<a href="#">20002899 5700</a>	Work Comp Fringe Ben	20002899	0.00	1,303.48	0.00	1,303.48	1,303.48
<a href="#">20002899 7010</a>	Advertising - Paid	20002899	0.00	6,615.00	0.00	6,615.00	6,615.00
<a href="#">20002899 7310</a>	Computer License & Fees	20002899	0.00	239.88	0.00	239.88	239.88
<a href="#">20002899 7340</a>	Dues & Subscriptions	20002899	0.00	50.00	0.00	50.00	50.00
<a href="#">20002899 7405</a>	Office Supplies	20002899	0.00	119.97	0.00	119.97	119.97
<a href="#">20002899 7415</a>	Operating	20002899	0.00	38,905.65	5,824.78	33,080.89	33,080.89
<a href="#">20002899 7460</a>	Postage	20002899	0.00	173.74	0.00	173.74	173.74
<a href="#">20002899 7470</a>	Printing & Publishing	20002899	0.00	10,842.87	0.00	10,842.87	10,842.87
<a href="#">20002899 7680</a>	Training & Education	20002899	0.00	411.00	0.00	411.00	411.00
<a href="#">20002899 7685</a>	Travel & Conferences	20002899	0.00	196.98	5.00	191.98	191.98
<a href="#">20002899 7840</a>	Telephone	20002899	0.00	144.00	0.00	144.00	144.00
<b>Total</b>			<b>0.00</b>	<b>138,543.84</b>	<b>6,130.49</b>	<b>132,413.35</b>	<b>132,413.35</b>
<b>Grand Total</b>			<b>0.00</b>	<b>138,543.84</b>	<b>6,130.49</b>	<b>132,413.35</b>	<b>132,413.35</b>

TWSA reserve = \$171,920.26 w/\$30,000 allocation by BOD in 23/24 towards water bottle filler grant program.

## 2023/24 TWSA Future Goals

The TWSA Board conducts annual goal setting and review. The Board Goals are as follows (reviewed 6/2023):

1. ***“Continue and increase emphasis on extensive education and outreach on focus topics of: source water protection, Aquatic Invasive Species (AIS) threats, treatment methods used for AIS and the value of municipal tap water.”***

As detailed in Action Plan Highlights 1.0 through 1.9 – a variety of actions happen towards this goal. Some highlights include regional partnership adoption of DRINK TAHOE TAP, microplastics, dog waste and trash messaging by the TAKE CARE outreach groups.

2. ***“Continue outreach and advocacy efforts for federal infrastructure funding, especially for fire flow capacity.”***

STPUD and IVGID conduct federal lobbying efforts on behalf of drinking water concerns for the Association. STPUD has conducted collective grant funding management for the TWSA group on fire flow enhancement infrastructure such as additional tanks, hydrants, pipe replacement and upgrades.

3. ***“Continue a strong communication relationship with Tahoe Regional Planning Agency (TRPA), Nevada Department of Environmental Protection (NDEP), Lahontan Regional Water Quality Control Board (LRWQCB) and other regulatory agencies on source water protection.”***

The most significant recent development includes participation on the Stakeholder Committee of the Tahoe Keys Control Methods Test working group. This is a mediated team coordinated by TRPA for the Tahoe Keys Property Owners Association “Control Methods Test” approved by Lahontan Regional Water Quality Control Board in January 2022.

Past participation has ongoing project review and mitigation suggestions provided regarding pesticide and herbicide use (land and water use) to Lahontan Regional Water Quality Control Board (LRWQCB). Agency involvement by Nevada Dept. of Environmental Protection and California Dept. of Public Health was prompted by water provider concerns. Initial public comment prompted the LRWQCB Board to direct staff to form a working group to address the water provider concerns and produce appropriate intake protection/mitigation language. This language was incorporated into the existing regulations.

TWSA staff has been heavily involved in the Nearshore Aquatic Invasive Weeds Working Group (NAIWWG) in the past 10 years. Public comment is offered. Research is conducted and shared with the group.

TWSA’s Executive Director and Chairman are in regular contact with agency staff regarding drinking water provider concerns. Staff has maintained presence on TRPA led planning and workgroup committees for shore zone projects and AIS projects.

TWSA is a sponsor for, and TWSA staff submits articles to TRPA’s *Tahoe in Depth* publication. This magazine is Tahoe’s environmental news print (also online) platform. Print copies are distributed quarterly via US Mail to all property owners in the Basin, and are offered at visitor locations.

4. ***“Maintain and improve project review / involvement process with TRPA, NV State Lands, Lahontan Water Board and other planning/regulatory/ advocacy agencies.***

*Current active projects include:*

- *Aquatic Invasive Species (AIS) Programs (threats/prevention programs, treatment methods, Integrated Weeds Management Plan)*

- *Trash as a Watershed Contaminant*
- *Groundwater Contamination at the "Y" / PCE Plume Project*
- *Tahoe Regional Planning Agency Shoreline Plan and Project Reviews ( buoy fields, shoreline projects)*
- *Nevada State Lands notifications on occupancy of lake bottom*
- *Truckee River Operating Agreement (TROA) Ongoing regulatory updates*
- *Ongoing federal and state regulatory updates*

TWSA members worked with TRPA on establishing a standardized Memorandum of Understanding (MOU) for routine water utility work, reducing the need to obtain individual permits for standard small scale construction and infrastructure upgrades. As outlined above in Action Plan highlights 4.0-4.1; TWSA staff and member agencies are actively involved in the planning and review of projects, activities and regulations related to source water protection at Lake Tahoe.

**5. *"Utilize regional studies/projects to determine how they protect source water quality. Continue to work with LTWIP as appropriate."***

Review of published reports and studies is conducted on an ongoing basis by TWSA staff and member agencies. Intensive staff resources have been directed to research and develop TWSA public comment on the potential use of aquatic herbicides for aquatic weeds control, driven by planning efforts in the Tahoe Keys area. Many of the reports and studies released in the past year are referenced in this annual report.

Over the past 2 years, TWSA directly supported a surface water and intake sampling microplastic research project by the Tahoe Environmental Research Center and are also monitoring Desert Research Institute microplastics research.

REPORT AT : [http://tahoetruckeesnapshotday.org/wp-content/uploads/2023/04/Event-2022-Report\\_Final04202023.pdf](http://tahoetruckeesnapshotday.org/wp-content/uploads/2023/04/Event-2022-Report_Final04202023.pdf)

# 22<sup>nd</sup> Annual Snapshot Day Report

## A Lake Tahoe Basin and Truckee Watershed Citizen Monitoring Event (May 21, 2022)



Prepared by  
Sarah Vidra  
Tahoe Water Suppliers Association



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Figure 1: Truckee River Watershed from Lake Tahoe, CA to Pyramid Lake, NV



## **Introduction**

### **What is Snapshot Day?**

Snapshot Day is a one-day, volunteer-based event designed to collect data indicating watershed health at a single point in time. Trained Volunteer Team Leaders bring groups of other volunteers to various pre-determined sites to collect water quality data. 2022 was the 22nd anniversary of Snapshot Day. Snapshot Day is sustained by support from dedicated staff, the funding of a few grants and donations, and by citizens who value the watershed they live in. It is important to note that citizen monitoring is designed to supplement existing agency monitoring efforts. All information is provided to the regulatory and resource management agencies responsible for protecting water quality in the Truckee River Watershed.

### **What are the objectives of Snapshot Day?**

While there is a great deal of high-quality agency and university-sponsored monitoring in the Tahoe-Truckee region, there is still insufficient information to assess the status of all aquatic resources in the Truckee River Hydrologic Unit, including the Lake Tahoe Basin and the Truckee River Watersheds. With proper training and quality assurance, community members can help fill this void by providing valuable watershed management and pollution prevention information.

The primary goals of this effort are two-fold:

1. Promote environmental education and stewardship.
2. Collect valuable water quality information.

In regards to collecting water quality data, this effort aims to:

- Screen for water quality problems, including the identification of sources of pollution and detection of illegal activities (e.g., chemical spills, filling of wetlands, diversions, illicit discharges, destruction of stream environment zones (SEZs), non-compliance with ordinances or regulations in place to protect natural resources, etc.);
- Provide water quality data that may be compared to standards set by the TRPA and the States of California and Nevada;
- Provide water quality data that may be used in status and trend analyses; and
- Provide some pre-and-post data for evaluating the effectiveness of restoration activities.



## Snapshot Day 2022

### 2022 Event Summary

Snapshot Day provides an annual opportunity to highlight citizen science's contributions to maintaining the Tahoe-Truckee region's environmental health. 2022 Snapshot Day's data demonstrates good water quality overall for the Tahoe-Truckee watershed.

In 2022, Snapshot Day reached its 22nd anniversary. It remains one of the longest-running citizen watershed monitoring events on the West Coast of the United States. Snapshot Day continues to highlight successful engagement with the public in active watershed stewardship while providing valuable data to the responsible agencies. As previous data sets are compiled and data storage is improved, this program can show long-term trends and better assist agencies in watershed conditions analysis.

### Volunteers and locations

Snapshot Day 2022 was a collaborative effort between the North Shore Lake Tahoe, South Shore Lake Tahoe, and the Middle Truckee River.

Volunteer and monitoring site locations are as follows:

*Table 1: Volunteer and monitoring site location numbers.*

	<b>Volunteers</b>	<b>Locations</b>
South Shore Lake Tahoe	115	40
North Shore Lake Tahoe	18	12
Middle Truckee River	24	21
<b>Totals for 2022</b>	<b>272</b>	<b>73</b>

This collaborative effort was sponsored by the Incline Village General Improvement District, the League to Save Lake Tahoe, and the Truckee River Watershed Council. For an expanded list of involved organizations, resource partners, and education partners, please see **Appendix A**.

In 2022, volunteers gathered data at a total of 73 locations throughout the Truckee River watershed from south of Lake Tahoe to the Nevada State line. A list of site names and codes can be found in **Appendix B**.

**Lake Tahoe Tributaries, South Shore**

- Angora Creek
- Bijou Creek
- Burke Creek
- Cold Creek
- Edgewood Creek
- Heavenly Valley Creek
- McFaul Creek
- Meeks Creek
- North Zephyr Creek
- South Zephyr Creek
- Tahoe Keys Marina
- Tallac Creek
- Taylor Creek
- Upper Truckee River
- Trout Creek

**Lake Tahoe Tributaries, North Shore**

- General Creek
- Griff Creek
- Hatchery Creek
- Lake Forest Creek
- Madden Creek
- McKinney Creek
- Quail Creek
- Rosewood Creek
- Secret Harbor Creek
- Tahoe City Urban Ditch

**Truckee River Tributaries, Middle Truckee River**

- Alder Creek
- Bear Creek
- Cold Stream
- Deep Creek
- Donner Creek
- East Martis Creek
- Main Stem, Truckee River
- Little Truckee River
- Martis Creek
- Prosser Creek
- Squaw Creek
- Trout Creek

## **Methods of Data Collection**

It is important to remember that the measurements made on Snapshot Day were designed to represent a single point in time and do not necessarily represent average conditions. Monitoring results are compiled in **Appendix B**, which includes both the field measurements collected by volunteers and nutrient and bacteria analyses conducted by designated laboratories.

Visual observations and photo documentation are performed in accordance with procedures developed by the California State Water Resources Control Board Clean Water Team. The standardized observation form, the *California Stream and Shore Walk Visual Assessment Form*, has been slightly revised to apply to the region better. At least three photos are taken at each sampling site: streambed conditions, view across the stream; and view upstream from the starting point of the stream walk upstream. However, volunteers are encouraged to photograph as much as possible, especially team members in the field.

The volunteers use a variety of instruments and kits on Snapshot Day. Much of the equipment has been purchased through the years with grants or donations; the remainder of the equipment is borrowed each year from various partners. All the instruments and kits are calibrated and tested at a quality control session held before the event. For additional information on the monitoring equipment used, see **Appendix C**.

## Water Quality Standards

The U.S. EPA has recommended criteria for nutrients and turbidity. Nevada, California, and the Tahoe Regional Planning Agency have specific water quality standards and indicators generally more stringent in certain watersheds and creeks, such as the Tahoe Basin, than elsewhere in the Truckee River Watershed. **Table 2** lists some of these standards for the Tahoe Basin.

*Table 2: Lake Tahoe water quality standards*

Parameter	Standard
Temperature	Shall not exceed 15°C, surface waters of Fallen Leaf Lake (C.A.)
pH	7.0 - 8.4 in Lake Tahoe (C.A. and N.V.)
Conductivity	Shall not exceed 95 µS/cm average in Lake Tahoe (C.A. and N.V.)
Dissolved Oxygen	Mean no less than 6.5 and a minimum of 4.0 mg/L for Lahontan waters designated as "cold freshwater habitat" (Lahontan Region, CA)
Turbidity	Shallow water shall not exceed 3 NTU near tributaries and 1 NTU not directly influenced by streams (TRPA)
Algae	Lahontan RWQCB waters shall not contain bio-stimulatory substances (nutrients) that cause algae to become a nuisance or to affect the water's beneficial uses (C.A.)
Total Nitrogen	Mean annual concentration in May is 0.087 mg/L, but the maximum allowable is a mean of no more than 0.21 mg/L (Lahontan Region, CA).
Soluble inorganic Nitrogen	Mean of no more than 0.06 mg/L for most tributaries to Lake Tahoe, Nevada side of Lake Tahoe (NDEP)
Total Phosphorous	Annual average of no more than 0.05 mg/L for most tributaries, Nevada side of Lake Tahoe and no more than 0.008 mg/L for most tributaries, California side of Lake Tahoe. Maximum allowable for California side is 0.018 mg/L (Lahontan Region, CA).
Soluble Reactive Phosphorous	Annual average of no more than 0.007 mg/L (combination of organic and inorganic) for Lake Tahoe, Nevada side (NDEP) and 0.009 mg/L for Lake Tahoe, California side (Lahontan Region, CA).
Fecal Coliform	Log mean of 20 CFU (30-day period) and a maximum of 40 CFU (Lahontan Region, CA).

For additional information on water quality objectives in California, refer to the Lahontan Regional Water Quality Control Board (Lahontan) *Basin Plan* at the following website:

[www.waterboards.ca.gov/lahontan/water\\_issues/programs/basin\\_plan/references.shtml](http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml)

For additional information on water quality standards in Nevada, refer to the following website:

[www.leg.state.nv.us/NAC/NAC-445A.html#NAC445ASec11704](http://www.leg.state.nv.us/NAC/NAC-445A.html#NAC445ASec11704)

## Data Results

This section gives an overview of the parameters measured and the data results. All the measured parameters are discussed, and some of the high and low measurements are highlighted for each of the measured parameters. Specific sites in figures are referred to by code, which can be cross-referenced by site names in **Appendix B**.

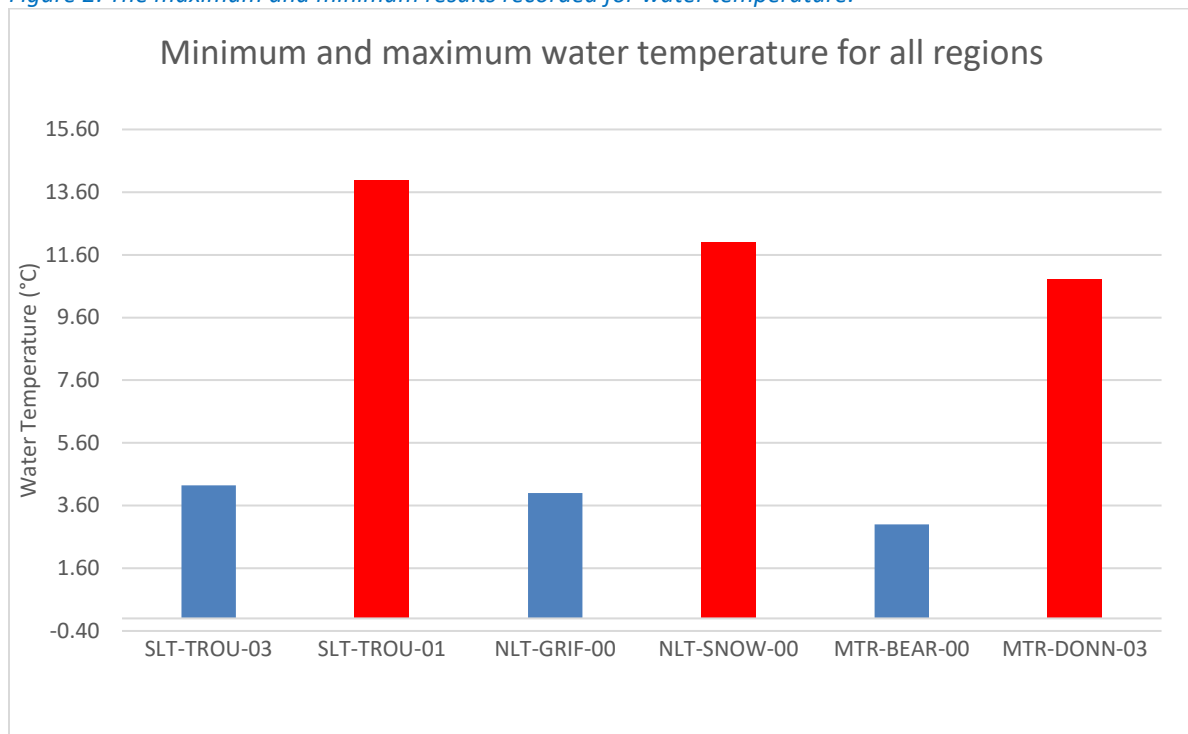
### Water temperature

Cooler water temperatures are considered better habitat for aquatic life in mountain streams and lakes since colder water contains more dissolved oxygen, an essential ingredient for fish and invertebrates. Higher temperatures promote nutrient solubility and can occur because of low-flow (shallow) conditions and/or a lack of canopy (vegetation) cover along stream banks, which acts as shade and thus prevents solar heating of the water.

In many Sierra streams, propagation of cold-water fish (i.e., trout or salmon) is a designated beneficial use of the water. In such streams, numerical and narrative water quality standards generally are set at levels that will "support the beneficial use" of a cold-water fishery. Such streams generally require cooler temperatures and higher dissolved oxygen content than water in streams and lakes that do not have "cold-water fishery" as a designated beneficial use. Rainbow trout prefer water temperatures between 12.8° C and 15.6° C, and the upper incipient lethal temperature (temperature at which 50% of the population survives 60 days) is 14.3° C.

In 2022, 69 sites were sampled for water temperature. The lowest recorded temperature from Snapshot Day 2022 was 3° C at the Bear Creek sampling location in the Middle Truckee watershed. The highest recorded temperature was 14.00° C recorded at Trout Creek at Bellevue Avenue in South Lake Tahoe. Figure 2 below represents the lowest (blue) and highest (red) temperatures for the four regions sampled during the 2022 event. The high temperature noted above was collected from a tributary to Lake Tahoe and did not exceed 15.6° C, the maximum optimal temperature for rainbow trout.

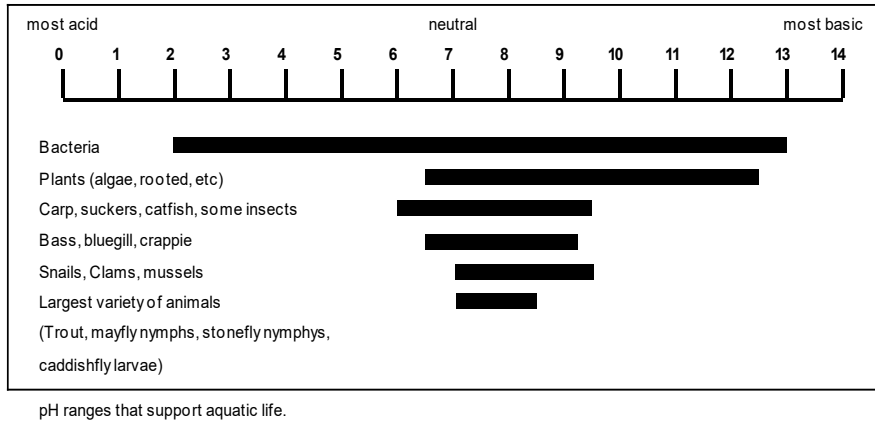
Figure 2: The maximum and minimum results recorded for water temperature.



**pH**

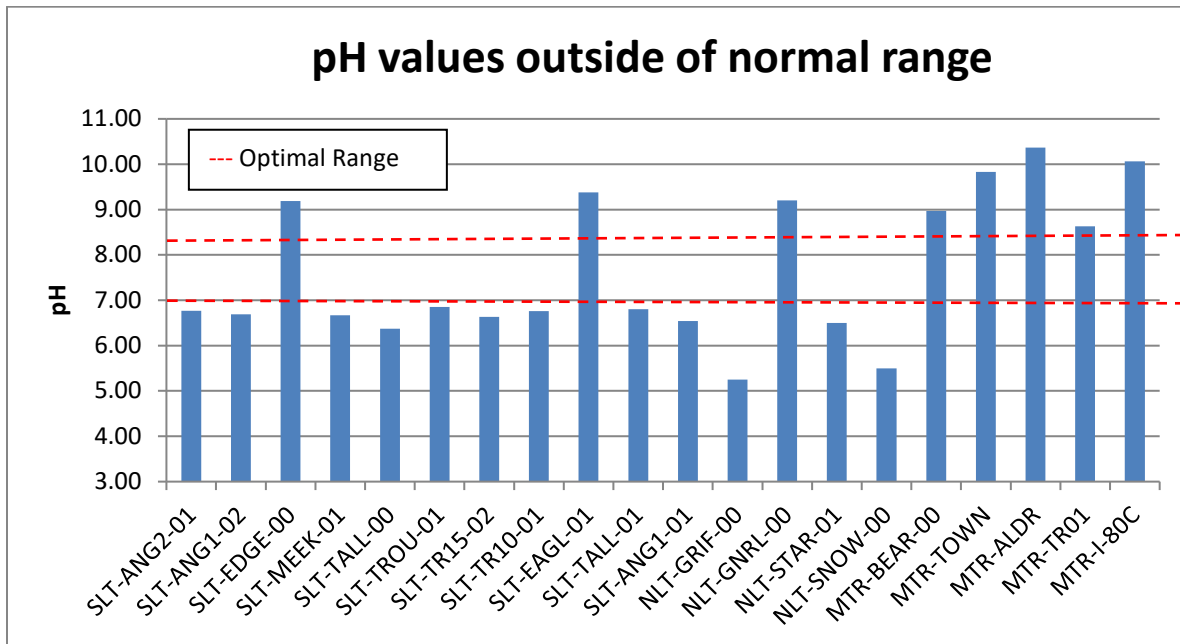
pH is a measurement of the degree to which water is "acidic" or "basic." pH is measured on a scale of 0 (very acidic) to 14 (very basic), with 7 in the middle as "neutral." Most aquatic life prefers a pH close to 7. **Figure 2** displays the pH ranges that support aquatic life.

*Figure 3: pH range that supports aquatic life*



Water in California within the Lake Tahoe Basin should not be below 7 or above 8.4. The Regional Water Board recognizes that some waters of the region may have natural pH levels outside the 7.0 to 8.4 range. This is commonly found in the tributaries to Lake Tahoe.

*Figure 4: pH results outside optimal range for aquatic life.*



The lowest pH measurement for Snapshot Day 2022 was 5.25, taken at Griff Creek in North Lake Tahoe. The highest pH measurement was 10.37 at Alder Creek in the Middle Truckee River region. Of the 69 sites that took pH readings, 13 sites had a pH below the optimal range, and 7 sample sites had a pH value above the optimal range.

## Dissolved Oxygen (D.O.)

Dissolved oxygen is a measure of the amount of gaseous oxygen (O<sub>2</sub>) dissolved in water. Dissolved oxygen is necessary to support aquatic life. When dissolved oxygen levels drop too low, stress occurs in aquatic life, especially fish.

