Tahoe Keys
PROPERTY OWNERS ASSOCIATION
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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

February 28, 2025

Subject: TKPOA 2024 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, WDID 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 Year 3 (2024) 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 2024 activities performed for the CMT Project, and an assessment of compliance with the applicable requirements of the subject Order.

The 2024 activities for the CMT Project were extensive. Six implementation and monitoring team contractors and consultants were retained by TKPOA and the Tahoe Regional Planning Agency (TRPA) to collect and analyze over 80,000 monitoring data points, which are summarized in the enclosed Annual Report. TKPOA created, organized, and presented 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 contain multiple environmental monitoring and data submittal provisions, including both a certification and report assessing restoration of non-target aquatic life and benthic communities within treatment areas two years post-herbicide application and a Sediment Monitoring Report (Lahontan 2022). The Biological Restoration Report/certification and Sediment Monitoring Report can be found in Appendix Z and BB, respectively, of the Annual Report.

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 can be found for the following permits/approvals:

- 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)

Certification of No Herbicide Discharges

In Year 3 of the CMT, no discharge of herbicide or any other substance occurred in the surface waters of the Tahoe Keys lagoons. Only non-herbicide Group A methods (UV-C and LFA) were used as well as non-herbicide "Group B Methods," which consisted of Diver Assisted Suction Harvesting (DASH), bottom barriers, and UV-C Spot Treatments. Sequential Group B treatments are two new methods added in 2024, consisting of bottom barriers followed by 1) DASH treatment or 2) UV-C spot treatment. These new Group B methods performed in Year 3 are fully described in the 2024 Annual Report.

Compliance with Order

As described in the enclosed Annual Report, the CMT Project measured instances of either elevated or depressed DO, pH, Total Phosphorous, Total Nitrogen, and turbidity in 2024 relative to the applicable Basin Plan Water Quality Objective (WQO). The elevated/depressed parameters can be predominantly 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, therefore no corrective action was necessary.

The data for the elevated/depressed parameters and a description of the follow-up monitoring are presented in Sections 3, 4 and 8 of the Annual Report and are in detailed tabular format in Appendix X (Instances of Elevated Water Quality Parameters).

TKPOA is pleased to report that greater than 98 percent of all required field data collection was achieved in 2024, a notable increase from the 90 percent achieved in Year 1. The data sets and collection events are further explained in the data completeness Appendix N of the 2024 Annual Report.

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,

Hallie Kirkingburg

General Manager
Tahoe Keys Property Owners Association

Enclosures

- CMT Project 2024 Annual Report Requirements Table
- CMT Project 2024 Annual Report and Appendices

cc (electronically with Enclosures):

- TKPOA Board of Directors
- TKPOA Waterways Committee
- Kimberly Caringer, Chief Partnerships Officer & Deputy Executive Director, Tahoe Regional Planning Agency
- Dennis Zabaglo, Aquatic Invasive Species Program Manager, Tahoe Regional Planning Agency
- Melissa Thorme, Stoel Rives LLP
- Ben Letton, Assistant Executive Officer and Ombudsman, Lahontan Regional Water Quality Control Board
- Timothy Middlemis-Clark, Supervising Water Resources Control Engineer, Enforcement & Special Projects, Lahontan Regional Water Quality Control Board
- Trevor Miller, Sr. Water Resource Control Engineer
- Tiffany Barulich, Water Resource Control Engineer, Lahontan Regional Water Quality Control Board

CMT Project Year 3 (2024) Annual Report Requirements Table

Permit/ Approval Document Section	Summary Reporting/ Compliance Requirement	Annual Report Section/Appendix
NPDES Permit NO. R6T-2022-0004 (January 13, 2022)		
VIII. Provisions, A. Standard Provisions; pg. 20	"In the event of noncompliance, notify Lahontan within 24 hours of incident and confirm in writing within 5 days."	Appendix K, O, X See cover letter
IV. Standard Provisions- Records, A. Record Retention; pg. D-3	"The Discharger must retain records of all monitoring information, including all calibration and maintenance records, copies of all reports required by this Order, and records of all data used to complete the application for this Order, for a period of at least three (3) years from the date of the application."	Appendix V
IV. Other Monitoring Requirements, A. Biological Monitoring; pg. E-13	"Biomonitoring must be conducted for each treatment area a minimum once before the application event and a minimum of annually thereafter."	Appendix Q, S, T, U, Z, AA, BB
IV. Other Monitoring Requirements, A. Biological Monitoring; pg. E-13	"A qualified biologist must provide a certification assessing restoration of non-target aquatic life and benthic communities within treatment areas two years post-treatment."	Appendix Z See cover letter
IV. Other Monitoring Requirements, B. Sediment Monitoring; pg. E-13	"Conduct background event- and post-event sediment monitoring for endothall and triclopyr residues in each treatment area; One pre-project and one-post project sediment sample must be collected."	Section 1.5 Appendix B, Q, U, Z, BB
IV. Other Monitoring Requirements, B. Sediment Monitoring; pg. E-13	"Provide a Sediment Monitoring Report with the two (2) year post-biological monitoring report and certification.	Appendix Z, BB
IV. Other Monitoring Requirements, C. Water Supply Monitoring; pg. E-14	"Include all Table E-5 Drinking Water Supply Monitoring Requirements."	Not applicable after Year 1
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."	Appendix A, B, C, E, F, G, H, I, J, K, M, N, P, Q, R, S, T, U, V, X, Z See cover letter
V. Reporting Requirements, A. General Monitoring and Reporting Requirements, No. 2; pg. E-16	"The reports must be presented 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."	Sections 2.7, 2.8, 3.1.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.4, 4.0, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.2.2, 4.2.3, 5.2, 6.1, 6.2, 6.3 Appendix A, B, C, E, K, N, Q, R, U, X, Z

Permit/ Approval Document Section	Summary Reporting/ Compliance Requirement	Annual Report Section/Appendix
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)."	Sections 3.1.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.4, 4.0, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.2.2, 4.2.3, 8.2, 8.3 Appendix B, K, N, Q, R, X
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."	Not applicable after Year 1
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."	Sections 2.2, 3.1.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.4, 4.0, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.2.2, 4.2.3, 8.2, 8.3, 9.0, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10.1, 9.10.2, 9.10.3, 9.10.4 Appendix A, B, E, I, K, N, P, Q, R, U, X, Z
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."	Sections 9.0, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10.1, 9.10.2, 9.10.3, 9.10.4
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."	Sections 9.0, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10.1, 9.10.2, 9.10.3, 9.10.4
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."	Section ES 1.2, 1.8, 1.8.5, 5.1.4 Appendix C, F, Y Herbicide mention not applicable after Year 1
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."	Not applicable after Year 1
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."	Not applicable after Year 1
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."	Not applicable after Year 1

Permit/ Approval Document Section	Summary Reporting/ Compliance Requirement	Annual Report Section/Appendix
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."	Sections 1.5, 2.4, 2.5, 2.8, 3.1.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.4, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.2.2, 4.2.3, 8.2, 8.3, Appendix A, B, E, I, K, N, P, Q, R, U, V, W, X, Y
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"	Not applicable after Year 1
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."	Section 1.4 Appendix A, H, I, U Herbicide mentions not applicable after Year 1
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."	See cover letter
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…"	Sections 2.7, 2.8, 2.9, 3.1.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.4, 4.0, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.2.2, 4.2.3, 5.0, 5.1.4, 5.2, 6.1, 6.2, 6.3 Appendix A, B, K, Q, R, X Herbicide mention not applicable after Year 1
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

Permit/ Approval Document Section	Summary Reporting/ Compliance Requirement	Annual Report Section/Appendix
V. Reporting Requirements, Table E-6 Summary of Reports; pg. E-22	"Annual Monitoring Report- March 1 of each year"	CMT Year 3 Annual Report (attached) Appendix A
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 T
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 S
VII. Rationale for Provisions, B.2. Special Studies, Technical Reports, and Additional Monitoring Requirements; pg. F-36	"The biological certification is required to be accompanied by a report detailing the pre-project and post-project monitoring, including detailed explanation of the assessment methods used and the rationale for the certification."	Appendix S, T, Z
Revised Amendment 1 Aquatic Pesticide Application Plan (May 18, 2022)		
8.9 Post CMT Assessment of Restored Conditions Based on Monitoring, 8.9.3 Timing; pg. 77	"A qualified biologist will evaluate all data collected, including water quality, macrophytes, and benthic macroinvertebrates. The biologist will prepare a restoration report to certify that recovery has been achieved within two years post herbicide application. Should recovery not be achieved, monitoring will continue up to a fifth year after the last aquatic herbicide treatment."	Appendix U, Z, AA, BB
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."	Sections ES 1.1, ES 2.2, ES 4.1, 1.8.1, 2.2, 8.1, 8.2, 8.3, Appendix A, E, K, R, Z
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."	Sections ES 1.5, 2.8, 2.9, 3.1.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.4, 4.0, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.2.2, 4.2.3, 5.0, 5.1.4, 5.2, 6.1, 6.2, 8.1, 8.2, 8.3, Appendix A, B, C, E, K, N, Q, R, Z Herbicide mention not applicable after Year 1
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 3; pg. 80	"Discussion of BMPs used and recommendation for improvements."	Sections 8.3, 9.0, 9.1, 9.2, 9.3, 9.4, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10.1, 9.10.2, 9.10.3, 9.10.4
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."	Not applicable after Year 1

Permit/ Approval Document Section	Summary Reporting/ Compliance Requirement	Annual Report Section/Appendix
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 5; pg. 81	"Amount and type (product) of herbicide used."	Not applicable after Year 1
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 6; pg. 81	"Detailed table showing sampling locations and associated results by date and the site."	Appendix C, K, Q, R, U, V,
9.0 Sample Methods and Guidelines, 9.9 Reporting Procedures and Record Retaining, No. 7; pg. 81	"Summary of herbicide application logs."	Not applicable after Year 1
Mitigation Monitoring and Reporting Program NO. R6T-2022-0005 (February 25, 2022)		
2.2 Turbidity Monitoring; pg. 22	"Turbidity monitoring must occur for bottom barrier application and diver assisted hand pulling."	Section 1.8.1, 2.2, 8.3, 9.4, 9.5 Appendix C, K, N, U, X
3.0 Water Quality Parameters; pg. 22	"Provide the location of the water quality measurements and the measurements themselves in an annual report."	Sections 2.5, 2.8, 3.1.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.4, 4.0, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.2.2, 4.2.3, 5.0, 5.1.4, 5.2 Appendix B, C, E, K, N, Q, R, U, V, X
7.1 Reporting; pg. 25	"Provide documentation of the selection/ performance of the herbicide application by a QAL holder following herbicide application."	Not applicable after Year 1
7.2 Reporting; pg. 25	"Describe the spill control BMPs implemented during herbicide application."	Not applicable after Year 1
7.3 Reporting; pg. 25	"Describe the contingency plans implemented following aquatic herbicide application."	Not applicable after Year 1
7.4 Reporting; pg. 26	"If herbicides are detected in nearby wells, provide documentation of the contingency plans implemented following herbicide application."	Not applicable after Year 1
7.5 Reporting; pg. 26	"Report if aeration systems were implemented."	Not applicable after Year 1
7.6 Reporting; pg. 26	"Report whether workers received awareness training and the Tribal Cultural Resources Awareness brochure."	Appendix H

Permit/ Approval Document Section	Summary Reporting/ Compliance Requirement	Annual Report Section/Appendix
Final Quality Assurance Project Plan (June 15, 2022)		
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."	Not applicable after Year 1
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."	Sections 1.4, 1.5, 1.6, 2.4, Appendix B, I, J, P, U
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."	Sections E.S 1.6, 1.4, 1.5, 1.6, 1.7 Appendix B, D, I, J, K, N, P, R, U, V
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"	Sections ES 1.1, ES 2.2, 3.1.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.4, 4.0, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.2.2, 4.2.3, 8.1, 8.2, 8.3 Appendix E, K, Q, R, X See cover letter

Permit/ Approval Document Section	Summary Reporting/ Compliance Requirement	Annual Report Section/Appendix
TRPA Permit EIPC2018-0011 (January 26, 2022)		
Special Conditions, No.22; pg. 10	"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: • Reduction of 75% in total invasive and nuisance plant biomass (biovolume) within treated sites. • Increase in occurrence and percent composition of native plants relative to non-native plants. • Reduction of non-native plant and fish habitat, therefore improving habitat for native species."	Sections ES 1.1, ES 4.1, 6.0, 6.1, 6.2, 6.3, 8.1 Appendix A, E, L, Z
Special Conditions, No.22; pg. 11	"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: • Reduction in suspended nitrogen, phosphorus, and total dissolved solids in the fall months during normal senescence; • Improvement in clarity of the water as measured by turbidity; and • Improve water column pH stability in all test areas to achieve pH values between 7.0 and 8.4. • Maintenance of the three (3)-foot vessel hull clearance." • Improved recreational and aesthetic values."	Sections ES 1.1, 3.1.1, 3.2, 3.3, 3.3.1, 3.3.2, 3.4, 4.0, 4.1, 4.1.1, 4.1.2, 4.1.3, 4.2, 4.2.1, 4.2.2, 4.2.3, 5.0, 5.1.4, 5.2, 8.1, 8.2, 8.3 Appendix Z

*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 – Year 3.

TAHOE KEYS PROPERTY OWNERS ASSOCIATION

TAHOE KEYS LAGOONS AQUATIC WEED CONTROL METHODS TEST: ANNUAL REPORT – YEAR 3

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

FEBRUARY 2025

TAHOE KEYS PROPERTY OWNERS ASSOCIATION

TAHOE KEYS LAGOONS AQUATIC WEED CONTROL METHODS TEST: ANNUAL REPORT – YEAR 3

FEBRUARY 2025

Prepared for
Tahoe Keys Property Owners Association

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TABLE OF CONTENTS

List of Figures

List of Tables

List of Appendices

LIST OF ABBREVIATIONS AND ACRONYMS

AIP	Aquatic Invasive Plants (including non-native and native plants)
BB	Bottom Barriers
BMI	Benthic macroinvertebrates
CMT	Control Methods Test
COC	Chain of Custody
DAR	Days after removal (Bottom Barriers)
DASH	Diver Assisted Suction Harvesting
DO	Dissolved oxygen
EIP	Environmental Improvement Program
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ERS	External Reference Sample
ESA	Environmental Science Associates
EWM	Eurasian watermilfoil
HABs	harmful algal blooms
IMP	Integrated Management Plan
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
MTS	Marine Taxonomic Services
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
NZMS	New Zealand mud snails
OM	Organic matter
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
RF	Rake Fullness
RL	Reporting limit
RWT	Rhodamine Water Tracer
SEA	Sierra Ecosystem Associates
TC	Turbidity curtain
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
TRP	Tarp
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
UVCET	UV-C Cumulated Exposure Time
VEL	vessel exit log
VHC	vessel hull clearance
WDR	Waste Discharge Requirements
WQO	Lahontan Water Board Basin Plan Water Quality Objectives
WQ	Water Quality

EXECUTIVE SUMMARY

ES 1.1 Introduction

The three-year Aquatic Weed Control Methods Test (CMT) was developed and implemented to test the utility and effectiveness of several Aquatic Invasive Plant (AIP) control methods through the collaboration and partnership of the Tahoe Keys Property Owners Association (TKPOA), Tahoe Regional Planning Agency (TRPA), and The League to Save Lake Tahoe (League). The CMT was conducted in compliance with permits issued by Lahontan and TRPA (Lahontan Regional Order NO. R6T-2022-0004 NPDES NO. CA6202201 WDID NO. 6A091701001; and TRPA File No: EIPC2018-0011, Project Number: 510-101-00).

The first year of the CMT (2022) included the use of "Group A" methods" consisting of non-herbicide methods: ultraviolet light (UV-C) and Laminar Flow Aeration (LFA), as well as a one-time application of two herbicides: Endothall and Triclopyr. In Years 2 and 3 of the CMT, the use of non-herbicide Group A methods was continued. Other, "Group B" non-herbicide methods were used in "subsites" of CMT sites that had been treated in Year 1 with Group A methods. The Group B methods in Year 2 and 3 were Diver Assisted Suction Harvesting (DASH), Bottom Barriers (BB), and UV-C Spot. (The uses of all methods were described in previous Annual Reports and in this report in Appendix I (Quality Assurance Project Plan). A primary goal of the CMT was to assess whether a 75% reduction or "knock-back" of AIP could be achieved in Year 1 with Group A methods and then maintained in Years 2 and 3 with Group B methods.

This report summarizes results of permit compliance actions (monitoring) and evaluations of the effectiveness of Year 3 non-herbicide methods on target AIP. Some comparisons with environmental conditions and monitoring results in prior CMT years are provided to illustrate how conditions in the Keys lagoons have changed over the three-year period of the CMT. [Note: A "Draft Final Report" that synthesizes results and provides a summary of the entire three-year CMT Project will be submitted to the Lahontan Regional Water Quality Control Board (Lahontan) and the Tahoe Regional Planning Agency (TRPA) on or before April 30, 2025.]

