

TKPOA Aquatic Invasive Species Program

2023 End of Season Report





Tahoe Keys Property Owners Association
South Lake Tahoe, California

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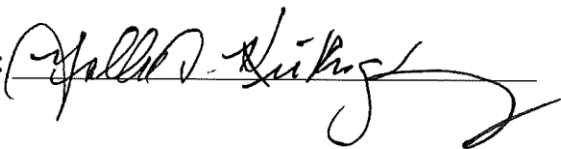
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1.0 INTRODUCTION

The Tahoe Keys have 167 acres of waterways with 1,528 homes and townhouses along with commercial businesses. The waterways include the Lake Tallac Lagoon (a storm water collection basin for South Lake Tahoe), the West Lagoon, and the East Lagoon. Both the West and East lagoons have direct connections to Lake Tahoe via the West and East channels.

The Keys Lagoons have an overabundance of aquatic plants, also known as aquatic macrophytes. Aquatic macrophytes became a problem in the 1980's when invasive weeds were first introduced to the lagoons. There are now three macrophyte species causing problems for boaters of the keys. These species are Eurasian watermilfoil (*Myriophyllum spicatum*), curlyleaf pondweed (*Potamogeton crispus*), and the native coontail (*Ceratophyllum demersum*). The species thrive during the summer when growing conditions are ideal. Every winter aquatic macrophytes die off and deposit a layer of detritus that decomposers break down into nutrients that fuel plant growth the following year. This excessive plant growth is a major cause for poor water quality in the Tahoe Keys lagoons. The TKPOA has been attempting to find a solution to this problem for decades.

Lahontan Regional Water Quality Control Board (LRWQCB) issued the TKPOA a Waste Discharge Requirements (WDRs) permit: Executive Order No. R6T-2014-0059. This specifies that the TKPOA must improve the control of aquatic invasive plants in the Tahoe Keys lagoons. The WDRs also state that the TKPOA must develop an Integrated Management Plan (IMP) for aquatic macrophytes and a Nonpoint Source Plan (NPS Plan) to improve water quality (Lahontan 2014). The TKPOA voluntarily added a Baseline Water Quality Program in 2016. The goal of the Baseline Water Quality Program is to establish an inventory for several water quality and sediment parameters. The baseline data will be used in future years to detect changes in water quality resulting from aquatic plant control methods implemented under the IMP and to monitor surface water input for the NPS Plan.

Property in and around the Tahoe Keys lagoons is controlled by multiple landowners including individual property owners, Tahoe Keys Property Owners Association, Tahoe Keys Beach and Harbor Association, Tahoe Keys Marina along with other commercial and governmental ownership. The TKPOA maintains the waterways for boating and other recreation. However, the ownership situation makes managing the waterways difficult as owners are not required to adapt to the TKPOA best management practices for the IMP.

The Water Quality (WQ) Department has been consulting with local agencies, universities, and scientists to better understand the problem and develop effective solutions. Proposed solutions are presented to the TKPOA Water Quality Board to determine if a project is feasible and how it could be best implemented. The WQ Department has already implemented several projects to help mitigate the aquatic vegetation nuisance in the Tahoe Keys. The WQ Department aims to develop a lasting solution that will reduce biomass of aquatic vegetation in all 167 acres of the Tahoe Keys Lagoons. The ideal solution would improve the water clarity, reduce the spread of Aquatic Invasive Species (AIS) and protect the famed clarity of Lake Tahoe.

2.0 2023 AIS PROGRAM

The WDRs issued to the TKPOA state five objectives that the IMP was to accomplish; therefore, the first Goal of the IMP is to fulfill the objectives named in the WDRs. These objectives are:

- Eliminate the spread of aquatic invasive species (AIS) from the Tahoe Keys to greater Lake Tahoe.
- Enhance the overall water quality of the Tahoe Keys lagoons and Keys Marina thereby improving Lake Tahoe water quality and associated clarity.
- Reduce habitat for non-native fish and enhance habitat for native fish in the Tahoe Keys lagoons and Keys Marina.
- Restore and maintain established beneficial recreational uses, including water contact safety in the Keys lagoons and commercial uses in the Keys Marina Implement a combination of cost-effective control measures that are feasible for long-term management of aquatic invasive plants (AIP).
- Implement a combination of cost-effective control measures that are feasible for long-term management of AIP.

The TKPOA AIS Program aims to effectively implement solutions to fulfill these objectives. During the 2023 season, the WQ Department's AIS staff conducted the projects outlined in this report to meet the WDR's set by LRWQCB.

In 2023, the Control Methods Test (CMT) continued to take place in the Tahoe Keys Lagoons. This is a three year long small-scale test designed to assess the effectiveness of herbicides, ultraviolet light treatment (UV), laminar flow aeration (LFA) and bottom barriers on targeted aquatic invasive species. Year 1 of the CMT included the treatment of herbicides, LFA, and UV. Year two of the CMT, 2023, included UV, LFA, Diver Assisted Suction Harvesting (DASH), and Bottom Barriers. Due to monitoring requirements of the CMT project, certain projects of the AIS program were paused until completion of the test. Projects that were continued in 2023 include the monitoring of the Boat Back-Up station, the West Bubble curtain, and the preexisting LFA project with bi-weekly harmful algal bloom (HAB) sampling. In past years, HAB monitoring was located specifically in the LFA treatment zone, however due to CMT requirements, there was an increase in HAB monitoring throughout the Keys Lagoons.

For more specific details of the CMT project, please refer to the Tahoe Keys Lagoons Aquatic Weed Control Methods Test: Annual Report – Year 2 (Tahoe Keys, 2024a). For specific details about the pre-existing LFA project, please refer to the 2023 TKPOA Laminar Flow Aeration End of Season Report (Tahoe Keys, 2024c).

2.1. 2023 Water Quality Monitoring and Sampling

AIS staff continued collecting water quality data for the IMP and required permits during the 2023 season. The sampling programs are conducted to ensure that the TKPOA is meeting requirements set by the LRWQCB and meeting the Water Quality Objectives (WQO) stated in the WDR. Samples and data were also collected for the State Water Board Region Six Harmful Algal Bloom (HAB) Program regarding the Laminar Flow Aeration (LFA) project and two stormwater sampling events. In 2023, all WDR monitoring requirements were fulfilled through the CMT project. AIS staff completed standard water quality monitoring at three locations per site at mid-depth. Figure 1 below illustrates the treatment sites as well as all the sampling and monitoring locations.