Low dissolved oxygen concentrations are typically the result of the following:

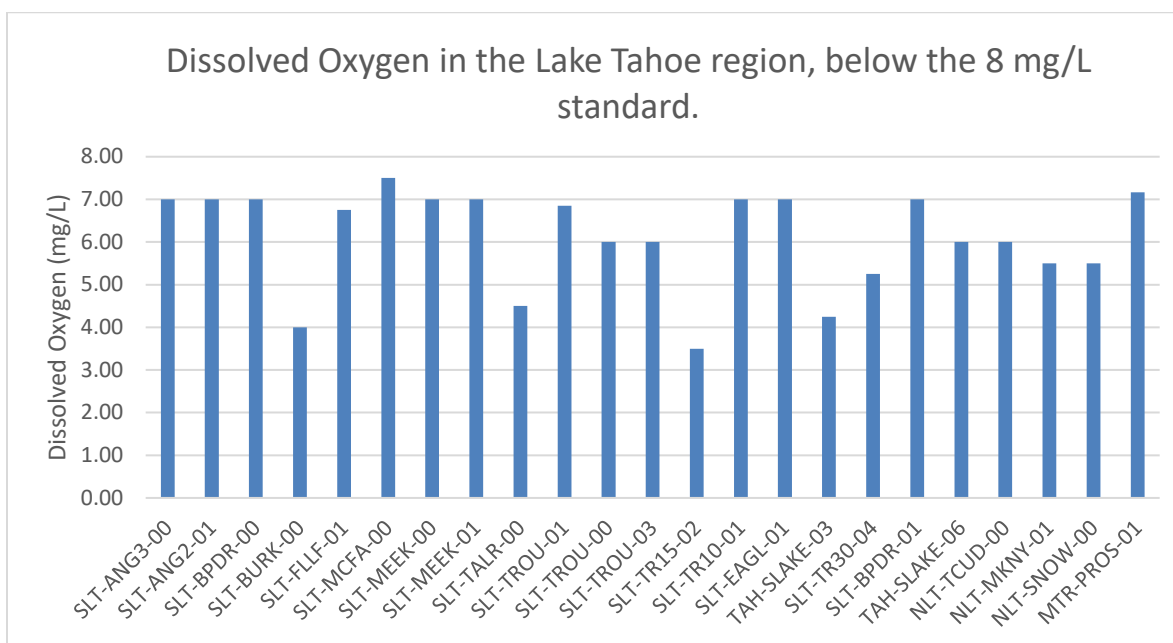
- Warming water: warmer water can dissolve and hold less oxygen than cooler water.
- Excess nutrients: too many nutrients in the water can fuel algae and bacteria growth, consuming oxygen upon decay.
- Slow or stagnant water: movement allows for oxygen and water to mix; slow or stagnant water thus has less dissolved oxygen than water in motion.

Water quality objectives for dissolved oxygen vary from Region to Region; most waters within the Lake Tahoe Basin have a dissolved oxygen concentration standard of at least 8.0 mg/L. Waters of the Truckee River have a dissolved oxygen standard of 5.0 mg/L or 6.0 mg/L depending on the reach of the river. Measurements below 5 mg/L are considered dangerous for cold water aquatic life.

The lowest dissolved oxygen content for 2022 was 3.00 mg/L, recorded at South Zephyr Creek in South Lake Tahoe. Three sampling locations had dissolved oxygen readings of 4.0 mg/L, two in North Lake Tahoe: Tahoe City Urban Ditch and Burton Creek at Star Harbor, and one in South Lake Tahoe at Meeks Creek above Highway 89.

All three regions had dissolved oxygen sites below 8.0 mg/L, with 25 records in total. In 2022, 4 sites had dissolved oxygen results less than 5 mg/L, compared to 13 sites in 2021. The highest recorded dissolved oxygen content was 10.00 mg/L, was collected at two locations in the South Lake Tahoe Region, Angora Creek at View Circle and Cold Creek above Pioneer Trail.

*Figure 5: Dissolved oxygen concentrations that were measured below 8 mg/L.*



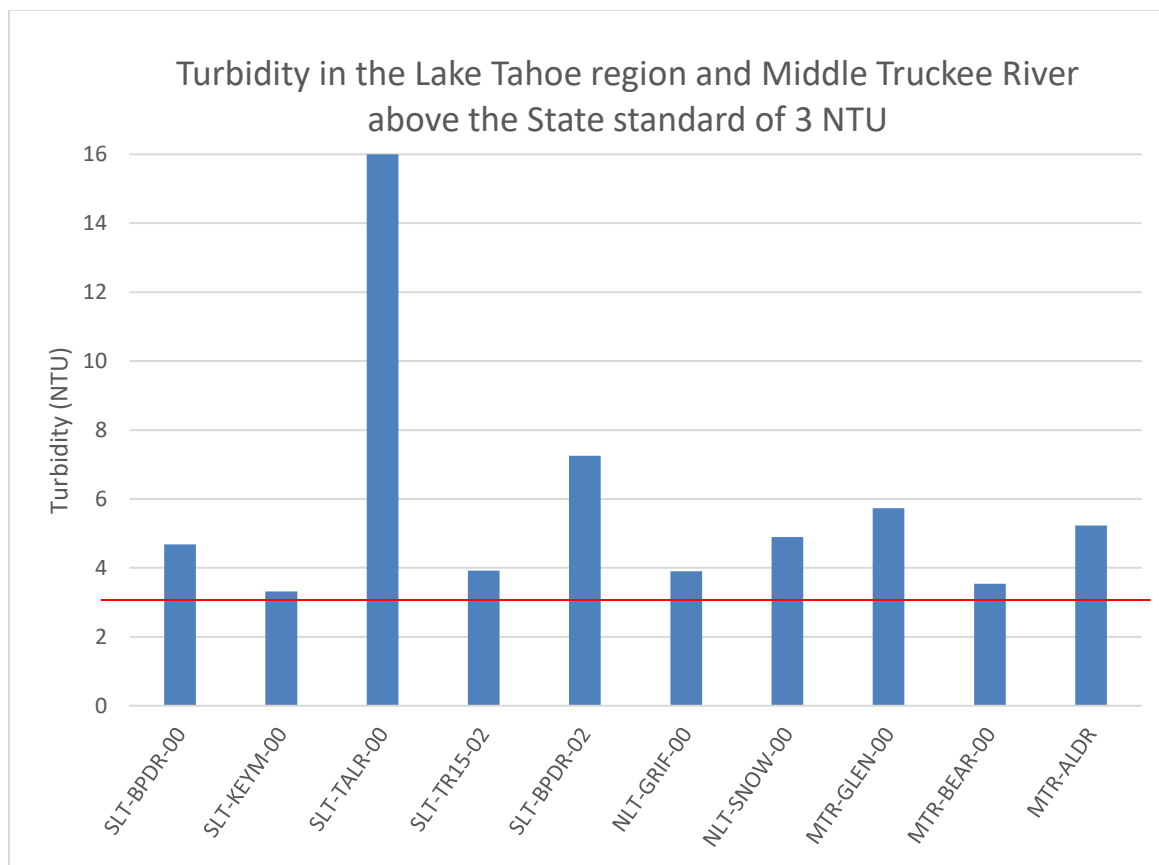
## Turbidity

Turbidity is a measure of the number of suspended particles in the water column. Turbidity is measured in NTUs (Nephelometric Turbidity Units); high NTU levels indicate poor water clarity, low NTU levels indicate high clarity. Algae, suspended fine sediment particles, organic matter, and some pollutants can cloud the water making it more turbid. High sediment loads can clog the gills of fish, negatively affect gravel beds and smother fish eggs and benthic invertebrates. The sediment can also carry pathogens, pollutants, and nutrients that affect Lake Tahoe's water quality.

The U.S. EPA's recommended criteria for turbidity in streams in Eco-Region II (forested mountains in the western U.S.) is at or below 1.3 NTU. The California portion of the Truckee River Watershed is located within this Eco-Region; however, the State of Nevada outside of the Tahoe Basin is located right outside this Eco-Region. The TRPA and Lahontan have a nearshore turbidity standard of 1-3 NTUs (measured by monthly means) in Lake Tahoe. The standard for the Lower Truckee River and associated tributaries in Nevada is 10 NTU.

For the 2022 Snapshot Day event, 10 of the 70 sample sites had turbidity readings above the 3 NTU standard established by Tahoe Regional Planning Agency (TRPA). The highest turbidity reading for the 2022 Snapshot Day event was 18.9 NTU from Taylor Creek at mouth in South Lake Tahoe; this sample was the only result over 10 NTU during the 2022 event.

*Figure 6: Turbidity readings that did not meet state or regional NTU standards.*





**Streamflow**

Streamflow is the measure of the volume of water that is flowing, which varies with precipitation. Streamflow can have significant impact on water quality; during low flow conditions, high water temperature, low levels of dissolved oxygen, and elevated presence of toxins can all be exacerbated. During high flow conditions, the likelihood of increased erosion and excess sediment transfer can be of concern. Streamflow conditions can also impact fish habitat and other aquatic organisms and may affect the ability to spawn and/or reproduce.

The water year of 2022 (Oct. 2021-September 2022) was an extremely dry year. The National Integrated Drought Information System (Drought.gov) has the following key points for the 2022 water year in California and Nevada.

- The water year 2022 started wet with a strong atmospheric river and ended in continued drought due to almost no precipitation during January through March.
- The Past three water years have been the driest in the California record. Both California and Nevada remain in almost 100% moderate to exceptional drought.

Most of the Sierra Nevada region experienced 38% or less of the average snowpack, dramatically affecting the amount of runoff from tributary streams and the water levels in the multiple reservoirs that serve as the primary water source for the greater Reno/Sparks area.

The graphs below show streamflow data collected by the U.S. Geological Survey (USGS) at two separate monitoring locations: a) Upper Truckee River upstream of Lake Tahoe; and b) Middle Truckee River at the Town of Truckee. This data illustrates the 2022 flow levels compared to an extremely wet year of 2017.

*Figure 7: Streamflow data from the Upper Truckee River above Lake Tahoe, California, during May for 2017 and 2022, respectively.*

**Upper Truckee River:**

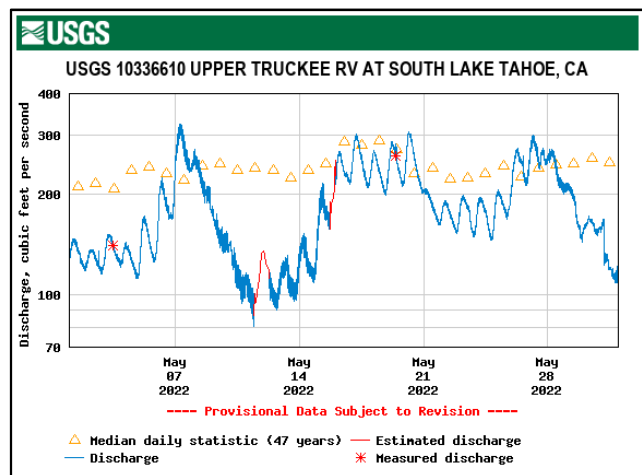
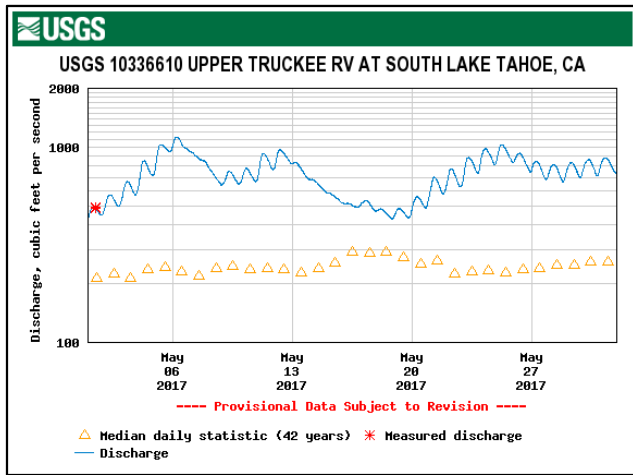
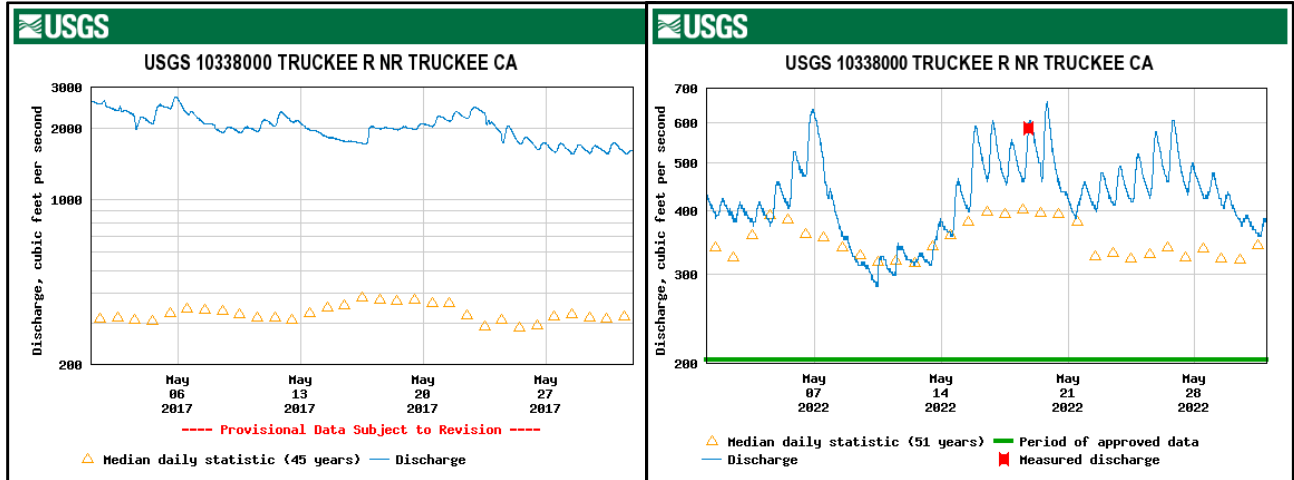


Figure 8: Streamflow data from the Middle Truckee River at the Town of Truckee, California, during May for 2017 and 2022, respectively.

Middle Truckee River:



## Conductivity

Conductivity is a measure of water's ability to pass an electric current. In water, conductivity is affected by the presence of inorganic dissolved solids such as chloride, nitrate, calcium, sulfate, and others. Conductivity in rivers and streams is mainly influenced by the geology through which the water flows.

Electrical conductivity is also sensitive to flows – at high flows, the charged particles that make conductivity are diluted, so measured conductivity should be lower. At low flows, the particles are more concentrated, and conductivity measurements will often be higher. Primary sources of charged particles in the Truckee River watershed are road sands, road deicers, and natural sources. Typically, urban areas or sites adjacent to high-traffic roads will show higher electrical conductivity readings.

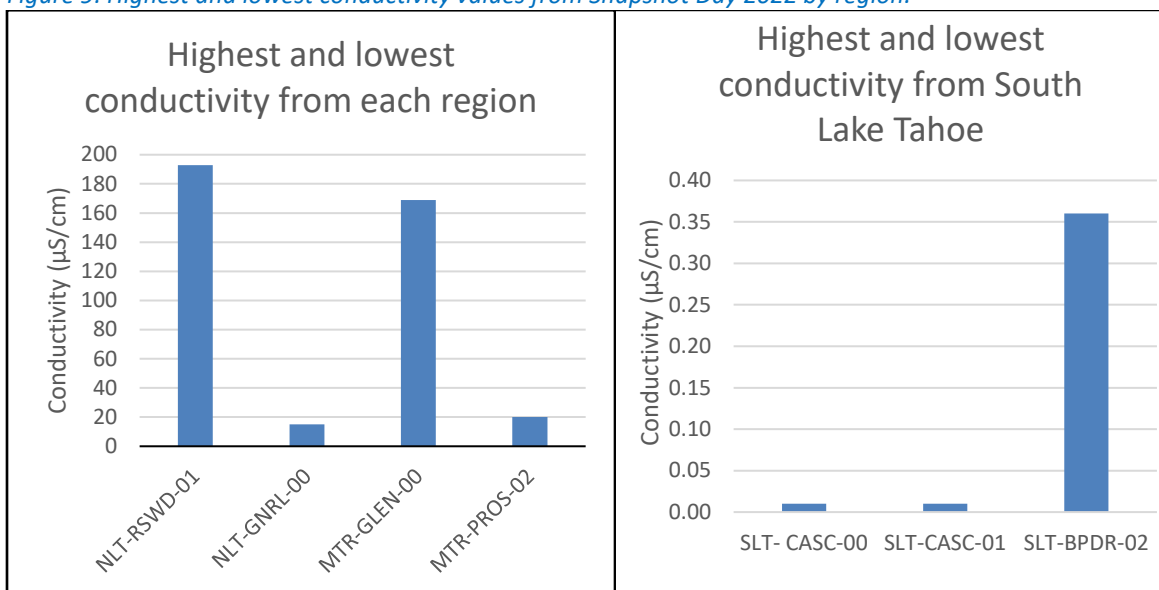
Abrupt changes in conductivity may indicate that new water sources or wastewater are being diverted into a stream or river. Acceptable ranges for water conductivity are dependent on the water type. **Table 4** displays acceptable conductivity ranges for several water types.

Conductivity was measured at 67 sample sites for Snapshot Day 2022. Conductivity was measured at 38 South Lake Tahoe sites with new meters, not calibrated with the event, which provided readings significantly lower than historic results for the region. The lowest conductivity recorded was 0.01  $\mu\text{S}/\text{cm}$ , measured at Cascade Creek at the mouth and above highway 89 in South Lake Tahoe. The highest conductivity recorded was 192.9  $\mu\text{S}/\text{cm}$  at Rosewood Creek in North Lake Tahoe.

*Table 3: Acceptable conductivity for different water types.*

Water Type	Conductivity $\mu\text{S}/\text{cm}$ (micro Siemens per centimeter)
Distilled Water	0.5 - 3.0
Melted snow	2 - 42
Potable water in the U.S.	30 - 1500
Irrigation Supply Water	< 750

*Figure 9: Highest and lowest conductivity values from Snapshot Day 2022 by region.*



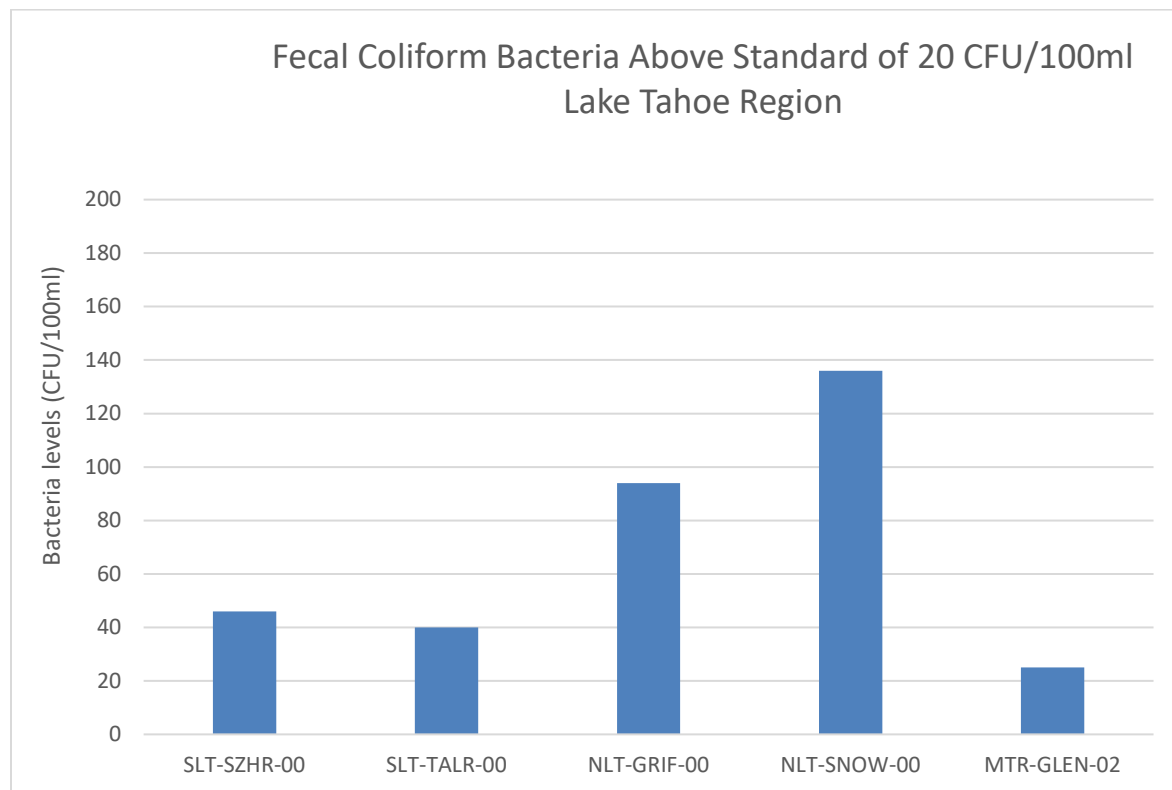
## Fecal Coliform Bacteria

Coliform bacteria are found in the feces of warm-blooded animals, including humans, pets, livestock, beavers, and birds. Fecal coliform is measured in colony-forming units (CFUs) counted per 100 milliliters of water (CFU/100 mL). CFUs are roughly equivalent to the number of bacteria cells. The Lahontan standard for fecal coliform is 20 counts per 100 mL for a single occurrence based on a logarithmic mean of 5 samples taken within 30 days. By using 20 CFU/100 mL as guidance for a tolerable threshold of coliform, we can determine if that threshold is exceeded for the Tahoe/Truckee regions.

*Escherichia coli* (*E. coli*) is the major species in the fecal coliform group. Of the five general groups of bacteria that comprise the total coliforms, only *E. coli* is generally not found growing and reproducing in the environment. Consequently, *E. coli* is considered to be the species of coliform bacteria that is the best indicator of fecal pollution and the possible presence of pathogens. As a result, testing for coliform bacteria can be a reasonable indication of whether other pathogenic bacteria are present.

Fecal coliform was measured at 64 locations on Snapshot Day 2022. Across all three regions, five of the samples had readings greater than 20 CFU/100 ml, and 36 samples had zero bacteria recorded.

Figure 10: Fecal coliform bacteria counts above 20CFU/100 mL standard – Lake Tahoe Region.



## Nutrients

Sixty-one water samples collected at Snapshot Day 2022 were analyzed for Nitrogen and Phosphorus, which are of most concern for algal growth and water clarity. Along with excess algae growth, nutrient concentrations that are too high can lead to odors, discolored waters, loss of clarity, and nighttime oxygen depletion.

Nitrogen stimulates algal growth, which in turn can lead to eutrophication in aquatic systems. The most common source of nitrate is runoff from fertilized areas such as lawns or other landscaped areas. Nitrate (a sub-component of Nitrogen) is a byproduct of septic systems – it is a naturally occurring chemical left after decomposing human (and other animals) waste.

Excess Phosphorus also stimulates high amounts of algal growth in aquatic systems. Phosphorus is naturally present in the environment in granitic and volcanic rocks found throughout the Tahoe Truckee watershed. Anthropogenic sources include various soaps, detergents, fertilizers, and other household chemicals.

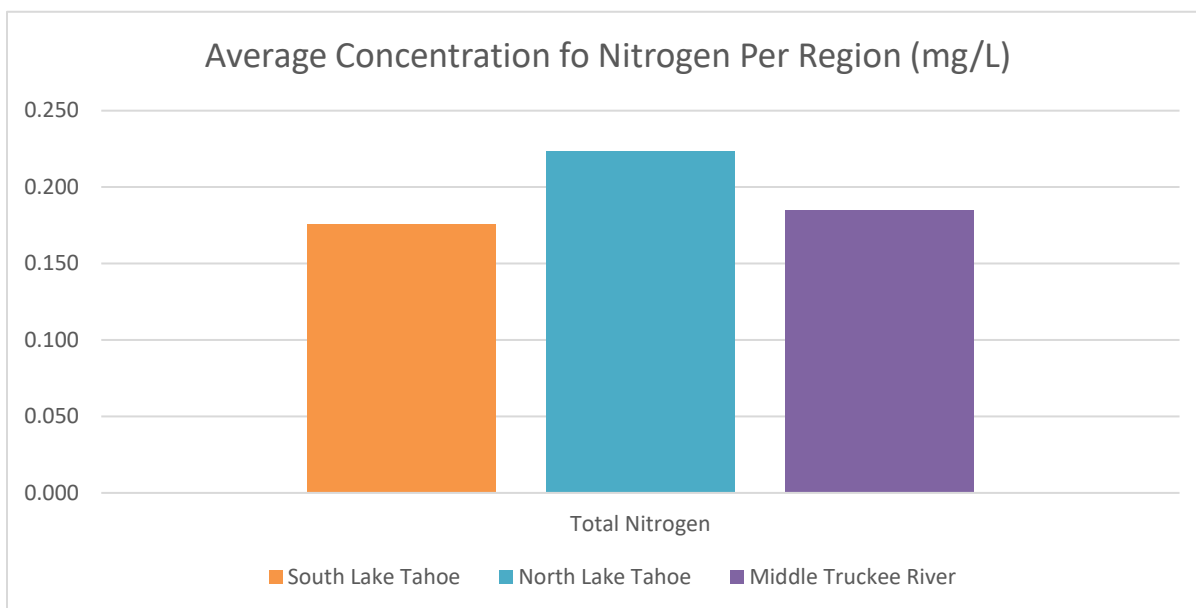
In 2022 the types of nutrients analyzed varied substantially amongst the participating entities. The variability of data collection makes an accurate comparison difficult throughout the watershed. The following information summarizes where the highest concentrations of nutrients were analyzed per region. Additionally, graphic representations of the average concentration of Total Phosphorus and Total Nitrogen are provided.