Interim and supplemental reports for Year 3 are accessible at https://www.keysweedsmanagement.org/permits-and-reports:

- Summer 2024 Tahoe Keys Lagoons Aquatic Weed Control Methods Test (CMT) Implementation and Interim Results: Special Report
- Supplemental Interim CMT Year 3 Report: Bottom Barriers

The link to the Environmental Impact Report/Environmental Impact Statement (EIR/EIS) that describes the project design, test methods, and mitigation monitoring and reporting program for this project is provided here:
https://www.waterboards.ca.gov/lahontan/water_issues/programs/tahoe_keys_weed_control/docs/feir_feis_final.pdf

ES 1.2 Setting, Context and Selection of Year 3 Control Methods

The CMT represents a comprehensive field-based project designed to adapt the use of various control methods to the changing AIP prevalence (frequency of occurrence) and abundance [also referred to as "biovolume" or "Rake Fullness" (RF)], and locations of AIP in the Keys West Lagoon and Lake Tallac Lagoon. Similarly, the water quality and efficacy monitoring associated with the CMT activities were adapted to changing environmental conditions at the CMT test sites. This adaptive approach, illustrated in Figure ES-1, shows how the use of data from each year helped

inform locations and selections of methods in subsequent years, including Group B methods. Herbicide application sites, and UV-C treatment sites that achieved approximately 75% reduction (or "knock-back") in abundance in Year 1 were selected for Group B treatments in Year 2 and Year 3. In particular, in Year 3, locations with increases in Curlyleaf pondweed were targeted for expanded UV-C Spot treatments, DASH, or the use of Bottom Barriers. CMT Year 3 continued Group A and Group B sites and methods, which are summarized in Figure ES-2.

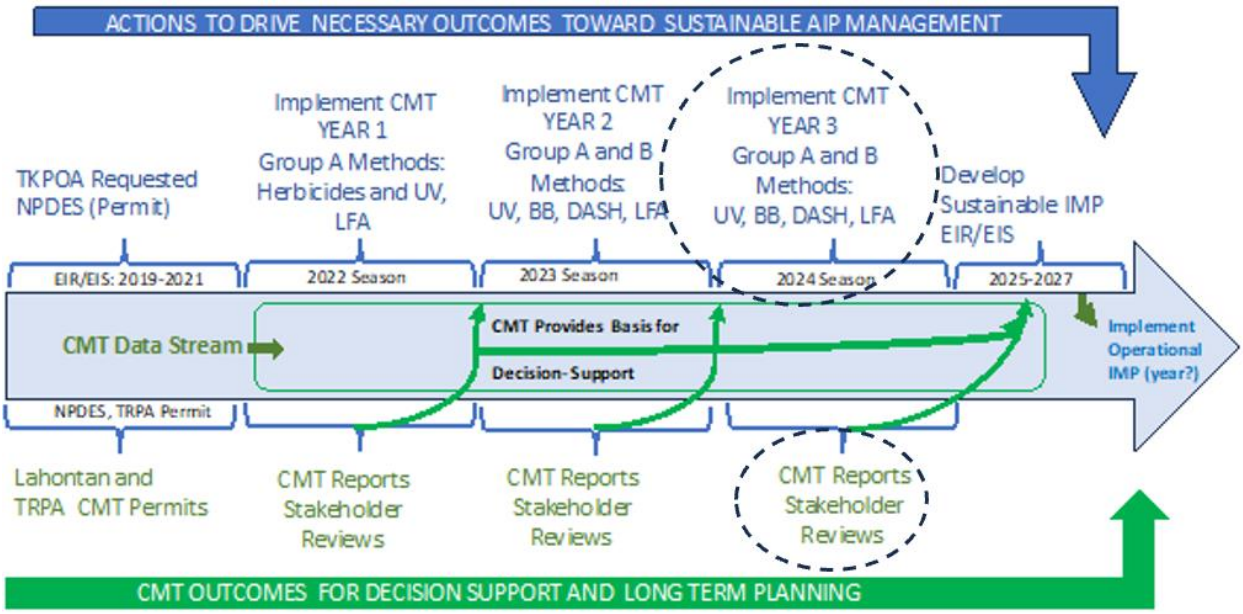


Figure ES-1. Conceptual model for CMT-driven decisions

The model in Figure ES-1 provided support for developing sustainable AIP management in the Tahoe Keys lagoons. Year 3 CMT implementation actions are circled.

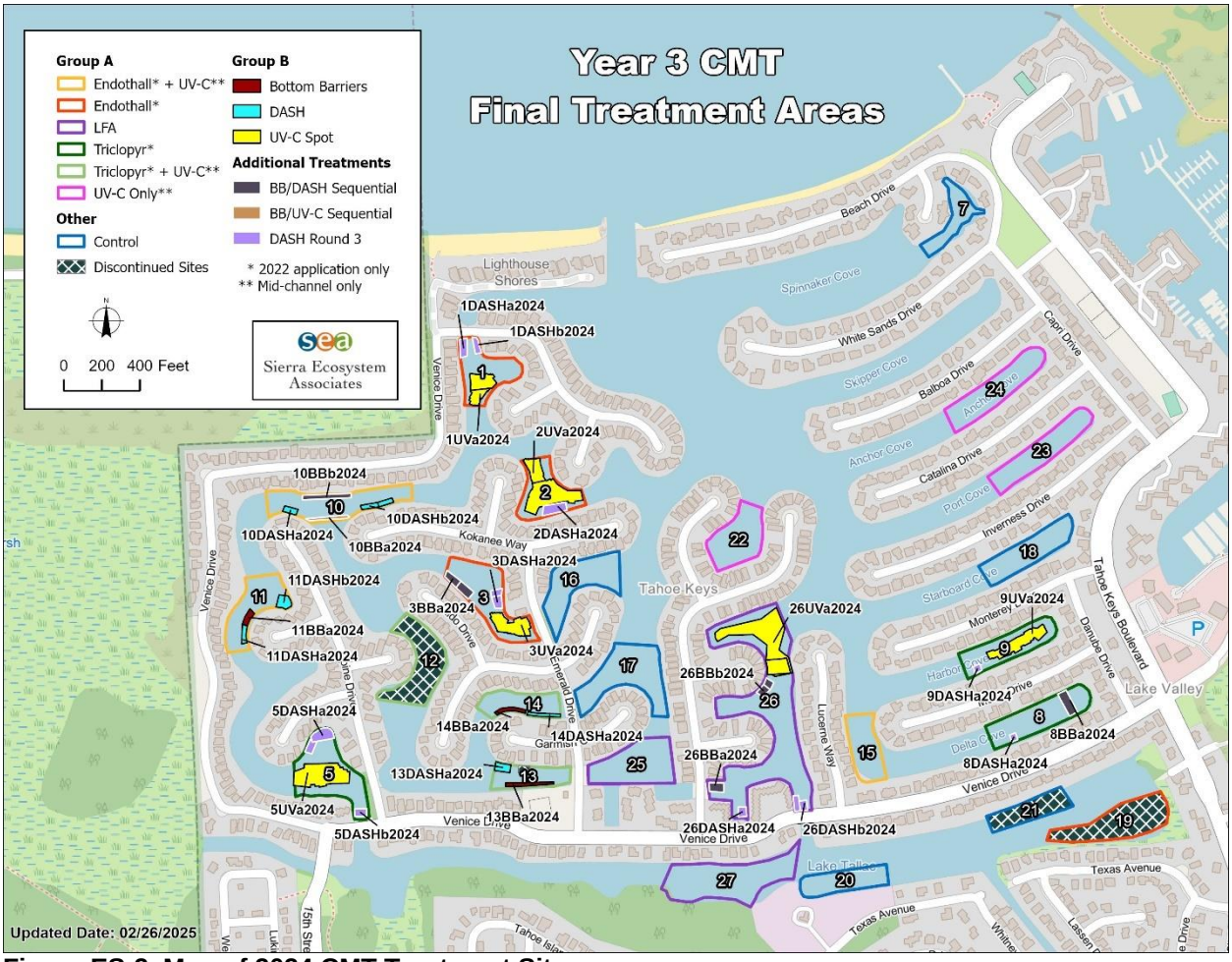


Figure ES-2. Map of 2024 CMT Treatment Sites

In 2024, as shown in Figure ES-2, the CMT continued Year 1 Treatments (UV-C and LFA) (Group A Treatments). In Year 3, Group B follow up treatments supplemented those undertaken in Year 1 and Year 2. [Note that "Controls" in the legend refers to CMT sites in which Group A and Group B treatments were not used.] Some mechanical harvesting was done in Control sites to maintain navigational accessibility.

ES 1.3 Goals and Objectives of Year 3

Two main goals were set for Year 3 of the CMT:

(1) Determine if continued Year 3 use of (non-herbicide) Group A, and Group B non-herbicide methods used in Year 2 could sustain 75% reduction in AIP biovolume (a surrogate for AIP biomass) and if a Vessel Hull Clearance of 3 feet could be maintained in Year 3.

(2) Successfully complete water quality and other monitoring required in the project permits.

ES 1.4 Implementation for Year 3 CMT Group A and B Methods

Year 3 CMT actions were coordinated through regular (bi-weekly) meetings of the Monitor Working Group (MWG) with participating stakeholders and contractors, and through separate weekly meetings with contractors. The CMT is managed through the Tahoe Keys Property

Owners Association (TKPOA) in collaboration with the following project partners: Tahoe Regional Planning Agency (TRPA), The League to Save Lake Tahoe (The League), and consultants and contractors including Dr. Lars Anderson, Sierra Ecosystem Associates (SEA), and Environmental Science Associates (ESA).

As part of adaptive management, an additional type of integrated treatment was tested in Year 3: "Sequential Post Bottom Barrier Treatments" (Sequential Treatment) using DASH or UV-C. These treatments were done in selected Bottom Barrier sites after the barriers were removed in the fall of 2024. The purpose of the sequential DASH and UV-C treatments was to suppress or kill newly sprouted Curlyleaf pondweed turions where the barriers had been removed, or other AIP that were present in these areas after barrier removal. Macrophyte rake samples were taken after barrier removal and after the Sequential Treatments to determine the effectiveness of the barriers alone and with the added Sequential Treatments. The types and sizes of non-herbicide Group A and Group B treatments in 2024 are listed in Table ES-1.

Table ES-1. Summary of Year 3 Non-herbicide Group A and Group B Methods

CMT Year 3 Group A and B Treatment Types	Number of Group A and B Treated Areas in 2024	Acres Treated in 2024*
Bottom Barriers	9	0.92
DASH (Includes 4 Sequential Treatment sites)	20	1.78
UV-Spot (Includes 2 Sequential Treatments sites)	8	4.05
UV-C Only	3	2.35
UV- C Combo	5	3.13
LFA	3	12.90
Total 2024 Group B Areas	**37**	**6.75**
Total 2024 Group A and B Areas	**48**	**25.13**

*UV-C and DASH treatments were repeated within the same areas.

ES 1.5 Monitoring in Year 3

In 2024, monitoring was conducted by TKPOA technical staff and TRPA contractors, and all laboratory analyses were done by the same laboratories as in CMT Years 1 and 2. As in Years 1 and 2, the physical rake sampling used to assess CMT treatment effectiveness was conducted by an independent contractor (ESA) under the supervision of TRPA and coordinated with the Monitor Working Group (MWG). Monitoring activities and completeness are reported in Table ES-2.

Table ES-2. Summary of Year 3 CMT Monitoring Completeness

Monitoring Activity (Responsible Entities)	Data Points	Data Completion (Sites with <100% Completeness)
Standard WQ Monitoring **(TKPOA)**	11,622	98% (8, 9, 15, 19, 20, 21, 26, 27)
Continuous WQ Monitoring (miniDOTs) **(Stratus)**	21,807	97% (1, 9, 13, 15, 16, 17, 18, 20, 21, 25, 27)
Turbidity Monitoring (BB) **(TKPOA)**	122	98% (3BBa)
Turbidity Monitoring (DASH) **(TKPOA)**	313	99% (5DASHa, 9DASHa)
DASH Weight and Turion Counts[2] **(TKPOA)**	66	98% (13DASHa)
Nutrient Grab WQ Sampling[1] **(ESA)**	1,128	99% (2, 11, 18)
HAB Sampling **(TKPOA)**	105	100%
Macrophyte Point Rake Sampling **(ESA)**	44,615	99% (3, 8)
Hydroacoustic Scans[1] **(TKPOA)**	13	86% (19,20,21,27)
PAR Profiling[2] **(TKPOA)**	1,119	98% (19,20)
Benthic Macroinvertebrates (BMI) Sampling **(ESA)**	26	100%
Muck Depth Monitoring[1] **(TKPOA)**	101	100%
Sample and Analysis of Sediments for Endothall and Endothall Degradants **(Blankinship and Associates)**	13	100%
Year 3 Data Point Totals:	**81,050**	**98%**

[1] Indicates more samples or added monitoring events than required and initially planned.
[2] Indicates monitoring that was added to augment CMT data but was not required by CMT permits.
[3] Parentheses indicate which CMT sites had deficient data collection (Refer to Figure ES-2.)

ES 1.6 Year 3 Environmental Conditions: Climate and Water Depths

The winter snowpack and the resulting spring runoff in 2024 was higher than in 2023 (Year 2) and 2022 (Year 1). The snowpacks and runoff in 2023 and 2024 doubled the volume of water in the Keys lagoons in the last two years and increased water depth by nearly 5 feet in 2024 compared to 2022. The water temperatures at mid-depth in 2024 were about the same as in 2022 and 2023. However, the additional increase in water depth in 2024 exacerbated deeper-water effects on aquatic plant growth conditions noted here: (1) Light available for plant and algae growth was reduced well below optimal levels near the bottom in CMT sites where depths reached 14-20 ft and water had moderate turbidity, and (2) Additional shoreline areas were submerged compared with 2022 and 2023. Exposed (dry) shoreline areas in 2022 and possibly some in 2023 did not support growth of AIP and these areas could not be treated with herbicides or UV-C in 2022. However, in 2023 and 2024, some additional submerged (“wetted”) shorelines provided more areas for AIP and native plants to grow, whether from existing dormant seeds, rhizomes, or turions, or through movement from existing adjacent populations in deeper water.

ES 2.1 Effect of Water Depth Changes on Invasive Aquatic Plants in the Tahoe Keys

Extensive rake sampling, which provides species-specific data, showed that AIP and native plants responded differently to changes in habitat conditions caused by changes in water depth (Table ES-3). Coontail and Curlyleaf pondweed increased the most in deep areas, whereas Eurasian watermilfoil increased mostly in shallower, nearshore areas.

Table ES-3. Changes in AIP and native *Elodea canadensis* abundance in shallow and deep-water habitat in untreated reference Control sites*

Habitat Changes:	Eurasian watermilfoil	Curlyleaf pondweed	Coontail	Elodea canadensis
Increased Shallow Nearshore Areas				
Deeper Mid-Channel Areas				

*The width of the arrows indicates relative level of change in species abundance associated with habitat change.

ES 2.2 Summary of Year 3 Treatments Effectiveness

In reviewing these summary results of the CMT, it is important to recognize that biological field monitoring and data collection have inherent variabilities in an uncontrolled setting, such as the Keys lagoons. For example, aquatic plants do not grow and reproduce uniformly, and they typically do not occupy space in a uniform pattern. Submersed aquatic plants often have “patchy” (un-even) three-dimensional (water column) distributions, and their growth patterns, and AIP abundance can change seasonally. A good example is Coontail, which has no roots and can freely move and change its location and alter how much of the water column it occupies weekly or monthly, or seasonally.

In addition to these variations, the way sampling methods are deployed also contributes to variability in data collection, whether rakes, divers, or hydroacoustic scanning devices are used. Variation can be reduced (but not eliminated) by multiple (replicated) sampling, uniform protocols, and by training monitoring field crews. Even with these protocols, field variations in aquatic plant population measurements are commonly 10-20%. Data provided from CMT plant monitoring represents a range of about +/-15% around an average value. This suggests that achieving an average of “75% reduction in biovolume” really represents a range from 60 to 90% reduction and that a value of 60% reduction may actually represent a 75% reduction. The summary table (Table ES-4) showing CMT methods effectiveness in Year 3 reflects this variability.

From the AIP RF monitoring data, three levels of effectiveness were assigned and shown in Table ES-4: Green arrows indicate an acceptable level of control: 60-75% reduction/maintenance in AIP abundance; Yellow arrows indicate partial control (>50-% reduction/maintenance in AIP abundance); and Red arrows indicate limited to no control (<50 % reduction/maintenance in AIP abundance). Note that sites treated once in Year 1 with Triclopyr (Sites 5, 8, and 9) sustained reduction of Eurasian watermilfoil, so DASH treatments mainly removed Coontail and Curlyleaf pondweed from those sites. The reasons for less than 75% reduction in some DASH and BB sites appears to be: 1) the movement of Coontail into these Group B areas, and 2) the sprouting of Curlyleaf pondweed turions after DASH was completed or BB were removed. The effect of Coontail incursion and Curlyleaf pondweed sprouting is derived from the physical rake sampling

data that shows species relative abundance data. (Detailed results for all treatments are provided in Appendix E. Tahoe Keys Lagoons Macrophyte Control Efficacy Report (Efficacy Report).