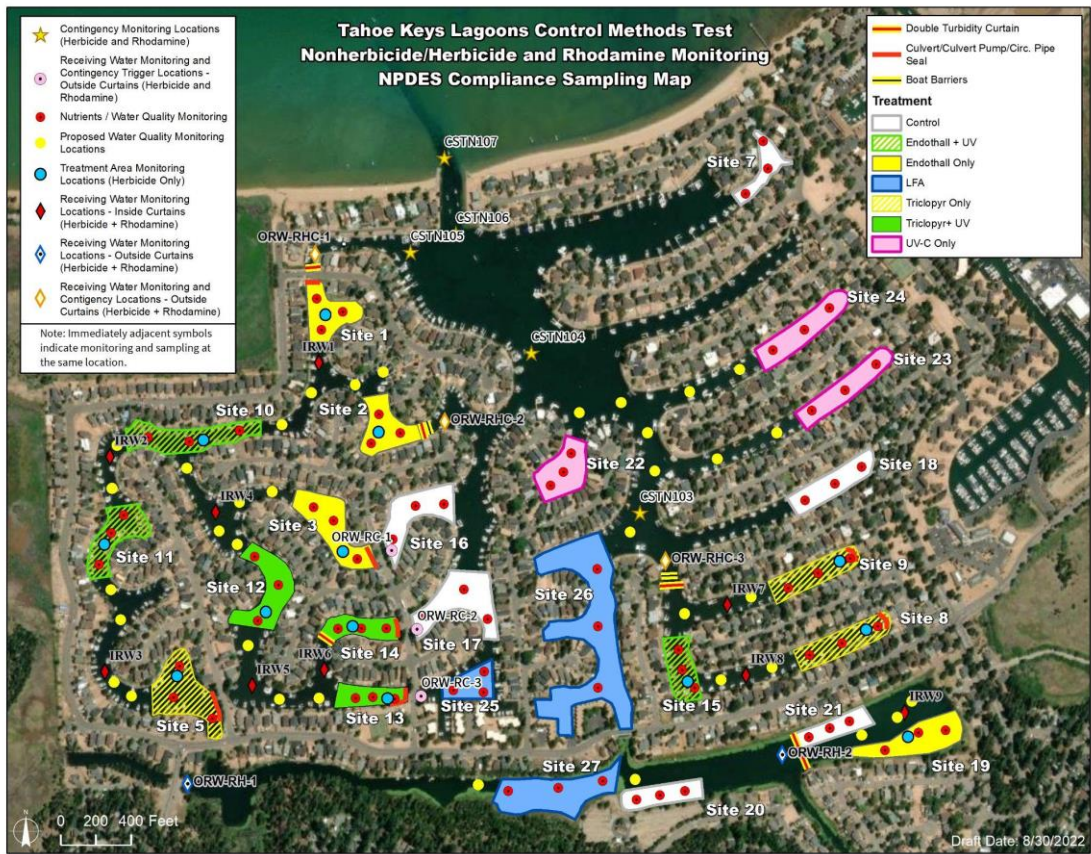


Figure 1. TKPOA Control Methods Test Monitoring and Sampling Locations

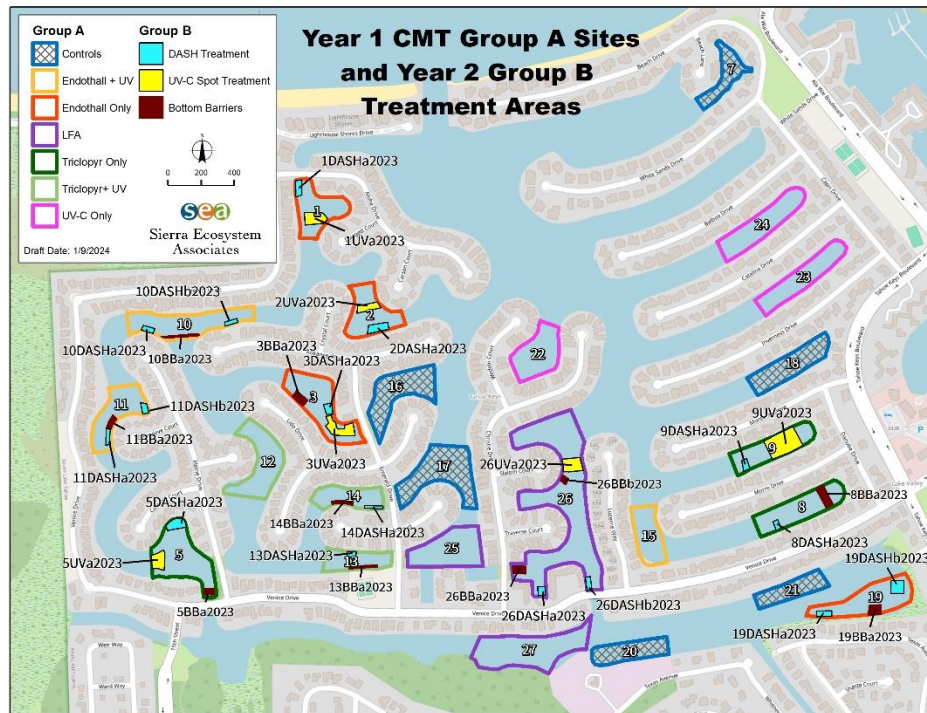


Figure 2. Year 1 CMT Group A Sites and Year 2 Group B Treatment Areas

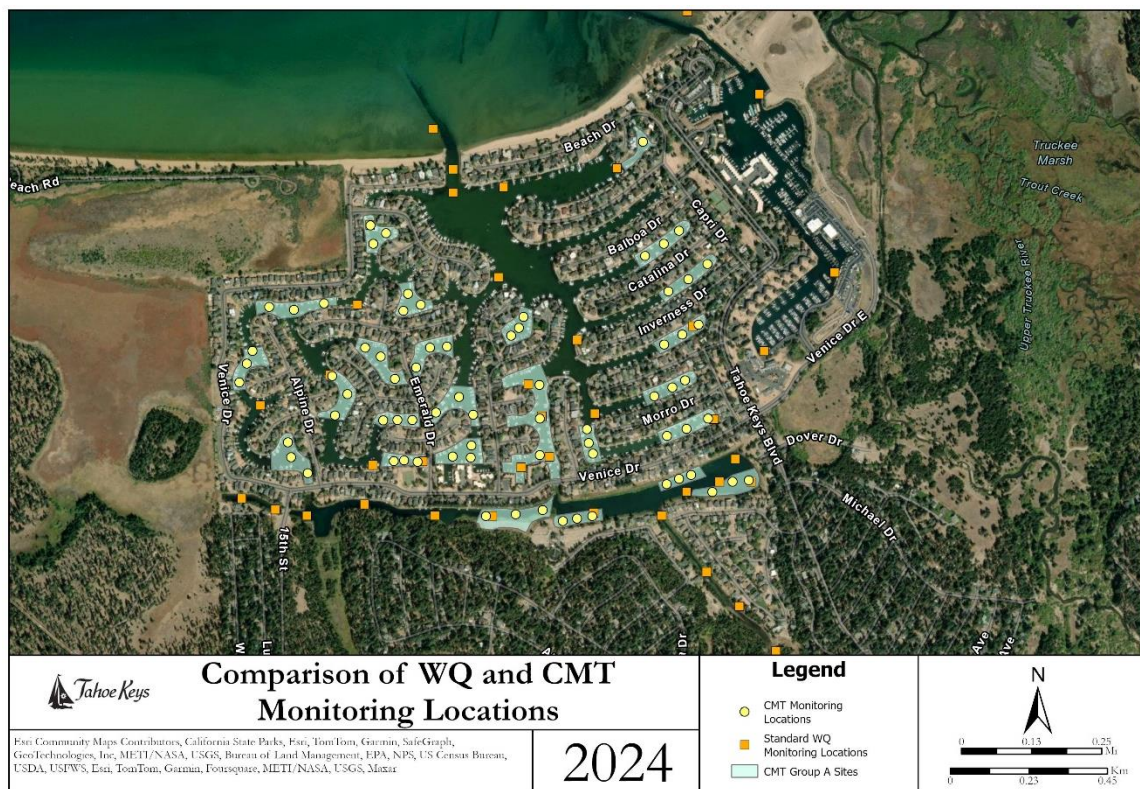


Figure 3. Comparison of WQ and CMT Monitoring Locations

2.2 Methods

2.2.1 Equipment

Water Quality data was collected using the OTT Hydromet HL4 Sonde probe. This probe is a portable multiparameter meter custom designed for the constituents the WQ department needs to monitor.

2.2.2 Calibration

Calibrations and QC checks were done routinely to ensure accuracy across all monitoring and sampling. The TKPOA Water Quality staff calibrated the Sondes probes weekly according to the manufacturer's instructions. On the specific day of sampling, DO was calibrated for more accurate readings due to instructions from the manufacturer. Calibration information was logged on to a calibration worksheet and then archived with the sampling data sheets for that event.

2.2.3 Sampling

For TKPOA specific information on water quality and cyanobacteria sampling procedures, please refer to Appendix A.

2.2.4 Parameters

The sites were measured for atmospheric and underwater parameters at each sampling station for each sampling day. Specific parameters are noted in Table 1:

Parameter	Method of Measurement	Description
Time of Day	Visual	Time of sampling at each site
Air Temp (°F) Cloud Cover (%) Last Precipitation Wind Speed (mph) Wind Direction	Website	The National Weather Service Website is used to determine the weather at the Tahoe Keys on each sampling day.
Water Depth	Hydromet HL 4 Sonde Probe	Depth in meters of water at each site. Used to determine the mid and surface level sampling points in the water column.
Water Temperature	Hydromet HL 4 Sonde Probe	Measure of thermal energy in a substance, or a measure of how hot or cold a substance is. Temperature influences several other parameters and can alter the physical and chemical properties of water (Fondriest Environmental Inc. 2016)
Specific Conductance	Hydromet HL 4 Sonde Probe	Measure in microSiemens per centimeter ($\mu\text{S}/\text{cm}$) of dissolved ionic particles in the water. Acts as a good indicator of Total Dissolved Solids.
	Hydromet HL 4 Sonde Probe	Amount (in parts per million) of oxygen present in

Dissolved Oxygen		water. An important parameter in water quality assessment due to its influence on aquatic organisms. (Fondriest Environmental Inc. 2016).
pH	Hydromet HL 4 Sonde Probe	Measure of acidity of a substance, with pH 7 being neutral.
Oxidation Reduction Potential	Hydromet HL 4 Sonde Probe	Oxidation Reduction Potential (ORP) recorded in millivolts. This is a key component in water quality to determine the health of an ecosystem.
Turbidity	Hydromet HL 4 Sonde Probe	Measurement of water clarity using Nephelometric Turbidity Unit (NTU)

Table 1. Water Quality Parameters

2.3 Laminar Flow Aeration Project

In 2023, the existing LFA project (Site 26) and the two new LFA treatment sites (25 and 27) were monitored in accordance with the CMT Requirements, and the project permits in accordance with the procedures instructed by Lahontan Regional Water Quality Control Board (LRWQCB). Refer to the 2023 Laminar Flow Aeration End of Season Report for more details (TKPOA 2024c).



Figure 4. LFA project area view from Venice Drive bridge looking North.

2.4 Water Quality Data Results

The WDR permit issued by LRWQCB states “Tahoe Keys Lagoons are physically connected to Lake Tahoe and have no site-specific water quality objectives (WQOs) of their own, so Lake Tahoe WQOs apply.” This means that even though the environment of the Tahoe Keys Lagoons is drastically different from Lake Tahoe Proper, the Keys still need to meet the same objectives.

Most of the Water Quality requirements for the WDR permits were fulfilled within the CMT project. Please refer to the Tahoe Keys Lagoons Aquatic Weed Control Methods Test: Annual Report – Year 2 (Tahoe Keys, 2024a) for more details on water quality data results and discussion.