### Nitrogen

#### Total Nitrogen (T.N.)

Total Nitrogen was analyzed throughout all three regions for Snapshot Day 2022, with 64 results. The Lahontan region has a total nitrogen standard of annual mean concentration of 0.087 mg/L, but the maximum allowable monthly mean is no more than 0.21 mg/L. South Lake Tahoe had a maximum detection of 0.388 mg/L at the Bijou Park Drainage site. North Lake Tahoe had a maximum detection of 0.463 mg/L of Total Nitrogen at the Snow Creek site. The Middle Truckee River region had a maximum detection of Total Nitrogen at the Upstream of the Glenshire Pond site with a result of 0.764 mg/L.

*Figure 11: Total Nitrogen average concentration by region for 2022.*



### Ammonia (NH<sub>3</sub>)

The highest ammonia (NH<sub>3</sub>) level was detected for 2022 at the Upper Truckee River site in South Lake Tahoe, measuring 0.092 mg/L. All North Lake Tahoe sites were analyzed at the laboratory minimum detection rate of < 0.020 mg/L. The Middle Truckee River had maximum ammonia (NO<sub>3</sub>) detection of 6 ppb at the Union Valley Creek site.

### Nitrite (NO<sub>2</sub>)

The highest nitrite (NO<sub>2</sub>) level was detected for 2022 at the Upstream of Glenshire Pond site in the middle Truckee river region, measuring 0.436 mg/L. All North Lake Tahoe sites were analyzed at the laboratory minimum detection rate of < 0.020 mg/L. The South Lake Tahoe region had a nitrite (NO<sub>2</sub>) maximum of 0.02 mg/L at the Bijou Park Draining below Hansen Resort site.

### Nitrate (NO<sub>3</sub>)

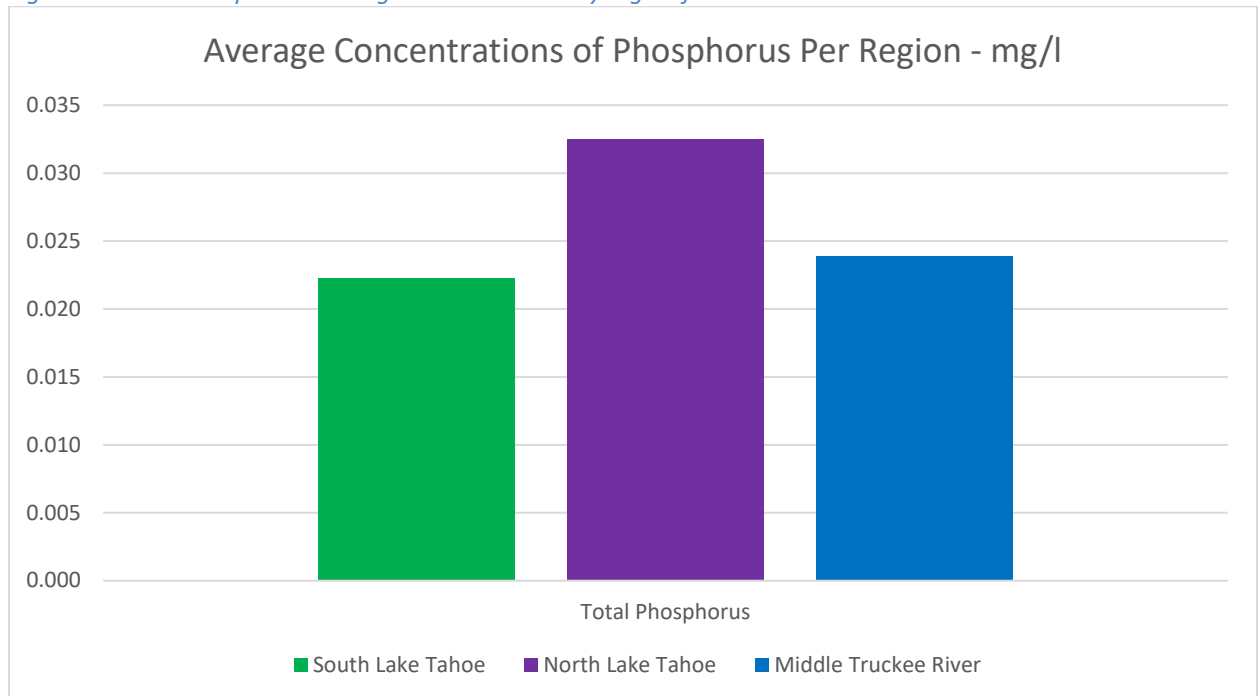
The maximum Nitrate (NO<sub>3</sub>) detection was 0.436 mg/L taken at the Upstream of Glenshire Pond sample site in the Middle Truckee River region. The maximum Nitrate result in North Lake Tahoe was 0.036 mg/L taken at Quail Creek. The South Lake Tahoe region had a maximum result of 0.246 mg/L. In total, 57 samples were analyzed for nitrate throughout the watershed, with 33 results at the laboratory minimum detection rate of <0.020 mg/L.

### Phosphorus

#### Total Phosphorus (T.P.)

For the 2022 Snapshot Day event, all three regions analyzed samples for Total Phosphorus. South Lake Tahoe had a maximum Total Phosphorus result of 0.065 mg/L from the Bijou Park Drainage below Hansen's Resort site. The maximum Total Phosphorus result for North Lake Tahoe of 0.057 mg/L was taken from Snow Creek. Martis Creek had the highest Total Phosphorus result for the Middle Truckee River region of 0.049 mg/L.

Figure 12: Total Phosphorus average concentrations by region for 2022.



## Visual Observations

Visual observations are also collected as a component of Snapshot Day monitoring. Visual observations included cloud cover, precipitation, wind, water clarity, in-stream flow, sample color, sample odor, and other items observed in the samples. This information helps to provide context to the water quality parameters that are being monitored and allows for the identification of potential causes of degraded water quality (i.e., the presence of urban development)

Visual observations were recorded at 66 from Snapshot Day 2022. Visual observations included cloud cover, precipitation, wind, water clarity, in-stream flow, sample color, sample odor, and other items observed in the samples.

*Table 4: Number of monitored sites with In-Stream Flow*

### **In-Stream Flow**

<b>dry creekbed</b>	<b>isolated pools</b>	<b>trickle</b>	<b>slow/ smooth</b>	<b>moderate rippling</b>	<b>rapid/ turbulent</b>	<b>flooding</b>
4	2	0	14	31	15	0

*Table 5: Number of monitored sites for each sample color classification*

### **Sample Color**

<b>None</b>	<b>amber</b>	<b>yellow</b>	<b>green</b>	<b>brown</b>	<b>gray</b>	<b>other</b>
60	3	0	0	0	0	1

*Table 6: Number of monitored sites for each sample odor classification*

### **Sample odor**

<b>None</b>	<b>Fresh algae</b>	<b>Chlorine</b>	<b>Rotten eggs</b>	<b>Sewage</b>	<b>Other</b>
62	2	0	0	0	0

*Table 7: Number of monitored sites with the presence of the objects noted.*

### **Other presence**

<b>Algae or other water plants</b>	<b>Oily Sheen</b>	<b>Foam or suds</b>	<b>Litter or trash</b>	<b>Other</b>
35	1	7	1	2

## Discussion

Compared to many other watersheds in the nation, data collected within the Truckee River watershed indicates good overall water quality. Mountain streams and snowmelt conditions feed the Truckee River watershed, which contains heavily forested headwaters as well as urban concentrations (Reno/Sparks) located in the lower portion of the watershed. The presence of concentrated urban development and high amounts of impervious surface areas exist within all regions of the watershed (upper, middle & lower). These land-use conditions can have a significant impact on water quality. They should continue to be monitored to assess the watershed's condition and ensure local water bodies meet regional and state standards.

The data collected for Snapshot Day 2021 show 77% of sites monitored have water quality objectives meeting regulatory requirements for Conductivity, Turbidity, and Fecal Coliform bacteria. The 2022 dataset shows a decrease in the number of sample sites with elevated pH levels, with only 12% of sites sampled recording pH values above 8.4 compared to 20% in 2021. Dissolved oxygen depletion has improved, with 30% of samples below 8 mg/L compared to 48% in 2021. Dissolved oxygen levels below 8 mg/L are of concern for fish and other aquatic organisms. The low water levels in 2022 and the continued drought conditions in the October 2021- September 2022 show an expected increase in water temperature and pH levels and a subsequent decrease in dissolved oxygen.

As previous data sets from the past 22 years are compiled and data storage is improved, this program will have the ability to show long-term trends and better assist agencies. It has been funded primarily through local, state, and private agencies. The extensive event coordination is partner-driven, and participation from an almost entirely volunteer basis is exceptional. The collaboration and continued dedication of those involved, from dedicated staff to engaged volunteers, make Snapshot Day a success each year. The ongoing success of this type of event exemplifies the value of citizen science and shows how community members can provide invaluable data collection and learn about their watershed at the same time.

For more information about how to get involved with water quality monitoring activities, contact the following agencies and organizations:

- *North Lake Tahoe*: Sarah Vidra (775) 832-1284; Incline Village GID Waste Not
- *South Lake Tahoe*: League to Save Lake Tahoe (530) 541-5388
- *Middle Truckee River (Tahoe City to Nevada State Line)*: Eben Swain, (530) 550-8760, x7; Truckee River Watershed Council



## References

Ambient Water Quality Criteria Recommendations: Rivers and Streams in Nutrient Ecoregion II, U.S. Environmental Protection Agency, December 2000

California State Water Resources Control Board Clean Water Team website:  
[http://www.swrcb.ca.gov/water\\_issues/programs/swamp/cwt\\_volunteer.shtml](http://www.swrcb.ca.gov/water_issues/programs/swamp/cwt_volunteer.shtml)

EPA's Draft Volunteer Stream Monitoring: A Methods Manual, U.S. Environmental Protection Agency

Nevada Administrative Code (NAC), Chapter 445A, Nevada Division of Environmental Protection, 1995 Revision

Standard Methods for Water and Wastewater Collection, 21<sup>st</sup> Edition, 2007

The California Streamside Biosurvey: An Introduction to Using Aquatic Invertebrates as Water Quality Indicators, California State Water Resources Control Board, September 2001

Water Quality Control Plan for the Lahontan Region, California Regional Water Quality Control Board, Lahontan Region, 1993 Revision

Water Supply Outlook, Natural Resource Conservation Service website, [www.nrcs.us.gov](http://www.nrcs.us.gov)

# Appendices

## Appendix A – Resource Partners

### 2022 Snapshot Day sponsors

- California State Water Resource Control Board
- Lahontan Regional Water Quality Control Board
- League to Save Lake Tahoe
- Pyramid Lake Paiute Tribe
- South Tahoe Public Utility District
- Tahoe Environmental Research Center
- Tahoe Water Suppliers Association
- Truckee River Watershed Council
- United States Geologic Survey
- Waste Not, Incline Village General Improvement District

### Citizen Monitoring Working Group Snapshot Day Planning Committee

- Eben Swain (Truckee River Watershed Council)
- Emily Frey (League to Save Lake Tahoe)
- Sarah Vidra (Incline Village General Improvement District)
- Joe Hill (Incline Village General Improvement District)

### Organizations hosting Snapshot Day 2022

- Incline Village General Improvement District
- League to Save Lake Tahoe
- Truckee River Watershed Council
- Tahoe Water Suppliers Association
- Lahontan Regional Water Quality Control Board
- U.S. Geological Survey, Carnelian Bay Field Station

### Laboratory Analyses (Nutrients and Bacteria)

- South Tahoe Public Utility District
- Lahontan Regional Water Quality Control Board Laboratory
- United States Geologic Survey
- High Sierra Water Lab

### Equipment and Contact

- California State Water Resource Clean Water Team, Erick Burres
- Incline Village General Improvement District, Sarah Vidra
- League to Save Lake Tahoe
- Tahoe Environmental Research Center
- Truckee River Watershed Council, Eben Swain
- United States Geological Survey, Paul Honeywell

**Special thanks to**

- Kelly Huck, Lahontan, for bacteria and turbidity analysis
- Paul Honeywell, U.S. Geologic Survey, Truckee, CA office, for coordinating bacterial analysis
- Ann Liston, Tahoe Environmental Resource Coalition, for hosting equipment calibration
- Dan Arce, South Tahoe Public Utility District, for nutrient analyses
- **And all the volunteers that make Snapshot Day possible!**

## Appendix B – Site names and codes

Snapshot Day site and site code are listed below.

South Lake Tahoe	
Angora Creek at Upper Truckee River Confluence	SLT-ANG3-00
Angora Creek at Washoe Meadows State Park	SLT-ANG2-01
Angora Creek upstream of Lake Tahoe Boulevard	SLT-ANG1-02
Bijou Park Drainage at Mouth	SLT-BPDR-00
Burke Creek at Mouth	SLT-BURK-00
Edgewood Creek at Mouth	SLT-EDGE-00
Fallen Leaf Lake near Dam	SLT-FLLF-01
Glen Alpine Creek at Fallen Leaf Lake	SLT-GLEN-00
Heavenly Valley Creek at Trout Creek Confluence	SLT-HEAV-00
Heavenly Valley Creek upstream of Pioneer Trail	SLT-HEAV-01
McFaul Creek at Mouth	SLT-MCFA-00
Meeks Creek at Mouth	SLT-MEEK-00
Meeks Creek upstream of Highway 89	SLT-MEEK-01
North Zephyr Creek at Mouth	SLT-NZHR-00
South Zephyr Creek at Mouth	SLT-SZHR-00
Tahoe Keys East Channel	SLT-KEYM-00
Tallac Creek at Mouth	SLT-TALL-00
Taylor Creek at Mouth	SLT-TALR-00
Trout Creek at Bellevue Avenue	SLT-TROU-01
Trout Creek at Mouth	SLT-TROU-00
Trout Creek at Saxon Creek Confluence	SLT-TROU-03
Upper Truckee River at Airport	SLT-TR15-02
Upper Truckee River at Christmas Valley	SLT-XMAS-01
Upper Truckee River at Mouth	SLT-TRMO-00
Upper Truckee River downstream of Elks Club Drive	SLT-TR20-01
Upper Truckee River upstream of Lake Tahoe Boulevard	SLT-TR10-01
Eagle Creek above Highway 89	SLT-EAGL-01
Cascade Creek at Mouth	SLT- CASC-00
Cascade Creek above Highway 89	SLT-CASC-01
Tallac Creek above Highway 89	SLT-TALL-01
Angora Creek at View Circle	SLT-ANG1-01
Timber Cove	TAH-SLAKE-03
Upper Truckee River at E. San Bernadino	SLT-TR30-04
Cold Creek above Pioneer Trail	SLT-COLD-02
Bijou Park Drainage at Warner Salas Road	SLT-BPDR-01

Bijou Park Drainage below Hansen's Resort	SLT-BPDR-02
Ski Run Marina	TAH-SLAKE-01
Kahle Beach	TAH-SLAKE-06
<b>North Lake Tahoe</b>	
Griff Creek at mouth	NLT-GRIF-00
Rosewood Creek abv Third	NLT-RSWD-01
Third Creek at mouth	NLT-THIRD-00
Secret Harbor Creek at mouth	NLT-SCRT-00
Tahoe City Urban Ditch at lake	NLT-TCUD-00
Quail Creek at mouth	NLT-QULC-00
General Creek at mouth	NLT-GNRL-00
Lake Forest Creek at mouth	NLT-LKFC-00
Hatchery Creek at Star Harbor	NLT-STAR-01
Madden Creek at mouth	NLT-MADC-01
McKinney Creek at HW-89	NLT-MKNY-01
Snow Creek at mouth	NLT-SNOW-00
<b>Middle Truckee River</b>	
ACOE boundary @ lahontan	MTR-MART-01
Martis Creek at Mouth	MTR-MART-00
Prosser Creek below dam	MTR-PROS-01
Downstream of dam	MTR-DONN-03
Donner @ confluence	MTR-DONN-00
Tahoe Donner Clubhouse	MTR-TROU-02
Union Valley Creek	MTR-GLEN-00
Upstream of Glenshire Pond	MTR-GLEN-02
LTR below boca dam	MTR-BOCA-00
LTR @ Boyington	MTR-BOCA-01
Prosser below 89	MTR-PROS-02
Bear Creek - west of confluence w Truckee	MTR-BEAR-00
Squaw - west of confluence w/ Truckee	MTR-SQCR-00
Truckee river in Town	MTR-TOWN
Alder Creek	MTR-ALDR
East Martis @ Bridge	MTR-EMAR
Mainstem below Tahoe dam	MTR-TR01
Coldstream Canyon	MTR-COLD-00
I80 @ Floriston	MTR-I-80C

## Appendix C – Monitoring equipment

Most monitoring teams are assigned the following field instruments:

- Armored Envirosafe thermometers (alcohol-filled, 0.5° C resolution);
- Standard pH indicator strips (0.5 pH unit resolution) or handheld Hannah pH meters (0.02 unit resolution);
- Handheld Oakton TDS Tester Conductivity meters (10  $\mu$ S/cm resolution or Oakton Conductivity Low+ meters 1  $\mu$ S/cm resolution); and
- Chemetrics dissolved oxygen kits (colorimetric, indigo carmine dye reaction, 1 mg/L resolution below 6 mg/L and 2 mg/L resolution above 6 mg/L)

Turbidimeters used at the staging locations were supplied by Truckee River Watershed Council, the League to Save Lake Tahoe, and the Tahoe Water Suppliers Association.

Nutrient and bacteria samples are kept chilled with ice or blue ice in coolers from the point of collection until arrival at the lab for analysis. Bacteria samples are collected in sterile Whirl-packs; nutrient and turbidity samples are collected in clean plastic bottles.

Bacteria samples are then transported from drop-off points at Lake Tahoe and Truckee to either the Lahontan Water Quality Lab in South Lake Tahoe or the U.S. Geologic Survey in Truckee. The need for multiple labs for such a large area is to ensure sample analysis within the allotted 24-hour holding time. Quality assurance is comparable as each lab uses the same method, SM9222 from Standard Methods for Water and Wastewater Analysis, 21 Edition, 2007.

Nutrient samples collected within the Lake Tahoe Basin are delivered to South Tahoe Public Utility District in South Lake Tahoe within the allotted hold time. Middle Truckee River samples are sent to High Sierra Labs for analysis.

# SOURCE

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*Hiding A Pump Station  
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# HIDING A PUMP STATION

An aerial shot of the concrete blocks off the shore of Lake Tahoe. Photo credit: TCPUD.

## in PLAIN SIGHT in SCENIC LAKE TAHOE

BY Spencer Archer, P.E., BCEE, DBIA

Tahoe City Public Utility District's (TCPUD's) new one million gallon per day (MGD) capacity surface water treatment plant will provide both drinking water and fire protection to the west shore communities of Tahoma and Homewood, California. Photo credit: TCPUD.



**OFFERING YEAR-ROUND RECREATION**, from world-famous ski resorts to watersports and beach activities, North Lake Tahoe offers something for everyone, including its permanent residents and more than three million annual visitors. The Tahoe City Public Utility District (TCPUD) is responsible

for bringing clean drinking water to approximately 5,500 water customers and the influx of seasonal visitors. TCPUD historically relied on groundwater, supplemented by a seasonal, temporary surface water treatment plant, to serve its customers on the west shore of Lake Tahoe.

With a need for a more permanent, drought-resistant solution, in 2013, TCPUD began design of a one million gallon per day (MGD) capacity surface water treatment plant to provide both drinking water and fire protection to the west shore communities of Tahoma and Homewood, California. The plant has been designed to facilitate potential future expansion for further regionalization of water supply in TCPUD's west shore service areas.

Kennedy Jenks (KJ) has been involved in every step of project development and implementation. Early in the project development phase, teams from KJ prepared the preliminary design, developed the California



Environmental Quality Act (CEQA) environmental review documents, supported a land acquisition for the new plant, and prepared the final design and public bid documents.

With design completed in 2020, KJ has continued to provide construction management support while the walls of the treatment plant go up and the lake intake pump station goes out of sight.

### Extreme Coordination to Relocate the Pump Station

The pre-existing lake intake pump station was located on, and adjacent to, a public beach with an intake structure

in Lake Tahoe. A primary goal for the project was to camouflage the new water treatment plant infrastructure into the surrounding natural environment, reduce visual impacts to public recreation facilities, and protect environmentally sensitive areas, including Lake Tahoe.

The project relocated the above-ground pump infrastructure to a submersible pump station in Lake Tahoe. Construction of the new in-lake infrastructure requires close coordination between the contractor, Thompson Builders Corporation (TBC), the dive team from Crescent Diving, the TCPUD, the public, and various regulatory and permitting entities. Early engagement and collaboration between these parties has been critical to successful implementation.

### Below the Surface

Innovative construction techniques are being used to construct the infrastructure in Lake Tahoe. To

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construct the submersible pump station, divers set up a ramp that conveys construction material into the water so that a barge can be used to float the materials to the approximate location they are sunk to the lakebed.

From there, the dive team goes underwater, with a live video and audio feed, to communicate with teams at the surface regarding final placement and other underwater conditions.

The team relies on the eyes and hands of what the divers can do underwater, and setting blocks underwater is a real constructability challenge to overcome.

**Monitoring a Remote, Submersible Pump Station**

The intake pump station, 650 feet offshore and 30 feet below the water surface, has three submersible pumps. In addition to the pumps, the unique pump station includes intake screens, pre-assembled components that can be installed by divers underwater, and coiled power cables to facilitate bringing the pumps to the water surface for future maintenance.

To monitor the remote pump station, innovative options including real-time pump curves, enhanced thermal cable modeling, and power quality monitoring are utilized. Source water is chlorinated for disinfection at the lake intake pump station, and the water is then treated at the water treatment plant building using membrane filters followed by ultraviolet light (UV) reactors. The treated water is conditioned with caustic soda prior to being pumped to the domestic distribution system.

**Turning Designs into Reality**

Lingering pandemic supply chain issues, extensive regulatory construction constraints, inclement weather, forest fires, and nonstandard construction methods are just some of the hurdles encountered in the construction phase of the project, which began in the summer of 2021.

“Successful implementation of a project of this complexity requires close coordination and partnership between all project members including the contractor, the district, the design

engineer, the public, and the number of regulatory and permitting agencies,” said Sarah Hussong Johnson, Senior Civil Engineer for TCPUD.


Through this commitment to partnership, the project team looks forward to the successful implementation of this important project to provide drought-resistant water supply and fire protection to communities along the west shore of Lake Tahoe.

**More Information**

For more information about the TCPUD West Lake Tahoe Regional Water Treatment Plant, visit [www.tcpud.org/watertreatmentplant](http://www.tcpud.org/watertreatmentplant).



*Spencer Archer, P.E., BCEE, DBIA, is the National Director of Design-Build at Kennedy Jenks.*





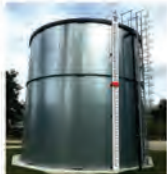






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## TKPOA CMT - YEAR 2 PLANNING WORKING GROUP UPDATE (no herbicide use years 2/3)

### Tahoe Keys Control Methods Test (CMT): Year-Two Objectives and Planning

#### Introduction and Year One Outcome:

The CMT is a multiphase/ multiyear project. The first year of the CMT was completed in the fall of 2023 and encompassed specific treatments (tools) for aquatic weed management from late May to October. The results of the intensive environmental monitoring and assessments of the effectiveness of replicated Year-One “Group A” treatments using herbicides, UV- light, and Laminar Flow Aeration (LFA) were reported in March. (These reports are available on the Tahoe Keys website Tahoe Keys Weeds <https://tahoekeysweeds.org>).