The Bottom Barrier section of Table ES-4 also indicates the effectiveness of Year 3 “Post-Bottom Barrier Removal” DASH and UV-C treatments (“Sequential Treatments”) applied where some of the Bottom Barriers had been removed. The intent of testing this adaptive management method was to reduce regrowth of Curlyleaf pondweed from newly sprouted turions and to reduce the establishment of AIP entering from adjacent areas. Both UV-C and DASH Sequential Treatments helped reduce AIP biovolume (RF) after bottom barriers were removed in the fall.

Table ES-4. Summary of Year 3 Group B effectiveness in sustaining control of AIP

Group B Treatment Type	Year 3 CMT Site	CMT Year One Treatment Type (Bold = Sequential Post Bottom Barrier Removal Treatments)	Maintained Year One Control? Yes ↑ Partial → No ↓	Notes and Limitations
Bottom Barrier (Barrier Type): PL= Pondliner;	3 (PL)	Endothall only	→	45 to 55% Reduction compared with non-barrier areas
	3a Sequential	**DASH One Time: 10/7**	↑	70 to 80% Reduction compared with non-barrire area
	5 (TRP)	**Triclopyr only**	**N/A**	BB Site 5 Discontinued in 2024; Replaced with DASH
	8 (PL)	Triclopyr only	↑	60 to 75% Reduction compared with non-barrier areas
	8 Sequential	**UV One Time: 10/25**	↑	75 to 85% Reduction; improved with Sequential treatment
	10 (PL)	Endothall combo	→	45 to 55% Reduction compared with non-barrier areas
	10a Sequential	**UV One Time: 10/24**	↑	60 to 80 % Reduction compared with non-barrier areas
	10b Sequential	**DASH One Time: 10/16**	↑	60 to 75 % Reduction compared with non-barrier areas
	11 (PL)	Endothall combo	↑	70 to 85 % Reduction compared with non-barrier areas
	13 (TC)	Triclopyr combo	→ ↓	30 to 50% Reduction compared with non-barrier areas
	14 (PL)	Triclopyr combo	→ ↓	30 to 50% Reduction compared with non-barrier areas
	19 (PL)	**Endothall only**	**N/A**	**Site 19 Discontinued in 2024; insufficient control in 2023**
	26a (TC)	LFA	→ ↓	40 to 55% Reduction compared with non-barrier area
	26a Sequential	**DASH One Time:10/9**	→ ↑	60 to 75% Reduction: Improved by DASH treatment
	26b (TC)	LFA	→ ↓	40 ot 50 % Reduction compared with non-barrier areas
	26b Sequential	**DASH One Time: 10/9**	→ ↑	60 to 75% Reduction: Improved by DASH treatment
				NOTE: DASH Ratings are for July-October 2024
Diver Assisted Suction Harvesting (DASH)	1a	Endothall only	→	45 to 55% Reduction compared with Controls
	1b	Endothall only	↑	60 to 80% Reduction compared with Controls
	2	Endothall only	↑	90% Reduction compared with Controls
	3	Endothall only	↑	90% Reduction compared with Controls
	5a	Triclpyr only	↑	75 to 85% Reduction compared with Controls
	5b	Triclopyr only	↑	80 to 90% Reducion compared with Controls
	8	Triclopyr only	↑	75 to 90% Reduction compared with Controls
	9	Triclopyr only	↑	90 to 95% Reduction compared with Conrols
	10a	Endothall combo	↑	90% Reduction compared with Controls
	10b	Endothal combo	↑	85 to 90 % Reduction compared with Controls
	11a	Endothall combo	↑	75 to 80% Reduction compared with Controls
	11b	Endothall combo	↑	90% Reduction compared with Controls
	13	Triclopyr combo	→	50 to 65% Reduction compared with Controls
	14	Triclopyr combo	→	50 to 65% Reduction compared with Controls
	19a	Endothall only (L.Tallac)	No DASH in 2024	Discontinued in 2024: insufficicent control in 2023
	19b	Endothall only (L.Tallac)	No DASH in 2024	Discontinued in 2024: insufficicent control in 2023
	26a	LFA	→	50 to 65% Reduction compared with Controls
	26b	LFA	→	50 to 65% Reduction compared with Controls
UV-C Spot Partial Completion of Full Rounds of Repeat Treatments	1	Endothall only	↑	95% Reduction compared with Controls
	2	Endothall only	↑	95% Reduction compared with Controls
	3	Endothall only	→	50 to 60 % Reduction compared with Controls
	5	Triclopyr only	↑	Variable: 50 to 75% Reduction compared with Controls
	9	Triclopyr only	↑ →	Variable: Spring 75 to 85% Reduction; fall 50% Reduction
	26	LFA	↑	50 to 75% Reduction compared with Controls
UV-C Combo (Group A) (Two Full Treatments)	10	Endothall combo	↑	No UV in 2022; 80% Reduction in middle areas only
	11	Endothall combo	↑	No UV in 2022; 80% Reduction in middle areas only
	13	Triclopyr combo	→	No UV in 2022; middle area less that 75% reduction
	14	Triclopyr combo	↑	No UV in 2022; 75-90 % middle; shoreline AIP poorly controll
	15	Endothall combo	↑	No UV treatment in 2022, 2023; 60-75% reduction in 2024
UV-C Only (Group A) (Four 1/2 Treatments)	22	UV only	↑	90% Reduction middle; shoreline AIP poorly controlled
	23	**UV only**	↑	**75 % middle section:Re-started UV in 2024**
	24	UV only	↑	90% Reduction middle area; shoreline poorly controlled
Laminar Flow Aeration (LFA)				
West Lagoon	25	Date started: 2022	↓	No reduction of AIP
West Lagoon	26	Date started: 2019	↓	No reduction of AIP: Increased Curlyleaf Pondweed abundanc
Lake Tallac	27	Date started: 2022	↓	No Reduction of AIP

A summary of the initial Group A, continued Group A, and Group B methods' effectiveness in sustaining a 75% reduction in AIP abundance through Year 3 is provided in Table ES-5. The variations in AIP reductions noted in Table ES-4 for Group B treatments explain the lower success observed for Bottom Barriers and DASH. Note that the evaluations for Bottom Barriers reflect AIP presence after the removal of the barriers, not during the months that BBs were in place. This suggests that follow-up treatments post-barrier removal could enhance the successful full-season

reduction in AIP since the experimental “Sequential” DASH and UV-C were effective. Rake data also showed that Coontail was consistently the most difficult to control, regardless of the methods used.

Another way to consider the effectiveness of treatment methods is to note what percentage of all treated sites or Group B areas achieved or maintained a 75% reduction in AIP abundance. Although considerable variation exists between similar (replicated) methods, Table ES-5 indicates that the methods with most success included UV-C at Combo sites, Triclopyr for Eurasian watermilfoil control, UV-C Spot treatments, UV-C Only, and Sequential UV-C and DASH.

Table ES-5. Year 3 Summary of Group A and Group B Methods Effectiveness: Percentage of Sites Achieving or Maintaining 75% Reduction in AIP Abundance

Group A Treatments	Percent of Group A Treatment Sites Achieving 75% Reduction of AIP
Endothall Only	40 - 50% (mid-channel areas)
Triclopyr Only (Eurasian watermilfoil as target)	75%
UV-C Combo-Endothall	90 -100% (mid-channel areas)
UV-C Combo-Triclopyr (Eurasian watermilfoil)	50%
LFA	0%
UV-C Only	100% (mid-channel areas)
Group B Treatments	**Percent of Group B Treatment Sites Achieving 75% Reduction of AIP**
Bottom Barriers	57%
DASH	69%
UV-C Spot	90 -100%
DASH Sequential Treatment (Post-Barrier Removal)	100%
UV-C Sequential Treatment (Post-Barrier Removal)	100%

ES 3.1 Increasing Threat from Curlyleaf Pondweed

Since its first discovery in 2003, Curlyleaf pondweed has spread in the Keys as well as Lake Tahoe (primarily along the South Shore). Data from the CMT shed light on the reasons for this rapid expansion.

ES 3.2 Expansion in the Keys

The *Annual Report – Year 2* and the *Summer 2024 Tahoe Keys Lagoons Aquatic Weed Control Methods Test (CMT) Implementation and Interim Results: Special Report* (Year 3 Interim Report) for CMT Year 3 identified and described the increasing threats to the West Lagoon from the spread of Curlyleaf pondweed. This aggressively growing and highly dispersive AIP has greatly expanded its distribution both in the Keys and in Lake Tahoe proper over the past decade and its encroachment in both shallow and deep areas in the Keys has accelerated its abundance over the past few years. For example, in 2022 and 2023, during the peak of its growth period (June-July) in un-treated “reference” Control sites, Curlyleaf pondweed had a frequency of occurrence from 40% to about 55%, meaning that about half or more of the physical rake samples retrieved this plant. In 2024, the frequency of occurrence has ranged from 55 to >70%. In all three years of the CMT, Curlyleaf pondweed exhibited its well-known “bi-seasonal” growth pattern: Maximum biomass in June-July (with dispersive turions being formed during this time), followed by turion release and gradual decline from late July to September, and then re-occurrence of plants from newly sprouted turions in September to November (Figure ES-3).

ES 3.3 Competitive Characteristics and Adaptation to Varying Water Depths

The ability of Curlyleaf pondweed to establish new growth and occupy new space during early to late fall distinguishes it from other AIP and from desirable native plants such as *Elodea canadensis* which typically senesce, decompose, or at least go dormant during this time. The dispersal of viable, fall-sprouting turions enables this advantage. Not only do the turions occupy new space, their initial shoot and leaf growth in the fall also allows them to utilize light at the bottom early the following spring when turbidity is very low. The light measurements (PAR profiles) in 2023 and 2024 confirm that in April-late May, light penetrates the deepest, which is also when lagoon/lake levels are low prior to the spring snowmelt runoff.

The bi-seasonal pattern and expansion of Curlyleaf pondweed in both shallow (Shoreline) and deep water (mid-channel) areas in 2024 is illustrated in Figure ES-3.

ES 3.4 Turion Propagule "Pressure": How many are produced in a growing season?

The DASH treatments and continued physical rake samples provided data to estimate the numbers of Curlyleaf pondweed turions produced during 2024. Turions counted in Sub-samples of DASH plants removed from known areas provided an estimate of turions produced per square foot or per acre. Similarly, the estimated area represented by each rake sample provides a basis for estimating the number of turions retrieved per rake sample. Each rake sample retrieves plants from approximately 0.15 to 0.2 sq meters. Using these two sources of data the estimated range of turion production per acre is from 109,000 to 150,000 for rake and DASH samples, respectively. This translates to 5 to 7 million turions in a 50-acre area of the West Lagoon (Figure ES-4), which can remain dormant for several years before conditions trigger sprouting. Considering that the sources of the estimates are very different (DASH counts vs. rake samples), this is a reasonable fit. However, since the distribution of Curlyleaf pondweed is variable, variation in turion production by location is expected and would contribute to the variation in estimates. Regardless of these uncertainties, the propagule pressure from turions has become enormous and helps explain the rapid incursion and spread of the plant within the Keys (including regrowth in CMT treatment areas) and along shoreline areas of Lake Tahoe proper.

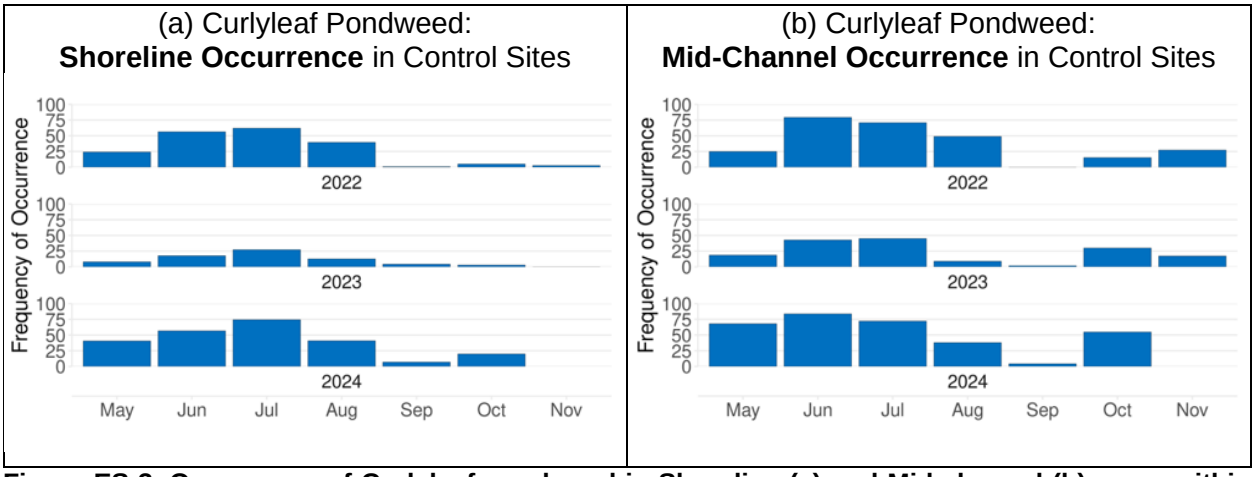


Figure ES-3. Occurrence of Curlyleaf pondweed in Shoreline (a) and Mid-channel (b) areas within untreated reference Control sites in the West Lagoon during Years 1,2,3 of the CMT.

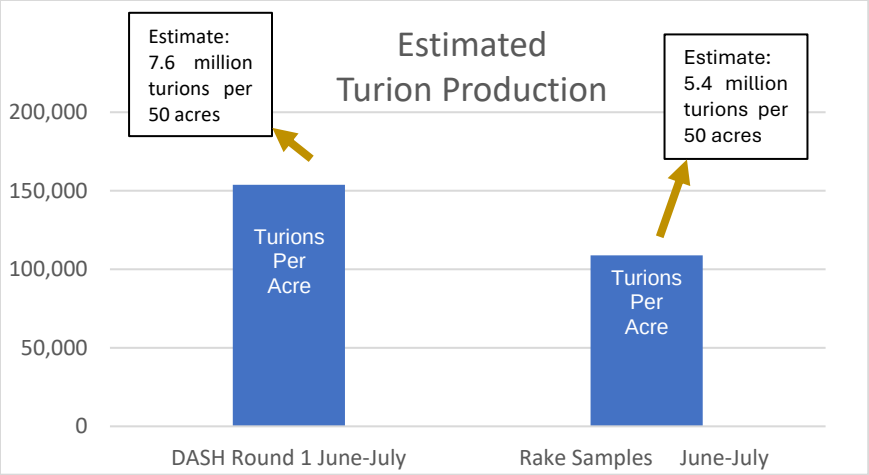


Figure ES-4. Estimated Turion Production

Two methods were used to estimate Curlyleaf pondweed turion production per acre in the Keys West Lagoon in 2024: (1) Estimates from DASH Treatments are based on the number of turions removed during peak turion production (June-July); and (2) from physical rake samples taken during peak turion production. Bars represent the number of turions per acre. Estimates for 50 acres contained in Figure ES-4 are based on the two "per acre" estimates to provide a conservative scale (about one-third of the Keys acreage) of potential annual turion production in the Keys West Lagoon

ES 3.5 Controlling Curlyleaf Pondweed: Strategies based on Reproductive and Dispersal Capacities

Data obtained in the CMT (and published reports) shows that the key to reducing the spread of Curlyleaf pondweed and eventually reducing its impact is to interfere with the three phases of its life cycle: (1) Production of turions in early-mid Summer, (2) dispersal of turions from mid-summer to fall, and (3) sprouting and establishment of turions in the fall. How this can best be achieved will require careful assessment of CMT treatment effects and determination of how to optimize the available methods that address all three critical phases of the plant's lifecycle. The Efficacy Report (Appendix E) will help provide the basis for these strategies.

The most significant change in AIP was the expansion of Curlyleaf pondweed in both shoreline and deeper mid-channel areas. Even though the frequency of occurrence of Curlyleaf pondweed was somewhat reduced in Triclopyr sites and some Endothall sites, it expanded in other sites probably as a result of prior year 'banks' of turions sprouting, turion dispersal from the current year's growth, and more suitable habitats due to deeper water and greater volume of water in 2024.

The high reproductive and dispersal capacity of Curlyleaf pondweed suggests that control and reduction of its occurrence and abundance should be the highest priority for the immediate future. With a propagule pressure of well over millions of turions each season, it will be essential to apply methods to address the existing 'bank' of turions, stop new turion production, and stop their successful establishment in the fall.

ES 4.1 Key Points from Year 3 CMT

(1) Increased water depth and water volume in 2024 continued to influence the relative abundance and distribution of AIP between nearshore and mid-channel, and appeared to result in more biovolume and prevalence of Curlyleaf pondweed, including in untreated reference Control sites.

(2) The successful reduction of Eurasian watermilfoil from Year 1 Endothall and Triclopyr applications continued in Year 3, though some recovery was noted in the Endothall sites. The continued efficacy (success) of the Year 1 Triclopyr application is most likely due to the herbicide's ability to move into the roots and rhizomes of Eurasian watermilfoil. [Note: some Eurasian watermilfoil recovery was seen in Endothall sites]

(3) Early and increased frequency of repeat treatments in UV-C Only sites resulted in better control of AIP in 2024 than in prior years. However, Coontail continued to be the least controlled AIP with UV treatments.