2.5 First Flush Sampling

As part of the Water Quality Certification and Waste Discharge Requirements for Tahoe Keys Property Owners Association Board Order No. R6T-2014-0059 (WDRs) issued by the California Regional Water Quality Control Board – Lahontan Region (LRWQCB), the Tahoe Keys Property Owners Association (the TKPOA) is to promote compliance with the City of South Lake Tahoe (CSLT) municipal separate storm sewer system (MS4) permit (LRWQCB Order No. R6T-2011-0101) for stormwater from TKPOA-owned facilities that drain into CSLT storm drains. In addition, for shared stormwater facilities, runoff from TKPOA facilities must either meet the surface water numeric effluent limits in the CSLT MS4 permit or the TKPOA must document coordination with CSLT to meet fine sediment and nutrient load reduction requirements. The numeric effluent limits in Order No. R6T-2011- 0101 are:

CONSTITUENT	MAXIMUM CONCENTRATION
Total Nitrogen as N	0.5 mg/L
Total Phosphorus as P	0.1 mg/L
Total Iron	0.5 mg/L
Turbidity	20 NTU
Grease and Oil	2.0 mg/L

Table 2. Numeric Effluent Limits

The sampling was designed to occur after the first significant storm event of the season, which was anticipated to produce runoff from both TKPOA-owned facilities and upgradient areas within the CSLT. This “first flush” runoff sampling is performed to identify the pollutants and nutrients that accumulate over the dry season and then are washed into the Tahoe Keys lagoons once the wet season begins. The “first flush” runoff is not intended to be representative of the average stormwater quality over the season but may represent reasonable maximum anticipated nutrient levels.

Water samples are collected from surface water drainages, within storm drain inlets, and from the outlet of accessible storm drains above the lake level. In 2023, six sampling locations were added, three in Pope Marsh and three in Upper Truckee Meadow. These sampling locations were added to create comparisons of stormwater runoff between the Tahoe Keys, Pope Marsh, and the Upper Truckee Meadow. Figure 3 shows the seventeen sampling locations from 2023. SW 1 is in the surface drainage at the south end of the Lake Tallac canal, just north of Tahoe Valley Elementary School. SW 2 is a storm drain outlet that enters the west part of Lake Tallac and drains areas along 15th Street south of the Tahoe Keys. SW 3 and SW 4 drain small areas within the western part of the West Lagoon area of the Tahoe Keys. SW 5 drains an area along Venice Drive just west of Christy Drive. SW 6 is a TKPOA-CSLT shared stormwater drain system that collects stormwater from TKPOA-owned communal areas and townhomes along Ala Wai Boulevard. SW 5 and 6 are in or receive drainage from potentially sensitive drainage areas that are identified in the January 2018 NPS Plan. SW 7 receives the runoff from single family residences and the TKPOA communal areas, including the Pavilion, between Ala Wai Boulevard and Capri Drive. SW 8 receives runoff

from single family residences, several townhomes, the TKPOA public area, and the Tahoe Keys Village commercial area along Lake Tahoe Boulevard and Danube Drive. SW 9 primarily drains runoff from outside of the Tahoe Keys along Tahoe Keys Boulevard. SW 10 and 11 are surface runoff drains from South Lake Tahoe. These two locations drain from the intersection of Highway 89 and Highway 50 and nearby South Lake Tahoe neighborhoods. SW 12 is surface runoff from Pope Marsh that on high water years can connect to Lake Tahoe. SW 13 is surface runoff located in Pope Marsh just outside a CSLT storm drain. SW 14 is off highway 89 and is surface runoff before it enters Poper Marsh. SW 15 and SW 16 are surface runoff located in Upper Truckee Meadow adjacent to CSLT storm drains from Venice Dr. E. SW 17 is located at the conjecture of Upper Truckee River and Trout Cr within Upper Truckee Meadow.

Sampling occurred on December 20th, 2023, due to precipitation as a mix of snow and rainfall of 0.51" and 0.52" December 18th and 19th respectively.

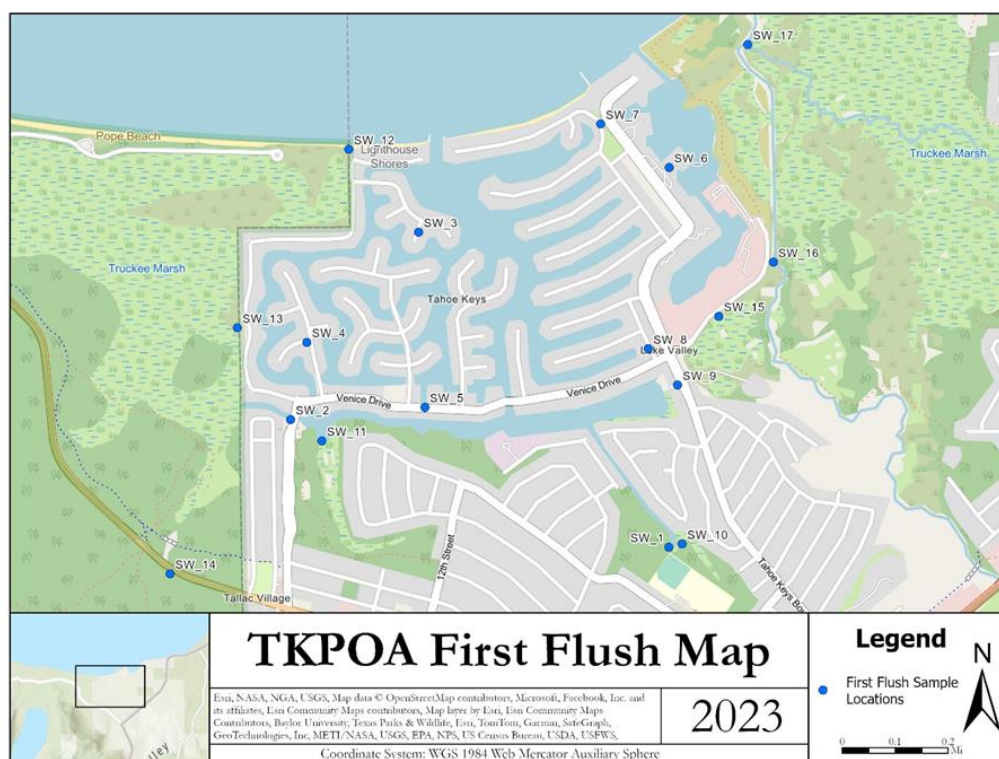


Figure 5. 2024 First Flush Site Map



Figure 6. 2018 Map and Storm Drains by SEA

2.5.1 Results

Results show that SW 1, SW 2, SW 3, SW 4, SW 5, SW 9, SW 10, SW 11, SW 12, and SW 14 exceed the numeric effluent limit for Total Phosphorus and SW 1, SW 3, SW 4, SW 5, SW 9, SW 11, SW 12, SW 13, and SW 14 exceed the nutrient effluent limit for Total Nitrogen.

In summary, lab results show the continued elevated nutrient runoff, like previous years, into Lake Tallac via SW 2, SW 11, SW 1, SW 10, and SW 9. Runoff at these locations comes from the South, outside of the Tahoe Keys. The exception for 2023 was SW 3 where results show highly elevated levels of Total Phosphorus and Total Nitrogen at 2.00 mg/L and 4.40 mg/L, respectively. This was due to a blockage of stormwater runoff at SW 3 by decaying plant debris. Once TKPOA AIS technicians unblocked the runoff, the sample was taken directly from the water that was sitting in decaying plant matter which would increase nutrient levels at this site. The Pope Marsh locations, SW 12, SW 13, and SW 14 also show higher levels of Total Phosphorus and Total Nitrogen than sites draining into the West Lagoon. Oil and grease were not analyzed in all sites due to a shortage of samples bottles.

Site	Total Phosphorus (mg/L)	Nitrate-Nitrite Nitrogen (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Total Nitrogen (mg/L)	Iron (mg/L)	Turbidity (NTU)	Oil & Grease (mg/L)
SW-1	0.062	0.22	0.52	0.74	1.1	8.8	ND
SW-2	0.30	0.032	0.52	0.55	0.12	3.8	ND
SW-3	2.0	0.12	4.3	4.4	6.9	76	N/A
SW-4	0.16	0.17	0.79	0.95	0.60	4.0	N/A
SW-5	0.50	0.031	1.4	1.4	3.9	60	N/A
SW-6	0.041	0.038	0.21	0.25	0.51	10	N/A
SW-7	0.020	ND	ND	ND	0.70	3.8	ND

SW-8	0.075	0.088	ND	0.22	0.67	25	N/A
SW-9	0.19	0.066	0.62	0.68	0.44	30	ND
SW-10	0.16	0.030	0.25	0.28	4.9	26	N/A
SW-11	0.18	ND	1.7	1.7	0.21	1.7	N/A
SW-12	0.16	ND	1.4	1.4	1.5	4.2	N/A
SW-13	0.080	ND	0.63	0.64	1.8	7.7	ND
SW-14	0.20	ND	0.55	0.56	0.67	33	ND
SW-15	0.091	ND	0.47	0.47	1.3	1.8	N/A
SW-16	0.025	0.036	ND	ND	0.41	2.8	ND
SW-17	0.048	ND	ND	ND	0.57	2.4	N/A

Table 3. December 20th “First Flush” Stormwater Sampling Results. Highlighted results exceed Numeric Effluent Limit

2.6 West and East Channel Projects: Boat Back-Up Station and Bubble Curtain

Aquatic macrophyte fragments have been dispersing from the Tahoe Keys into Lake Tahoe since the early 1970’s. The invasive weeds struggle to survive in Lake Tahoe proper due to decreased nutrients and lower temperatures. However, in recent years, Tahoe’s average surface water temperature has increased, and is predicted to continue moving towards warmer temperatures (Schladow, et al., 2022). A warmer habitat could lead to a more hospitable environment for invasive plant species in the future. This prompted the TKPOA to develop a system that would prevent many fragments from dispersing into the lake. The system now utilizes the combined strategies of the Boat Back-Up station, bubble curtains, and bottom barriers.