Since the primary objective of the CMT is to develop data for improved management of aquatic weeds in the Keys, the use of Year-Two CMT, “Group B” (non-herbicide) treatments is dependent on meeting three key criteria based on the Year-One “Group A” treatments: 75% reduction in target weed biovolume; achieving a “Vessel Hull Clearance” (for navigation); and enhancing conditions for desirable native plants. These criteria were met in several sites that had received herbicides or UV treatments including Endothall herbicide treatments, UV treatments and selective reduction of Eurasian watermifoil in Triclopyr herbicide treatments. (The criteria were not met in the LFA as this method generally required multiple seasons for effectiveness. Also, sites intended as “Combination Herbicide/UV” were not completed due to lack of access for UV treatments. These sites will receive UV treatments in Year-Two).

#### Year Two Objective and Strategies:

The Year-Two objective is to determine if the successful control criteria achieved in 2022 can be sustained using the Group B (non-herbicide) methods, which include bottom barriers, diver assisted suction hand removal, localized UV treatments (and continued LFA). Group B methods will be most effective when applied where small areas of aquatic weeds have begun to emerge in spring/early summer in the Year-One CMT sites.

To identify potential Group B treatment sites, aquatic weed (macrophyte) rake surveys and hydroacoustic scans were conducted in mid-May. The results of the spring macrophyte surveys are under evaluation. This information will be used to determine which Group B methods will be used based on the decision scheme outlined in the CMT EIR/EIS as well as the Lahontan Water Board NPDES permit and the TRPA approval. The decision criteria and associated Group B methods are briefly outlined on the following page. When the location(s), types and extent of aquatic plants emerging in late May, 2023 are known, the appropriate Group B method will be assigned to areas that provide a comparable conditions for of each Group B methods within the same CMT site or between sites. The goal is to allocate sites that provide replicate Group B methods for statistical comparisons of their effectiveness. However, since the abundance and species occurrence in spring cannot be manipulated, the Group B methods will be selected to provide the best available representative conditions.

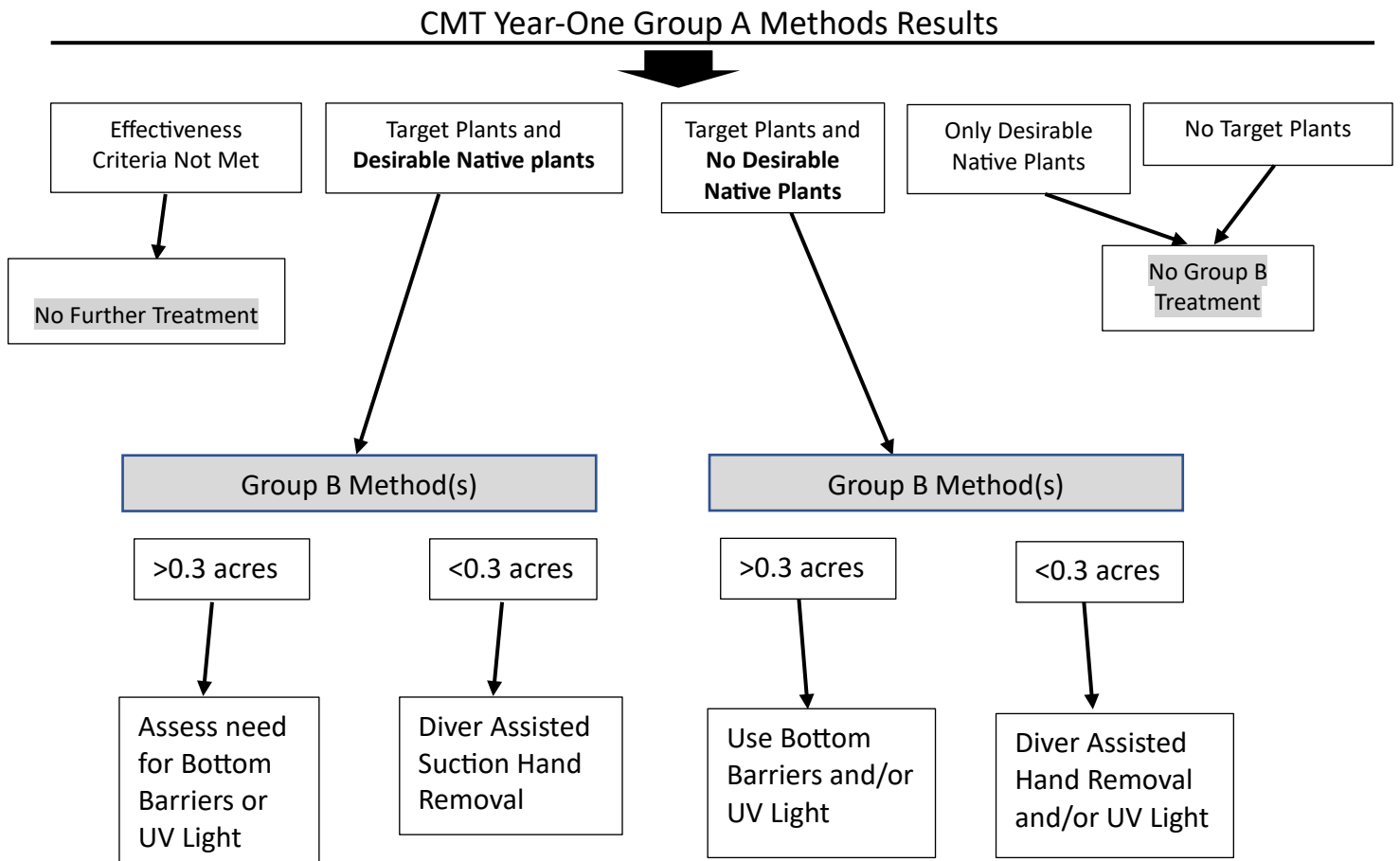
Monitoring during Year Two includes the water quality variables macrophyte assessment as in Year One, except that no herbicide monitoring will be done since no herbicides are used in Year

Two). Due to the small sizes of Group B sites, macrophyte rake spatial sampling will be adjusted to ensure that Group B sites are adequately assessed for species composition and frequency of occurrence by species. Note that rake sampling will not be done on bottom barriers except for pre-installation and post-removal. This protects the barriers from rake damage. However, bottom barriers will be monitoring periodically by divers for integrity and for sediment or plants accumulating on the surface. In addition, added photo-documentations will be done with underwater GoPro camera systems (video and still images) to augment physical samples and hydroacoustic scans, depending upon adequate visibility (low turbidity).

Coordination and documentation of monitoring and Group B methods deployment will be coordinated through TKPOA and TRPA staff and TKPOA and TRPA contractors. As in Year-One, regular online meetings of the Monitoring Work Group (MWG) will be held to ensure compliance with monitoring and to facilitate CMT activities. TKPOA will continue to provide updates to homeowners through the monthly Keys Breeze, E-blasts and other communication avenues.

CMT Year-Two activity is already underway with refinement in monitoring, preparation and calibration of monitoring equipment, coordination of work schedules and updated training and other field reporting systems that document CMT activities.

Figure 1. Group B Decision Framework.



# Group B Site Selection - Objectives

- During Year 2, Group B methods will be implemented in the most successful CMT Group A sites where the 75% “knock down” criteria was met
- Group B testing efficacy will be compared against controls and other Group B methods within the same Group A sites

**GOAL: Group B methods to sustain the 75% reduction from successful Year 1 treatment “knock down”**

**DRAFT**

# Group B Site Selection - Assumptions

- Group B model site selection will consider 2022/2023 hydroacoustic scans, Calculated Target Species Biovolume (CTSB) data, and 2023 visual data
- Final Group B test areas are dependent on total acreage and DASH/BB costs

**DRAFT**

# Year 2 Monitoring Requirements

Monitoring Activities	Year 2 Monitoring (Group B)			Continued Year 1 Monitoring (Group A)		
	DASH*	UV-C Spot	BB*	Control	LFA	Other CMT Sites
Standard WQ	X	X	X	X	X	X
Continuous WQ	X	X	X	X	X	X
Cyanobacteria	X	X	X	X	X	X
Hydroacoustic Scans	X	X	X	X	X	X
Herbicide Sediment (Group A Sites and Control)				X		X
Nutrient Grabs		X		X	X	
Macrophyte	X	X	X	X	X	X
Harvesting				X	X	X
Muck Depth				X	X	
Percent Organic Matter				X	X	
Light Levels	X	X	X	X	X	
BMI	X	X	X	X	X	
Turbidity (During DASH and install/removal of BB)	X		X			

\*Additional monitoring and reporting requirements will apply if TKPOA elects to exercise the LMCAP

\*DASH – Diver Assisted Suction Harvesting

\*BB – Bottom Barrier

**DRAFT**



# Group B Site Selection - Possible Locations

CMT Treatment Area	Group B In-Water Location (Nearshore)	Group B In-Water Location (Mid-Channel)
Endothall Only	1 BB, 2 DASH	1 BB, 1 DASH, 3 UV-C Spot*
Triclopyr Only	1 BB, 2 DASH	1 DASH, 3 UV-C Spot*
Endothall Combo*	1 BB, 1 DASH	1 BB, 1 DASH
Triclopyr Combo*	1 BB, 1 DASH	1 BB, 1 DASH
UV-C Only*	N/A	N/A
LFA	N/A	N/A
Controls	N/A	N/A

\*UV-C treatment is a continuation of Group A methods in UV only and Combo areas

\*UV-C Spot is a Group B treatment

**DRAFT**

# Total Group B In-Water Acreages

Group B In-Water Locations	Total Acreages
Bottom Barrier (Nearshore)	0.75
Bottom Barrier (Mid-Channel)	1.0
DASH (Nearshore)	1.25
DASH (Mid-Channel)	0.75
UV-C Spot Treatment (Nearshore)	0.0
UV-C Spot Treatment (Mid-Channel)	1.25

**DRAFT**

# Next Steps

- Contractor selection
- Prep equipment and finalize monitoring schedules
- Spring (baseline) surveys for site selection
- Identify Group B test site locations (late-may)
- Contractors start work (mid-june)

**DRAFT**

# 60 Possible Locations of Group B Treatments

Group A CMT Site	Group B Test Methods	Total Acreage of Group B Test Areas	Acreage of Group A Site	Group B Percentage of Group A Site Acreage
Site 1 (Endothall Only)	1 DASH, 1 UV-C	0.50	1.5	33%
Site 2 (Endothall Only)	1 BB, 1 DASH, 1 UV-C	0.75	1.5	50%
Site 3 (Endothall Only)	1 BB, 1 DASH, 1 UV-C	0.75	2.1	35%
Site 8 (Triclopyr Only)	1 BB, 1 UV-C	0.50	1.6	31%
Site 9 (Triclopyr Only)	1 UV-C, 1 DASH	0.50	1.5	33%
Site 10 (Endothall Combo)	1 BB, 1 DASH	0.50	2.0	25%
Site 11 (Endothall Combo)	1 BB, 1 DASH	0.50	1.6	31%
Site 14 (Triclopyr Combo)	1 BB, 1 DASH	0.50	1	50%
Site 15 (Endothall Combo)	1 BB, 1 DASH	0.50	1.2	41%



March 15, 2023

Mr. Mike Plaziak, Executive Officer  
 Lahontan Regional Water Quality Control Board  
 2501 Lake Tahoe Boulevard  
 South Lake Tahoe, CA 96150  
 Via Email: Lahontan@waterboards.ca.gov

Subject: TKPOA 2022 Annual Report for Tahoe Keys Lagoons Aquatic Weed Control Methods Test; Lahontan Regional Water Quality Control Board Order No. R6T-2022-0004, NPDES No. CA6202201, WDIID No. 6A091701001

Dear Mr. Plaziak:

In accordance with the Monitoring and Reporting Program (MRP) requirements of the subject Order (Attachment E to NPDES No. CA6202201, Section V.C.), the Tahoe Keys Property Owners Association (TKPOA) submits this annual report for the Tahoe Keys Lagoons Aquatic Weed Control Methods Test (also referred to as the Control Methods Test Project or CMT Project). The enclosed report presents a summary of the 2022 activities performed for the CMT Project, and an assessment of compliance with all requirements of the subject Order.

The 2022 activities for the CMT Project were extensive. Twelve implementation and monitoring team contractors and consultants were retained by TKPOA and the Tahoe Regional Planning Agency (TRPA) to collect and analyze over 75,000 monitoring data points, which are summarized in the enclosed Annual Report. Because of the tremendous amount of data collected in 2022, TKPOA created, organized, and presents the raw data in a Dropbox account that can be accessed when reviewing the summaries, analyses, and appendices of the Annual Report. Separate correspondence will be supplied to you and your staff in the near future with guidance on how to access and view the raw data.

### Annual Report Contents

The CMT Project permits and approvals contained multiple environmental monitoring and data submittal provisions. Certain permit and approval provisions contain similar information requirements. To assist with review of the Annual Report and other Lahontan Regional Water Quality Control Board (Lahontan Water Board) annual submittal requirements, TKPOA prepared the enclosed table (Annual Report Requirements Table) that identifies the section(s) of the Annual Report or appendix(es) where reporting information for the following permits/approvals can be found:

- Lahontan Water Board NPDES Permit No. R6T-2022-0004 (January 13, 2022)
- Tahoe Regional Planning Agency EIP Permit No. EIPC2018-0011 (January 26, 2022)
- Mitigation Monitoring and Reporting Program (February 25, 2022)
- Lahontan Water Board Approval of Revised Amendment 1 to the Aquatic Pesticide Application Plan (May 18, 2022)
- Final Quality Assurance Project Plan (June 15, 2022)

### Compliance with Order

As described in the enclosed Annual Report and as the Lahontan Water Board staff was previously notified, the CMT Project experienced exceedances and incursions of the NPDES Permit limitations. Four types occurred related to: 1) receiving water limits (RWLs) for Endothall herbicide immediately outside of the double turbidity curtains at one location in the West Lagoon following extreme wind events that dislodged the barrier curtains, 2) RWLs for Endothall herbicide inside of the double turbidity curtains within the Lake Tallac treatment area following the 21 DAT permit limit, 3) RWLs for Endothall herbicide for internal receiving waters adjacent to herbicide treatment sites inside of the double turbidity curtains, and 4) Basin Plan Water Quality Objectives (WQOs), both within and outside of the treatment areas and including in untreated CMT Project Control sites.

For the Endothall concentration exceedances ( $> 100 \mu\text{g/L}$ ) in the West Lagoon, transient exceedances occurred immediately outside of the double turbidity curtains adjacent to CMT Project Site 2. The dates of the recorded exceedances were May 28, June 2, June 7, June 8, and June 10, 2022 at monitoring site ORW-RHC2. For the Endothall concentration exceedances within the Lake Tallac treatment area (treatment side of the double turbidity curtains), the dates of recorded exceedances were on June 25 and 28, 2022, which were beyond the 21 DAT limit for treated areas. For the internal receiving waters adjacent to herbicide treatment sites, Endothall concentrations were above RWLs for both the West Lagoon and Lake Tallac at various times during the period May 28 through June 28, 2022.

The above herbicide issues are itemized by CMT Project site in Table 14-1 (Section 14) of the Annual Report. The Lahontan Water Board staff notifications are referenced in Section 3.2.3 (Notifications) of the Annual Report and listed in Appendix Q (List of Correspondence with Permitting Agencies, TKPOA Homeowners, and Stakeholders). No other herbicide concentration issues occurred within or outside of the herbicide treatment areas in the West Lagoon or Lake Tallac. Notably, the  $10 \mu\text{g/L}$  limit for Rhodamine WT Dye was not exceeded at any time.

For the Basin Plan WQOs, multiple exceedances for several water quality parameters were recorded in 2022. Some of these exceedances can be attributed to CMT Project activities (CMT treatments, including the presence of the double turbidity curtains). Others can be attributed to the pre-CMT existing or “natural” conditions of the Tahoe Keys lagoons and the differences in water quality characteristics compared to Lake Tahoe proper (which raises the issue of whether site specific objectives are needed for the Keys). The large number of recorded compliance level exceedances for the multiple WQO parameters makes it impractical to include the locations and dates in this transmittal letter, but the data are presented in Sections 4 through 17 of the Annual Report and are in detailed tabular format in Appendix X (Instances of Elevated Herbicide and Water Quality Parameters).

Lastly, TKPOA is pleased to report that greater than 90 percent of all required field data collection was achieved in 2022, despite the numerous challenges posed by field operations of this type and scale in an environmental (i.e., non-laboratory) setting. These challenges were beyond the control of TKPOA and TKPOA/TRPA contractors and consultants and were created by extreme weather conditions, wildlife interference, equipment and material supply chain delays, labor shortages and turnover, and unhealthy air quality caused by regional wildfires. These events are further explained in the data completeness Section 3.7 of the Annual Report. Based on the experience gained from the first year of CMT Project implementation, including the 2022 challenges, several improvements are planned for 2023 in communications, reporting procedures, and scheduling that will help increase and improve data gathering and monitoring for the second year of the Project.

### Changes in Facility Contact Information

TKPOA recently changed its management structure and is now operated by First Service Residential. With this change in management, near-term changes in general managers will occur as TKPOA concludes the transition.

As current Interim General Manager, I will continue to serve TKPOA through March 17, 2023. From March 18 through 26, 2023, TKPOA will be managed by Shane Gillaspie, who also serves as Executive Vice President to First Service Residential. Effective March 27, 2023, Hallie Kirkingberg will become TKPOA's new General Manager. The contact information for Mr. Gillaspie and Mr. Kirkingberg will remain the same as my current business telephone and address.

### 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 assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best 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. (40 C.F.R. §122.22(d).)

Respectfully submitted,



Mark J. Madison, P.E.  
 Interim General Manager  
 Tahoe Keys Property Owners Association

### Enclosures

- CMT Project 2022 Annual Report Requirements Table
- CMT Project 2022 Annual Report and Appendices

### Cc (electronically with Enclosures):

- TKPOA Board of Directors
- TKPOA Water Quality Committee
- Kimberly Chevallier, Environmental Improvement Program Division Manager, Tahoe Regional Planning Agency
- Dennis Zabaglo, Aquatic Resources Program Manager, Tahoe Regional Planning Agency
- Shane Gillaspie, Executive Vice President, First Service Residential
- Hallie Kirkingberg, General Manager, TKPOA (effective March 27, 2023)
- Melissa Thorne, Downey Brand LLP
- Robert Tucker, P.E., Senior Water Resource Control Engineer, Lahontan Regional Water Quality Control Board
- Russell Norman, P.E., Water Resource Control Engineer, Lahontan Regional Water Quality Control Board
- Tiffany Racz, M.S., Water Resource Control Engineer, Lahontan Regional Water Quality Control Board

## CMT Project Annual Report Requirements Table

Permit/ Approval Document Section	Summary Reporting/ Compliance Requirement	Annual Report Section/Appendix
<b>NPDES Permit NO. R6T-2022-0004 (January 13, 2022)</b>		
IV. Other Monitoring Requirements, C. Water Supply Monitoring; pg. E-14	"Include all Table E-5 Drinking Water Supply Monitoring Requirements."	Multiple Sections including 1.3, 12.0
V. Reporting Requirements, A. General Monitoring and Reporting Requirements, No. 1; pg. E-16	"Comply with all Standard Provisions (Attachment D) related to monitoring, reporting, and recordkeeping."	Multiple Appendices including G, H, I, M, O, P, Q, S, U, X, Y, Z, EE, FF, GG
V. Reporting Requirements, A. General Monitoring and Reporting Requirements, No. 2; pg. E-16	"The reports must present in tabular and graphical formats, all data collected for the entire project. Any additional water quality monitoring samples collected and analyzed beyond requirements in this Order must be reported."	Multiple Sections including 2.6, 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.2.3, 5.2.1, 5.2.2, 5.2.3, 5.3.3, 6.2.1, 6.2.2, 6.2.3, 6.3.3, 7.2.1, 7.2.2, 7.2.3, 7.3.3, 8.2.1, 8.2.2, 8.2.3, 9.2.1, 9.2.2, 9.2.3, 9.3.3, 10.2.1, 10.2.2, 10.2.3, 10.3.3, 11.0 Multiple Appendices including S, R, Y, Z
V. Reporting Requirements, A. General Monitoring and Reporting Requirements, No. 3; pg. E-16	"For each parameter with a receiving water limitation, the Discharger must determine and report compliance status with respect to the receiving water limitation... All exceedances of receiving water limitations must be identified within the table(s)."	Multiple Sections including 1.4.1, 1.4.2, 2.2, 12.1, 14.1 Multiple Appendices including X, Z
V. Reporting Requirements, B. Annual Information Collection, No. 1; pg. E-16	"A summary discussing compliance/ violation of this Order and effectiveness of the BMPs implemented in reducing or preventing non-compliance with this Order associated with aquatic herbicide, Rhodamine WT and lanthanum-modified clay applications."	Section 16.0
V. Reporting Requirements, B. Annual Information Collection, No. 2; pg. E-16	"Monitoring data and recommendations for improvements to the APAP including BMPs and the monitoring program based on evaluation of the monitoring results. All receiving water monitoring data must be compared to receiving water limitations and existing receiving water quality."	Multiple Sections including 2.2, 5.3.2, 14.0, 16.0, 16.1, 16.2, 16.6
V. Reporting Requirements, B. Annual Information Collection, No. 3; pg. E-16	"Identification of BMPs currently in use and a discussion of their effectiveness in meeting the requirements in this Order."	Multiple Sections including 1.3, 1.4, 2.1, 2.2.1, 16.2
V. Reporting Requirements, B. Annual Information Collection, No. 4; pg. E-16	"A discussion of any BMP modifications made to address violations of this Order."	Multiple Sections including 2.7.1, 2.7.2



Permit/ Approval Document Section	Summary Reporting/ Compliance Requirement	Annual Report Section/Appendix
V. Reporting Requirements, B. Annual Information Collection, No. 5; pg. E-17	"Map(s) showing the location/ size of each treatment area including locations of all monitoring conducted with unique monitoring station identifiers for each monitoring station, the specific herbicide applied to each treatment area denoted."	Multiple Sections including 1.1, 1.3
V. Reporting Requirements, B. Annual Information Collection, No. 6; pg. E-17	"Quantity of aquatic herbicides, Rhodamine WT and lanthanum-modified clay applied to each application area during each application event."	Multiple Sections including 1.3, 3.2.1 Appendix U
V. Reporting Requirements, B. Annual Information Collection, No. 7; pg. E-17	"Information utilized to establish target mixed chemical concentration and the quantity of each chemical discharged in each treatment area including measurements and calculations of treatment area, volume, and any other information utilized for these calculations."	Multiple Sections including 1.3, 3.2.1 Appendix U
V. Reporting Requirements, B. Annual Information Collection, No. 8; pg. E-17	"Information on the herbicide applied to each treatment area and plant survey data collected and include any other treatment (non-chemical or mitigation effort) performed on each area."	Multiple Appendices including EE, U
V. Reporting Requirements, B. Annual Information Collection, No. 10; pg. E-17	"Sampling results indicating the name of the staff performing the sampling and their affiliation, location/ name of each monitoring station, date, map showing each treatment area and associated treatment area/ receiving water sampling locations, name of parameter and its concentration detected, minimum levels, method utilized, method detection limits for each analysis, comparison of monitoring results to receiving water limits, and description of the QA/QC Plan measures and results."	Multiple Sections including 1.1, 14.0, 17.0 Multiple Appendices including G, H, Z, GG
V. Reporting Requirements, B. Annual Information Collection, No. 11; pg. E-17	"An application log containing: Date of application; Location of application; Name of applicator; Type/ amount of aquatic herbicide, Rhodamine WT; level of water body, time application started/ stopped, application method, rate/ concentration; visual monitoring assessment; and Certification that applicator(s) followed the APAP and implemented the BMPs"	Appendix U
V. Reporting Requirements, B. Annual Information Collection, No. 12; pg. E-17	"Records of all applicator and associated staff safety training including name of all staff trained, date/time of training and summary of training material covered. Training records are to include documentation of aquatic pesticide applicator daily, morning safety briefings in addition to any other one-time or routine training conducted."	Appendix O