(4) Group B UV-C Spot and DASH small-scale treatments were generally effective, particularly when the Group B methods were started early in the AIP growing season (early June) and were used in larger areas. Larger areas can reduce the incursion of AIP from surrounding populations that are not treated.

(5) The number of Curlyleaf pondweed turions collected from the DASH treatments and rake samples shows production of several million turions each season, which provides extremely large "propagule" pressure and explains the rapid increase in the Keys in recent years. These data underscore the need for both spring and fall management of this expanding AIP due to its bi-modal reproductive phenology.

(6) LFA sites show no reduction in AIP and, in fact, appeared to enhance the growth and abundance of Curlyleaf pondweed.

(7) Nutrients were similar between most CMT treatment sites and reference Control sites; however, Total Nitrogen (Total N) and Total Phosphorous (Total P) were occasionally elevated when compared with Control sites during UV-C treatments.

1.0 COMPLIANCE REPORTING: CONTROL METHODS TEST (CMT) YEAR 3 (2024)

1.1 Organization of the Report

This Year 3 annual report provides documentation, monitoring results, and associated data files and other compliance records required under the following Lahontan Regional Water Quality Control Board (Lahontan) NPDES permit and the Tahoe Regional Planning Agency (TRPA) permit: (Lahontan Regional 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). Project reporting sections follow this sequence: General CMT Year 3 Setting and Scope, Management and Coordination, Documentation of Training, Quality Assurance Project Plan (QAPP), Calibration Records, Flow Conditions, Implementation of Group B Methods, Contingency Actions, Monitoring (Water Quality and Nutrients), LFA Effects, Examples of AIP Responses to CMT Treatments, Summary and Conclusions, BMPs, References, and Appendices.

1.2 CMT Year 3 Setting and Comparison with Year 1 and Year 2

The CMT was designed as a three-year project to develop field data on several control methods to reduce and then sustain reduction of aquatic invasive plants (AIP) in the Tahoe Keys lagoons (see Figure 1-1). The first year of the CMT consisted of testing three larger-scale approaches for control of AIP: (1) UV-C light (UV-C); (2) Application of two selective aquatic herbicides (Endothall and Triclopyr); and (3) UV-C Combo/sequence of shoreline herbicide applications followed by center area (mid-channel) UV-C treatments. These methods were replicated (3x) in small (about 1-2 acre) sites. Due to prolonged use of turbidity curtains (with boat barriers) that impeded access to the “combination” treatment sites, the UV-C treatments portion of the combination herbicide/UV-C tests were delayed until Year 2. Therefore, 2024 was only the second year of UV-C methods in UV-C Combo mid-channels.

The hydrologic and bathymetric conditions in CMT sites in Year 3 were very different from Year 1 (2022), but somewhat similar to Year 2 (2023). The most significant differences were: (1) two feet deeper water in the Keys lagoon in 2024 compared to 2023, (2) five feet deeper water in 2024 than in 2022, and (3) less light penetration for deeper water plant growth in all sites, especially those deeper than 12-14 feet. Overall, these increases in water depth and water volume in Year 3 (2024) increased the relatively shallow habitat for AIP in shoreline areas and provided more vertical “growing space” in the water column. Section ES 1.6 provides a detailed description of these conditions.

The tests methods conducted in 2022 are termed “Group A methods”. (Links to the relevant reports of CMT Year 1 and Year 2 are provided in Appendix A) Year 3 (2024) testing consisted only of non-herbicide methods: (1) Continued Group A UV-C Only light as follow up to this method used in 2022 and 2023, and continued Group A LFA; and (2) continued Group B methods as follow-up to the same methods in 2023 plus expanded Group B areas and “Sequential Treatments” in site-specific locations.

The continued use of non-herbicide Group A methods in Year 2 (and in Year 3), namely UV-C and LFA, is consistent with the design and intent of the CMT, which is to determine if these larger scale Group A methods can sustain 75% reduction in AIP abundance when used in multiple, sequential years. Group B methods in 2024, as in 2023, included UV-C Spot treatments, Bottom Barriers, and DASH in smaller-scale areas within Year 1 (2022) herbicide applications sites (Table ES-1). The intent of these actions in Year 3 was to determine if continued, non-herbicide Group

A methods, alone and/or together with Group B methods, could sustain 75% knock-back of AIP (reduction of abundance), which) was achieved within Group A sites in 2023. The Year 3 treatment schedule is provided in Appendix F (Year 3 Treatment and Intervals Calendar).

In Year 3, certain Group B methods (DASH and UV) were also used as “Sequential Treatments” in some Bottom Barrier sites after the barriers had been removed in the fall. This adaptive experimental approach was intended to determine if AIP reinfestation in barrier-covered areas could be reduced.

1.3 Management and Coordination of CMT Project

The CMT is managed through the Tahoe Keys Property Owners Association (TKPOA) in collaboration with the following project partners: Tahoe Regional Planning Agency (TRPA), The League to Save Lake Tahoe (The League), and consultants and contractors, including Dr. Lars Anderson (CMT Lead Science Consultant), Sierra Ecosystem Associates (SEA) (CMT Program Management), and Environmental Science Associates (ESA) (TRPA CMT Contractor for Monitoring and Efficacy). For Year 3, the following contractors were also part of the CMT implementation team: Stratus Engineering Associates LLC, Hiuga Diving Co., Inventive Resources, Inc., Clean-FLO (Restorative Lake Sciences LLC), and Blankinship and Associates.

The CMT control methods and their associated monitoring activities were coordinated through weekly TKPOA Project Management meetings, bi-weekly meetings of the Monitor Working Group (MWG) led by Dr. Anderson, and through frequent communications between TRPA, TRPA contractors, TKPOA staff and TKPOA contractors. Entities responsible for field operations are described in Monitoring Completeness Table ES-3. Records of meetings are provided in Appendix G. Record of Project Meetings. [Note that TRPA’s contractor ESA, which was not involved with CMT Treatments, was specifically employed to provide independent assessments of CMT Treatment results (see Appendix E)].

1.4 Documentation of Training, Qualifications, and Experience

The required compliance training was primarily associated with proper field sampling protocols, field documentation, proper sample stewardship/chain of custody forms (COCs), aquatic plant identification, boat operations, and diver safety and certifications. The documentation is provided in Appendix H. Documentation of Training, Qualifications, and Experience.

1.5 Protocols for Monitoring: QAPP

The QAPP (Appendix I) procedures provided in Year 1 (2022) were applied to Year 3 with the following modifications:

(1) Sediment sampling and analysis for Endothall and its degradants were conducted to determine if Endothall or its degradants were present from applications of Endothall made in 2022.

(2) Nutrient sampling was limited to: Control sites, LFA sites, and sites in which UV-C treatments occurred including UV-C Only sites, UV-C Combo sites and UV-C Spot treatments. Nutrient sampling was also conducted in Sequential UV-C treatments.

(3) Macrophyte Rake sampling was modified to increase the number of samples in specific Group B treatment areas while maintaining the total number of rake samples at 30 per

CMT Site. This change was made to ensure adequate assessment of AIP abundance and conditions within the small Group B areas and in areas that received “Sequential Treatments” (see Table 1-1 and Appendix C).

(4) The fresh weight of all plants on rake samples taken from selected sites was recorded to determine if weight and Rake Fullness rankings from the same samples were correlated.

1.6 Calibration Records

Records for equipment and instruments calibration are in Appendix J. Calibration Logs.

1.7 Flow Conditions at the West Channel

Year 3 did not require documentation of flow rates because no herbicide applications were made in 2024. However, water depth and water volume (ac-ft) in the CMT sites were higher in 2024 than in 2023, and much higher than in 2022 (Year 1). These conditions are described in Section ES 1.6 of this report.

1.8 Implementation of CMT Treatment Methods: Group A Continuing Non-Herbicide Methods and Group B Methods and Sequential Post-Barrier Removal Methods

The CMT Year 3 Group B methods are described here, and their sites and sizes of applications are summarized in Table ES-1 and in detail in Table 1-1.

Table 1-1. Summary of Year 3 CMT Continuing Group A and Group B Methods

2024 CMT Treatments	CMT Site	2022 Treatment Type	Total Group A Site Sq. ft. (APAP 1)	Year 3 Sq. ft.	Group B and Continuing Group A Method Implementation Dates	Number of Rake Samples per site Year 3
Bottom Barriers (BB)	3	Endothall only	91,476	7,439	5/20 - 5/22, 9-16-9/18	10
	5	Triclopyr only	95,832	-	-	-
	8	Triclopyr only	69,696	6,305	6/12 - 6/13, 6/17, 10/9	10
	9	Triclopyr only	65,340	-	-	-
	10a	Endothall combo	87,120	3,067	6/6, 9/30, 10/1	5
	10b	Endothall combo	See above*	6,006	6/3 - 6/5, 9/26, 9/30	10
	11a	Endothall combo	69,696	2,538	6/10, 10/3, 10/7	5
	13	Triclopyr combo	43,560	4,022	6/11, 10/2	5
	14	Triclopyr combo	43,560	3,018	5/23, 9/19, 9/23-9/24	5
	19	Endothall only	87,120	-	-	-
	26a	LFA	265,716	3,614	5/29, 9/23-9/24	5
	26b	LFA	265,716	3,975	5/28, 9/25	5
Total Bottom Barriers Square Footage				**39,984**		
Total Bottom Barrier Acreage				**0.92**		
Diver Assisted Suction Harvesting (DASH)	1a	Endothall only	65,340	3,566	6/18 - 6/19, 8/7-8/8, 10/1-10/2	10
	1b	Endothall only	See above*	2,407	6/20, 8/8, 10/2	
	2	Endothall only	65,340	5,770	6/24 - 6/25, 8/12, 10/17	10
	3	Endothall only	See above*	4,844	6/26 - 6/27, 8/13, 10/17	5
	5a	Triclopyr only	See above*	8,746	7/22 - 7/25, 8/27-8/28, 10/9-10/10, 10/14	10
	5b	Triclopyr only	See above*	2,444	7/29 - 7/30, 8/29, 9/3-9/4, 9/30-10/1	5
	8	Triclopyr only	See above*	1,247	8/5, 9/9, 10/17	5
	9	Triclopyr only	See above*	1,466	8/6 - 8/7, 9/10, 10/2-10/3	5
	10a	Endothall combo	See above*	2,259	7/1 - 7/2, 8/13, 8/15	5
	10b	Endothall combo	See above*	4,146	7/2 - 7/3, 8/15, 8/19	5
	11a	Endothall combo	See above*	2,314	7/8 - 7/9, 8/19, 10/15	5
	11b	Endothall combo	See above*	4,474	7/9 - 7/11, 7/15, 8/19-8/21	10
	13	Triclopyr combo	See above*	3,473	7/17 - 7/18, 8/22, 8/26	5
	14	Triclopyr combo	See above*	2,791	7/15 - 7/17, 8/21-8/22	5
	19a	Endothall only	See above*	-	-	-
	19b	Endothal only	See above*	-	-	-
	26a	LFA	See above*	2,171	7/31, 9/5, 10/8	5
	26b	LFA	See above*	4,420	7/31 - 8/1, 9/5, 9/9, 10/9	5
Total DASH Square Footage				**56,538**		
Total DASH Acreage				**1.30**		
UV-C Spot	1	Endothall only	See above*	13,702	7/8 - 7/9, 8/13-8/14, 9/19-9/20, 10/25, 10/28	15
	2	Endothall only	See above*	39,045	7/10 - 7/12, 7/15 - 7/16, 8/19-8/22, 9/23-9/26, 10/21-10/25	20
	3	Endothall only	See above*	16,475	6/20 - 6/21, 7/24-7/25, 8/30, 9/3, 10/7-10/8	15
	5	Triclopyr only	See above*	29,558	6/17 - 6/19, 7/26, 7/29-7/31, 9/4-9/6, 9/9, 10/9-10/11, 10/14	15
	9	Triclopyr only	See above*	18,256	6/14 - 6/15, 7/20, 7/22-7/23, 8/22, 8/24, 10/2-10/3	15
	26	LFA	See above*	49,851	5/30 - 6/1, 6/3 - 6/5, 71-7/2, 7/9-7/13, 8/9-8/10, 8/12-8/16, 9/17-9/21, 9/23-9/25	20
Total UV-C Spot Square Footage				**166,887**		
Total UV-C Spot Acreage				**3.83**		
UV-C Combo (Group A)	10	Endothall combo	See above*	40,349	6/27, 7/1 - 7/3, 8/6-8/9, 8/12, 9/13, 9/16-9/18, 10/18, 10/21-10/24	20 mid-channel
	11	Endothall combo	See above*	30,259	6/24 - 6/26, 6/28, 8/1-8/2, 8/5, 9/10-9/12, 10/15-10/17	15 mid-channel
	13	Triclopyr combo	See above*	17,095	6/10 - 6/12, 7/17-7/18, 8/27-8/29, 9/27, 9/30, 10/1	15 mid-channel
	14	Triclopyr combo	See above*	20,204	6/12 - 6/14, 7/19, 7/22-7/23, 8/23, 8/26, 10/2-10/4	10 mid-channel
	15	Endothall combo	52,272	28,255	6/6, 6/10 - 6/13, 7/15-7/19, 8/18-8/21, 9/26-9/28, 9/30-10/1	30
Total UV-C Combo Square Footage				**136,162**		
Total UV-C Combo Acreage				**3.13**		
UV-Only (Group A)	22	UV only	65,340	32,349	6/17 - 6/20, 7/24-7/27, 8/25-8/28, 10/4, 10/7-10/9	20 mid-channel, 10 nearshore
	23	UV only	69,696	35,860	6/26 - 6/29, 7/1, 7/29-8/2, 9/6-9/7, 9/9-9/11, 10/10-10/12, 10/14	20 mid-channel, 10 nearshore
	24	UV only	78,408	33,992	6/21 - 6/22, 6/24 - 6/25, 8/3, 8/5-8/8, 9/12-9/14, 9/16, 10/16-10/19	20 mid-channel, 10 nearshore
Total UV-C Only Square Footage				**102,201**		
Total UV-C Only Acreage				**2.35**		
Sequential Treatments:						
BB then UV-C Spot	*10a*	Endothall combo	See above*	3,067	10/24	5
	8a	Triclopyr only	See above*	6,305	10/25	5
Total BB then UV Square Footage				**9,372**		
Total BB then UV Acreage				**0.22**		
BB then DASH	*3a*	Endothall only	See above*	7,439	10/7 - 10/8	
	10b	Endothall combo	See above*	6,006	10-15 - 10/16	5
	26a	LFA	See above*	3,614	10/9	5
	26b	LFA	See above*	3,975	10/9	5
Total BB then DASH Square Footage				**21,034**		
Total BB then DASH Acreage				**0.48**		
Total Sequential Treatments				**0.70**		
Total Year 3 UV-C Acreage				**9.52**		
LFA (Group A Treatment)	25	LFA	178,596	178,596	Ongoing	30
	26	LFA	265,716	265,716	Ongoing	30
	27	LFA	117,612	117,612	Ongoing	30
Total LFA Square Footage				**561,924**		
Total LFA Acreage				**12.90**		
Total Year 3 Group B Acreage				**6.75**		
Total Year 3 Treatment Acreage				**25.12**		

*See above statements reference previously mentioned treatment size.

1.8.1 BB Installation and Removal

BB were used to cover specific areas within the larger CMT Group A sites (Figure 1-2). As in Year 2, these smaller scale treatments were intended to determine if the successful reduction in AIP from CMT Year 1 Group A methods (i.e., efficacy greater than 75% reduction in biovolume) could be sustained with Group B treatments in Year 3. Most Group B areas in Year 3 were identical to the areas in Year 2 with some exceptions. The Bottom Barrier area in Site 5 was replaced with DASH treatment because the BB was not effective in sustaining AIP control. Other BB sites were increased in size (see Table 1-1 for detailed list.). These changes were made in response to macrophyte rake sampling data from fall 2023 and spring 2024 with the intent of focusing control methods on problematic populations of AIP.

In Year 3, only two types of bottom barrier materials were used: Pond Liners and Lake Bottom Blankets, which were chosen for their ease in installation and better anchoring stability. Links to additional information and results can be found in Appendix A. Links to CMT-Related Documents. Divers installed the barriers and secured them in place with rebar. As in Year 2, the corners of the barriers were georeferenced (GPS), and the NE corner was marked with an underwater label. The integrity of the barriers was checked bi-weekly and other monitoring crews reported if abnormalities were observed. The BB locations, installation, removal dates, turbidity monitoring, and duration of cover are summarized in Table 1-2 and Appendix K. Turbidity Data. Table 1-3 shows the dates that macrophyte surveys were conducted and approximate “Days After Removal” (DAR) of barriers. The “Sequential Post-Barrier Removal” treatments are summarized in Table 1-4.