2.6.1 Boat Back-Up Station

The Boat Back-Up Station (BUS) was implemented in the Spring of 2016 to reduce the amount of plant fragments that enter Lake Tahoe through TKPOA waterways. The station works by using a series of signs and channel markers creating a “roadway” for boaters to follow. As a watercraft moves into a designated area, they stop the vessel, reverse their propeller (this is to untangle and release any weeds caught in the propeller, keel, or rudder) and then back up ten feet to dislodge any weed fragments. Once this is complete, the boater continues out to Lake Tahoe proper.

The TKPOA Boat Back-Up Station is the only one of its kind in the Tahoe Basin. The BUS has shown immense success through years of water compliance, monitoring, and education. In 2020, it was determined that there was a 93.62% compliance rate while monitoring the BUS. TKPOA will continue our efforts through community involvement, on-the-water outreach, and education to help protect Lake Tahoe as this is one of the most promising ways to keep fragments from entering the lake.

2.6.2 Bubble Curtain

This Bubble Curtain (BC) is powered by one large compressor and consists of tubing running along the length of the entrance channels in the East and West lagoons. The tubing releases a wall of bubbles that function as a permeable wall to prevent weed fragments from leaving the Lagoon, while also safely allowing boaters to pass.

In 2022, a second bubble curtain was installed in the West Channel (WC) to improve its functionality. Four 10` x 25` bottom barriers were installed underneath the additional bubble curtain to limit plant growth around the air tubing.

The West Channels' plant content was monitored daily throughout the 2023 season. Certain days were skipped due to weather or staffing issues. The West Channel was monitored for a total of 47 days. During the winter season, WQD staff completed weekly visual inspections of both the WC and EC bubble curtains.

On every scheduled monitoring day from June 21, 2023, to October 12, 2023, the West Channel was surveyed by the AIS team and the plant content was removed. Around 8:30 AM, the skimmer crew went to the West Channel and collected floating plant fragments from the area to record the volume of the plants that were present. The East Channel BC was not surveyed due to mechanical issues with the East Channel compressor for most of the boating season. It was back in service on February 9, 2024.

AIS Staff concluded that over the 47 days of monitoring, approximately 21.42 ft³ of weed fragments were collected in the West Channel. Species composition of plants was not recorded during the 2023 season.

In 2022, the Bubble Curtain Working Group was created with members from TKPOA, LTSLT, TRPA, TRCD, Suntex, Inventive Resources Inc., and Marine Taxonomic Services. This group was formed to improve the efficacy and monitoring protocols for all lake wide bubble curtains. The Bubble Curtain Working Group did not meet in 2023.



Figure 7. East Channel Double Bubble Curtain

2.7 Bottom Barriers

Bottom barriers are a proven way to eliminate aquatic vegetation growth. In 2010, a partnership of agencies implemented bottom barriers in Emerald Bay. This project used around five acres of bottom barriers coupled with diver assisted hand pulling. When the barriers were removed, there was only sand beneath them. Due to their effectiveness, it was decided bottom barriers would be utilized in the Tahoe Keys. In 2023, the Bottom Barrier Project was suspended due to conflicts with the CMT project, however, bottom barriers were utilized as a Group B treatment for the 2023 CMT Year 2 project. Refer to the CMT Annual Report – Year 2 (Tahoe Keys, 2024a) for more information on CMT Bottom Barrier treatment and the 2023 Bottom Barrier End of Season Report (Tahoe Keys, 2024b) for more information on the TKPOA Bottom Barrier program.

2.8 Surveys and Monitoring Projects

Certain aquatic vegetation can negatively impact water quality more than others and more dense vegetation can hinder boaters. To determine where water quality might be worse in the lagoons, the TKPOA monitors vegetation type and density. These programs help track the year-to-year changes in vegetation along with density in certain areas. The AIS program plans to implement more programs in the coming years.

2.9 Annual Macrophyte Survey

The Annual Macrophyte Survey was conducted once during the 2023 season. This survey sampled 735 points throughout the Tahoe Keys Lagoons and Lake Tallac. At each point, a sample is taken by raking the bottom of the water column with a sampling rake. The sample is then analyzed, and the percentage of each species is estimated. The percentage and species are recorded on a data sheet, input into GIS software, and checked against archived data to determine what plants are growing where. These results were published in the 2023 Macrophyte Report created by Sierra Ecosystem Associates (SEA). This report helps identify and quantify changes to the aquatic vegetation within the Tahoe Keys Lagoons. The Annual Macrophyte Survey was not completed within CMT sites. However, additional macrophyte surveys were conducted in treatment sites (bi-weekly) by an outside contractor to fulfill permitting requirements.

Refer to the 2023 Macrophyte Survey Report for more information (Tahoe Keys, 2024d) and the Tahoe Keys Lagoons Aquatic Weed Control Methods Test: Annual Report – Year 2 (Tahoe Keys, 2024a).



Figure 8. Points Sampling Locations for the SEA 2023 Macrophyte survey

2.10 Hydroacoustic Scans

Throughout the 2023 season, the AIS staff mapped plant density in the Tahoe Keys Lagoons. This was utilized in the CMT project to show the progress of the treatments throughout the season. These scans, in conjunction with the data collected, will determine the efficacy of the CMT project. Summaries and analysis of these scans are included in the Tahoe Keys Lagoons Aquatic Weed Control Methods Test: Annual Report – Year 2 (Tahoe Keys, 2024a). AIS staff utilized two boats (Boston Whalers) equipped with a HDS 7 Live Lowrance systems with Active Imaging 3 in 1 Sonar Transducer to thoroughly scan the West Lagoon and Lake Tallac. The data is then uploaded onto the BioBase software to determine plant density based on the structure scan produced by the Lowrance system. Hydroacoustic scanning was also conducted in the Tahoe Keys Marina and Tahoe Keys Complex. The Tahoe Keys Lagoons experienced a dramatic increase in water level from 2022 to 2023. The approximate 4 ft rise contributed to the improved percent biovolume heat maps.

2023 West Lagoon Hydroacoustic Scans

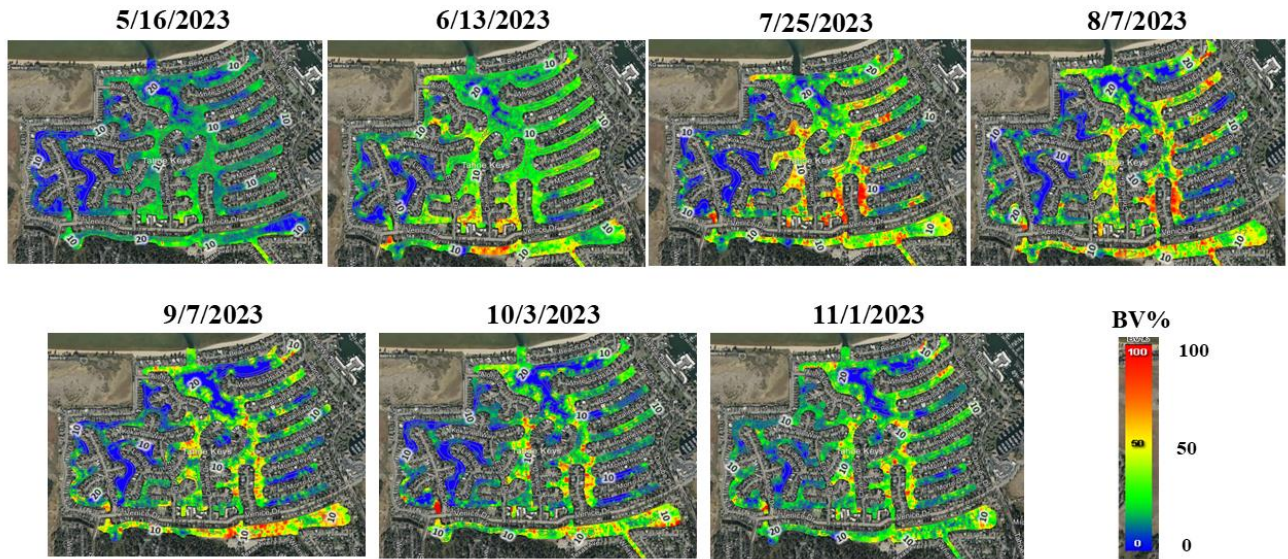


Figure 9.2023 West Lagoon Scan Compilation

2.11 Radar Systems

Two radar systems were in place and fully functional throughout the 2023 season. They are located at the West Channel entrance and at a key intersection where it was visible to most boaters in the Tahoe Keys. The goal of these systems is to encourage boaters to reduce their wakes and speeds while in the TKPOA waterways.