<b>Permit/ Approval Document Section</b>	<b>Summary Reporting/ Compliance Requirement</b>	<b>Annual Report Section/Appendix</b>
V. Reporting Requirements, C. Annual Report; E-17-18	"If there is no herbicide and rhodamine application during the annual report period, the Discharger must provide the Executive Officer a certification that no discharge to any surface waters occurred."	N/A
V. Reporting Requirements, E. Reporting Protocols, No. 6-a; pg. E-19	"Report data in a tabular format. Summarize data to illustrate whether the herbicide applications are conducted in compliance with effluent and receiving water limitations..."	Multiple Sections including 1.4.1, 5.3.2, 14.1, 14.2, 16.2 Appendix S
V. Reporting Requirements, E. Reporting Protocols, No. 6-b; pg. E-19	"Attach a cover letter that identifies any violations; discusses corrective actions taken/ planned; and provides a schedule for corrective actions. Identified violations must include a description of the requirement that was violated and a description of the violation."	See cover letter
V. Reporting Requirements, E. Reporting Protocols, No. 6-c; pg. E-19	"Submit to the Lahontan Water Board, signed and certified as required by the Standard Provisions (Attachment D)."	See cover letter
V. Reporting Requirements, Table E-6 Summary of Reports; pg. E-22	"Pre-Biological Monitoring Report- March 1 of the year following pre-biological monitoring"	Appendix CC
V. Reporting Requirements, Table E-6 Summary of Reports; pg. E-22	"Post-Biological Monitoring Report- March 1 of the Year following completion of post-biological monitoring"	Appendix DD
<b>Revised Amendment 1 Aquatic Pesticide Application Plan (May 18, 2022)</b>		
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 1; pg. 80	"Summary that discusses overall results, issues concerning compliance of the permit and effectiveness of the APAP."	Section 16.0
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 2; pg. 80	"Summary of monitoring data, including improvements/ degradation in water quality because of the use of herbicides."	Multiple Sections including 5.2, 6.2, 7.2, 9.2, 10.2, 16.4
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 3; pg. 80	"Discussion of BMP's used and recommendation for improvements."	Multiple Sections including 1.3, 1.4, 2.1, 2.2.1, 16.2
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 4; pg. 81	"Final map showing location of each herbicide application."	Section 1.1

<b>Permit/ Approval Document Section</b>	<b>Summary Reporting/ Compliance Requirement</b>	<b>Annual Report Section/Appendix</b>
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 5; pg. 81	"Amount and type (product) of herbicide used."	Section 1.3 Appendix U
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 6; pg. 81	"Detailed table showing sampling locations (GPS referenced) and associated results by date and the site."	Appendix S
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 7; pg. 81	"Summary of herbicide application logs."	Appendix U
<b>Mitigation Monitoring and Reporting Program NO. R6T-2022-0005 (February 25, 2022)</b>		
3.0 Water Quality Parameters; pg. 22	"Provide the location of the water quality measurements and the measurements themselves in an annual report."	Multiple Appendices including EE, R, S, Y
7.1 Reporting; pg. 25	"Provide documentation of the selection/ performance of the herbicide application by a QAL holder following herbicide application."	Appendix U
7.2 Reporting; pg. 25	"Describe the spill control BMPs implemented during herbicide application."	Section 2.2.1 Multiple Appendices including F, L
7.3 Reporting; pg. 25	"Describe the contingency plans implemented following aquatic herbicide application."	Section 2.2.1 Appendix M
7.4 Reporting; pg. 26	"If herbicides are detected in nearby wells, provide documentation of the contingency plans implemented following herbicide application."	Section 12.2
7.5 Reporting; pg. 26	"Report if aeration systems were implemented."	Section 2.8
7.6 Reporting; pg. 26	"Report whether workers received awareness training and the Tribal Cultural Resources Awareness brochure."	Appendix O

<b>Final Quality Assurance Project Plan (June 15, 2022)</b>		
3.7 Project Tasks, Action 19. Removal of Curtains, No. 3; pg. 34	“Samples of turbidity must be taken at surface, mid-depth, and bottom and reported in the annual report. Calibration reports must be included.”	Multiple Sections including 2.5, 2.7.1, 2.7.2, 3.7.1, 3.7.4, 3.7.5, 3.7.7 Multiple Appendices including P, R
10.0 Data Verification and Validation, 10.2 Field Measurements; pg. 62	“Data verification/ validation results will be included. These results will include explanations of any qualifiers attached to sample results by the laboratory during data verification, or by the Contractors’ Data QA manager during data validation, including the rationale behind rejecting any data as unusable. Data verification will be reviewed by CMT Project managers.”	Section 1.9 Multiple Appendices including F, G
12.0 Documentation and Reporting; pg. 62-63	“Documentation will include original field notes, photographs, field forms, calibration records, laboratory data packages that include completed chain-of-custody forms, electronic files from water quality data loggers, water level recorders, and a rain gauge. All the information will be summarized in a report, with written records provided in appendices. The report will be provided as electronic pdf files. Photographs, laboratory data packages, and electronic files from water quality and hydrology instruments will be made available electronically on portable file storage devices.”	Multiple Appendices including EE, H  Cover letter (paragraph 2)
12.0 Documentation and Reporting; pg. 63	“The report will provide much of the information used to evaluate CMT and evaluate water quality compliance in an antidegradation analysis; however, the data report will not include these evaluations and analyses. Data analyses and interpretation included in the data report will include comparisons of results to Basin Plan water quality objectives, estimating a seasonal water balance for the lagoons, and preparing a conceptual model that describes nutrient loading to and nutrient cycling within the Tahoe Keys lagoons.”	Multiple Sections including 4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.2.3, 5.2.1, 5.2.2, 5.2.3, 5.3.3, 6.2.1, 6.2.2, 6.2.3, 6.3.3, 7.2.1, 7.2.2, 7.2.3, 7.3.3, 8.2.1, 8.2.2, 8.2.3, 9.2.1, 9.2.2, 9.2.3, 9.3.3, 10.2.1, 10.2.2, 10.2.3, 10.3.3
<b>TRPA Permit EIPC2018-0011 (January 26, 2022)</b>		
Special Conditions, No.22; pg. 10, 11	“Submit annual efficacy monitoring reports for three years from the date of project implementation. Effects of the treatments on plant biovolume, plant species composition, and water quality within the CMT test areas shall be compared with reference sites. Specific efficacy monitoring will determine if the following CMT goals are achieved, including the following:	Appendix E

	<ul style="list-style-type: none"> <li>• Reduction of 75% in total invasive and nuisance plant biomass (biovolume) within treated sites.</li> <li>• Increase in occurrence and percent composition of native plants relative to non-native plants.</li> <li>• Reduction of non-native plant and fish habitat, therefore improving habitat for native species."</li> </ul>	
Special Conditions, No.22; pg. 11	<p>"Improved water quality in the test sites, such that water quality objectives are more frequently met, therefore improving water quality and associated clarity. This includes the following:</p> <ul style="list-style-type: none"> <li>• Reduction in suspended nitrogen, phosphorus, and total dissolved solids in the fall months during normal senescence;</li> <li>• Improvement in clarity of the water as measured by turbidity;</li> </ul> <p>and</p> <ul style="list-style-type: none"> <li>• Improve water column pH stability in all test areas to achieve pH values between 7.0 and 8.4.</li> <li>• Maintenance of the three (3)-foot vessel hull clearance."</li> <li>• Improved recreational and aesthetic values."</li> </ul>	Multiple Sections including 16.4, 16.5

\*To find the page numbers for the referenced section/ appendix numbers, go to the table of contents located in the body of the Annual Report.

full report available at : <https://tahoekeysweeds.org/>

# **TAHOE KEYS PROPERTY OWNERS ASSOCIATION**

## **TAHOE KEYS LAGOONS AQUATIC WEED CONTROL METHODS TEST: ANNUAL REPORT – YEAR 1**

PREPARED PURSUANT TO

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD  
LAHONTAN REGION  
ORDER NO. R6T-2022-0004  
NPDES NO. CA6202201  
WDID NO. 6A091701001

AND

TAHOE REGIONAL PLANNING AGENCY  
FILE No: EIPC2018-0011  
PROJECT NUMBER: 510-101-00

**MARCH 2023**

**TAHOE KEYS PROPERTY OWNERS ASSOCIATION**  
**TAHOE KEYS LAGOONS AQUATIC WEED**  
**CONTROL METHODS TEST: ANNUAL REPORT – YEAR 1**

**MARCH 2023**

Prepared for  
Tahoe Keys Property Owners Association



Prepared by  
Dr. Lars Anderson

*In association with*  
Sierra Ecosystem Associates



Sierra Ecosystem  
Associates  
2311 Lake Tahoe Blvd., Ste. 8  
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**LIST OF ABBREVIATIONS AND ACRONYMS**

AIP	Aquatic Invasive Plants (includes non-native and native plants)
APAP	Aquatic Pesticide Application Plan
BMI	Benthic macroinvertebrates
CalEPA	California Environmental Protection Agency
CMT	Control Methods Test
COC	Chain of Custody
DAT	days after treatment
DO	dissolved oxygen
EIP	Environmental Improvement Program
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ERS	External Reference Sample
ESA	Environmental Science Associates
EWM	Eurasian watermilfoil
HABs	harmful algal blooms
IRI	Inventive Resources, Inc
Lahontan Order	Lahontan Water Board Order No. R6T-2022-0004
Lahontan Water Board	California Regional Water Quality Control Board, Lahontan Region
LFA	Laminar Flow Aeration
LMC	Lanthanum-Modified Clay
LMCAP	Lanthanum-Modified Clay Application Plan
MDL	method detection limit
µg/L	microgram per liter
mg/L	milligram per liter
MMRP	Mitigation Monitoring and Reporting Program
MWG	Monitor Working Group
N	Nitrogen
N/A	not applicable
ND	not detected
NPDES	National Pollutant Discharge Elimination System permit
NR	data not reported
NT	not treated
NTU	Nephelometric Turbidity Units
Ortho-P	Orthophosphate
ORP	oxidation reduction potential
Permit	Tahoe Regional Planning Agency Permit No. EIPC2018-0011
PAR	Photosynthetically Active Radiation
P	Phosphorous
Project	Tahoe Keys Lagoons Aquatic Weed Control Methods Test
PPB	parts per billion
PPM	parts per million
QA/QC	Quality Assurance/Quality Control

QAL	Qualified Applicator License
QAPP	Quality Assurance Project Plan
RL	reporting limit
RWL	Receiving Water Limits
RWT	Rhodamine Water Tracer
SEA	Sierra Ecosystem Associates
SpC	specific conductivity
TA	Test Area
TCP	3,5,6-Trichloro-2-pyridinol
TKN	Total Kjeldahl Nitrogen
TKPOA	Tahoe Keys Property Owners Association
TMP	3,5,6-trichloro-2-methoxypyridine
Total N	Total Nitrogen
Total P	Total Phosphorus
TRPA	Tahoe Regional Planning Agency
TRPA EIP Permit	Tahoe Regional Planning Agency Permit File No. EIPC2018-0011 (Project 510-101-00)
UV/UV-C	Ultraviolet light/ UV-C= 253.7 nm
VEL	vessel exit log
VHC	vessel hull clearance
WDR	Waste Discharge Requirements

### 1.0 EXECUTIVE SUMMARY

This document reports on the specific regulatory compliance actions and the results as part of implementation of the requirements of Lahontan Regional Water Quality Control Board National Pollutant Discharge Elimination System (NPDES) Permit Order R6T-2022-0004 (Lahontan Order) and required Amendments to the Aquatic Pesticide Application Plan (APAP). Additionally, Tahoe Regional Planning Agency (TRPA) Permit EIPC2018-0011, Special Condition #2 incorporates Mitigation Monitoring and Reporting Program (MMRP) requirements, Special Condition #3 incorporates Waste Discharge Requirements (WDR) and Lahontan Order permit requirements.

The following provides a brief overview and orientation to the “Tahoe Keys Lagoons Aquatic Weed Control Methods Test” (CMT) project, the compliance and mitigation context, and the organizational structure of the Report in compliance with the Lahontan Order.

The development of the CMT and its implementation required a productive collaboration among many agencies, nonprofit advocacy groups, and other stakeholders. The history and process leading to the CMT can be found in Appendix A and Appendix B (Anderson 2022; SEA 2023).

### 1.1 Setting of CMT Project

The Lahontan Order (see Appendix C) permitted the implementation of the CMT in the Tahoe Keys West Lagoon and Lake Tallac, immediately south of the West Lagoon (Figure 1-1) in South Lake Tahoe.

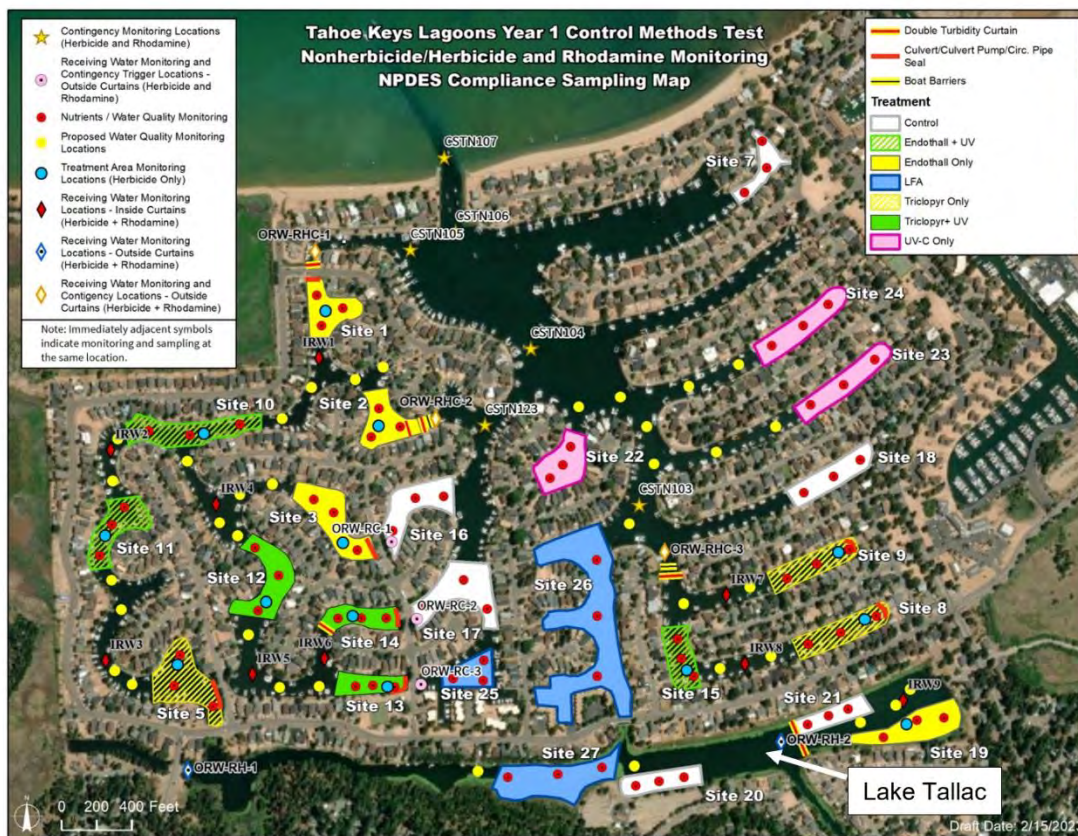


Figure 1-1. Overview Map of CMT Sites and Monitoring Locations

## 1.2 Goal and Objectives of the Three-Year CMT

The overarching objective of the CMT project is to acquire useful information on the capabilities and feasible uses of several control methods to manage aquatic weeds in the Keys lagoons including non-native Eurasian watermilfoil (*Myriophyllum spicatum*), non-native curlyleaf pondweed (*Potamogeton crispus*) and excessive growth of native coontail (*Ceratophyllum demersum*). In this report, these target plants are referred to as Aquatic Invasive Plants (AIP). Specific goals are to achieve 75% reduction in AIP biovolume, provide sufficient vessel mobility, and provide better environmental conditions for desirable native aquatic plants. The goal of Year 1 of the CMT was to determine the ability of the Year 1 test methods (also referred to as "Group A" methods) to achieve a 75% reduction in AIP biovolume. In CMT sites where 75% reduction is achieved, (Group B) methods can be tested for effectiveness in sustaining AIP control in Years 2 and 3.

## 1.3 Herbicide Use

The Lahontan Order and the accompanying APAP provided the specific protocols for herbicide applications and regulatory limits or thresholds for both water quality and levels of herbicides including their degradants. In the West Lagoon, the CMT included a one-time, limited-use test application ("treatment") using two Environmental Protection Agency (EPA) and California Environmental Protection Agency (CalEPA)-approved aquatic herbicides: 1) Endothall (Aquathol K potassium salt), and 2) Triclopyr Renovate 3 (liquid) and Renovate "OTF" (granular). Both were tested in the Tahoe Keys West Lagoon but in Lake Tallac, only Endothall (Aquathol K) was applied at a single site. Renovate was applied to achieve a concentration of 1 mg/L (1 ppm). (Renovate is the formulation of Triclopyr containing triclopyr acetic acid triethylamine salt.) Aquathol K was applied to achieve a concentration of 2 mg/L (2 ppm). These application rates are less than one-half the permitted maximum concentrations based on EPA and CalEPA approved product labeling.

The surface area to which herbicides were applied in replicated treatment sites was 15.5 acres within the total West Lagoon area of 110 acres and a single 2-acre site in the 23-acre Lake Tallac. Note that for Combination herbicide/ultraviolet light (UV) sites, herbicides were applied only to the near shore areas; thus, the actual area to which herbicides were applied was less than one-third the total areas of these sites, and usually less than 25% of the water volume in the site.

## 1.4 Monitoring and Mitigations

The CMT was implemented in accordance with required mitigation and monitoring actions prescribed in the Lahontan Order, the APAP and its amendments, and the MMRP. These actions included monitoring for herbicide active ingredients and their degradants as well as a wide range of water quality variables. Mitigation included the installation and maintenance of double turbidity curtains at strategic points to separate herbicide treated CMT sites from the rest of the West Lagoon and to restrict herbicide application to one site in Lake Tallac. The Lahontan Order also prescribed specific monitoring following use of non-herbicide "treatments" that are critical components of the CMT, including UV treatments alone, combinations of UV and herbicide treatments, and the use of Laminar Flow Aeration (LFA). (Note: UV in this report refers specifically to UV-C, germicidal UV with a wave length of 253.7 nm.)

This report documents all compliance required actions during the implementation of the CMT, including pre-project training and certifications as required by the Lahontan Order. A summary of the implementation process and actions is provided in Appendix A (Anderson 2022).

The report documents the following exceedances and incursions in regulatory limits:

#### 1.4.1 Herbicides and RWT Dye

- a) RWL for Endothall (100 µg/L) inside Site 19 (Lake Tallac) more than 21 DAT;
- b) Endothall outside of Site 19 within the double turbidity curtains;
- c) transient RWL for Endothall outside all sites in Area A except Sites 13, 14;
- d) RWL for Endothall outside double turbidity curtains in the West Lagoon near Site 2 (Area A).
- e) Detection of Triclopyr less than RWL outside double turbidity curtains at Site 15.
- f) RWT dye less than RWL was detected adjacent to treatment sites and outside double turbidity curtains. (See Table 2-2.)

There were no RWL exceedances of Triclopyr (400µg/L) or RWT dye (10µg/L) at any time. Dates, Endothall levels, and duration of exceedances are provided in Table 14-1.

#### 1.4.2 Water Quality

- a) Exceedances in turbidity (>10% higher NTU than controls) occurred in most treatment sites as described in Section 3.7.7.
- b) Exceedances in DO occurred in most bottom water samples in controls and in some mid-depth samples in Area A and to a lesser extent in Areas B and C (Lake Tallac).
- c) Exceedances in pH ranges occurred in all sites including controls. However, pH ranges in some herbicide- and UV-only sites had transient excursions to within the regulatory range (due primarily to reduced aquatic plant carbon assimilation and reduced photosynthesis).
- d) The water quality exceedances are shown graphically in Sections 4.0 through 12.0.

### 1.5 TRPA EIP Permit

In addition to the NPDES, the TRPA required specific monitoring actions to determine the effectiveness of the CMT (Group A) treatments. These compliance actions were delineated in an Environmental Improvement Program (EIP) permit issued by TRPA on January 26, 2022 (Project 510-101-00; File No. EIP C2018-0011; Appendix D), referred to in this report as TRPA EIP Permit.

### 1.6 TRPA Monitoring Role

A key component of the CMT project is the deliberate use of independent on-the-water monitoring teams separate from the herbicide application team and Tahoe Keys Property Owners Association (TKPOA) monitoring teams, particularly for monitoring herbicide and herbicide degradant levels in surface water. To implement the independent monitoring approach, TRPA contracted with highly skilled and experienced contractors expressly for monitoring herbicides, RWT dye, water quality outside sites, nutrients, benthic macroinvertebrates (BMI), nutrients associated with harmful algal blooms (HABs), and the effectiveness of treatments on AIP and native aquatic plants. This approach was intended to reduce the potential for perceived bias in key sampling and data collection, including the effects of CMT (Group A) methods on AIP, and to provide a higher level of confidence for regulators. High confidence in the data is critical for valid assessments of the test methods results. The CMT results will be used to improve and sustain management of AIP in the entire Keys lagoon system going forward.



## 1.7 Field Sampling and Data Collection

Monitoring to comply with CMT permits (Lahontan Order and TRPA EIP Permit) resulted in many thousands of data points, field action documentations, laboratory analyses, photo-records, as well as specific compliance and notification reporting to permitting agencies during key CMT implementation events. These data sets and their interpretation are provided under specific headings below for the monitoring or other contingency actions taken. The Tahoe Keys Lagoons Macrophyte Control Efficacy Monitoring Report: Year 1 for the TRPA EIP Permit is provided in Appendix E (ESA 2023). However, since data on effectiveness and some water quality monitoring variables may be related (correlated or causal), the final section of this report provides a brief discussion of these results for context of the overall monitoring results of the CMT with AIP responses.

## 1.8 Organization of Reporting

### a) Focus on Treatment

The CMT is designed to compare effects of the different treatments on AIP and native species, water quality and BMI levels. Therefore, the monitoring reports are organized by each type of treatment, and comparisons with untreated “control” sites. Except for specific training, certifications compliance, and monitoring compliance, the results are presented in the following format (Figure 1-2) with each CMT treatment described separately. The emphasis on “treatment” reflects both the Environmental Impact Report and Environmental Impact Statement (EIR/EIS) documents that focused on potential impacts of CMT treatments, and the monitoring specified in the Lahontan Order.

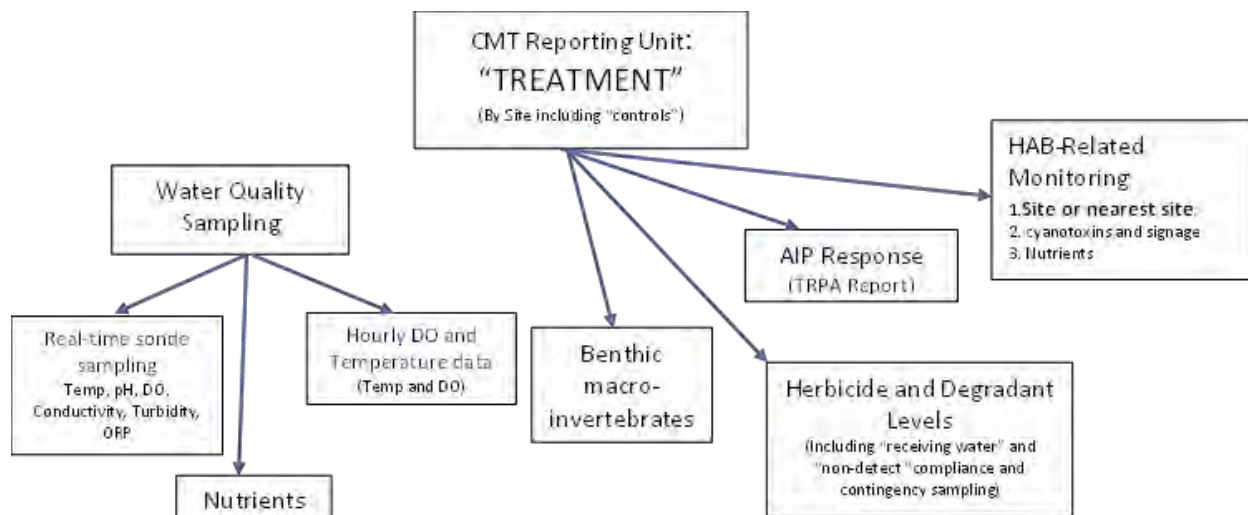


Figure 1-2. Organization of CMT Monitoring Reporting

The NPDES required several compliance actions including those associated with preparation for CMT treatments (pre-CMT). These pre-CMT actions included certifications and training of field staff and contractors, mitigation actions, contingency event planning and actions, site-specific water quality monitoring, herbicide monitoring, BMI and HABs monitoring, and AIP species presence and abundance (biovolume) surveys.