Table 1-2. Summary of Bottom Barrier Treatments: Installation, Removal, Duration and Turbidity

Bottom Barrier Site	Size (Sq. ft.)	Installed	Turbidity: Pre/ 24 hrs Post Install (NTU)	Removed	Turbidity: Pre/ 24 hrs Post Removal (NTU)	Number of Days Barriers Were in Place
3BBa	7,439	5/20-5/22	0.93 / 0.79	9/16 - 9/18	11.19 / 9.15	119
8BBa	6,305	6/12 - 6/13, 6/17	0.88 / 1.28	10/9	3.25 / 2.95	114
10BBa	3,067	6/6	0.75 / 0.8	9/30, 10/1	2.54 / 2.63	117
10BBb	6,006	6/3-6/5	0.67 / 0.75	9/26, 9/30	2.54 / 2.41	117
11BBa	2,358	6/10	0.85 / 1.53	10/3, 10/7	3.6 / 3.8	119
13BBa	4,022	6/11		10/2	3.21 / 3.29	113
14BBa	3,018	5/23	1.53 / 1.44	9/19,9/23-9/24	9.55 / 3.12	124
26BBa	3,614	5/29	1.04 / 0.77	9/23 - 9/24	2.51 / 0.68	118
26BBb	3,975	5/28	1.24 / 1.04	9/25	1.01 0.77	120

Table 1-3. Bottom Barrier Macrophyte Survey Dates

Bottom Barrier Site	Removal Date	Macro Survey Date	Days After Removal (DAR)	Macro Survey Date	DAR	Macro Survey Date	DAR	Macro Survey Date	DAR
3 BBa	9/18/24	9/18/24	0	10/1/24	13	10/15/24	27	10/29/24	41
8 BBa	10/9/24	10/14/24	5	10/28/24	19				
10 BBa	10/1/24	10/2/24	1	10/8/24	7	11/5/24	35		
10 BBb	9/30/24	10/2/24	2	10/8/24	8	11/5/24	36		
11 BBa	10/7/24	10/8/24	1	11/5/24	29				
13 BB	10/2/24	10/8/24	6	10/21/24	19	11/5/24	34		
14 BB	9/24/24	9/30/24	6	10/7/24	13	10/21/24	27	11/4/24	41
26 BBa	9/24/24	9/30/24	6	10/8/24	14	10/22/24	28	11/5/24	42
26 BBb	9/25/24	9/30/24	5	10/8/24	13	10/22/24	27	11/5/24	41
Sequential: BB >> DASH									
Sequential: BB >> UV									

Table 1-4. Summary of Year 3 Sequential Post-Barrier Removal Treatments

Site	Material	Total Sq Ft (mapped)	Installation Date(s)	Removal Date(s)	Number of Days BB's In Place	% Top of BB Covered with Dirt/Debris at Removal Date	% Top of BB Covered with Plant Growth at Removal Date	Post- BB Removal "Sequential Treatment" (Date)
3BBa2024	Pond Liner	7,439	5/20 - **5/22**	9/16 - **9/18**	119	25%	0%	DASH (10/7 - 10/8)
8BBa2024	Lake Bottom Blanket	6,305	6/12 - 6/13, **6/17**	**10/9**	114	100%	25%	UV (10/25)
10BBa2024	Pond Liner	3,067	**6/6**	9/30, **10/1**	117	10%	0%	UV (10/24)
10BBb2024	Pond Liner	6,006	6/3 - **6/5**	9/26, **9/30**	117	100%	25%	DASH (10/15 - 10/16)
11BBa2024	Lake Bottom Blanket	2,538	**6/10**	10/3, **10/7**	119	100%	>10%	No Sequential Treatment
13BBa2024	Pond Liner	4,022	**6/11**	**10/2**	113	100%	50%	No Sequential Treatment
14BBa2024	Pond Liner	3,018	**5/23**	9/19, 9/23 - **9/24**	124	10%	0%	No Sequential Treatment
26BBa2024	Pond Liner	3,614	**5/29**	9/23 - **9/24**	118	100%	>10%	DASH (10/9)
26BBb2024	Lake Bottom Blanket	3,975	**5/28**	**9/25**	120	100%	50%	DASH (10/9)

1.8.2 UV-C Only and UV-C Spot Treatments

As in Year 2, Year 3 UV-C treatments were made using two UV-array sizes: 8 ft X 40 ft and 16 ft X 40 ft. The larger array vessel was used for mid-channel sections of UV-C Combo Sites 13, 14, 10, 11 and follow up (continued) Group A, UV-C Only Sites 22, 23, and 24; the smaller vessel array was used mainly for UV-C Spot treatments and for some nearshore-dock areas. In Year 3, UV-C treatment in Site 23 was re-started. [Note that this site was only treated once with UV-C in 2023.]). On average, each site was treated between 10 to 15 minutes with spatial “overlap” to ensure adequate UV-exposure.

The larger vessel (16 ft x 40 ft) focused on mid-channel areas and moved positions every 7.5 minutes with a 50% overlap. The smaller vessel (8 ft x 40 ft) focused on the nearshore or smaller UV-C Combo sites and changed positions every 10-15 minutes with sufficient physical overlap (several feet) to ensure complete exposure of each area. For detailed reporting on UV-C treatments in 2024 see Appendix L. UVC Light Aquatic Invasive Plant Control Pilot Project-Summary of Treatment Field Activities for the 2024 Treatment Season.

The frequency and timing of UV-C Only and UV-C Spot treatment sites are summarized in Table 1-1. Generally, the full-site (UV-C Only) treatments required 4 to 5 days; combination treatments took 3 to 4 days; and UV-C Spot treatments (Group B UV) took one half- to one day depending on the area size. The UV-C Spot areas were delineated by GPS-generated polygons so that re-

treatments and monitoring for nutrients and macrophytes could be done in the correct locations (see Appendix C, E, and Y).

1.8.3 Diver Assisted Suction Harvesting (DASH)

The DASH method was used to collect and remove AIP from localized infestations. Maps for DASH sites in Year 3 were provided to the dive team and monitoring crews. The dive crew also used shoreline (docks) landmarks and GPS to confirm removal boundaries. The DASH methods used in Year 3 were the same as in Year 2.

DASH is done using a pumped-venturi suction generating flow system so that divers could direct hand-pulled plant material into the end of the suction tube that deposited the plants into a fine mesh (3 mm pore) “sock” retained in a receiving box at the water surface. The “sock” captured plant material and allowed water to pass through. Once the “sock” (mesh bag) was filled to its capacity, the contents were transferred to 40-gallon plastic pails and weighed. During a DASH event, separate sub-samples of the removed plants were saved in 5-gallon pails for drying to later count the number of turions removed. During the DASH operations, a topside crew member used a hand-held screen net (3 mm pores) to remove floating surface fragments generated by divers’ actions. Divers could usually finish clearing a 2,000 sq ft area within a day (Appendix M. Standard Operating Procedures). [Note that the data from these turion counts and the rake samples were used to estimate the “propagule” pressure described in the Section ES 3.4, Figure 1-4.]

1.8.4 Laminar Flow Aeration (LFA)

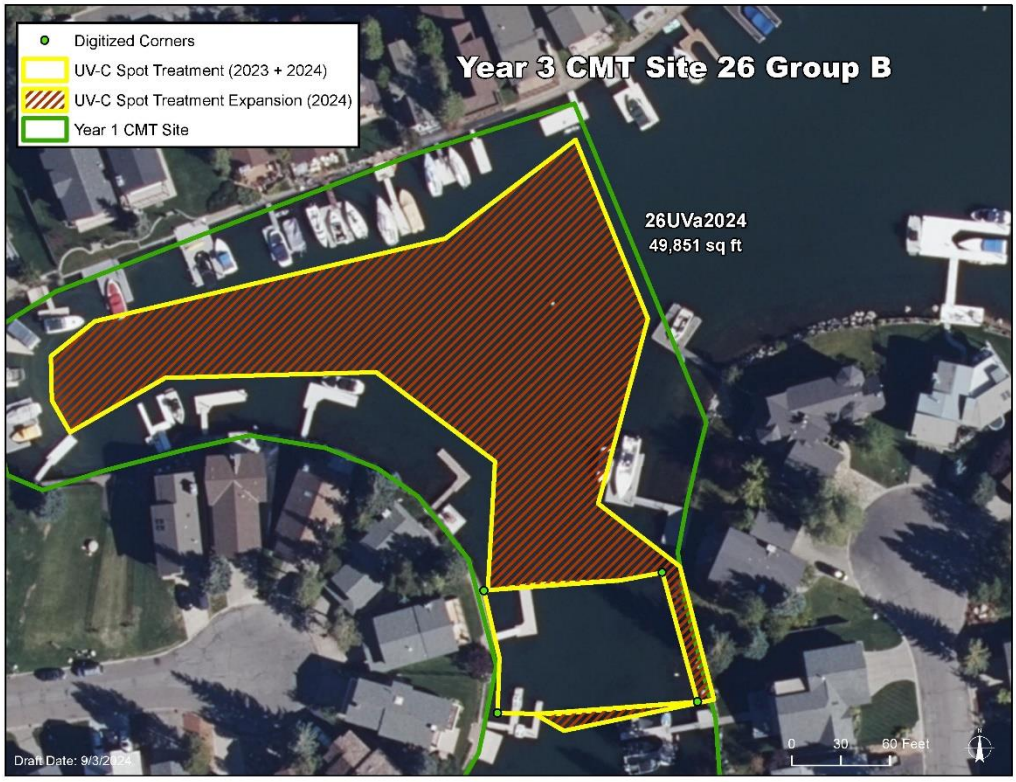
The LFA system is comprised of air compressors and a series of anchored air diffusers that constantly produce a stream of bubbles in the water column. The LFA system mixes the water column and increases oxidation of organic material and may reduce availability of nutrients that encourage the growth of algae. In addition to Site 26, in which LFA was installed in 2019, Sites 25 and 27 had LFA systems installed in late 2022 (Figure 1-1). The LFA system in Site 27 was manually turned off for the winter in December 2024. This system was shut off due to winter recreation by homeowners residing around Lake Tallac.

Note that two Group B UV-C Spot treatments, two BB installations, and two DASH treatments were also completed in 2024 in LFA Site 26 (Figure 1-1). These additional Group B methods were added due to the increased presence of Curlyleaf pondweed in LFA Site 26 between 2022 and 2024 to reduce further expansion of this aggressively spreading invasive plant.

1.8.5 Example of Group B Treatment Area Detail

A detailed view of LFA Site 26 (Figure 1-1) shows the arrangement of three Group B Treatment Areas (BB, UV-C Spot, and DASH) and). the relatively small DASH and BB area comprising Group B compared with the UV-C Spot treatment. As noted above, the three Group B methods were in response to increases in AIP, especially Curlyleaf pondweed, in this site. Group B treatments were evaluated by adjusting (increasing) the number of rake samples per square foot compared with the CMT (LFA) site as a whole. [Note: The broader scale hydroacoustic scans do not consistently distinguish the small Group B areas from the biovolume of the entire Site.] This approach for evaluating Group B treatments is described in detail in Appendix E.

The Group B locations in Figure 1-1 show two polygons outlining the area added to the 2023 treatments in 2024. Similar detailed maps showing all Group B locations are provided in Appendix E.



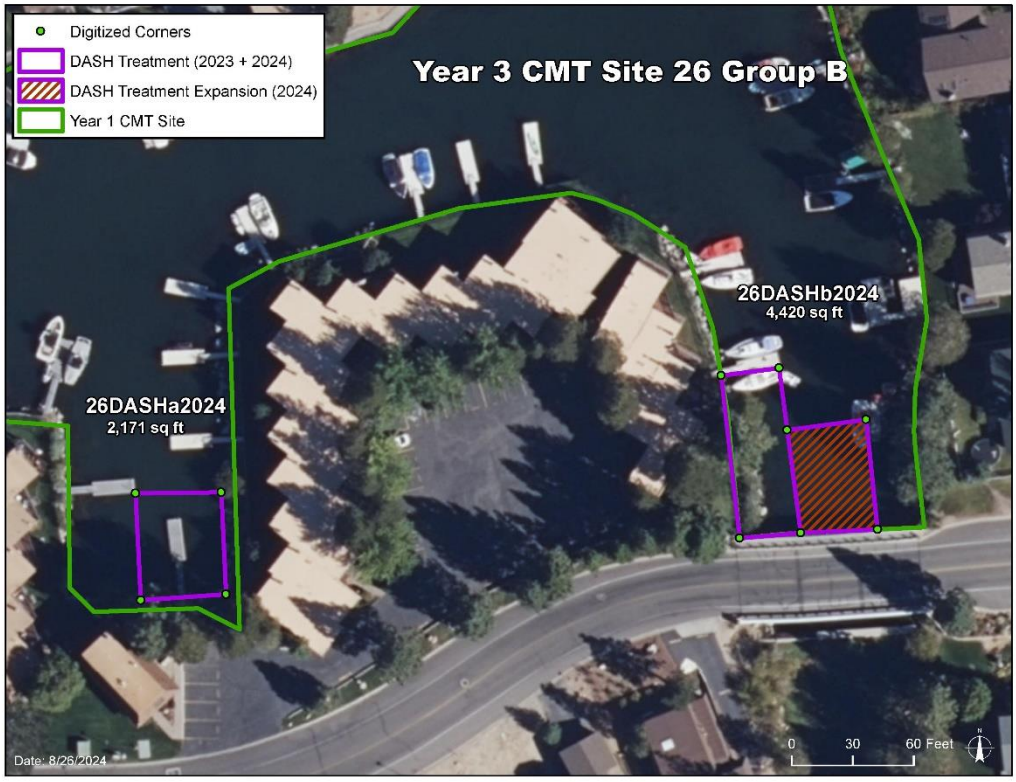


Figure 1-1. Group B area configurations (polygons) in LFA Site 26.

1.9 Installation of Contingency Sub-surface Aeration Systems

This contingency was not needed in 2024 because no herbicides were applied, and no barriers or turbidity curtains were installed. The only “subsurface” aeration systems in operation were the LFA systems installed in LFA Sites 25, 26, and 27.

2.0 MONITORING CONTEXT AND CONDITIONS

2.1 Continued Group A (Non-Herbicide) Treatment Monitoring

UV-C Only, UV-C Combo, and LFA control methods were continued in 2024 from 2023. The same monitoring was also continued as stated in the QAPP, MMRP, and MRP.

2.2 Group B Monitoring

The types of monitoring in 2024 associated with each Group B method are summarized in Table 2-1, consistent with monitoring conducted in 2023 (see Appendix N. Data Completeness Table and Evaluation). However, since additional "post-barrier removal ("Sequential") DASH and UV-C treatments were made in 2024, additional macrophyte rake sample surveys were conducted, and additional nutrient samples were taken following the "Sequential UV" treatments in compliance with the MMRP. (Table 2-1).

Table 2-1. Group B Methods Monitoring Action (MMRP Requirements; QAPP)

Monitoring Action	Bottom Barrier Treatments	UV-C Spot Treatments	DASH Treatments
Nutrients: Total P, Total N, Ortho P, TKN, Nitrate+Nitrite	None	Pre/Post treatments. **Additional samples were taken following "Sequential" UV-C treatments**	None
Turbidity	Pre/ Post Installation and Removal	None	During diver activity **Additional turbidity measurements were made during "Sequential DASH" treatments.**
Macrophyte Surveys (Rake sampling)	Pre/ Post Installation and Removal; at 14-day intervals after Removal	Pre/ Post UV-C treatments based on UV-C treatment Schedule. **Additional rake samples were taken pre- and post-"Sequential UV" treatments**	Pre/Post Diver activity Within 7 to 10 days after each of two DASH Treatments. **Additional rake samples were taken pre- and post-"Sequential DASH" treatments**

(Modifications to 2024 CMT monitoring are indicated in **bold** type.)

2.3 Notifications

A List of Correspondence with Permitting Agencies, TKPOA Homeowners, and Stakeholders from Year 3 Activities (through December 31, 2024) is provided in Appendix O. List of Year 3 Email Correspondence with Permitting Agencies, TKPOA Homeowners, and Stakeholders.

2.4 Unreliable or Uncertain Data

Data obtained from field monitoring were reviewed by respective contractors, TKPOA staff technicians, and SEA data managers (Appendix P. QAQC Documentation). Any omissions or

suspect or incorrect data were either confirmed or not included in summary tables or graphs and were noted in descriptions of the data.

2.5 Missing Data or Missing Monitoring Events

When miniDOTs went missing, malfunctioned, or were damaged by vessels, the data from "standard" weekly water quality monitoring was often sufficient to provide some of the missing data. However, some gaps remained, which are noted in the miniDOTs data and summary graphs (Appendix D. Record of miniDOT Issues).

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

Monitoring in Control sites was done so that potential effects of CMT treatments (Continuation of Group A and Group B treatment methods) could be detected. For a three-year project, such as CMT, the year-to-year environmental variations can complicate comparisons. It is assumed that yearly variations would affect Control sites as much as treatment sites so comparisons within the same year would usually be considered valid. However, the CMT goal was to determine the effects of multi-year treatments. The main difference in conditions between Year 1 and Year 3 was the continued increase in water depth within the West Lagoon. Between 2022 and 2024, water depth increased by approximately 6 feet. These changes also affected untreated reference Control sites. For example, plant growth in Control sites in 2024 was denser than in 2023, but not as dense as in 2022 (Figure ES-3).

2.7 Examples of Year 3 CMT Group B Methods

Group B methods used in 2024 were, with some minor exceptions, in the same CMT sites as in 2023 to determine if the Group B methods could sustain control achieved in Year 1. This was determined by comparing effects on plants in the CMT untreated reference Control sites (see Figure 1-1 as an example Group B Treatment location in Site 26). Examples of these types of graphs are provided in Figures 2-1, 2-2, and 2-3. The detailed complete efficacy results are provided in Appendix E.