Figure 10. Mobile Radar System in West Lagoon

2.12 TKPOA Boat Count

The TKPOA annual boat count was conducted four times during the 2023 season. Due to the number of rental properties in the Tahoe Keys, and the resulting flux of boat numbers, it is important to track the number of boats and powered watercrafts (PWC) that are inside the Tahoe Keys Lagoons. On June 13, 2023, July 5, 2023, August 8, 2023, and September 6, 2023, the WQ

Department split into nine groups to determine the number of boats in each section of the Tahoe Keys lagoons. The East Lagoon and Beach and Harbor were added to the boat count in 2023. Each boat was equipped with one driver and one counter to get an accurate number of each boat in a particular section. This gave the TKPOA a total number of boats in the Keys Lagoon, not including kayaks, pedal boats, or other non-motorized vessels. Lake Tallac was not included in the boat count due to it being classified as a non-motorized lagoon.

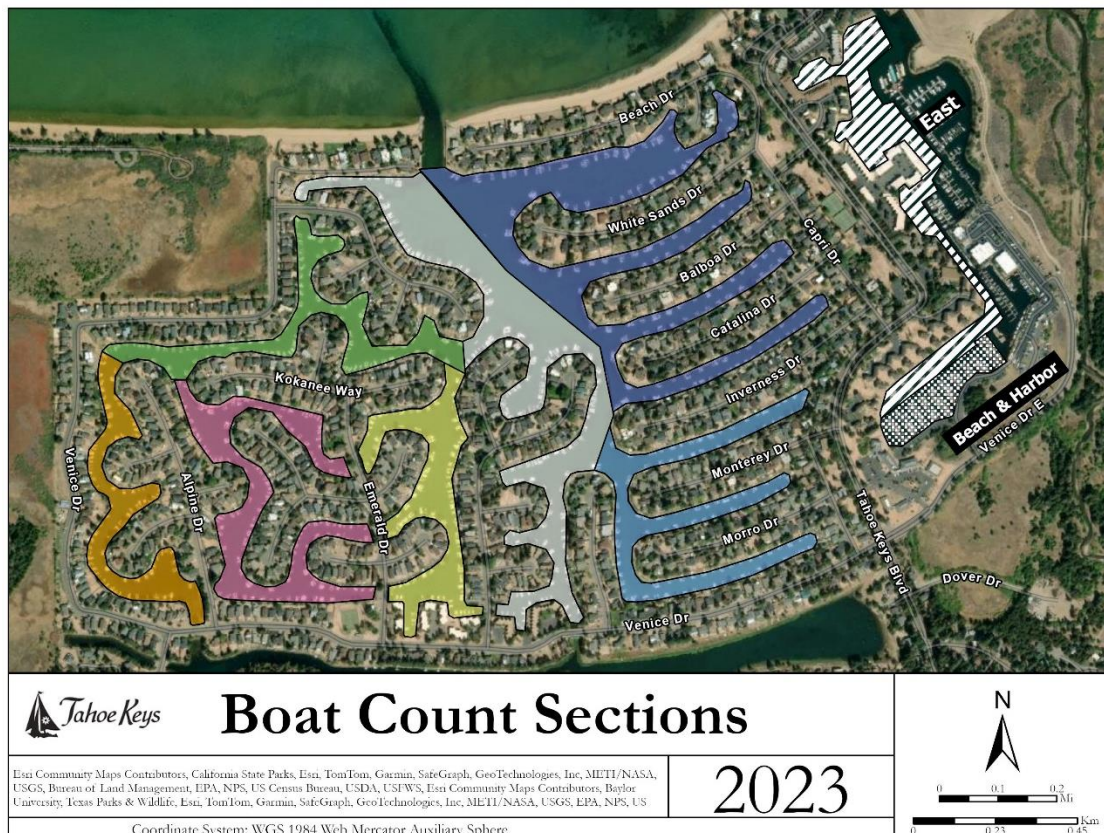


Figure 11. 2023 Boat Count Zones

2.13 Mapping and Data Analysis Software Implementation

- a. **GIS Software:** The TKPOA WQ Department purchased GIS software late in the 2019 season. The AIS staff have made new maps for projects and will continue to use the software for project proposals and site descriptions. In 2023, AIS staff utilized ArcGIS and GIS Pro desktop applications.
- b. **BioBase:** The WQD continues to utilize BioBase as a mapping software. This software uses complex algorithms to process sonar files from the hydroacoustic scans and create detailed bathymetric and biovolume heat maps. These maps are critical for project planning and tracking aquatic plant growth.

2.14 Water Quality Administrative Record

The WQ Department Staff compiled all the documented correspondence that took place between the TKPOA and outside organizations regarding the AIS Program. This correspondence was cataloged by month and year in both paper and electronic copies. This has allowed the TKPOA

Board of Directors and the Water Quality Committee to have documented records of the Association's AIS Program efforts.

2.15 Cigarette Butt Collection and Monitoring

Cigarette butts contain carcinogenic chemicals that can be harmful to the environment if not disposed of properly. To help with proper disposal, the League to Save Lake Tahoe (LTSLT) has a program where they supply cigarette butt canisters to companies around the basin. In late 2019, the TKPOA volunteered to participate in the program. AIS staff has installed 7 cigarette canisters in different TKPOA common areas. During the 2023 season, the TKPOA staff collected cigarette butts from each canister on October 16, 2023. After the collection, the TKPOA staff reported the results to the League by completing their requested Google Form, "Tahoe Cigarette Disposal Program Data." For the 2023 season, the visual percent fullness for the average canister from the TKPOA area was around 15% full.

2.16 Monitoring of the Tahoe Keys Complex

The Tahoe Resource Conservation District (TRCD) funded a diver assisted hand pulling project that has taken place since 2020. The hand pulling was conducted by Marine Taxonomic Services (MTS). During the 2023 season, TKPOA AIS staff continued to monitor regrowth in the project area through hydroacoustic scans. This will help determine the effectiveness of diver assisted hand pulling and if it has lasting effects on aquatic vegetation reduction.

2.17 LG Sonic Industrial Wet Ultrasound

Harmful Algal Blooms (HABs) have increased in size and occurrence worldwide due to warmer temperatures and increased nutrient inputs via direct and indirect sources (Paerl et al., 2018). HABs are caused by microscopic cyanobacteria that photosynthesize and multiply very quickly when water conditions are right. These conditions include warm stagnant waters, prolonged sunlight, and an influx of nutrients. During the process, different cyanobacteria species can emit toxins called anatoxin-a and microcystins which are harmful to animals and humans. Once these blooms die off, they sink to the bottom where bacteria decompose them depleting the waters of oxygen creating an unhealthy ecosystem (California Water Quality Monitoring Council). Since 2017, the Tahoe Keys Lagoons have had a steady increase of HABs, especially in the dead-end zones with limited circulation. HABs are now a common occurrence every summer season throughout the lagoons.

In 2023, the Tahoe Keys Property Owners Association (TKPOA) installed two LG Sonic Industrial Wet ultrasonic devices to evaluate a new method of controlling HABs in dead-end waterways. These devices emit low-power ultrasonic waves in the top water layer, which interferes with the algae's ability to reach the surface to access sunlight and nutrients, preventing photosynthesis. This causes the algae to sink to the bottom where they decompose naturally without releasing harmful toxins. The ultrasonic waves have no negative effects on aquatic organisms, animals, or humans (Lg Sonic 2023).

CMT Sites 5 and 13 were determined optimal test sites due to their dead-end locations as well as previous years' HABs occurrences. Site locations are shown in Figure 12.



Figure 12. Lg Sonic Unit Locations in Site 5 and Site 13

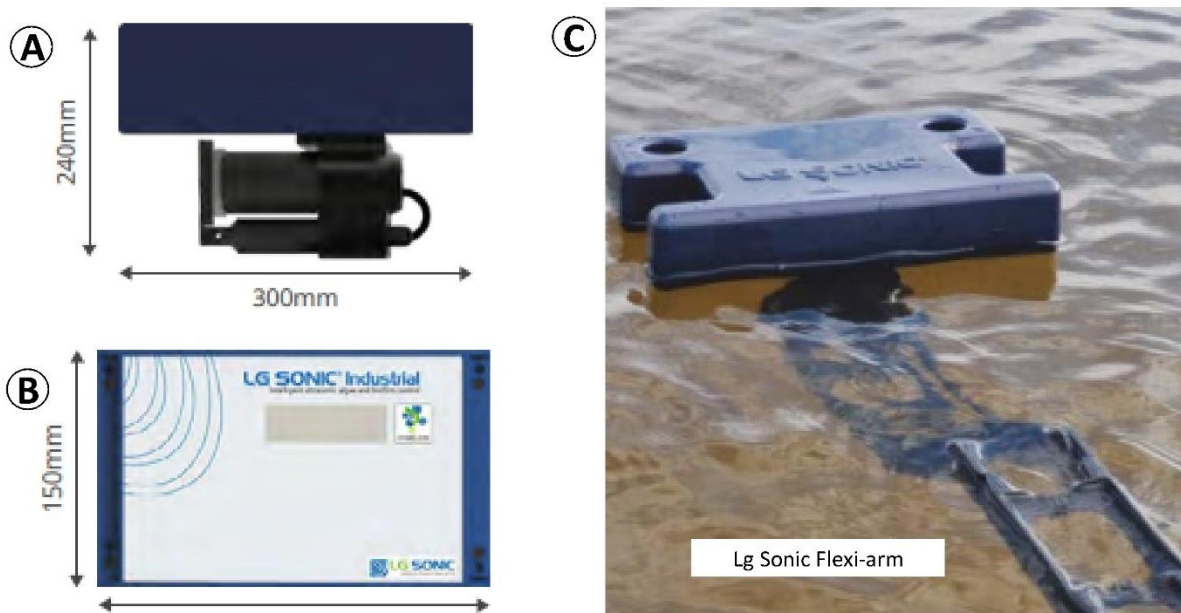


Figure 13. Transmitter unit attached to float B. Control Box C. Flexi-arm attachment.