Therefore, the compliance reporting is separated into two sections: “pre-CMT” results and “post-CMT treatments” results. Post-CMT includes monitoring data collected on and after the first treatment date (May 25, 2022 to November 30, 2022). Most monitoring is highly “CMT site-specific” which means “Treatment-Specific.” However certain required monitoring was conducted outside of designated sites (e.g., between sites within the curtained areas; and outside mitigation curtains). This format therefore addresses the question: How did each CMT (Group A) treatment affect the monitoring variables?

#### b) Sequence of Reporting

There are seven types of CMT (Group A) treatments (including controls). The treatments and their associated monitoring information are provided in the following order:

- (1) Control (non-treated sites)
- (2) Endothall-only sites (West Lagoon and Lake Tallac)
- (3) Triclopyr-only sites
- (4) UV-only sites
- (5) Endothall/UV sites
- (6) Triclopyr/UV sites
- (7) LFA Sites

For each type of treatment, the specific monitoring data is provided in the following sequence:

- Control sites: Nutrients, Water Quality, AIP Responses
- Herbicide-only sites and Combination sites: Nutrients, Water Quality, Herbicide and Degradants, AIP Responses
- UV-only sites: Nutrients, Water Quality, AIP Responses
- Laminar Flow Aeration: Nutrients, Water Quality, AIP Responses

#### c) Graphic Data Representation

For ease and clarity in comparing the various treatments conditions with untreated “control” sites, data pertaining to treatments (2) through (7) are provided graphically with side-by-side control site data. In graphs that pertain to specified regulatory limits such as dissolved oxygen (DO), pH, Total Nitrogen (Total N), Total Phosphorous (Total P), and herbicides, the appropriate limits (single limit or limit range) are indicated on each graph. Appropriate limits are also shown on graphs showing data from control sites.

### 1.9 Quality Assurance/Quality Control (QA/QC)

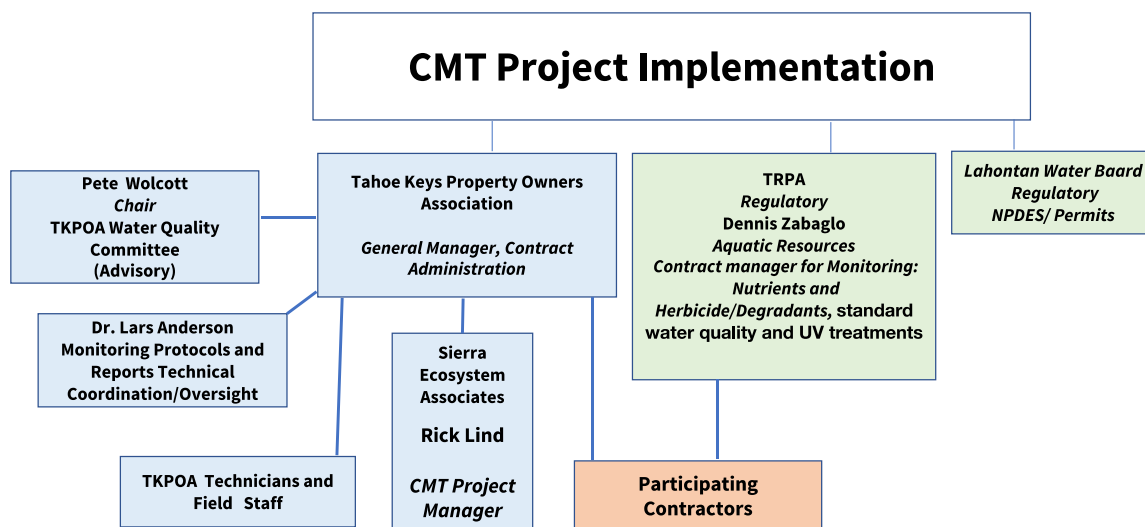
The CMT Quality Assurance Project Plan (QAPP) (see Appendix F) defines the steps and documentation required to ensure that monitoring is conducted properly and consistently, and results in reliable data. The section also provides information on the reasons for exclusion of data (if any) and appropriate substitute data sources. In addition, Technical Memos and/or tables describe specific water quality sampling and analyses procedures for quality control actions (see Appendix G).

QAPP compliance includes daily monitoring, team meetings, and coordination. For monitoring samples analyzed by off-site laboratories, proper Chain of Custody (COC) records are provided in Appendix H.

## 2.0 PRE-CMT COMPLIANCE ACTIONS (PRIOR TO MAY 25, 2022)

### 2.1 Management and Coordination of CMT Project

The CMT project was coordinated and managed pre- and post-implementation through a TKPOA/TRPA/Dr. Lars Anderson/Sierra Ecosystem Associates (SEA) leadership team and with weekly meetings of a larger CMT Monitor Working Group (MWG). The MWG consisted of key leadership in TKPOA, SEA, TRPA and representatives from all contractors hired to install and remove curtains, apply CMT treatments, and conduct monitoring. Other stakeholders participated in the MWG including The League to Save Lake Tahoe. When specific regulatory questions arose, representatives from Lahontan Water Board participated. Through the MWG weekly meetings, pre-CMT and post-CMT activities were identified, aligned for action by responsible team(s), and any problems that surfaced were resolved through these discussions. As of the date of this report, over 70 MWG meetings have been held with written notes taken and reviewed by MWG members. The CMT organizational structure is shown in Figure 2-1 (Anderson 2022). The record of the MWG and other coordination meetings between January 2022 and January 2023 is provided in Appendix I.



**Figure 2-1. Organization Structure for Management and Coordination of CMT Actions**

This structure ensured scientific rigor and independent oversight (TRPA) for the implementation and monitoring of the CMT and to comply with the permits. Multiple team efforts and frequent coordination meetings were held to coordinate actions including:

- a) Reviewing and communicating compliance and scheduling requirements to contractors.
- b) Coordinating installation of containment curtains, culvert and pipe seals, and boat barriers.

- c) Notifying homeowners and boating community of CMT actions that might affect them.
- d) Pre-CMT treatment sampling for BMI in sediment, water quality, and macrophytes.
- e) Scheduling and coordinating herbicide and UV light treatments.
- f) Monitoring schedules, documentation, and quality assurance post-treatment.
- g) Coordinating sample shipments to laboratories.
- h) Coordinating available watercraft (work boats) to accomplish monitoring tasks.
- i) Determining if hydraulic conditions were acceptable before herbicides could be applied.
- j) Responding rapidly to changing conditions and taking contingency mitigation steps where necessary.
- k) Preparing and submitting all pre-herbicide application compliance documents to Lahontan and TRPA.
- l) Meeting with permitting agencies (Lahontan Water Board and TRPA) to ensure compliance actions were taken, and to communicate any conditions warranting contingency measures or additional monitoring.

### 2.1.1 Coordination and Readiness of CMT Teams

For each CMT activity, training and field practice of each “action” was conducted by the requisite team whether TKPOA staff, TRPA staff, or through contracted service providers. Since this was the first time such a complex and large, multi-team effort had been undertaken in the Keys, and since this was the first permitted use of aquatic herbicides in or near Lake Tahoe, both training and coordination were essential to successfully executing the actions needed.

Specific actions included:

- a) On-site team meetings: Daily briefing for each team was conducted to ensure that needed equipment, supplies, staff, and boats were ready.
- b) Calibration of equipment/field instruments was done regularly according to equipment manufacturer- or more frequently.
- c) Teams documented their compliance/schedules using uploaded forms to a common data collection/file submittal system.
- d) Coordination and review meetings:

(1) MWG met weekly (via Zoom) to discuss the status of monitoring and CMT treatment progress. Any problems identified were discussed and resolved either at subsequent MWG meetings, or at separate follow-up focused meetings. The participants of the MWG included all contractors, in-house staff (TKPOA, TRPA), the League to Save Lake Tahoe, and Lahontan Water Board representatives when specific permit clarifications were necessary. At the time of this report, the MWG had met 73 times.

(2) Agency/TKPOA meetings. Two to four times per month TRPA, TKPOA (representatives from TKPOA Water Quality Committee and the General Manager for TKPOA), TKPOA consultants, and The League to Save Lake Tahoe met (via Zoom) to discuss the status of CMT implementation, to coordinate field activities as needed, and to make any adjustments to activities.

(3) TKPOA Staff/TKPOA Management/TKPOA consultants and representative(s) of the TKPOA Water Quality Committee met weekly (Zoom/in person). Specific

planning for CMT implementation, compliance, field activities, and other monitoring and weed control activities were discussed.

- (4) TKPOA Water Quality Committee meetings: Monthly and then quarterly meetings (Zoom/in person) were held to discuss water quality and related matters affecting TKPOA. The agenda always includes an update and discussion of CMT progress, issues, and proposed actions.

## **2.2 Aquatic Pesticide Application Plan Amendments 1 and 2**

In order to obtain final approval to start the CMT treatments, the original APAP (April 30, 2021) was amended twice to clarify and finalize monitoring sites and two treatment sites that differed from the original APAP (specifically delineation of sites 13 and 14 for Triclopyr/UV treatments), and provide a Spill Response Plan and contingency plan for use of Lanthanum-Modified Clay (LMC). TKPOA received final approval of APAP Amendments 1 (Appendix J) and 2 (Appendix K) on May 25, 2022. (Note Figure 1-1 shows the final treatment and monitoring sites as provided in APAP Amendment 2.)

### **2.2.1 Spill Prevention and Response Plan**

As part of the mitigation and contingency planning, a professional certified hazardous waste removal team was deployed during all applications of herbicides. Preventative protocols are provided in the QAPP (Appendix F). During herbicide applications, the spill contingency team maintained mobile pumping and storage systems adjacent to each treated site until the application was finished. The spill contingency contractor information is provided in Appendix L. As planned, no spills occurred during any of the CMT herbicide applications (see Appendix M). An example of the deployed spill response equipment is shown in Figure 2-2 below. The equipment was moved to each site prior to herbicide application at the site. (Note: storage tank and hoses as well as the black culvert plug at the water's edge.)



**Figure 2-2. Example of Spill Prevention and Contingency Pumping Equipment Deployed During Herbicide Applications**

### 2.2.2 Lanthanum-Modified Clay Application Plan

The potential for increased phosphorous (P) in the CMT sites was recognized as was the potential for P stimulated HABs. The Lanthanum-Modified Clay Application Plan (LMCAP) was developed as a possible mitigation action to reduce P if it became elevated. The LMCAP provided the criteria on which a voluntary decision could be made to apply a modified lanthanum clay product (PhosLock) (Appendix N).

### 2.3 Documentation of Training, Qualifications, and Experience

Due to the diversity and technical nature of CMT team actions, specific training and verification of certifications and qualifying experience were documented in compliance with the Lahontan Order (see Appendix O).

### 2.4 Protocols for Monitoring

The QAPP was submitted to the Lahontan Water Board and to contractors and managers (Amendment F). The QAPP provided detailed instructions on materials, equipment, and their use for all types of CMT monitoring and was part of the overall CMT QA/QC.

### 2.5 Calibration Records

Several types of field monitoring equipment and instrumentation were used during the CMT. Most equipment and instrumentation have manufacturer specifications for calibration methods and frequency. These protocols were followed although, in some cases, more frequent calibrations were made (e.g., for water quality measurements using multiprobe sonde units). Calibration Logs for monitoring equipment can be found in Appendix P.

## 2.6 Hydraulic Flow Conditions at the West Channel

A key prerequisite for initiating herbicide applications specified in the Lahontan Order and MMRP was the presence of a hydraulic gradient driving flow from Lake Tahoe into the Keys via the West Channel (see top of Figure 1-1). The reason for this requirement was to add an additional mitigating “buffer” (or resource protection measure) to reduce the likelihood of herbicides or their degradants from entering either the West Channel or Lake Tahoe proper. Typically, melting spring snowpack drives increases in Lake Tahoe water elevation, which in turn results in filling the Tahoe Keys lagoons. Due to drought conditions, the winter and early spring snowpack was below normal for 2022 and the lake level in general was low. The snowpack and projected snowmelt-rise in Lake Tahoe was carefully monitored and the flow within the West Channel was measured in the weeks and days before and during the applications of herbicides. TKPOA provided Lahontan with the monitoring data showing predictive lake level elevations indicating a window of likely inflow to the Keys during late May. Before the planned first herbicide applications, lake elevations were monitored and net inflow in the West Channel was measured with an in-line flow meter mounted on an anchored vessel approximately 12 hours before the first applications on May 25, 2022. Inflow continued through the last application on May 31, 2022. A series of storms beginning May 27, 2022, contributed additional snowpack to the higher elevations, which produced additional lake-level and Keys lagoon level rise until mid-June. As the snowpack/hydrologic flow model predicted, hydrologic conditions had a net inflow before and during herbicide applications (see Appendix Q. List of Correspondence with Permitting Agencies, TKPOA Homeowners, and Stakeholders). Table 2-1 displays a summary of hydraulic flow conditions at the West Channel.

**Table 2-1. Summary of Hydraulic Flow Conditions at the West Channel**

Date	Time	Shallow (ft./sec)	Mid (ft./sec)	Deep (ft./sec)	Average (ft./sec)
5/24/2022 *Test	5:00 PM	.025	.023	.033	.027
<b>5/25/2022</b>					
	6:00 AM	.08	.04	-.09	.03
	6:30 AM	.13	.01	-.12	.01
	7:00 AM	.12	.06	-.10	.03
	7:30 AM	.11	.09	-.10	.03
	8:00 AM	.11	.00	-.12	.00
2-hour Average Flow (ft./sec)					.01
<b>5/27/2022</b>					
	6:00 AM	-.04	.15	.07	.06
	6:30 AM	-.01	.17	.05	.07
	7:00 AM	.00	.19	.13	.10
	7:30 AM	-.02	.17	.11	.08
	8:00 AM	.03	.13	.05	.07
	9:00 AM	-.05	.09	.09	.05
	10:00 AM	-.04	.05	.07	.03
	11:00 AM	-.03	.10	.11	.06
2-hour Average Flow (ft./sec)					.08
Daily Average (ft./sec)					.06
<b>5/29/2022</b>					
	6:00 AM	-.10	.02	.08	.01
	6:30 AM	-.06	.19	.11	.08
	7:00 AM	-.06	-.02	.06	-.01
	7:30 AM	.00	.27	.13	.13
	8:00 AM	-.02	.06	.11	.05
	9:00 AM	.01	.09	.06	.05

Date	Time	Shallow (ft./sec)	Mid (ft./sec)	Deep (ft./sec)	Average (ft./sec)
	10:00 AM	-.09	.01	.02	-.02
	11:00 AM	.14	.17	.02	.11
2-Hour Average (ft./sec)					.05
Daily Average (ft./sec)					.05
5/31/2022	6:00 AM	.00	.05	.04	.03
	6:30 AM	.01	.12	.05	.06
	7:00 AM	.07	.20	.03	.10
	7:30 AM	.05	.12	.01	.06
	8:00 AM	.02	.11	-.01	.04
	9:00 AM	.00	.00	.03	.01
	11:00 AM	.05	.01	-.02	.01
	12:00 PM	-.02	-.02	.00	-.01
2- Hour Average (ft./sec)					.06
Daily Average (ft./sec)					.03

## 2.7 Curtain and Boat Barrier Installations and Integrity Assurance

### 2.7.1 Installation

As part of the CMT permit requirements, sites identified for herbicide applications were required to be isolated from the main waterway areas of the West Lagoon and Lake Tahoe. The use of containment curtains effectively isolated three major boating exclusion zones of the CMT sites: Area A (west side of the West Lagoon behind curtains installed at Site 2); Area B (containing sites 8, 9 and 15 in southeast area of the West Lagoon); and Area C (Lake Tallac, all non-motorized boating). Figure 2-3 shows the boating restricted areas (A, B, and C).





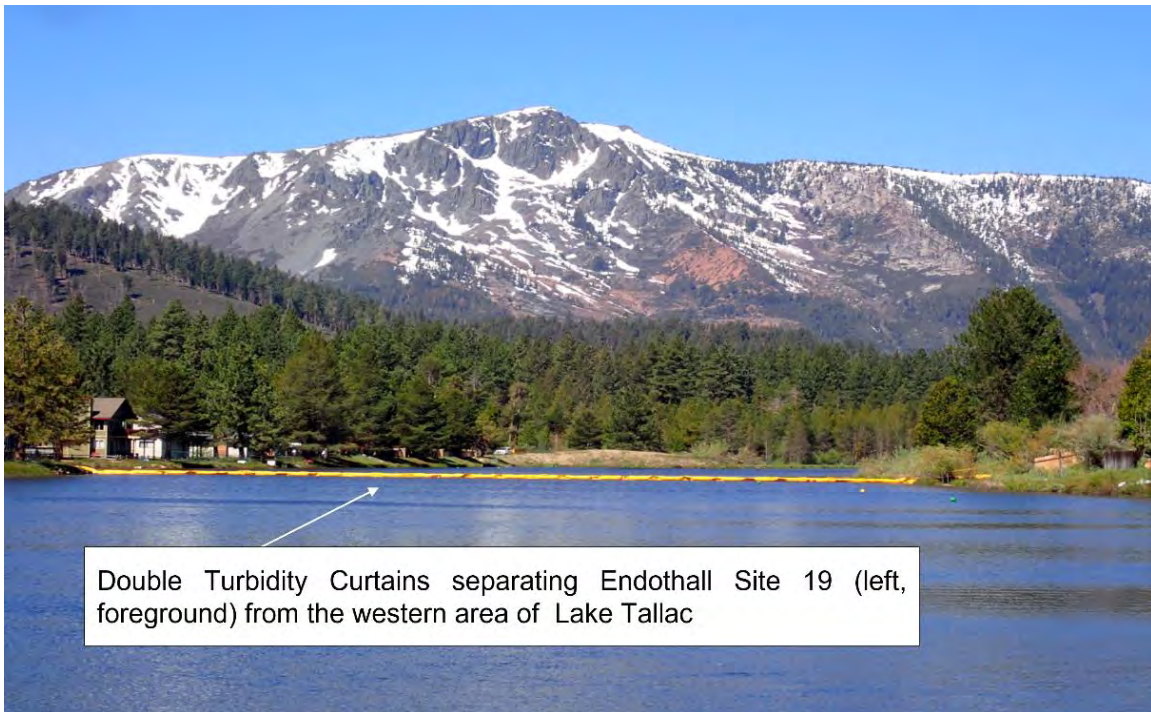
**Figure 2-3. Designated Boating Restricted Areas (A, B, C) Separated by Double Turbidity Curtains and Barriers**

The double turbidity curtain installation and removal required divers to manipulate heavy curtain materials and hardware so that curtains were placed properly, anchored securely to the bottom, and adjusted to fit the specific site. Divers must manipulate these materials while in some contact with the bottom. The bottom sediments in the Keys are comprised of highly organic, unconsolidated materials that are easily disturbed by the physical activity needed to install (and remove) the curtains. This process was routinely monitored to assess effects on turbidity in the local areas of curtain placement and, as anticipated, turbidity was elevated compared to areas not disturbed, and to levels in the same areas before installations began (see Appendix R). It should be noted that when storm-driven disturbance of some curtains occurred, the highest priority was reestablishing curtain integrity; in some cases, this resulted in delayed or absent turbidity monitoring. These circumstances are noted in Table 2-2.

To protect the integrity of the curtains, and to prevent boats from breaching the curtains, physical metal barriers (pilings) and plastic fencing were installed outside the curtains for Areas A and B. Figures 1-1 and 2-3 show where the curtains were installed prior to applications of herbicides. During installation and removal of curtains, turbidity was monitored to ensure disturbance was minimized (Appendix R). Examples of the double turbidity curtain installations are shown in Figures 2-4 and 2-5.



**Figure 2-4. Double Curtain in the West Lagoon**



**Figure 2-5. Double Curtain Installed in Lake Tallac**

2.7.2 Responses to Storm-Driven Partial Curtain Dislodging

Heavy storm events occurred within a few days after initiation of the first CMT treatments, which required rapid responses to re-secure curtains affected by winds and choppy waters. At Site 2, an additional double turbidity curtain was installed outside of the original outer curtain to prevent movement of detected herbicide. No herbicides or degradants were detected at contingency monitoring stations nearest to the West Channel (“CSTN 105” or “CSTN 106”, Figure 1-1). Table 2-2 summarizes the curtain installation and response actions taken.

**Table 2-2. Summary of Double Turbidity Curtain Installation, Removal and Response Actions**

CMT Test Area	Installation Date(s)	Incident & Date (if applicable)	Action & Adjustment Date (if applicable)	Associated Sampling (Detected Endothall level µg/L) Numbers in bold indicate exceedance.	Removal Date(s)
Site 1	5/19	N/A	N/A	9/21 2 consecutive ND	9/23
Site 2	<ul style="list-style-type: none"> <li>• 5/17-5/18 (Inner)</li> <li>• 5/28 (Outer)</li> </ul>	<ul style="list-style-type: none"> <li>• 5/28 RWT Dye detection, curtain malfunction confirmed, exceedance</li> <li>• 6/2 Exceedance</li> <li>• 6/7 Exceedance</li> <li>• 6/8 Exceedance</li> <li>• 6/10 Exceedance</li> </ul>	<ul style="list-style-type: none"> <li>• 5/28 24-hour notification, contingency sampling, curtain inspection</li> <li>• 5/28-5/29 Readjustment, second double curtain installation</li> <li>• 6/2 24-hour notification, contingency sampling</li> <li>• 6/5 5-day report</li> <li>• 6/7 24-hour notification, contingency sampling</li> <li>• 6/12 Notification with lab results from contingency sampling</li> <li>• 6/15 Report of noncompliance</li> <li>• 6/16 Notification with lab results through 6/13</li> </ul>	<ul style="list-style-type: none"> <li>• 5/28 ORW-RHC2 (210), CSTN123 (ND) 5/29- ORW-RHC2 (82), CSTN123 (29) 5/30- ORW-RHC2 (20), CSTN123 (10) 5/31- ORW-RHC2 (33), CSTN123 (6.4)</li> <li>• 6/1 ORW-RHC2 (61), CSTN123 (4.7)</li> <li>• 6/2 ORW-RHC2 (<b>110/120</b>), CSTN123 (4.1)</li> <li>• 6/3 ORW-RHC2 (82), CSTN123 (2.5)</li> <li>• 6/7 ORW-RHC2 (<b>110</b>), CSTN123 (7.4)</li> <li>• 6/8 ORW-RHC2 (<b>140</b>), CSTN123 (7.5)</li> <li>• 6/9 ORW-RHC2 (66), CSTN123 (3.8)</li> <li>• 6/10 ORW-RHC2 (<b>110</b>), CSTN123 (ND)</li> <li>• 6/11 ORW-RHC2 (29), CSTN123 (ND)</li> <li>• 9/21 2 consecutive ND</li> </ul>	<ul style="list-style-type: none"> <li>9/13-9/14 (Inner)</li> <li>9/22 (Outer)</li> </ul>
Site 14	• 5/31-6/1	• N/A	• N/A		7/6
Site 15	• 5/12-5/16, 5/23-5/24	• 5/30 RWT Dye detection	<ul style="list-style-type: none"> <li>• 5/30 Notification, contingency sampling</li> <li>• 9/1 Lahontan confirms removal</li> </ul>	• 5/30 ORW-RHC3 (20), CSTN103 (ND), 8/26, 8/29- 2 consecutive ND	9/2

Lake Tallac	<ul style="list-style-type: none"> <li>• 5/5-5/11</li> </ul>	<ul style="list-style-type: none"> <li>• 6/21 Exceedance (21 DAT)</li> <li>• 6/28 Exceedance (28 DAT)</li> </ul>	<ul style="list-style-type: none"> <li>• 7/5 24-hour notification, contingency sampling</li> <li>• 7/13 5-day report</li> </ul>	<ul style="list-style-type: none"> <li>• 6/21 IRW9 (380), TA19 (360)</li> <li>• 6/28 IRW9 (220), TA19 (220)</li> <li>• 7/5 IRW9 (5.4) TA19 (61)</li> <li>• 8/16, 8/23 2 consecutive ND</li> </ul>	9/20
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### 2.8 Preparations and Installation of Contingency Sub-surface Aeration Systems

At each CMT site, power access for contingency aeration systems was identified and aeration systems were assigned and staged (Figure 2-6). Use of the aeration was intended to mitigate potential reductions in DO and increase water-column mixing. Table 2-3 provides aeration activation dates. No aeration systems were installed in control sites.