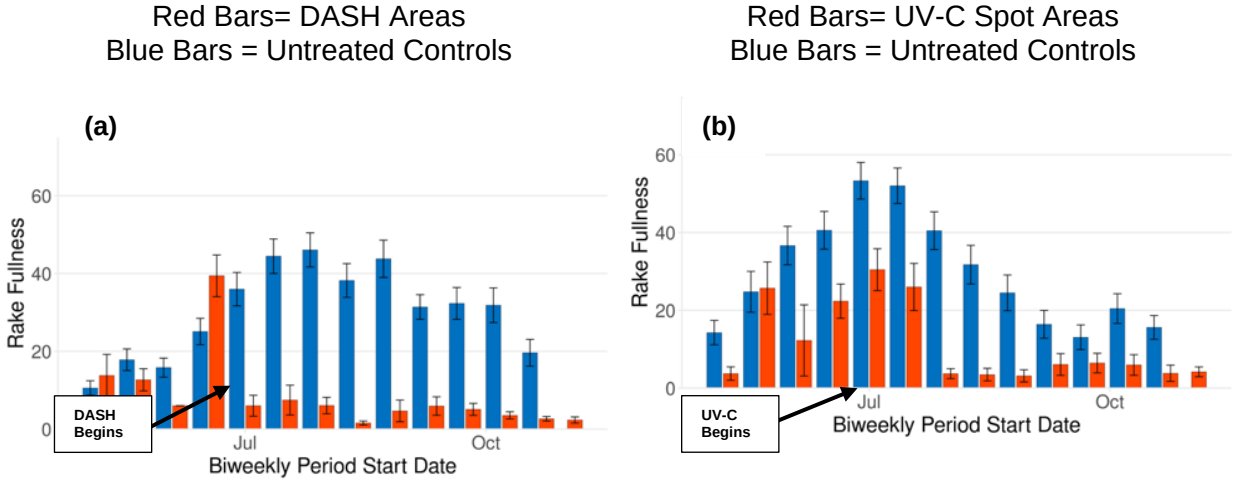


Figure 2-1. Example of Year 3 RF in the Group B treatment areas in the original Endothall treatment sites (1, 2, and 3). DASH (a) and UV-C Spot (b) treatments began in late June-early July (arrows) The red bars represent RF in the Group B methods areas compared with average of Control sites (blue bars).

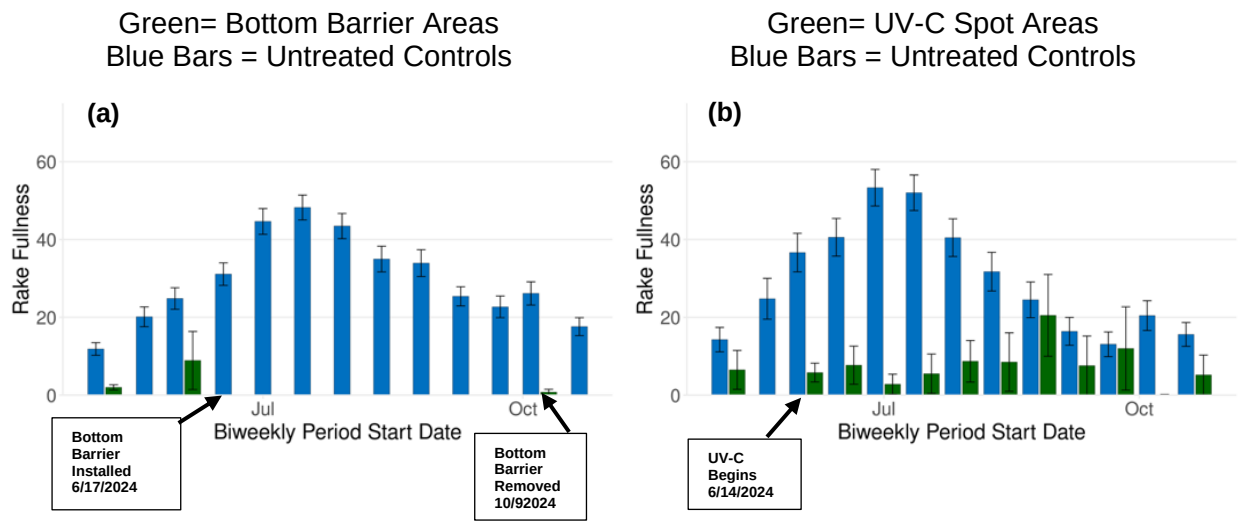


Figure 2-2. Year 3 CMT effects of Group B treatments in sites originally treated with Triclopyr in 2022. (a) Example of Year 3 RF in Group B BB in Site 9; (b) example of Group B UV-C Spot treatment in Site 8.

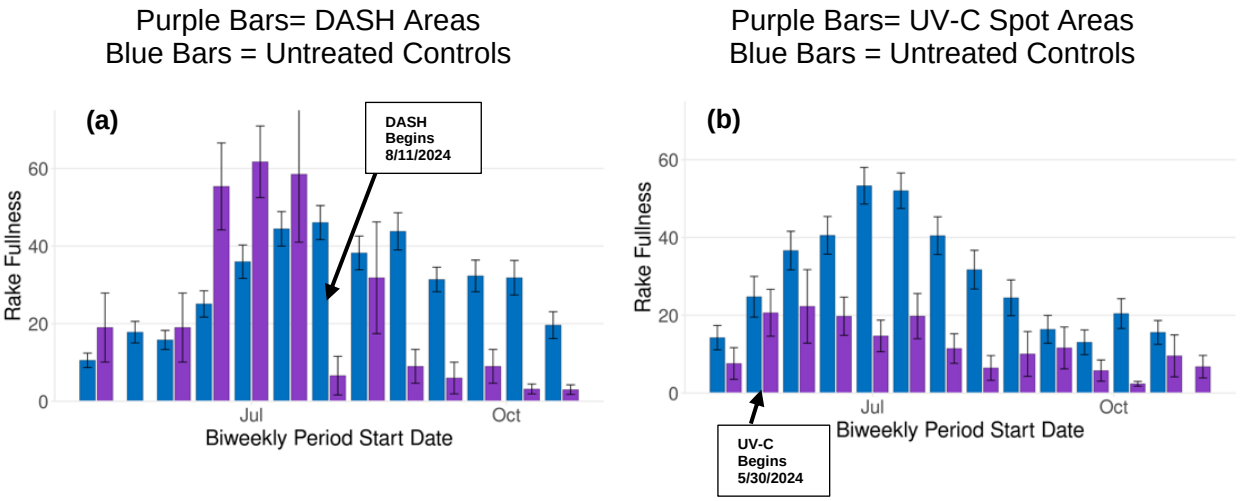


Figure 2-3. Year 3 CMT effects of Group B treatments in Site 26 in which LFA has been used since 2019 (see Figure 1-1 for locations of Group B areas.) (a) DASH treatments; (b) UV-C Spot treatments.

2.8 Photosynthetically Active Radiation (PAR) Monitoring

PAR was measured monthly to compare underwater light levels associated with some of the CMT treatments and untreated "controls". A LICOR spherical PAR detector was used to measure light at 0.5 m intervals to obtain a PAR profile. Since light is a major driver of plant growth, this data may help explain changes in species composition and abundance of macrophytes at different depths, and particularly in very deep areas resulting from increasingly higher water levels in 2023 and 2024 (see CMT Year 2 Annual Report).

Three major trends in PAR in the lagoons can be observed in the data from 2023 and 2024:

(1) Maximum PAR below the water surface occurs in early spring and gradually decreases by middle to late summer due to increased phytoplankton (algae) and increased aquatic plant leaf canopy cover;

(2) Deep water in 2024 reduced the habitats that have optimal PAR for aquatic plant growth; and

(3) PAR levels in the West Lagoon decreased far more rapidly with depth compared to levels just offshore in Lake Tahoe proper (Figure 2-4).

The seasonal pattern of PAR in the spring West Lagoon "light field" may drive early growth of the previous fall-sprouted Curlyleaf pondweed in deep areas because the plants have already developed leaves that capture the energy for photosynthesis before other species develop leaves. This may explain the observed abundance of Curlyleaf pondweed in the deepest areas of the CMT sites. Additional data on PAR methods is provided in Appendix M.

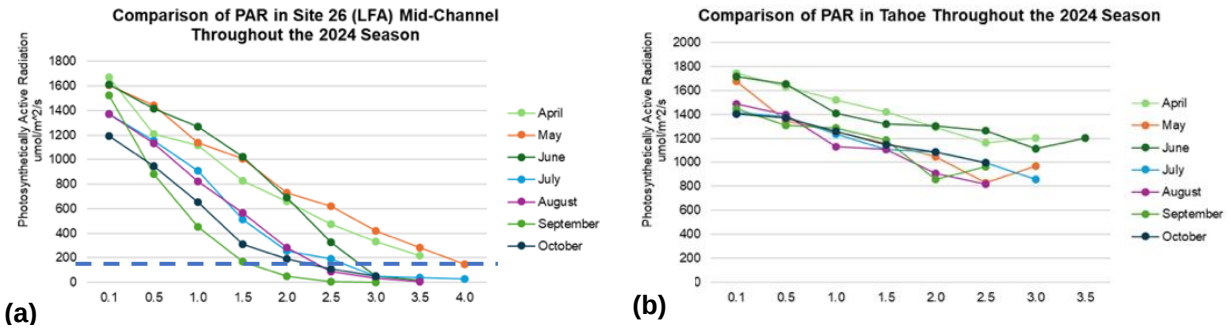


Figure 2-4. PAR depth profiles in (a) LFA Site 26 and (b) Lake Tahoe (offshore).

Figure 2-4 shows that, in the LFA Site 26, the spring (April-May) PAR is adequate for active submersed plant growth (>150 µmol/m2/sec), and reaches 4 meters deep, but by July, these PAR levels only reach about 2.5 meters. PAR levels in Lake Tahoe change very little from the surface to 3.5 meters. The dashed line for Site 26 indicates PAR levels adequate for rapid AIP growth. These data show that light can be a growth-limiting factor in the Keys lagoons, particularly in deeper areas. However, some AIP such as Curlyleaf pondweed are able to establish under low-light conditions (see Table ES-3 and Figure ES-3).

2.9 Assessment of Monitoring Completeness

Overall monitoring completeness was 98% for Year 3 activities. The specific monitoring activity and respective completeness is shown in Table ES-2 of this report. A detailed description of Year 3 monitoring activities including the referenced table is provided in Appendix N. The most common instance of incomplete monitoring was due to loss, malfunction, or vessel damage of the temperature/dissolved oxygen loggers ("miniDOTs") (Appendix D). These miniDOTs are inspected and downloaded weekly but are otherwise un-attended. In most cases of data-losses, the weekly mid-depth sonde DO and Temperature measurements were able to substitute for the missing miniDOTs data.

3.0 WATER QUALITY MONITORING

3.1 Control Sites in West Lagoon (Sites 16, 17, 18, 7)

3.1.1 Continuous Temperature and Dissolved Oxygen (DO) (miniDOT Data)

Patterns of temperature and DO in Control sites were similar to Year 2 (2023) conditions, even though inflows and total water volume in the Keys resulted in two feet deeper water in 2024. Three of the Control sites had DO levels just below the 5mg/L threshold limit, but Site 7 showed the lowest bottom water DO (below 5 mg/L from July to October) (Figure 3-1d). The decreased DO in untreated Control sites was not a result of CMT activities but was most likely due to poor mixing of the water column. [Note: Nutrient levels are provided in graphs summarizing data from the various treatment sites (see Section 4.0)]

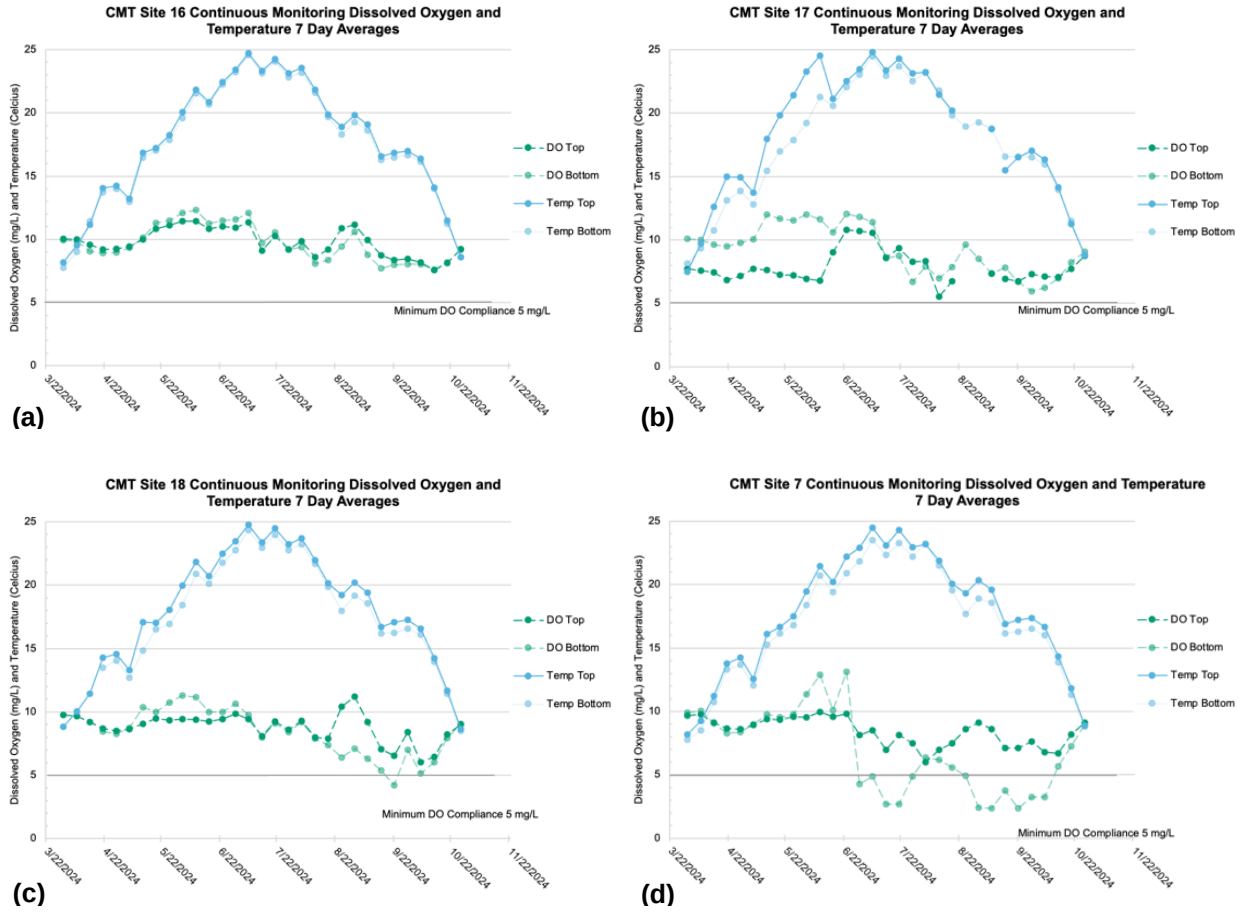


Figure 3-1. (a-d) Temperature and DO in Control sites in 2024: 16(a), Site 17(b), Site 18(c), and Site 7(d). [Note: the horizontal line at 5 mg/L is the WQO for minimum DO.]

3.2 West Lagoon and Lake Tallac CMT Treatment Sites: Mid-Depth Temperature, DO, pH, Conductivity, Turbidity, ORP, DO

The following graphs compare mid-depth water quality variables in 2024 Control sites with 2023 and 2024 CMT sites where different control methods were used. Generally, for Lake Tallac (Figure 3-2) and for the West Lagoon (Figures 3-3, 3-4, 3-5), water quality variables in sites treated with herbicides in 2022 were very similar to the untreated Control sites in Year 3. Similarly, water quality variables in UV-C Only Site 23 (Figure 3-6) were similar to Control sites in 2024. This suggests that variations from Control Site water quality values in 2023, which may have resulted from the massive increase in water volume from 2022 to 2023 of water, were not evident by 2024. The temperature and DO patterns at mid-depth were consistent with the "surface" temperatures (maximum 25°C) and DO record by the miniDOTs (see Figure 3-1). DO was above 5 mg/L except for transient occurrences below 5 mg/L in June in Endothall sites in 2024 and June/July in 2023 (Figure 3-2). In nearly all treatment sites, including UV-C Only and LFA sites, mid-summer and late summer showed a peak in turbidity. Turbidity was generally highest in 2023. However, in 2024, turbidity in treatments sites and Control sites were very similar. All treatment and Control sites had pH level above the WQO (pH 8.5) during part of the summer months. The elevated pH was not due to the CMT but was likely due to photosynthesis in AIP and native aquatic plants. Conductivity was either stable, or gradually increased between spring and fall, which is typical and reflects increases in dissolved constituents, particularly during late summer senescence. Some increase in conductivity may also be due to mid-summer senescence of Curlyleaf pondweed and native pondweed such as Leafy Pondweed.