In Site 5, the transmitter unit and float were placed around 1ft away from the edge of the dock attached with a loose chain so it could change with the water levels. The transmitter faced South towards the largest part of the ‘problem area’ with no obstruction. The transmitter cable was secured along the dock up to the control box housed inside a waterproof enclosure. The power cable was secured along the dock up to the house and plugged into a waterproof outlet box.

Site 13 used a 6-foot stake along the water's edge to provide a stable source of attachment. One end of the Flexi-arm was attached to the stake, the other end to the transmitter/float, making sure it was fully submerged and facing a North-West direction. The transmitter cable was connected to the control box set on a concrete pad inside a waterproof box. The power cable fed into an underground pipe and connected to the power source inside the TKPOA pumphouse.

After consultation with the Tech team at LG Sonic regarding the Tahoe Keys Lagoon characteristics, ‘Program 9’ was chosen for its specific wave form, frequency pause and amplitude that would work best within the waterways. This program was in a factory setting before shipment and installation.

3.0 HARVESTING PROGRAM

With the harvesting program, the TKPOA WQ Department aims to help homeowners remove the aquatic vegetation through mechanical harvesting. These harvesters have been utilized since the 1970s to control aquatic vegetation. Historically, the aquatic harvesters and skimmer boat crews were the primary means for the TKPOA to control the aquatic vegetation and has continued to be the primary means accompanied with other methods to meet the requirements of the WDR issued by the LRWQCB in 2014. One of the goals of the CMT project is to reduce the amount of needed aquatic plant harvesting in future years.

In 2023, harvesting operations were altered to comply with the CMT. Several changes were implemented to accomplish this, however unlike 2022, harvesting operations were able to begin mid-June like previous years. Modified harvesting zones were implemented in the West Lagoon to avoid interference with CMT treatment sites. The East Lagoon’s harvesting zones were not changed. See harvesting zones in Figures 11 and 12 below.



Figure 14. 2023 West Lagoon and Lake Tallac Harvesting Zones

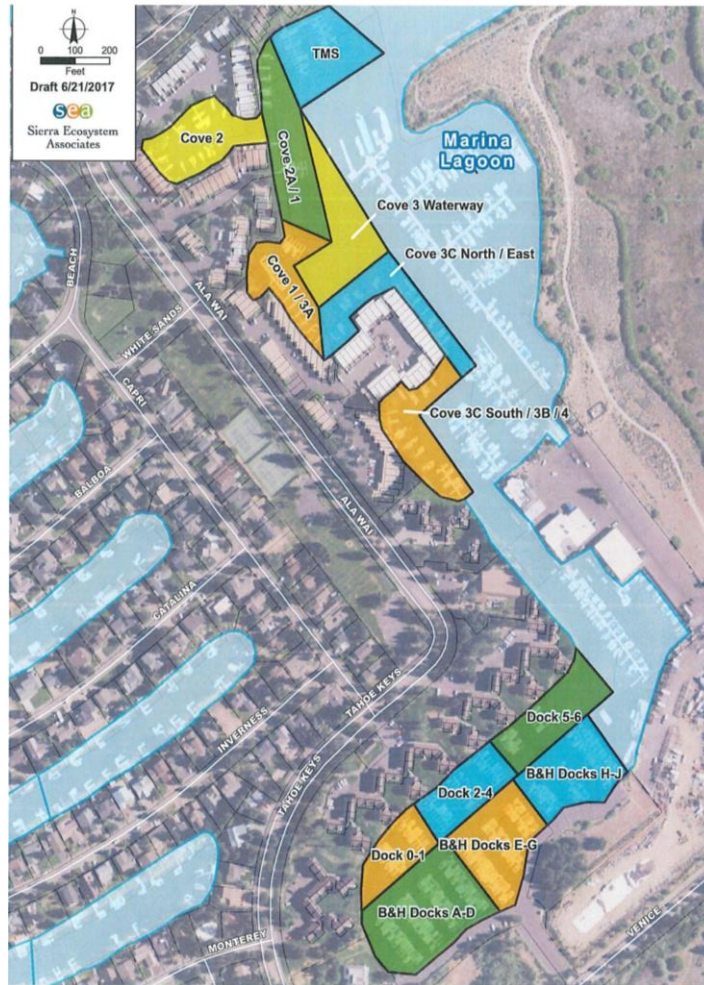


Figure 15. 2023 Tahoe Keys Marina Harvesting Zones

3.1 Harvesting Results

During the 2023 harvesting season, the WQ Department removed a total of 780 tons (6,345 cubic yards) of plants and plant fragments from the water (Table 2). This was broken down into 603 tons (4,910 cubic yards) that were removed by the harvesters and 177 tons (1,435 cubic yards) that were removed by the skimmer boats. To get a more accurate measurement of weeds harvested, WQ staff switched from cubic yards to tons as it is a better comparison to the weigh station at South Tahoe Refuse Center (STRC) where the weeds were weighed and disposed of in 2023. In past years, TKPOA staff believe the amount of weeds harvested was grossly overestimated by the harvesters. To compensate for the overestimation in past years, WQ staff applied a formula of a 75%, 50% and 25% application to each “load” off a harvester depending on if they classified it as a full load, half load or quarter load. By doing so, the estimates from the harvesters this year were much closer to the actual number weighed in tons by the STRC when compared. Therefore, there was high confidence in adjusting past numbers in this way to make a yearly comparison. Figure 13 details a comparison in the monthly harvesting totals from 2019 through 2023.

Month	Harvester 3 (tons)	Harvester 4 (tons)	Harvester 6 (tons)	Harvester 5 (tons)	TOTAL (tons)	TOTAL (yd ³)	Skimmer Boats Total (tons)	Skimmer Boats Total (yd ³)
Jun	15.8	13.3	5.35		34.5	279	8.6	70
Jul	27.1	113	32.5		172	1395	25.4	206
Aug	74.7	100	36.2	2.47	214	1730	47.1	381
Sep	56.8	57.2	23.7	10.6	148	1201	73.6	596
Oct	10.3	21.1	3.91	2.28	37.6	304	22.5	182
Totals	185	304	102	15.3	606	4910	177	1435

Table 4. Volume of Weeds Removed in (tons) and (cubic yards) in 2023 by harvesters and skimmer boats

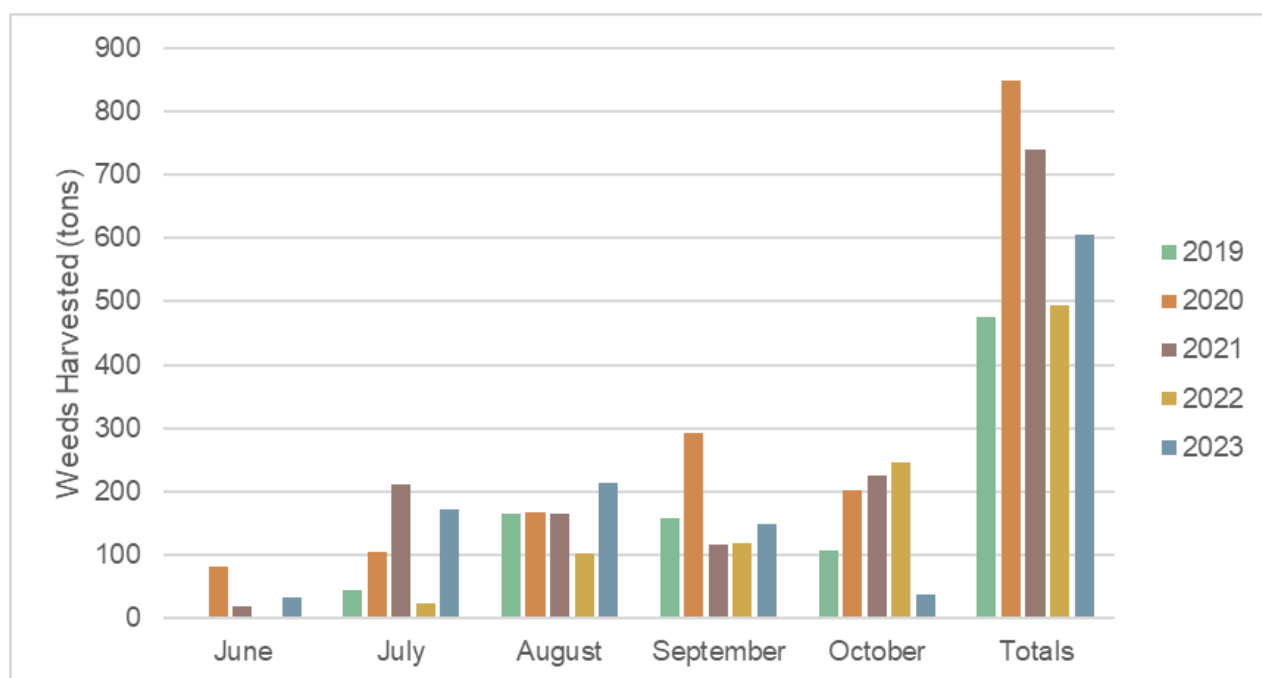


Figure 16. Tons of Plant Material Harvested by Month since 2019 with adjustments made to previous years.