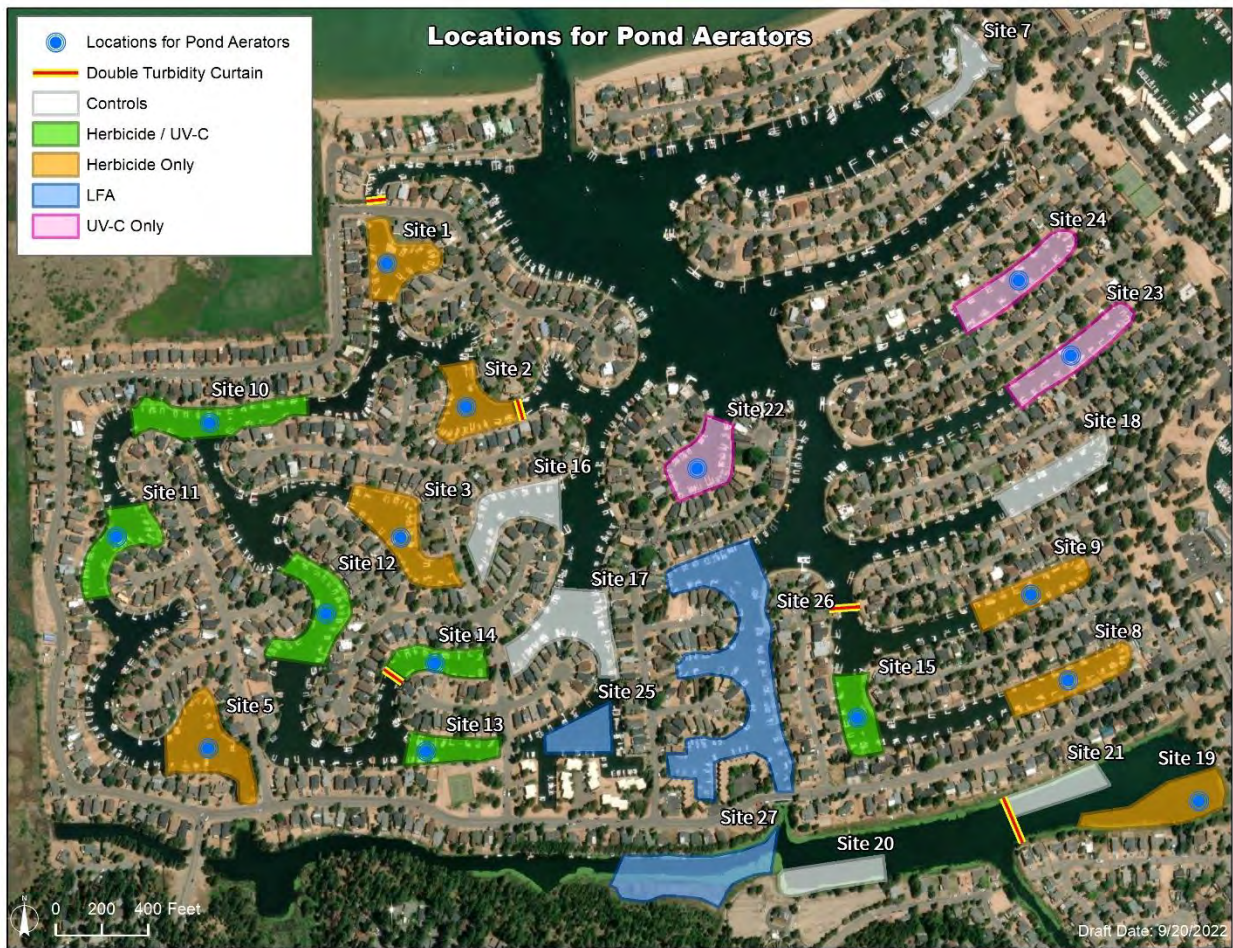


Figure 2-6. Location of Contingency Sub-Surface Aerator Systems in each CMT Treatment Site (except LFA Site 26)

**Table 2-3. Aeration Activation Dates**

Site(s)	Activation Date	Turn-off Date(s)
1, 2, 3	6/27	9/26- 9/30
5, 8, 9	6/28	9/5-9/9
14, 15	7/6	9/26-9/30
19	7/6	9/21- 9/23
10, 11, 12, 13	7/7	9/26- 9/30

**2.9 Notifications to Permitting Agencies, TKPOA Homeowners, and Stakeholders**

Prior to, and during the CMT treatments and monitoring, formal notifications were required to Lahontan Water Board, TRPA, TKPOA Homeowners, and others. A list of correspondence throughout the CMT project is presented in Appendix Q. Figure 2-7 below shows a partial group of observers that witnessed initial herbicide applications in the vicinity of CMT Sites 9 and 15.



**Figure 2-7. Observers of Initial CMT Project Herbicide Applications**

### 3.0 MONITORING CONTEXT AND CONDITIONS

#### 3.1 Treatment Focused Reporting

The objective of the extensive CMT monitoring was to determine how the different CMT treatments (herbicide-only, UV-only, herbicide/UV combinations, and LFA-only) affected water quality, herbicide, and degradant residence time (persistence), BMI populations, and responses of both the targeted AIP and desirable native aquatic plants. Therefore, the results are organized by treatment type. Figures (graphs) and tabular data contain mean (average) values for the three replicate sites for each treatment and control. With each graph or tabular summary, reporting limits (or acceptable ranges of values, such as pH) are indicated. However, as observed with several monitoring variables in “control” sites, regulatory limits were breached absent of any CMT treatments, particularly with pH, Total N, Total P, turbidity, and in some cases DO. Similarly, some of the water quality limits stated in the Lahontan Order and MMRP were driven by conditions and standards related to Lake Tahoe proper. However, because the Tahoe Keys lagoons (and Lake Tallac) have very different “baseline” conditions, the Lake Tahoe values are regularly exceeded for nutrients and turbidity in the Keys. For example, see Table 1 in APAP Amendment 1 for a comparison of Tahoe Keys Lagoons with Lake Tahoe (Appendix J).

Several appendices are included that provide detailed monitoring data by site or by adjacent sampling areas as appropriate. The water quality monitoring data included in the body of this report are means (averages) for the triplicate treatment sites for CMT herbicide and related control sites. Detailed data by individual site is provided in Appendix S with links to that data set. For UV treatments, water quality data is provided by each site because the UV treatments in separate sites were both sequential and staggered by more than a week and included repeat UV treatments. This UV treatment regime necessitated breaks in monitoring to adhere to required post-UV sampling schedules.

For herbicide and degradant level reporting, data is presented for each CMT herbicide site (herbicide alone or “combination herbicide/UV” sites), for other required sampling locations outside the perimeters (boundaries) of the sites, and for areas outside the curtain boundaries. The following information is provided in each graphic: CMT treatment, dates of monitoring, variable measured, and the same variables for the representative control sites at the same or nearby dates. Each graph provides a demarcation line(s) or symbol that shows the “regulatory” level (Reporting Limit or Receiving Water Limit), or range (e.g., for pH). References to the appendices for data used for the graphs are provided.

#### 3.2 Post-CMT Activities. (May 25, 2022 through November 30, 2022)

##### 3.2.1 Herbicide Application Schedule

Table 3-1 shows the CMT herbicide sites treated by date, type of herbicide, and site number (see also Final Herbicide and Rhodamine Water Tracer Dye Monitoring Plan in Appendix T and QAL/Aquatechnex Report/McNabb, 2022 in Appendix U). Applicators adhered to BMPs as described in the APAP to insure safe transport, loading and use of aquatic herbicides and RWT dye. Note that applications were purposefully “staggered” with a one-day break between sets of treatments to provide sufficient time for post-application monitoring for herbicides and degradants. The last day of herbicide applications was May 31, 2022. Therefore, a 6-day difference was seen between treatments in Sites 8, 9, 15 (Area B) and the last treatment in Sites 12, 13, 14 (Area A). In the results, this sequence is reflected in reporting dates and in calculating “days after treatment”

(DAT). Examples of the herbicide and Rhodamine Water Tracer (RWT) dye applications are shown in Figure 3-1.

**Table 3-1. Record of CMT Herbicide Applications (2022) \***

Site Number	Treatment	Proposed Herbicide	Herbicide Rate (final concentration)	Application Date	Application Day
8	Herbicide-only	Triclopyr	1.0 ppm	5/25/22	1
9	Herbicide-only	Triclopyr	1.0 ppm	5/25/22	1
15	Combination	Endothall	2.0 ppm	5/25/22	1
No Applications				5/26/22	
1	Herbicide-only	Endothall	2.0 ppm	5/27/22	2
2	Herbicide-only	Endothall	2.0 ppm	5/27/22	2
3	Herbicide-only	Endothall	2.0 ppm	5/27/22	2
No Applications				5/28/22	
5	Herbicide-only	Triclopyr	1.0 ppm	5/29/22	3
10	Combination	Endothall	2.0 ppm	5/29/22	3
11	Combination	Endothall	2.0 ppm	5/29/22	3
No Applications				5/30/22	
12	Combination	Triclopyr	1.0 ppm	5/31/22	4
13	Combination	Triclopyr	1.0 ppm	5/31/22	4
14	Combination	Triclopyr	1.0 ppm	5/31/22	4
19 (Lake Tallac)	Herbicide-only	Endothall	2.0 ppm	5/31/22	4

(Source: TKPOA APAP Amendment 2 dated May 24, 2022 and Aquatechnex Report)

\*Note: All applications were done in concert with the injection of RWT dye (<10 ppb) which was monitored using a flow-through fluorometer to assess movement of herbicides post-application.



**Figure 3-1. Examples of the Herbicide and RWT Applications**

Figure 3-1 above shows (a) Liquid Endothall plus RWT dye; (b) Near-shore (Combination site) Triclopyr pellet application by air blower; (c) RWT dye injection immediately following air blower Triclopyr pellet application.

**3.2.2 Contingency Spill Report**

No spills occurred during loading of herbicides, RWT dye, or applications of herbicides and RWT dye. See Appendix M for more information.

### 3.2.3 Notifications

Prior to and during CMT treatments and monitoring, specific notifications were provided to appropriate recipients (see Appendix Q). These notices included planned herbicide application dates, West Channel flow conditions, weather-related problems, initiation of contingency aeration systems, status of herbicide dissipation, curtain integrity, responses to curtain dislodging, and conditions allowing removal of curtains (based on herbicide “non-detect” status).

### 3.2.4 Calibration Records

All monitoring equipment and instrumentation requires calibration to ensure that the data obtained from these devices is accurate and meets the technical specifications provided by the product manufacturer. Each monitoring team from TKPOA, Environmental Science Associates (ESA), Blankinship & Associates, Inc., and Stratus Environmental, Inc. documented the calibrations made during their monitoring actions. These records are provided in Appendix P.

## 3.3 **Unreliable or Uncertain Data**

During the numerous CMT monitoring events and related field data collection, some data appear to not be reliable. This may be due to equipment malfunction or other anomalous circumstances. These events are summarized in Appendix G, which includes explanations for non-inclusion of the specific unreliable data points.

## 3.4 **Missing Data or Missing Monitoring Events**

In some cases, a monitoring event (date/time/site) is missing. This may be due to errors in scheduling, inclement weather making on-water monitoring hazardous, equipment malfunction, physical equipment dislodging, or damaging of anchored loggers (e.g., displacement of hourly miniDOT DO and temperature loggers by wildlife).

In some cases, other data may be substituted from other instrumentation if it was obtained within a reasonable date and location of the missing data. Note that the Lake Tallac “control” Site 21 has been disqualified and was not included as a representative control due to migration of Endothall to Site 21 from nearby CMT Site 19 (see referenced initial control Site 21 in the Endothall-only treatment results in Section 3.5 and 4.2). These events are summarized in Section 3.5.1 with explanations for the causes of missing data.

## 3.5 **Control Sites in West Lagoon and Lake Tallac (Sites 16,17,18, 7, 20, 21)**

### 3.5.1 General

Control Sites 16 and 17 were located mid-West Lagoon, outside of turbidity curtains. Site 18 was located in the east area of the West Lagoon. No boating restrictions occurred in any of the control sites in the West Lagoon. Control Site 20 was located in Lake Tallac several hundred feet outside the turbidity curtains that isolated Site 19 (and 21) from the rest of Lake Tallac. Note: AIP response and monitoring for RWT dye and Endothall near Site 21 suggested that this original “control” site was compromised by exposures to Endothall from nearby Site 19. Since Lake Tallac is in effect a separate waterbody from the West Lagoon, control Site 20 is the only one used to compare pre-CMT and post-CMT results with the Endothall treatment at Site 19.



### 3.5.2 Limitations on Control Site Comparisons with CMT Treatment Sites

Figures 1-1 and 2-3 show that none of the West Lagoon control sites were located behind the turbidity curtains. The Lake Tallac control Site 20 was also located outside the turbidity curtains. These locations were chosen to provide a certainty of “un-treated” conditions, particularly free of any herbicide contact, for a direct comparison of conditions in treatment sites. Therefore, unlike the CMT-herbicide sites, none of the control sites were subject to the turbidity curtain-induced constraints in water movement, boating restrictions, or harvesting restriction, all of which activities contribute to surface and sub-surface water exchange that normally occur with the West Lagoon unrestrained waters, including influences of West Channel water flows. In contrast, for the CMT-herbicide treated sites, water movement and exchange with areas outside the site were restricted from typical boating and mechanical harvesting which, taken together typically mix water within sites and adjacent water. In an attempt to mitigate the more stagnant conditions in Area A, a twin outboard vessel was temporarily anchored near some CMT sites in Area A and run for several hours to move surface water. The same vessel was also run within Area A for several days to improve mixing. In addition, sub-surface aerators were installed and activated (see Section 2.8).

Another important difference between controls sites and CMT treatment sites is that harvesting was used in the West Lagoon controls sites, two Endothall/UV sites, and LFA Site 26, whereas no harvesting occurred in the CMT-herbicide or UV-only sites (Table 3-2). The harvesting, which occurred mid- to late-summer, potentially affected two types of monitoring results: 1) Comparisons of AIP biovolume in control sites and CMT treatment sites; and 2) comparisons of nutrients and water quality between control sites and CMT treatment sites. This meant that CMT treatment efficacy was evaluated against harvested conditions beginning in August and not directly compared with truly “untreated” conditions. This suggests that results for efficacy would have been more favorable- for all methods- had comparisons been made with unharvested conditions.

Therefore, control site conditions cannot be assumed to have strictly “equivalent” conditions compared to the CMT sites. However, these sites provide the nearest approximation of conditions expected to be “unaffected” by the CMT treatments. The potential ramifications of these differences in control and CMT treatment sites are addressed in the summary and recommendations section of this report (Section 16.0), and in the Tahoe Keys Lagoons Macrophyte Control Efficacy Monitoring Report: Year 1 (Appendix E).

**Table 3-2. Harvest Events in CMT Sites**

CMT Site	Harvest Dates
Control Site 16	8/9, 8/30, 8/26,9/23
Control Site 17	8/11,8/31,9/15,9/21
Control Site 18	8/17, 10/7, 10/14
Endothall/UV Site 11	9/27
Endothall/UV Site 15	9/8, 9/9, 10/10, 10/11
LFA Site 26	8/15, 8/16, 9/2, 9/12, 9/13, 9/19, 10/12, 10/13

### 3.6 Pre-CMT Treatment Monitoring Results

Pre-CMT treatment monitoring occurred before any herbicide or UV treatments began. For convenience in comparisons of pre- and post- CMT data, and for consistency in graphic formats,

the “pre-CMT” results are shown sequentially as part of the entire period of monitoring, or in tabular format so that a continuous record of results pre-CMT data through post-CMT data is shown. Similarly, control site data is initially presented separately (Section 4.0) including pre-CMT and post-CMT sampling dates.

For ease of reference, the data on graphs and tables showing sample or monitoring dates after May 25, 2022 are “post-CMT”; since the data was collected after the first CMT-herbicide application on May 25, 2022 (Table 3-1). Monitoring was scheduled to comply with the Lahontan Order, APAP, and MMRP, and physical locations were located as shown in Figure 1-1 map and legend. See Appendix V for a summary of monitoring schedules, frequency, and locations.

### 3.7 Assessment of Monitoring Completeness

The purpose of the data completeness assessment is to evaluate and document the extent to which complete monitoring data sets were generated during Year 1 monitoring activities of the CMT project. The monitoring completed in Year 1 resulted in a voluminous number of data points. This extensive data also illustrates the complexities of the sampling events and monitoring sequences. Monitoring activities and schedules are set forth in the approved permits, EIR/EIS, MMRP, and the QAPP.

The organization of the data completeness tables, factors affecting data collection, the method used to calculate the provided statistics, details of each monitoring activity, and additional sampling events that occurred are described here. Changes made to the sampling procedure are addressed as well as percent of data completion, data points that were not addressed in the provided statistic, and how the data sets are displayed on the data completeness table. (Note: The summary tables provided throughout Section 3.7 do not address data QA/QC as the data was only reviewed for completeness). (QA/QC documentation is in Appendix G).

#### Completeness Table Organization

The columns shown on Tables 3-3 through 3-9 represent the different monitoring activities while the rows represent monitoring stations and site numbers. The tabular content is color-coded with symbols as appropriate to show the completeness of monitoring actions as follows:

- Green represents a complete data set.
- Blue represents weather, instrument error, or other factors that prevented a complete data set although other data exists to supplement for a full evaluation of the monitoring activity.
- Yellow represents insufficient data was collected and no supporting data exists to allow for a full evaluation of the monitoring activity.
- The  $\Delta$  symbol signifies that the site was not confirmed until later in the CMT.
- Diagonal lines signify that the site was not fully treated so the associated sampling did not occur.
- Boxes containing N/R signify there is ‘No Record’ of the data as the monitoring activity does not apply to that site.

#### 3.7.1 Circumstances Affecting Data Collection

A variety of conditions affected data collection. High velocity wind events occurred during May 27-28, June 3-5 and June 11-12 that interfered with monitoring. The Mosquito Fire created hazardous air quality from September 11-12. In mid-July, some miniDOTs loggers were lost

possibly due to failures with miniDOTs rigging, buoy malfunction, and boat collisions. On at least one occasion, bears were observed displacing the miniDOTs loggers, which were never found. Since the turbidity curtains remained in place longer than planned, Combination Treatment Sites 12-14 were not treated with UV during Year 1, so the monitoring events that would have been associated with those treatments did not occur. Similarly, LFA Sites 25 and 27 were not installed on schedule due to delays in equipment availability that delayed the start of sampling and monitoring at those sites. The LFA systems for Sites 25 and 27 were installed mid-November 2022.

Another factor affecting turbidity data collection was the terminology used to describe the water quality objective for turbidity. The Lahontan Order states, "Increases in turbidity must not exceed natural levels by more than 10%." The term 'natural levels' was difficult to interpret and implement since the CMT project created a combination of unique environments within the test areas. For turbidity curtain monitoring, "natural levels" as used in this Annual Report meant pre-installation levels measured one hour prior to curtain installation/ removal at the location of the curtains. "Natural levels" was not represented by control sites because of the substantial differences in the water quality characteristics between the control sites and where the curtains were in place. (Note: For standard water quality monitoring, control sites were used for comparing trends in turbidity conditions relative to treated sites)

### 3.7.2 Data Completeness Evaluation Method

All of the planned dates for sampling/monitoring events were checked against the recorded and documented actual monitoring. The percentage of successful sampling/data collection was calculated by dividing the number of actual sampling data points by the expected or required number of data points, and then multiplying by one hundred to provide the percentage of data completion.

### 3.7.3 Herbicide Residue and Degradant/RWT Dye Monitoring

Herbicide Residue and Degradant sampling was performed concurrently with RWT dye monitoring. Sampling for herbicides in water was comprised of composite samples (Surface/Mid/Bottom water column). Sediment grab samples for herbicide analysis was done with a Petite Ponar sampler per MMRP and QAPP. Water samples and sediment samples were analyzed for Endothall, Triclopyr, 3,5,6-trichloro-2-methoxypyridine (TMP), and 3,5,6-trichloro-2-pyridinol (TCP). Sampling the water column inside test areas required one pre-treatment sample followed by a frequency of 7 DAT, then weekly sampling until 2 non-detects occurred 48 hours apart. Water samples outside the curtains (receiving water) were collected 3 DAT, 7 DAT, then weekly until 21 DAT or until 2 consecutive non-detects occurred.

RWT dye was measured three times a week at receiving water stations behind the curtains or until the dye was no longer detectable at sampling stations between/adjacent to treatment sites. Receiving water stations outside the curtains were monitored starting 2 DAT, and continued at 48-hour intervals until 14 DAT or until the dye was non-detect. RWT dye detected at a receiving water station outside of the curtains triggered monitoring of the nearest contingency station. Once detected, contingency station monitoring occurred in 48-hour intervals until 2 consecutive non-detects occurred 48 hours apart.

Sediment sampling required one pre-treatment sample as well as one post-treatment sample that was 90-120 DAT. Data collected but not addressed in this report includes weather measurements, depth measurements, general field observations, GPS coordinates, and certain water quality

measurements. Of the 3,570 scheduled samples to be collected, this number plus additional samples taken resulted in a 100% data completion for herbicide, sediment, and RWT dye monitoring. Tables 3-3 and 3-9 show this information with green boxes for all applicable CMT Year 1 sites.<sup>1</sup>

#### 3.7.4 Standard Water Quality Monitoring (Inside CMT Treatment Sites)

Standard water quality inside test areas was measured at three buoys per CMT site. Monitoring was initially planned to be measured at three depths, but upon consulting with agency staff, it was agreed that a single mid-depth monitoring sample would be performed to meet the 11 am–2 pm requirement for water quality monitoring. Due to logistics, mid-depth measurements were deemed most representative. Pre-treatment measurements were scheduled for all sites. Herbicide sites were monitored at 3 DAT to 30 DAT, three times a week, then weekly until November. Similarly, UV sites were monitored at 3 DAT, three times a week until November. Once herbicide was applied, combination and control sites were monitored at 3 DAT to 30 DAT, three times per week. Then, once UV treatment began, the combination sites were monitored at 3 DAT, three times a week until November. LFA sites were monitored every other week. Data points collected but not addressed in this report are weather measurements, depth measurements, and general field observations.

Measurements included in the completeness calculations are:

- Temperature
- DO
- pH
- Turbidity
- ORP
- SpC

Of the 19,512 data points scheduled to be collected, 17,460 were gathered resulting in 89.5% data completion for standard water quality monitoring inside test areas. Table 3-3 shows all sites, except Site 7, as blue due to all sites having at least one late or missed sampling event. Even with these minor issues, the quantity of standard water quality data collected during Year 1 was sufficient to evaluate all parameters as intended for the CMT project requirements at these locations. Site 7 was designated as yellow with a  $\Delta$  symbol to signify that insufficient data was collected because the final location of Site 7 location was decided late in the year. Sites 10-14 and 25-27 are blue but have diagonal lines because they were not fully treated due to the inaccessibility for UV treatment and delay in LFA installations, respectively.<sup>2</sup> The percent completeness would have been higher had all the combination sites been accessible to UV treatments. (Note: Sites 10 and 11 were treated once with UV September 26 and October 5, respectively.)

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<sup>1</sup> Revised APAP Amendment 1, Section 8.2.4, Herbicide Active Ingredient Residues and Degradants; pg. 68 – 70 & Table 7. CMT Monitoring Details – Herbicide Only Treatment; pg. 54.