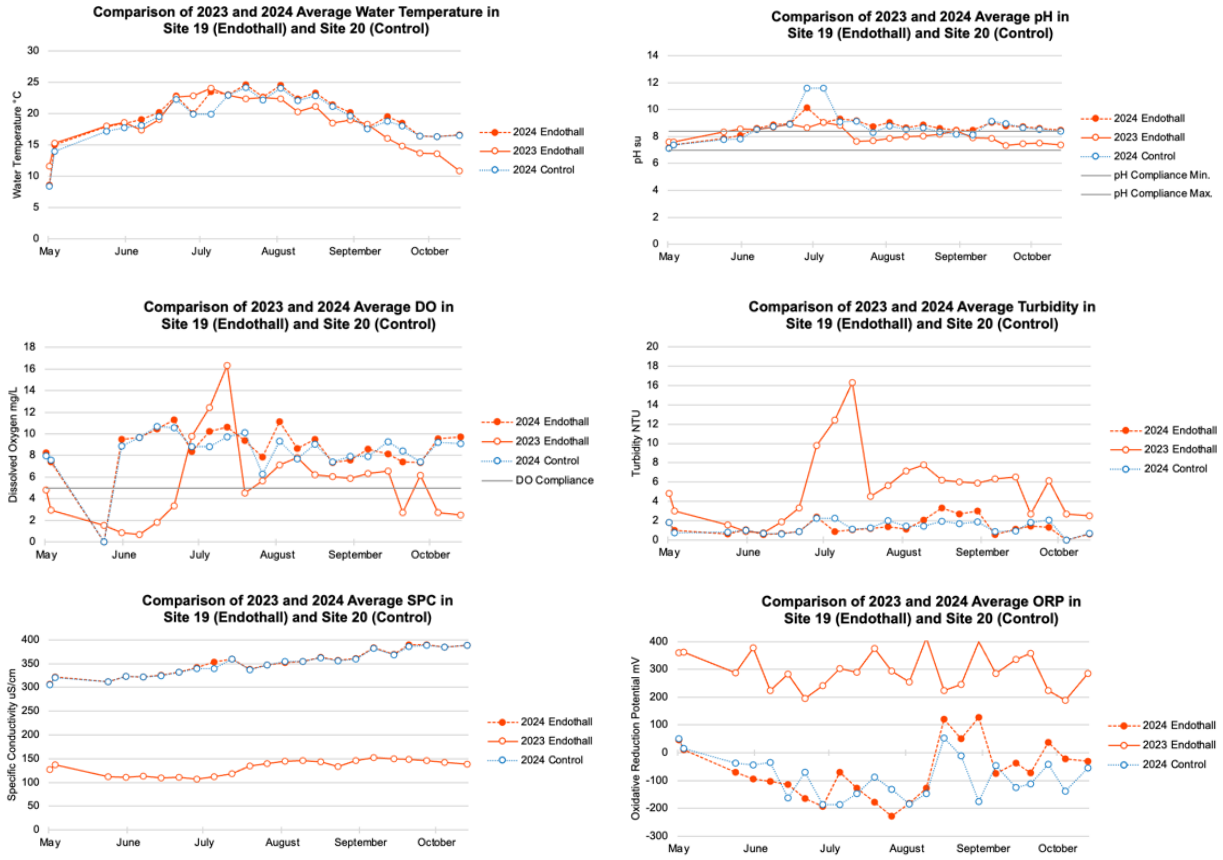


Figure 3-2. 2023-2024 Mid-depth water quality variables in Lake Tallac 2022 Endothall site.

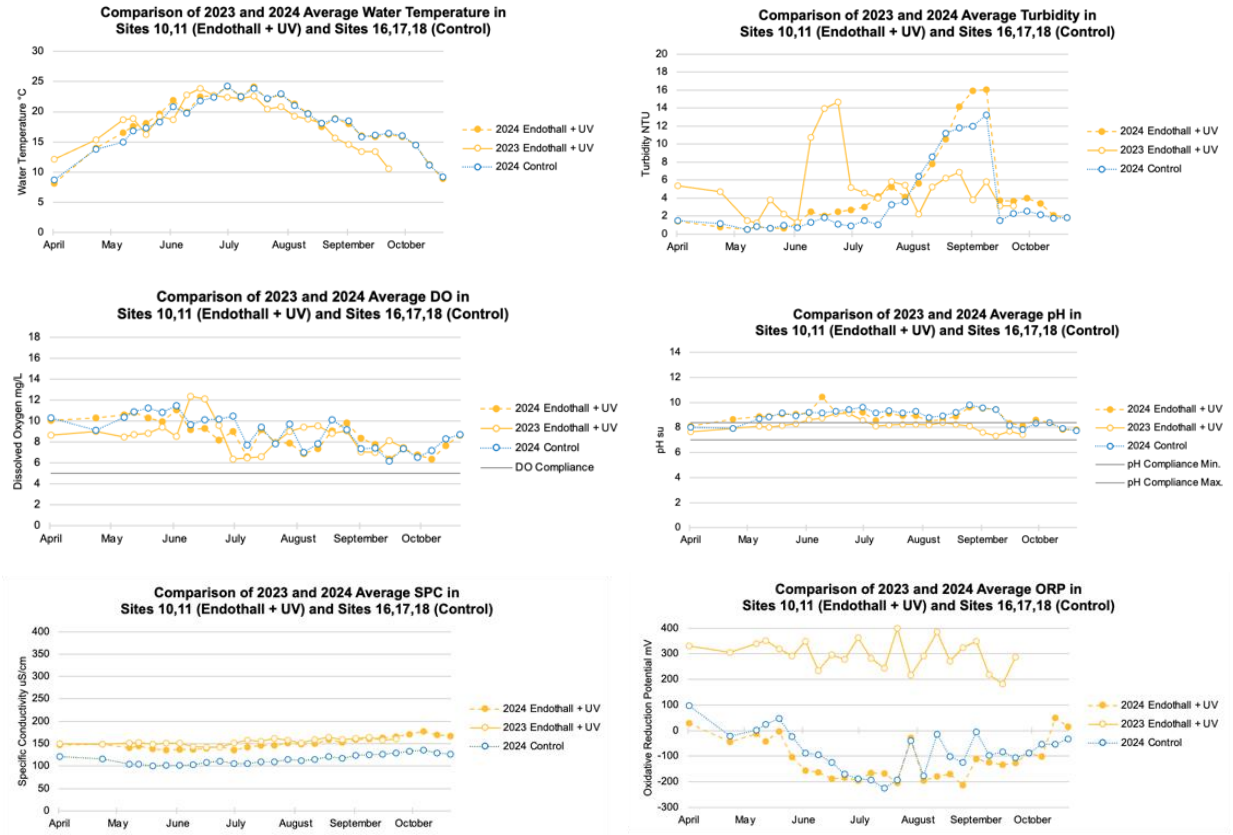


Figure 3-3. 2023-2024 Mid-depth water quality variables in the West Lagoon 2022 Endothall-UV-C Combo sites. [Note: Endothall was applied in 2022 only, followed by UV-C treatments in 2023 and 2024.]

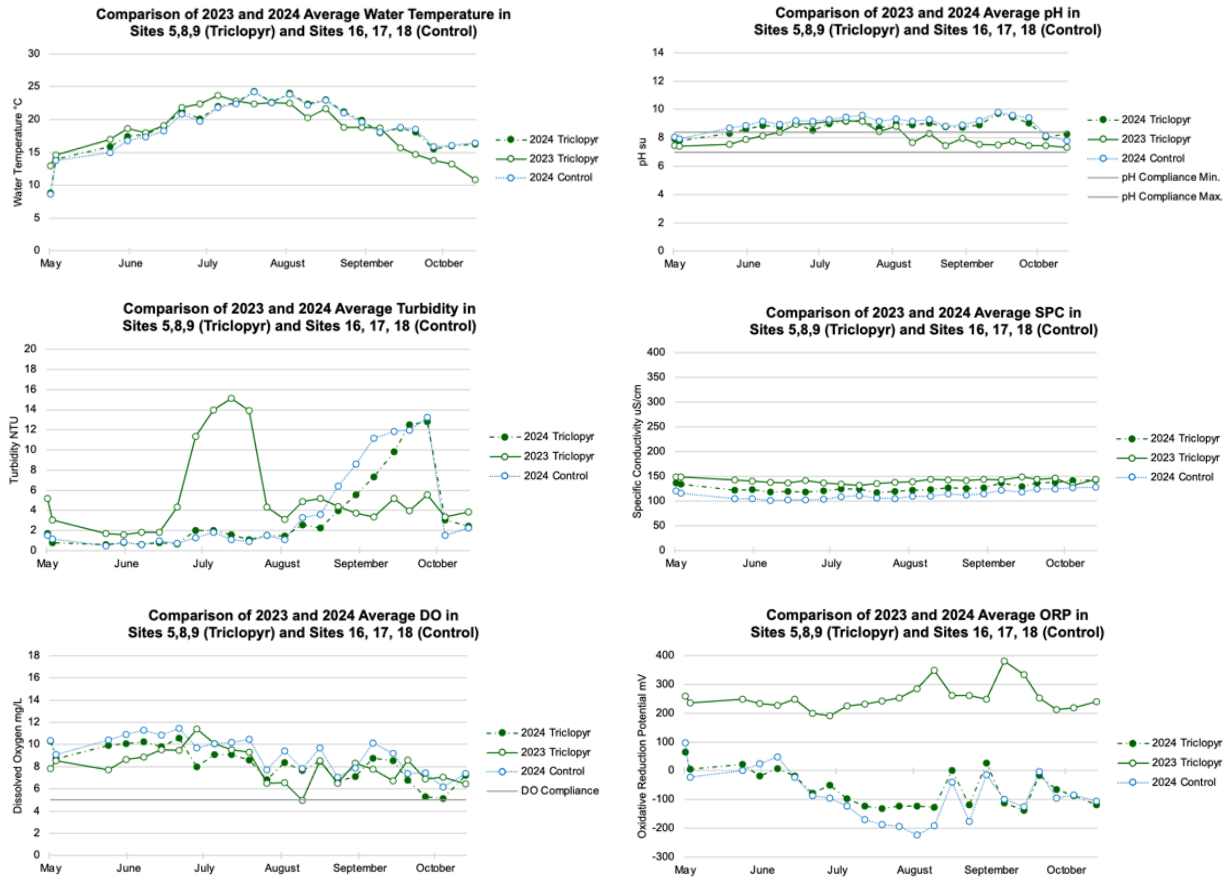


Figure 3-4. 2023-2024 Mid-depth water quality variables in the West Lagoon 2022 Triclopyr sites.

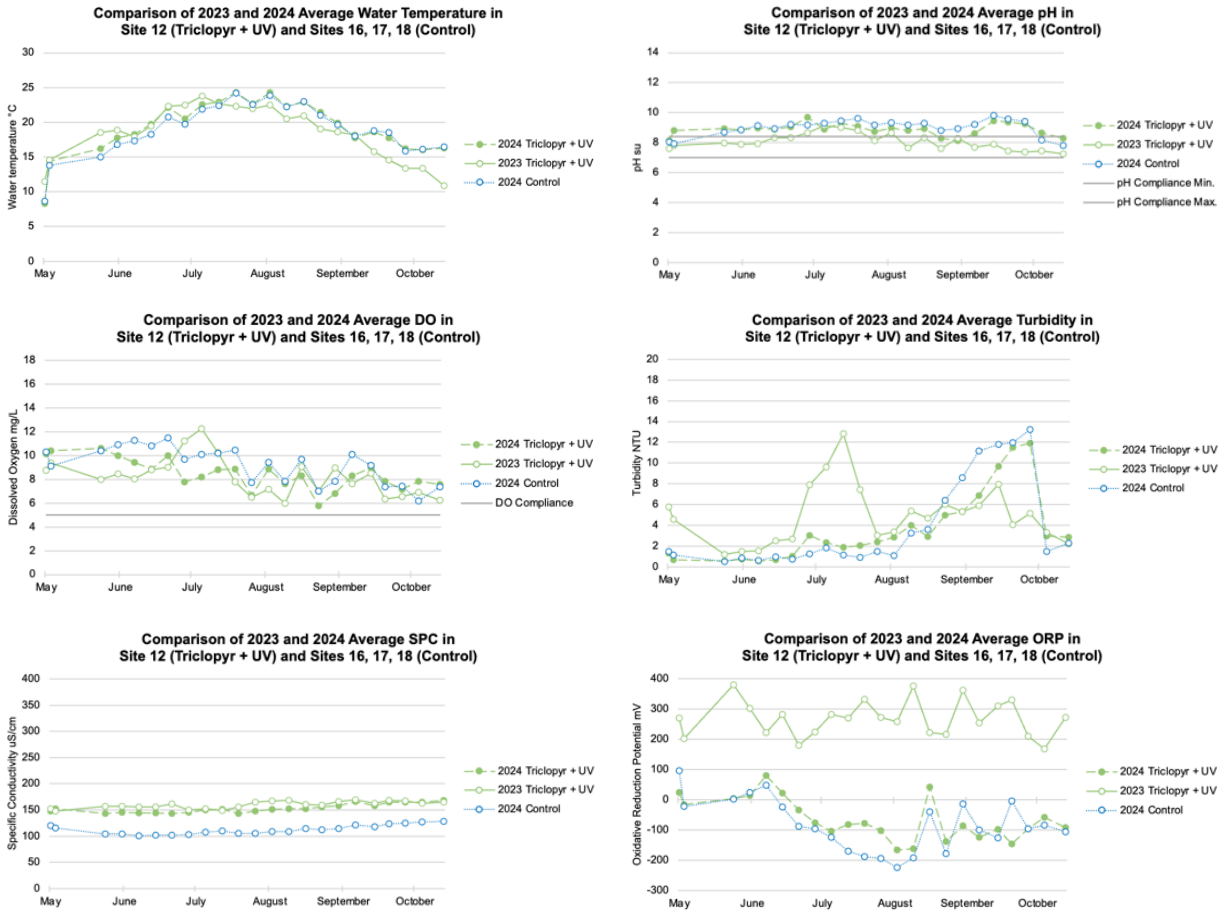


Figure 3-5. 2023-2024 Mid-depth water quality variables in the West Lagoon 2022 Triclopyr-UV-C Combo sites with 2023-2024 UV-C treatments.

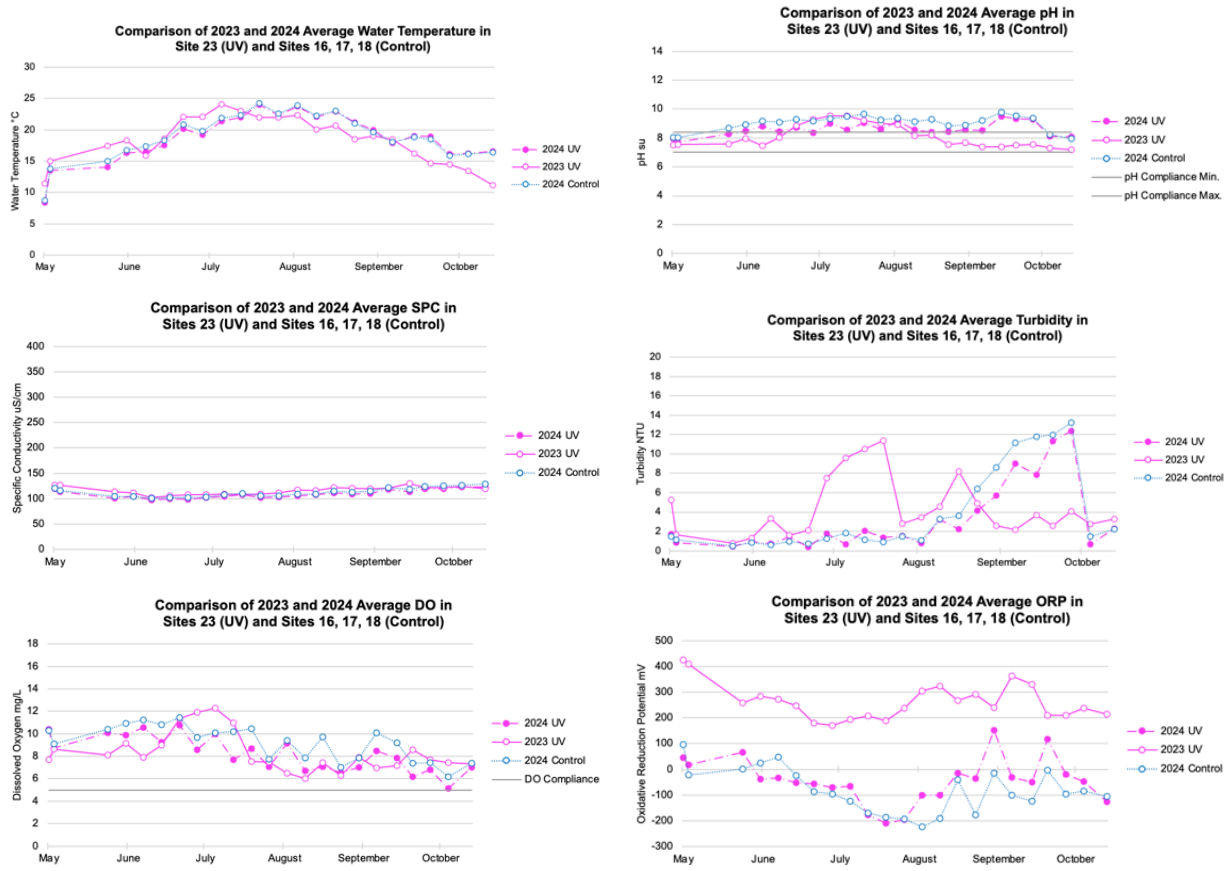


Figure 3-6. 2023-2024 Mid-depth water quality variables in the West Lagoon UV-C Only treatment sites.