3.1.1 Harvesting Discussion

The 2023 season was an impactful harvesting year. An outside contractor was brought in to train new hires and fix the fleet of boats. The WQ Department was fully staffed, and new training techniques were used to ensure each harvester driver was responsible for and capable of the maintenance of their harvester. All boats, harvesters and trailers are in working condition and have been placed on a preventative maintenance schedule. A new disposal method was implemented to eliminate on-site weed drying. This has streamlined operations and allows for same day drop off with accurate weight measurements of weeds harvested. We will be more accurately able to determine the rate of removal season after season which will aid in determining effective alternative methods being tested.

4.0 PUBLIC OUTREACH

4.1 Best Management Practices (BMP)

In an undeveloped environment, runoff from precipitation is absorbed into the ground and filtered through soil, wetlands, and root systems. As urbanization of the Lake Tahoe Basin increases, wetlands, wet meadows, and riparian habitat are removed or threatened. Compromising these habitats removes the basin's natural water treatment and filtration system. As impervious surfaces (such as pavement) increase, filtration is further disturbed. Disrupted filtration contributes to an input of nutrients and sediment into the lake, decreasing its' renowned clarity.

The biggest cause for concern regarding the lake's clarity decline is the presence of nitrogen, phosphorus, and fine sediment. The best way we can decrease input of these factors into the lake is to implement Best Management Practices (BMP) on all properties. BMP implementation is particularly important in the Keys because of the proximity to Lake Tahoe. Figure 14 is taken from TRPA (ArcGIS, 2024). This map outlines the current BMP status of TKPOA homeowner lots. The blue area represents properties that have a TRPA BMP certificate issued and the pink area represents properties that have a TRPA BMP source certificate issued.

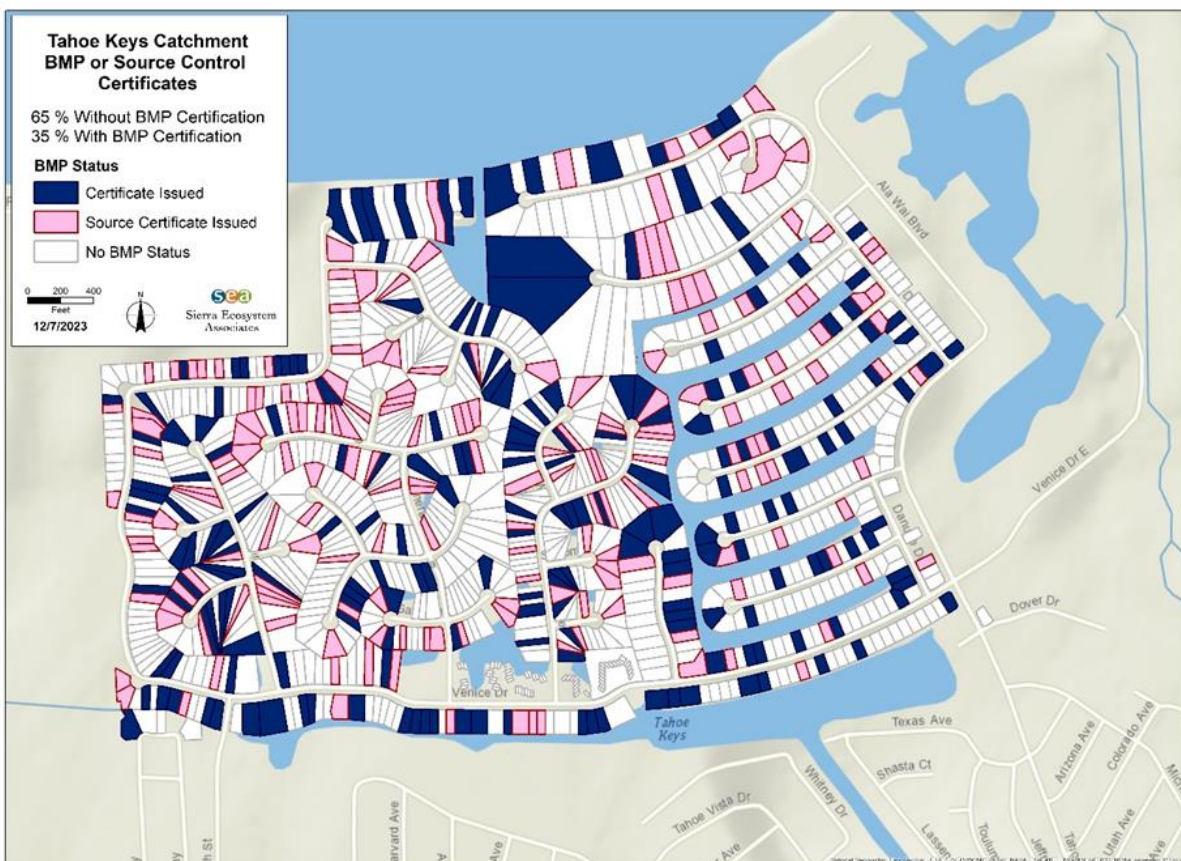


Figure 17. TKPOA Parcels with BMP or Source Control Certificates (NPS, 2024)

4.2 Traditional Marketing and Education Center

For internal communication with the TKPOA property owners, the TKPOA WQ team utilized traditional marketing tactics to inform homeowners of projects being implemented throughout the 2023 season. For example, large signage (Figure 19) was created and dispersed in the West Channel and at entry points throughout the Keys informing homeowners that there would be divers throughout the Keys waterways for the entirety of the summer. As an additional follow up, door hangers (Figure 18) were made and placed only on doors of homes where a homeowner's dock could be blocked or if their boating would be delayed or impacted.

The TKPOA team created and printed rack cards (Figure 20) for Tahoe Keys Marina, the TRPA Inspection Centers, and for the TKPOA Education Center located at the Pavilion for homeowners, renters, boaters, and visitors to read handouts and see maps of the CMT project. The rack cards were created to be double sided where one side educated the public on what aquatic invasive species (AIS) are and the threats they pose to Lake Tahoe and the other side informed public and homeowners on the active divers in the Keys waterways for the CMT project. See below figures of the printed rack cards. The Education Center also included physical samples of the invasive aquatic weeds that are in the Keys.

Another form of traditional marketing utilized were the monthly Keys Breeze articles that were published and printed only for TKPOA homeowners. The TKPOA WQ Department would update the residents on CMT project updates, budget information and water quality facts. These would be mailed monthly to homeowners for those who may not have been reached on the digital platforms. Regarding connecting with homeowners that might not have been reached on e-blasts, the team would also use traditional phone campaigns to inform homeowners of the upcoming CMT vote and encourage them to participate in the vote. The goal was to reach each homeowner directly to connect with those who previously have not been involved or notified with the other forms of marketing.



Figure 18. Door Hanger



Figure 19. Signage for Keys waterways and entrance points



Figure 20. TKPOA Informational Rack Card (front and back).

4.3 Digital Marketing and Social Media

The TKPOA WQ Department has been increasing outreach efforts in recent years. During the 2023 season, TKPOA staff communicated to various stakeholders - homeowners, agencies, and the public - through digital marketing and communications by updating the WQ Department website, keysweedsmanagement.org. This site was the primary social platform to inform stakeholders on the CMT project, harvesting schedule, public events, project reports and releases. In addition to the website, the TKPOA WQ Department updated and utilized the “tahoekesypoa_wq” Instagram for homeowner outreach. The TKPOA WQ utilized its’ Instagram primarily to collaborate and partner with posts from the League’s “Keep Tahoe Blue” page. In addition, the TKPOA was able to send engaging, modernized and visually appealing e-blasts to homeowners through an updated online program successfully achieving the goal of reaching more property owners.

4.4 Tahoe Keys Communication Team

Externally, the TKPOA WQ department has a goal of improving effective and synchronized messaging across platforms and agencies to avoid discrepancies. To achieve that goal, TKPOA worked closely with Zephyr Collaboration, TRPA and the LTSLT to work on communication

goals to solidify similar and approved messaging to various stakeholders. During the 2023 season, this team would meet often to brainstorm communication tactics surrounding the ever-evolving CMT project updates.