<sup>2</sup> Revised APAP Amendment 1, Tables 7-10 - CMT Monitoring Details; pg. 53-58 & MMRP- Attachment B, Section 3.0, Water Quality Parameters; pg. 22-23

**Table 3-3. Level of Completeness Summary for Key Year 1 CMT Monitoring Activities**

■	Complete data set.								
■	Weather, Instrument error, or other factors prevented a complete data set although other data exists to supplement for a full evaluation of the monitoring activity.								
■	Insufficient data was collected, and no supporting data exists to allow for a full evaluation of the monitoring activity.								
△	The site wasn't confirmed until later in the CMT.								
///	Site wasn't fully treated so the associated monitoring did not occur.								
N/R	No Record as the monitoring activity does not apply to that site.								
Stations	Herbicide & RWT Dye	Turbidity	WQ (Inside)	WQ (miniDOTs)	HABs	Scans	Nutrients	Macrophyte	BMI
<b>Site 1</b>									
TA1	■	■	N/R	■	■	■	■	■	■
H1	N/R	N/R	■	N/R	N/R		N/R	N/R	N/R
H2	N/R	N/R	■	N/R	N/R		N/R	N/R	N/R
H3	N/R	N/R	■	N/R	N/R		N/R	N/R	N/R
<b>Site 2</b>									
TA2	■	■	N/R	■	■	■	■	■	■
H4	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H5	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H6	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 3</b>									
TA3	■	N/R	N/R	■	■	■	■	■	■
H7	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H8	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H9	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 5</b>									
TA5	■	N/R	N/R	■	■	■	■	■	■
H10	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H11	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H12	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 7</b>	N/R	N/R	△	△	N/R	■	△	△	△
<b>Site 8</b>									
TA8	■	N/R	N/R	■	■	■	■	■	■

■	Complete data set.								
■	Weather, Instrument error, or other factors prevented a complete data set although other data exists to supplement for a full evaluation of the monitoring activity.								
■	Insufficient data was collected, and no supporting data exists to allow for a full evaluation of the monitoring activity.								
△	The site wasn't confirmed until later in the CMT.								
▨	Site wasn't fully treated so the associated monitoring did not occur.								
N/R	No Record as the monitoring activity does not apply to that site.								
Stations	Herbicide & RWT Dye	Turbidity	WQ (Inside)	WQ (miniDOTs)	HABs	Scans	Nutrients	Macrophyte	BMI
H13	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H14	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H15	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 9</b>									
TA9	■	N/R	N/R	■	■	■	■	■	■
H16	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H17	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H18	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 10</b>									
TA10	■	N/R	N/R	■	■	■	■	■	■
HC22	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC23	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC24	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 11</b>									
TA11	■	N/R	N/R	■	■	■	■	■	■
HC25	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC26	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC27	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 12</b>									
TA12	■	N/R	N/R	■	■	■	■	■	■
HC28	N/R	N/R	▨	N/R	N/R	N/R	N/R	N/R	N/R
HC29	N/R	N/R	▨	N/R	N/R	N/R	N/R	N/R	N/R
HC30	N/R	N/R	▨	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 13</b>									

■	Complete data set.								
■	Weather, Instrument error, or other factors prevented a complete data set although other data exists to supplement for a full evaluation of the monitoring activity.								
■	Insufficient data was collected, and no supporting data exists to allow for a full evaluation of the monitoring activity.								
△	The site wasn't confirmed until later in the CMT.								
▨	Site wasn't fully treated so the associated monitoring did not occur.								
N/R	No Record as the monitoring activity does not apply to that site.								
Stations	Herbicide & RWT Dye	Turbidity	WQ (Inside)	WQ (miniDOTs)	HABs	Scans	Nutrients	Macrophyte	BMI
TA13	■	N/R	N/R	■	■	■	■	■	■
HC31	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC32	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC33	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 14</b>									
TA14	■	■	N/R	■	■	■	■	■	■
HC34	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC35	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC36	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 15</b>									
TA15	■	■	N/R	■	■	■	■	■	■
HC37	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC38	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
HC39	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 16</b>			N/R	■	■	■	■	■	■
C40	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
C41	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
C42	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 17</b>			N/R	■	■	■	■	■	■
C43	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
C44	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
C45	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 18</b>			N/R	■	■	■	■	■	■
C46	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R

■	Complete data set.								
■	Weather, Instrument error, or other factors prevented a complete data set although other data exists to supplement for a full evaluation of the monitoring activity.								
■	Insufficient data was collected, and no supporting data exists to allow for a full evaluation of the monitoring activity.								
△	The site wasn't confirmed until later in the CMT.								
▨	Site wasn't fully treated so the associated monitoring did not occur.								
N/R	No Record as the monitoring activity does not apply to that site.								
Stations	Herbicide & RWT Dye	Turbidity	WQ (Inside)	WQ (miniDOTs)	HABs	Scans	Nutrients	Macrophyte	BMI
C47	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
C48	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 19</b>									
TA19	■	N/R	N/R	■	N/R	■	■	■	■
H19	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H20	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
H21	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 20</b>			N/R	■	■	■	■	■	■
C49	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
C50	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
C51	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 21</b>			N/R	■	N/R	■	■	■	■
C52	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
C53	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
C54	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 22</b>			N/R	■	N/R	■	■	■	■
U55	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
U56	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
U57	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 23</b>			N/R	■	N/R	■	■	■	■
U58	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
U59	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
U60	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 24</b>			N/R	■	N/R	■	■	■	■



■	Complete data set.									
■	Weather, Instrument error, or other factors prevented a complete data set although other data exists to supplement for a full evaluation of the monitoring activity.									
■	Insufficient data was collected, and no supporting data exists to allow for a full evaluation of the monitoring activity.									
△	The site wasn't confirmed until later in the CMT.									
▨	Site wasn't fully treated so the associated monitoring did not occur.									
N/R	No Record as the monitoring activity does not apply to that site.									
Stations	Herbicide & RWT Dye	Turbidity	WQ (Inside)	WQ (miniDOTs)	HABs	Scans	Nutrients	Macrophyte	BMI	
U61	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R	N/R
U62	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R	N/R
U63	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 25</b>			N/R	■	■	■	△	△	■	■
A64	N/R	N/R	△	N/R	N/R	N/R	N/R	N/R	N/R	N/R
A65	N/R	N/R	△	N/R	N/R	N/R	N/R	N/R	N/R	N/R
A66	N/R	N/R	△	N/R	N/R	N/R	N/R	N/R	N/R	N/R
<b>Site 26</b>			N/R	■	■	■	■	■	■	■
A67	N/R	N/R	■	N/R	N/R		N/R	N/R	N/R	N/R
A68	N/R	N/R	■	N/R	N/R		N/R	N/R	N/R	N/R
A69	N/R	N/R	■	N/R	N/R		N/R	N/R	N/R	N/R
<b>Site 27</b>			N/R	■	N/R	■	■	■	■	■
A70	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R	N/R
A71	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R	N/R
A72	N/R	N/R	■	N/R	N/R	N/R	N/R	N/R	N/R	N/R

3.7.5 Standard Water Quality Monitoring (Outside CMT Treatment Sites)

Standard water quality outside test areas was measured at mid-depth with the same frequency as inside test areas. Data points collected but not addressed in the following statistic are weather measurements, depth measurements, and general field observations. The parameters measured and addressed were:

- Temperature
- DO
- pH

Of the 3,663 data points scheduled to be collected, 3,321 were collected resulting in a 90.6% data collection completion. Sites in this category are labeled with NT (Not Treated) following a station number to identify the multiple monitoring station locations outside each treatment site. Due to different nomenclature for these sites, this monitoring activity is provided in a separate table (Table 3-4). Sites NT3, 21, 22, and 23 are blue because they were not monitored as originally scheduled, but have the correct number of samples, whereas Sites NT29, 30, 32, 35, 43, and 44 are blue because they only missed one sampling event. Sites NT11, 38, 41 and 46 are yellow because they never got sampled. Due to the great number of monitoring stations so close together, it was decided that it would not be necessary to sample NT11, 38, 41, and 46 as sufficient data would be collected at the nearby monitoring stations.<sup>3</sup>

**Table 3-4. Standard Water Quality Monitoring (Outside Test Areas)**

<span style="color: green;">■</span>	Complete data set.
<span style="color: blue;">■</span>	Weather, Instrument error, or other factors prevented a complete data set although other data exists to supplement for a full evaluation of the monitoring activity.
<span style="color: yellow;">■</span>	Insufficient data was collected, and no supporting data exists to allow for a full evaluation of the monitoring activity.
Station	Level of Completeness
NT1	
NT2	
NT3	
NT4	
NT5	
NT6	
NT7	
NT8	
NT9	
NT10	
NT11	
NT12	
NT13	
NT14	
NT15	
NT16	
NT17	
NT18	

<sup>3</sup> Revised APAP Amendment 1, Tables 7-10 - CMT Monitoring Details; pg. 53-58 & MMRP- Attachment B, Section 3.0, Water Quality Parameters; pg. 22-23

<input type="checkbox"/>	Complete data set.
<input type="checkbox"/>	Weather, Instrument error, or other factors prevented a complete data set although other data exists to supplement for a full evaluation of the monitoring activity.
<input type="checkbox"/>	Insufficient data was collected, and no supporting data exists to allow for a full evaluation of the monitoring activity.
Station	Level of Completeness
NT19	
NT20	
NT21	
NT22	
NT23	
NT24	
NT28	
NT29	
NT30	
NT31	
NT32	
NT33	
NT34	
NT35	
NT36	
NT37	
NT38	
NT39	
NT40	
NT41	
NT42	
NT43	
NT44	
NT45	
NT46	
NT47	

3.7.6 Continuous Water Quality: Hourly Loggers (miniDOTs)

Continuous (hourly) water temperature and DO measurements were automatically collected and logged using miniDOTs sensors, which were downloaded weekly. (Note that pH, DO, and temperature were also measured using sondes three times per week at mid-depth in each site and outside all CMT sites.) The miniDOTs loggers were attached to a buoy affixed to an anchoring chain and line so that one logger was stationed near the surface, and one was located near the bottom. As the aquatic macrophyte growing season progressed, plants were observed growing around the miniDOTs that could affect the data collection sensors. To solve this issue, TKPOA staff installed meshed cages around each miniDOT. Also, during the 2022 summer, water levels in the lagoons decreased that in turn gradually reduced the distance between loggers at the surface and those attached near the bottom. Following the loss of several miniDOTs (July-August), TKPOA staff created and installed reinforced buoy and anchorage systems with newly

purchased miniDOTs. Appendix W provides a record of the dates miniDOTs went missing and when they were reinstalled. The completed calculations for this monitoring activity were based on daily averages calculated from weekly downloads of the miniDOT and whether every site received a full download. Of the 17,800 expected data points to be collected, 14,586 were collected resulting in 81% data collection completion. Table 3-3 shows most of the sites as blue due to the missing miniDOTs for the reasons mentioned above. However, other standard water quality measurements provided supplemental data for temperature and DO.<sup>4</sup>

### 3.7.7 Turbidity Monitoring During Curtain/Barrier Installment and Removal

The turbidity monitoring schedule during installation and removal of the curtains began 1 hour before and continued hourly during in-water activity with rotations between both sides of the curtains. A turbidity measurement was to be collected 24 hours post-installation/removal to determine whether turbidity levels exceeded 25% above pre-installation conditions. Additionally, a turbidity measurement was taken 24 hours pre- installation/removal to confirm baseline conditions.

If turbidity levels exceeded 10% above pre-installation/removal measurements, then turbidity monitoring was to continue daily until values met the Tahoe Basin Plan water quality objectives. If turbidity levels did not exceed 10% above pre-installation measurements, then turbidity monitoring was deemed complete. As noted in Section 3.7.1, 'natural levels' is used as pre-installation measurements recorded one hour prior to curtain installation/removal at the location of the curtains. Turbidity was initially planned to be measured at three depths, but consultation with agency staff resulted in single mid-depth monitoring samples. The data completeness statistic presented in Table 3-3 is based on individual monitoring events as opposed to total data points. There were 24 monitoring events scheduled and 18 were completed for curtain/barrier installation and removal resulting in 75% data completion. The missing events were due to a combination of emergency actions associated with new curtain installations following extreme wind events, communication gaps between the installers and the water quality technicians, changes in staffing, and other factors. Sites 1, 2, 14, and 15 are yellow on Table 3-3 because there was one or more missed monitoring events that prevented a full evaluation of this monitoring activity.<sup>5</sup>

The tables in Appendix R display all turbidity measurements collected for turbidity curtain installation and removal. The pale-yellow color represents the measurements where turbidity levels exceeded the pre-installation measurement by more than 10%. Due to the extended presence of herbicides, the turbidity curtains remained in place longer than anticipated creating stagnant water and increased turbidity behind the curtains in Lake Tallac, Area C, and Sites in Areas A and B (Figure 2-3). Appendix X presents more information on the dates that turbidity exceedances occurred.

Section 2.7.1 describes the loose, organic sediment in the Keys lagoons that is readily suspended by minor disturbances and contributes to turbidity levels during activities such as turbidity curtain installation and removal. As shown in Appendix R, turbidity measurements outside the curtains increased during curtain removal due to a combination of effects related to the curtain removal,

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<sup>4</sup> Revised APAP Amendment 1, Tables 7-10 - CMT Monitoring Details; pg. 53-58 & MMRP- Attachment B, Section 3.0, Water Quality Parameters; pg. 22-23

<sup>5</sup> Revised APAP Amendment 1, Tables 7-10 - CMT Monitoring Details; pg. 53-58 & MMRP- Attachment B, Section 3.0, Water Quality Parameters; pg. 22-23



prior treatment activities, and mixing of the water outside and inside of the curtains. Elevated turbidity levels during curtain removal were unavoidable and work had to continue to conclude extraction of the curtains. As a result, work was not paused, and the associated 48-hour post turbidity measurements were not taken during the curtain removal period. None of the increased turbidity levels noted above caused a nuisance as defined in Water Code section 13050(m) or was demonstrated to adversely affect the water for beneficial uses, which is the primary objective.

3.7.8 Turbidity Monitoring of LFA Systems and Culvert Bladders/Plugs

Monitoring for LFA and culvert bladders/plugs was to be completed 1-hour prior to installation/removal consisting of visual monitoring of the surface water and water column surrounding area. If increases in turbidity were observed, a turbidity measurement was to be completed. If turbidity levels increased 10% above pre-installation/removal measures, then all work was to cease, and turbidity monitoring was to continue daily until measurements returned to baseline conditions. (Note: The Site 26 LFA system was installed prior to the CMT project in 2019 so no turbidity monitoring was required during 2022.) In mid-November 2022, the LFA systems for Sites 25 and 27 were installed and visual turbidity monitoring was completed. No observations of elevated turbidity were reported.

The lagoons water level was low (about 1 foot above invert of culverts) at the time of installation and below the culverts during removal of the culvert plugs. When installing the culvert bladders and plugs, vacuum trucks were utilized to remove sediment contents out of the culverts to establish a tight seal for the bladders. No visual indications of elevated turbidity were reported during the culvert bladders/plugs installation. TKPOA staff subsequently completed inspections morning and night to ensure the bladders remained inflated and no seepage occurred (Table 3-5).<sup>6</sup> Of the 134 days of scheduled inspection for the turbidity curtains/culvert plugs, two days were missed as a result of wildfire smoke causing unhealthy air quality conditions, resulting in 98.5% data completion. (The extremely poor air quality would have been a risk to the health of staff doing outside activities.) Table 3-5 displays this information as the box for September is blue showing that some data was not collected, but supplemental data exists for a full evaluation of the monitoring activity.

**Table 3-5. Turbidity Curtain/Culvert Plug Inspection**

	Complete data set.
	Weather, Instrument error, or other factors prevented a complete data set although other data exists to supplement for a full evaluation of the monitoring activity.
Month	Level of Completeness
May	
June	
July	
August	
September	

<sup>6</sup> APAP Amendment 1, 10.9 Measures to Minimize Sediment Disturbance (Turbidity Curtain Installation /Removal & LFA System Installation); pg.102, QAPP, 3.7 Project Tasks, Action 13. Installation/Removal of double “turbidity” curtains and culvert “plug”/“bladder” and “Boat Barriers”; pg. 17

New procedures will be implemented in 2023 for bottom barrier and diver-assisted hand suction turbidity monitoring. See Section 16. for a more detailed description of what these procedures will entail.

### 3.7.9 Nutrient Grab Water Quality Sampling

Nutrient Grab samples were collected as composite samples (surface/mid-depth/bottom) of the water column on a weekly basis, except LFA sites, which were sampled in spring and fall only. Pre-treatment sampling was conducted at all sites except LFA. Herbicide site sampling occurred at 7-30 DAT, whereas UV site sampling occurred at 12-60 DAT. Combination and control sites were a mix of the two depending on which treatment cycle they were following at a given time. Data points that were not addressed in the following calculations are weather measurements, depth measurements, general field observations, photos, dominant species present, and water quality measurements. Data points that were included were the lab results for:

- Total N
- Nitrate+Nitrite
- Total Kjeldahl Nitrogen (TKN)
- Total P
- Orthophosphate (Ortho-P)

Of the 1,100 planned data points to be collected, 1,088 were gathered, resulting in 98% data completion. Table 3-3 shows Site 7 as yellow because its location was not decided until late in Year 1. Site 15 is blue because although treated with UV, the associated sampling began a few days late. Sites 16, 17, 21, and 22 are blue due to one missed sampling event. Sites 23 and 24 are blue because they began sampling too early. Sites 10-14 have blue diagonal lines because they weren't fully treated (no UV treatments due to lack of access from extended presence of boat barriers and turbidity curtains), so the associated sampling did not occur. Sites 25-27 have green diagonal lines as the treatments didn't occur, but complete data sets exist.<sup>7</sup>

### 3.7.10 HABs Monitoring and Responses

Monitoring for HABs followed standard protocols used at LFA Site 26 in prior years as part of Lahontan Water Board's regional monitoring program. The sequence of monitoring included initial visual inspection for the presence of algae, and if present, follow up water samples were taken for laboratory analysis for presence of cyanobacteria and cyanotoxins, and sampling began for Total P, alkalinity, and Cyanotoxins. If a visual indicator was confirmed by lab results, then sampling in that area continued every two weeks until cyanotoxin levels became non-detect. Depending on the results, appropriate signs were posted in the area to inform the public. Data points not addressed in the following statistic are weather measurements and general field observations whereas data points included the lab analyses for:

- Microcystins
- Cylindrospermopsin
- Anatoxins

Of the 380 anticipated monitoring events, 344 were completed, resulting in 90.53% data completion for cyanobacteria grabs. As shown on Table 3-3, Sites 1, 2, 5, 8, 12, and 13 are blue

<sup>7</sup> Revised APAP Amendment 1, Tables 7-10. CMT Monitoring Details; pg. 53-58

due to one or more missed sampling events. However, despite the missed sampling event(s), the data missed does not affect a full evaluation of the monitoring activity.<sup>8</sup>

Responses to HABs sampling included notifications to Lahontan, posting of proper signage based on presence and level of cyanotoxins, and review of nutrients and alkalinity for the potential use the LMCAP (see Table 3-6). LMCAP option was considered based on criteria of cyanotoxin presences, elevated Total P and sufficient alkalinity (MMRP). This sequence, however, did not provide a practical response time for effective mitigation of the rapid increases of cyanobacteria in mid- to late- summer for the following reasons: 1) the time between a visual indication of potential HABs to obtaining laboratory analysis for cyanotoxins and laboratory analysis for nutrients often required 10-14 days; 2) within a 10- to 14-day period, during the elevated water temperatures (>23 C), cyanobacteria typically would have increased 3 to 5 fold; 3) Total P and Ortho-P levels (susceptible to LMCAP) would already have driven the bloom beyond the utility of modified Lanthanum. This condition was discussed thoroughly at the weekly MWG meetings and the consensus was that the LMCAP would not mitigate the already rapidly increasing HABs. Thus, there was too much lag-time between the visual indication of HABs and receiving the data needed to determine if criteria were met for potential deployment of LMCAP to ensure that the use of modified Lanthanum would be effective (see Appendix Y. Harmful Algal Blooms Nutrients Data). However, mitigation actions were taken through the continuous use of subsurface aerators. Recommendations to improve HAB detection and improve mitigation are provided in Section 16.6.

**Table 3-6. HAB Signage Posting**

7/20/2022 <b>Caution</b> Signs Posted:	15 <sup>th</sup> Street, Tahoe Keys Blvd, Lighthouse Shores, West Channel Bulkhead, Beach and Harbor, kayak launches.
8/30/2022 <b>Warning</b> Signs Posted:	15 <sup>th</sup> Street, Tahoe Keys Blvd, Lighthouse Shores, West Channel Bulkhead Beach and Harbor, kayak launches.
9/22/2022 <b>Danger</b> Signs Posted:	Site TA5 (Warning level signs in all other areas)
9/29/2022 <b>Danger</b> Signs Posted:	Site TA3 and Site TA5 (Warning level signs in all other areas)
10/14/2022 <b>Warning</b> Signs Posted:	Site TA3, Site TA5, 15 <sup>th</sup> Street, Tahoe Keys Blvd, Lighthouse Shores, West Channel Bulkhead, Beach and Harbor, kayak launches.
10/26/2022 <b>Danger</b> Sign Posted:	Site TA5 (Warning level signs in all other areas)
11/16/2022 <b>Signs</b> Removed:	Results indicate Caution is highest level in the Keys; instructed by Lahontan to remove HAB advisory signs. HAB signs removed prior to Thanksgiving Holiday.

Regarding visual observations and frequency of sampling: if a visual observation was noted, either by TKPOA or another entity, the site was sampled following the initial visual observation, then re-sampled every 2 weeks through October regardless of the presence or absence of visual indicators.

<sup>8</sup> APAP Amendment 1, Section 8.2.3, Cyanobacteria and Harmful Algal Bloom (HAB) Monitoring, pg. 67-68; MMRP- Attachment B, Section 6.0, Adverse Conditions Reporting, pg. 25; QAPP, Table 5-1: CMT Water and Sediment Quality Monitoring (See summary in Attachments H-1 and H-2), pg. 43-44

### 3.7.11 Macrophyte Point Rake Sampling

Macrophyte point rake sampling required twice monthly completion of thirty (30) point rake samples per site to collect data on the frequency of occurrence, percent composition of species, plant health ratings, and rake fullness (QAPP Attachment H in Appendix F). Herbicide, UV, combo, and control sites required one pre-treatment sample followed by sampling at 14 DAT, then twice monthly sampling until 120 DAT. LFA sites had a sampling frequency of one pre-treatment, one mid-season, and one in the fall. Data points not addressed in the statistic are weather measurements, general field observations, photos taken for each rake sample, percent composition of species, record of the lagoon zone (shoreline, mid channel etc.), and health ratings of the presented species.

Of the anticipated 7,830 data points to be collected, 7,739 were completed, resulting in 98% data completion for macrophyte point rake sampling. Table 3-3 shows Sites 1, 2, 3, 9, 13, 22, and 23 as blue due to a small number of sampling events missed. The location of Sites 7 and 25 (labeled with the  $\Delta$  symbol), were not decided until later in the season so much of the previously planned sampling did not occur in those sites. Sites 10-14 have diagonal lines to show that these Combination sites did not get treated with the intended UV light applications. Diagonal lines are also shown for Sites 25-27 because of the late LFA installation. Site 26 is blue because the schedule for sampling occurred later than originally planned; however, this timing did not affect a full evaluation of the monitoring activity as all three required samplings were collected for this site.<sup>9</sup>

### 3.7.12 Hydroacoustic Scans

Hydroacoustic scans were performed twice per month using boat-mounted transducer (Lowrance HDS 7 Live) and Biobase software to measure and interpolate plant biovolume and height. Data points collected but not addressed in the completeness statistic are weather measurements, general field observations, GPS coordinates, and the boat used to complete the scan. There were 13 anticipated hydroacoustic scans to be completed, and more were performed, resulting in 100% data completion with additional data to complement existing data. Table 3-3 represents this information with green boxes for all sites.<sup>10</sup>

### 3.7.13 BMI Sampling

BMI sampling occurred in the spring using a Petite Ponar grab, and D net as explained in the permit. Sites 7 and 25 were an exception since BMI sampling did not occur in these sites until the fall when their locations were determined. Additionally, Site 27 was sampled in both the spring and fall. Data points collected but not addressed in the statistic are weather measurements, depth measurements, percent of submerged vegetation, percent abundance, taxa richness, percent biovolume, traits of the taxa, temperature and DO. The percentage of completeness was calculated based on the amount of sampling events that occurred. All 25 scheduled sampling events were accomplished for BMI monitoring, resulting in 100% data completion. Additional sampling events were completed that will complement existing data. Table 3-3 represents this information with green boxes for all sites.<sup>11</sup>

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<sup>9</sup> Revised APAP Amendment 1, Section 8.2.1.2, Species Identification and Relative Abundance; pg. 62-63; Table 7-10. CMT Monitoring Details, pg. 53-58

<sup>10</sup> QAPP, Attachment H

<sup>11</sup> Revised APAP Amendment 1, Section 8.2.5, Benthic Macroinvertebrates (BMI), pg. 69