4.5 TKPOA Town Hall Forums

The TKPOA held two Town Hall Forums (THF), during the 2023 season, on June 22nd and October 26th to inform homeowners and the public about the CMT project. These Town Hall Forums were a hybrid structure so homeowners could attend in person or on the online platform, Zoom. Speakers included our Waterways Committee Chairman, Pete Wolcott, in addition to the TKPOA consultants, CMT lead scientist, Dr. Lars Anderson and the President of Sierra Ecosystems Associates, Rick Lind. The main topics discussed during these Town Hall Forums were the 2023 Control Methods Test Update and Year 3 of the CMT Project. The THF that occurred on October 26, 2023, was focused around informing our homeowners in addition to engaging more to attend by including a Happy Hour and Raffle event; this new method of attracting our homeowners was successful, as we had more in house attendance. The goal for 2024 is to continue to engage and provide more creative solutions to engage our homeowners and the public to attend the informative Town Hall Forums.

5.0 2024 PROJECTS AND RECOMMENDATIONS

5.1 Utilizing a Data Collection Software to streamline Data Collection

For the 2023 season, AIS staff recommend upgrading data collection protocols from paper datasheets to electronic data collection devices utilizing a program such as Fulcrum. This upgrade will streamline data collection and QA/QC protocols.

5.2 Radar System/Boat Traffic Monitoring in the West Lagoon

The TKPOA would like to use the West Channel radar system to monitor boat traffic coming into the Keys. This would help track the number of boats in the Tahoe Keys over time.

5.3 Best Management Practices (BMP) Certificates

The TKPOA plans to improve the BMP program for the 2023 season. The goal is to improve internal communication to homeowners and increase the number of property owners getting BMP certifications from TRPA. To improve communication, TKPOA will push BMP applications through e-blasts, Keys Breeze, and directing homeowners on keysweedsmanagement.org on how to apply and get the BMP certification.

5.4 2024 Outreach

The AIS staff plans to continue to utilize the keysweedsmanagement.org site in addition to its Instagram for social media promotion. The goal for the 2024 season is to improve outreach in a multitude of ways. Some are improving video and photography content by investing in a drone to collect aerial shots of the Keys and CMT project. Others include modernizing flyers, social media posts and e-blasts.

5.5 Harvesting Recommendations

Conveyor systems for the Tahoe Keys Marina are being evaluated for better safety and efficiency. Continuing preventative maintenance on all machines to keep the boat fleet functional is essential

for smooth operations. An evaluation on a better way to manage and harvest Coontail will be done at the beginning of the 2024 season.

5.6 Boat Ramps

Another goal for the 2024 season is to improve the various boat ramps around the Keys Lagoons. This would streamline water quality operations, reduce drive time, and maximize efficiency. The redesign of these ramps is currently under the permitting process. The ramps to be redesigned are modifications to pre-existing ramps on the East and West sides of Garmisch Court, and addition of ramps on the East and West sides of 15th street for better access into Lake Tallac. The addition of ramps on 15th street would increase harvesting operation efficiency by cutting down harvester travel time and by increasing access to the West side of Lake Tallac.

5.7 Continuation of Ultrasound Testing

The TKPOA team installed two LG Sonic Industrial Wet ultrasonic devices to test a new method of controlling HABs in dead-end waterways. The areas they were installed in were in the CMT Sites 5 and 13 as they were determined to be optimal test sites due to their dead-end locations as well as previous years' HABs occurrences. Next year, the goal is to install the ultrasonic units in the same sites and evaluate what other sites could benefit from this device.

6.0 DISCONTINUING REPORTING

This AIS and Harvesting report will be discontinued in 2024. All the information found in this report is redundant to the 2014 Waste Discharge Requirements (WDR) permit reports and can be found in the Integrated Management Plan (IMP) and the Non-point Source Plan (NPS) published annually by January 31st. The Water Quality Department website (keysweedsmanagement.com) will be updated throughout the year with information on the activities occurring on the waterways for each season.

7.0 ACKNOWLEDGMENTS

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8.0 ABBREVIATIONS AND ACRONYMS

AIS	Aquatic Invasive Species
BMI	Benthic Macroinvertebrates
BMP	Best Management Practices
CMT	Control Methods Test
CSLT	City of South Lake Tahoe
EC	East Channel
GIS	Geographic Information System
GPS	Global Positioning System
IMP	Integrated Management Plan
IRI	Inventive Resources, Inc.
IWMP	Integrated Weed Management Plan
LFA	Laminar Flow Aeration
LRWQCB	Lahontan Regional Water Quality Control Board
LTSLT	League to Save Lake Tahoe
SEA	Sierra Ecosystem Associates
TKPOA	Tahoe Keys Property Owners Association
TRPA	Tahoe Regional Planning Agency
WDRs	Waste Discharge Requirements
WQO	Water Quality Objective
WC	West Channel
WET Lab	Western Environmental Testing Laboratory
WQD	Water Quality Department

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10.0 REFERENCES

ArcGIS web application. (2023). Retrieved March 24, 2023, from <https://gis.trpa.org/bmpmappingtool/>.

Fondriest Environmental, Inc. Fondriest Environmental. (n.d.). Retrieved April 3, 2023, from <https://www.fondriest.com/>.

Lahontan Regional Water Quality Control Board (Lahontan) 2014. Water Quality Certification and Waste Discharge Requirements for TKPOA. https://www.waterboards.ca.gov/lahontan/water_issues/programs/tahoe_keys_weed_control/docs/TKPOA_WDR.pdf

Schladow, S. G., Troy, A., & Watanabe, S. (Eds.). (2022). (rep.). *Tahoe: State of the Lake Report*. UC Davis. Retrieved from https://tahoe.ucdavis.edu/sites/g/files/dgvnsk4286/files/inline-files/2022_SOTL_complete-reduced_3.pdf.

Tahoe Keys Property Owner's Association. (2022). *Summer 2022 CMT Implementation Special Report* (Order No. R6T-2022-0004, NPDES No. CA6202201, WDID No. 6A091701001).

Tahoe Keys Property Owner's Association. (2023a). *Tahoe Keys Lagoons Aquatic Weed Control Methods Test: Annual Report – Year 1* (Order No. R6T-2022-0004, NPDES No. CA62temp02201, WDID No. 6A091701001).

Tahoe Keys Property Owner's Association. (2023b). *2022 Bottom Barrier Monitoring Report* (Order No. R6T-2014-0059).

Tahoe Keys Property Owner's Association. (2023c). *2022 TKPOA Laminar Flow Aeration End of Season Report* (Order No. SB14007IN).

Tahoe Keys Property Owner's Association. (2023d). *Tahoe Keys 2022 Aquatic Macrophyte Survey*. Collected for TKPOA by Sierra Ecosystem Associates. January 2023.

APPENDIX A.

TKPOA Water Quality Department Sampling Procedures

Water Quality Sampling Procedure

- a. Review the Sampling Checklist.
- b. Verify that all required sampling equipment is gathered.
- c. Once on the boat with all necessary materials, AIS staff will collect and record the following general information onto the data sheet: date, sample collector, boat driver, start time of each sample, air temperature, cloud coverage, last precipitation, wind speed, and wind direction.
- d. Measure constituents using a Hydromet HL4 Sonde. Hydromet monitoring protocol includes:
 - Lower the instrument to the desired depth in the water column, according to the data sheet (Mid and Surface).
 - Allow adequate time to ensure the HL4 data stabilizes before recording information onto the data sheet.
 - For each depth, record Hydromet reading for each parameter onto the data sheet.
 - Verify that all required data has been collected before moving on to the next site.
- e. Data collected at each site surface and midpoint will include:
 - Depth (m), water temperature (°C), pH (su), dissolved oxygen (mg/L), oxidation-reduction potential (mV), Turbidity (NTU) and specific conductivity (uS/cm)
 - Visual Observations (i.e. the presence of algae, odor, fish, insects, or amphibians in a sample site etc.), if applicable.

Cyanobacteria and Nutrient Sampling Procedure

- a. Review the Sampling Checklist.
- b. Sample Collector wears proper PPE.
- c. Verify that all required sampling equipment is gathered.
- d. Once on the boat with all necessary materials, AIS staff will collect and record the following general information onto the bottle: Sample ID Number (for contract laboratories), Sampling Date and Time, Site Name/ Station Code, Preservative (optional depending on sampling), Collector's Initials
- e. Holding the correct sample bottle, lower into the water column to desired depth.
- f. For nutrients: triple rinse the collection bottles before collecting the actual sample, filling roughly three-quarters of the bottle. For cyanobacteria do not rinse the sample container..
 - Return the container to the surface quickly and, if necessary, pour out a small volume of the sample to allow for homogenization.
 - Quickly replace the cap and tighten securely.
 - Place in an iced cooler for preservation.

Sampling Checklist

- a. Check the weather forecast for sampling day to determine if conditions are appropriate for sampling to occur.

- b. Verify sampling materials delivery.
- c. Verify, if applicable, that the selected analytical lab is scheduled to pick up samples the day after they are to be collected, as hold times on parameters (such as nutrients) require quick processing.
- d. Calibration of the Hydromet HL4 Sonde should occur weekly and take place no later than a day prior to the scheduled sampling event. Sampling should not occur if calibration is not completed. Calibrate according to the manufacturer's instructions.

Appendix B.

LRWQCB Sample Bottle Collection Protocol

<https://drive.google.com/file/d/0B40pxPC5g-D0T01OVUx4amhDaVk/view?resourcekey=0-YziwP3Sjox8LO2a2HH4BJQ>