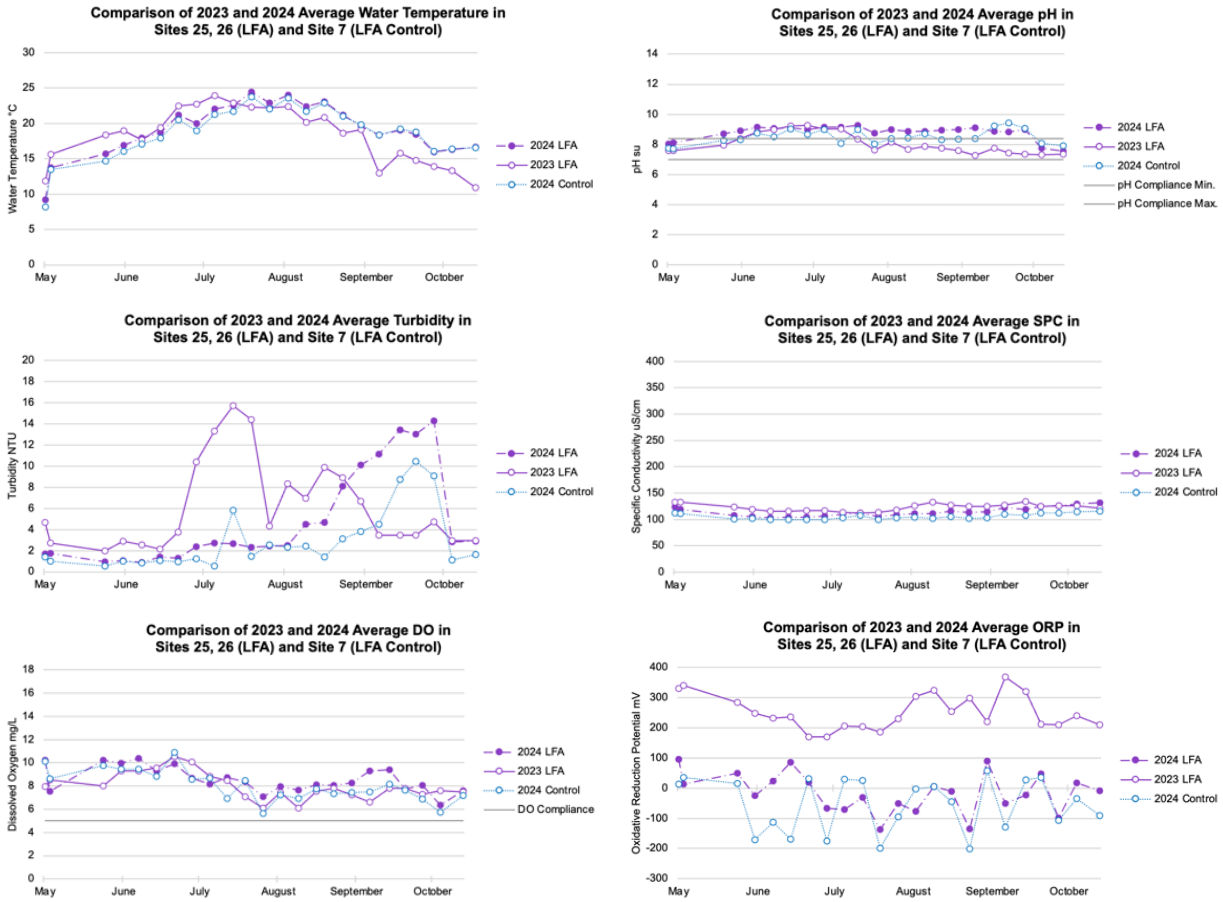


Figure 3-7. 2023-2024 water quality variables in the West Lagoon CMT Laminar Flow Aeration (LFA) sites.

3.3 Control and LFA Sites in Lake Tallac (Sites 20, 27)

3.3.1 Continuous Temperature and DO (miniDOT Data)

Temperature and dissolved oxygen general patterns in Sites 20 and 27 were similar in 2024 (Figure 3-8). However, two results of LFA use in Site 27 are clear compared with Control Site 20. First, the temperature within the LFA site was uniform vertically with no evidence of a thermocline forming. Second, DO remained uniform vertically and was sustained above 5 mg/L even when DO fell below 5mg/L in the Control Site 20 during June-August (Figure 3-8). The lack of vertical mixing in 2024 was noted in 2022 and 2023 as well. [Note: Control Site data from the miniDOTs is contained in Figure 3-1 above.]

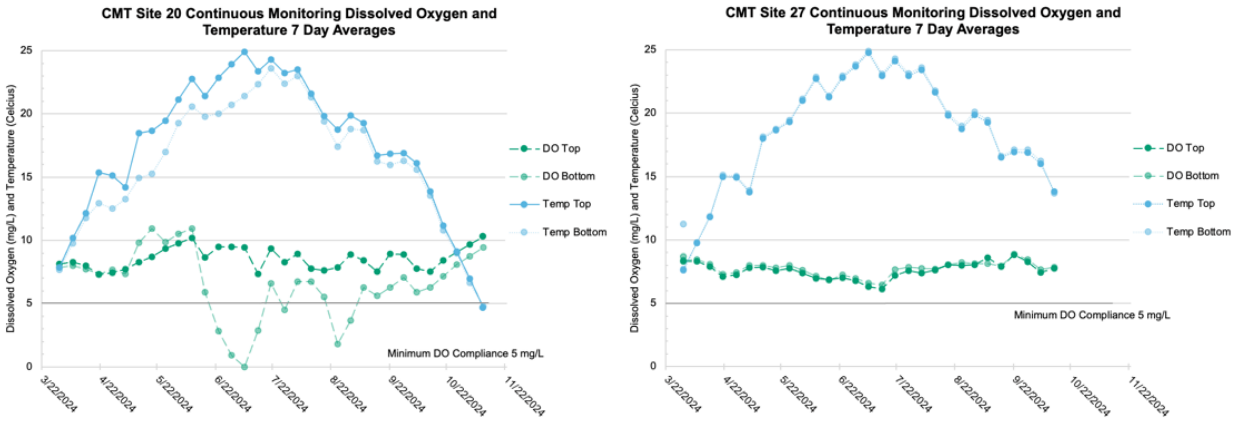


Figure 3-8. Temperature and DO in Lake Tallac Control Site 20 (left graph) and Lake Tallac LFA Site 27 (right).

3.3.2 Lake Tallac Mid-Depth Water Quality Monitoring

The 2024 seasonal water quality patterns in Lake Tallac Site 19 that had been treated with Endothall in 2022 were very similar to the water quality values in Lake Tallac Control Site 20 in 2024. In the West Lagoon, this similarity between sites previously treated with herbicides in 2022 and current values in West Lagoon Control sites suggest that in 2024, in general, water quality is the same in Control sites as 2022 herbicide treated sites. (Figure 3-9).

Turbidity and DO were elevated in July in 2023 but were similar to levels in Control Site 20 in 2024. As in the West Lagoon CMT sites, pH was above WQO of 8.4 in the Control and Site 19 in 2024, but somewhat lower in 2023 (Figure 3-9).

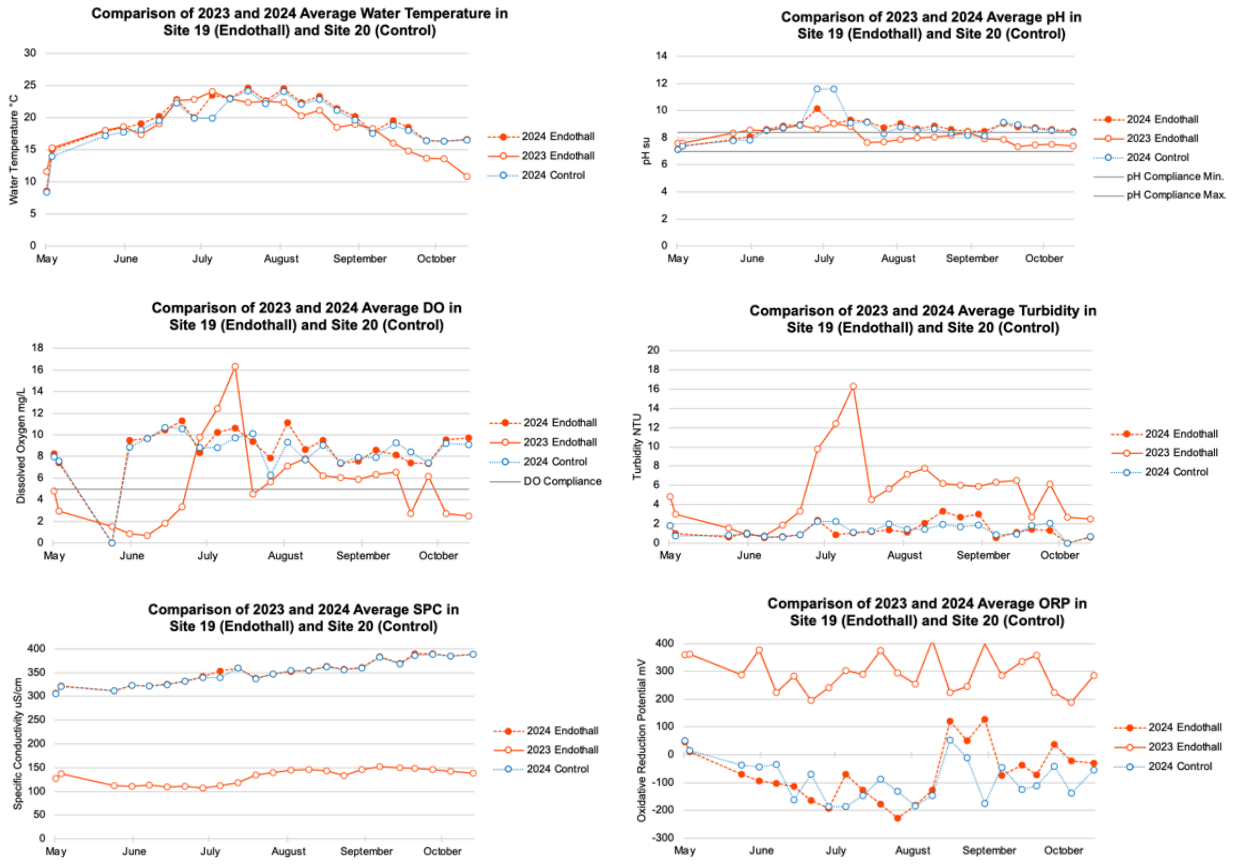


Figure 3-9. 2023-2024 Mid-depth water quality variables in Lake Tallac Control Site 20and 2022 Endothall Only Site 19.

3.4 Continuous DO and Temperature in 2024 CMT Treatment Sites

The following series of graphs were generated from the weekly averages of hourly recording of DO and temperature uploaded from two sets of miniDOTs. One logger in each site was positioned just below the surface (ca. 0.25 to 0.5 m below surface); the other logger was positioned 0.25 to 0.5 meters from the bottom in each site. Both miniDOTs were secured with an anchor at the same location and downloaded weekly as in Years 1 and 2 of the CMT. [Note: Figure 3-1 shows DO and Temperature for Control sites.]

In nearly all CMT Treatments, DO in some replicate sites declined below the WQO of 5mg/L in mid- to late summer. This was also true for some Control sites (Sites 18 and Site 7, Figure 3-1). The low bottom water DO indicate lack of mixing due to development of a moderate thermocline (warm water at the surface separated by cooler water near the bottom.) The LFA Sites 25, 26, and 27 showed the most vertically uniform DO due to mixing by continuous aeration and did not have any decline below the WQO of 5mg/L (Figure 3-1).

The temperature pattern was similar in most of the CMT sites, with a mid-summer maximum of about 25^{o}C. All sites, except LFA sites, developed moderate thermoclines evidenced by the slightly lower bottom water temperatures and by the reduced DO near the bottom. LFA sites had the most vertically uniform temperature which, as with DO, indicates that the aeration system provided good mixing of the water column throughout the summer and fall.

Overall, in 2024, no consistent pattern of DO or temperature differences was associated with prior (2022) herbicide treatments, or with subsequent Group B or UV-C treatments, when compared with the ranges of DO and temperature observed in the Control sites.

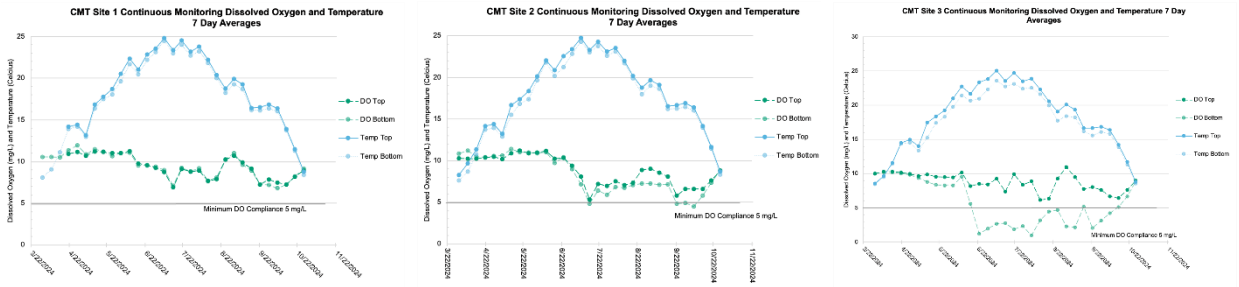


Figure 3-10. 2024 DO and Temperature top and bottom water column for 2022 Endothall Only Sites 1,2,3. [Note: for this set of figures, WQO for DO minimum value is 5mg/L (horizontal line).]

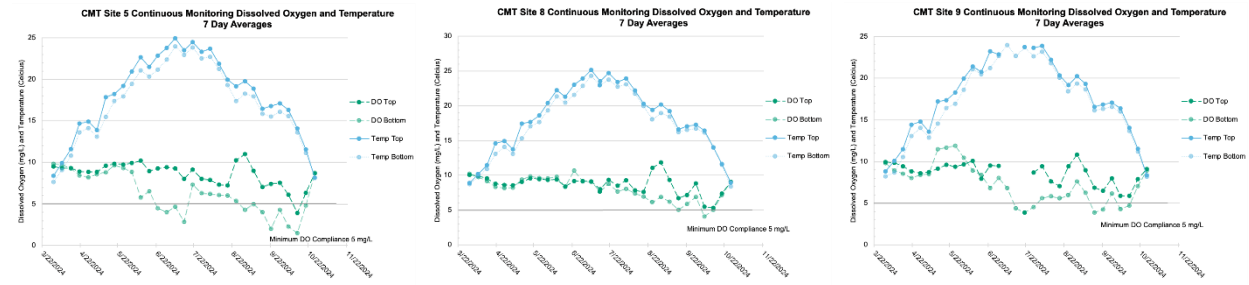


Figure 3-11. 2024 DO and Temperature top and bottom water column for 2022 Triclopyr Only Sites 5,8,9.

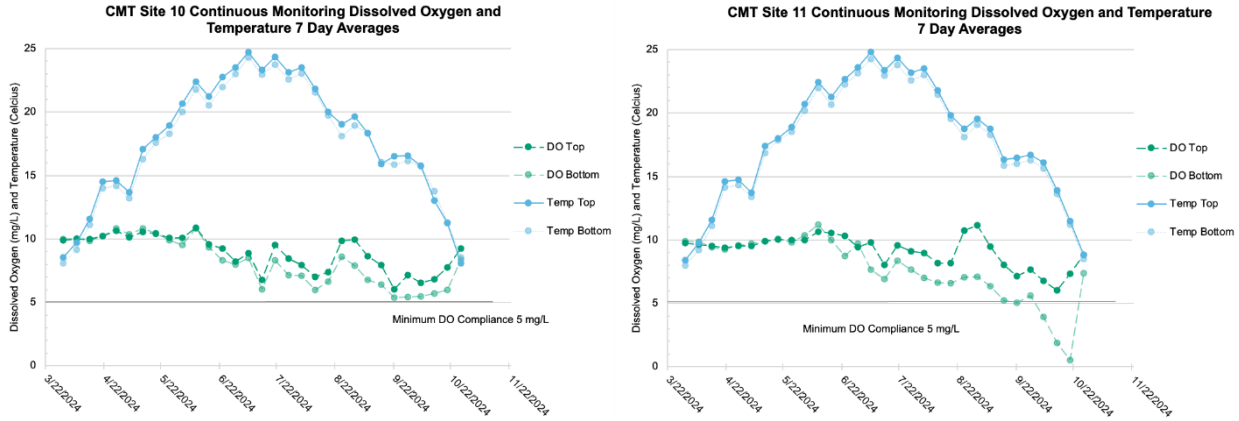


Figure 3-12. 2024 DO and Temperature top and bottom water column for 2022 Endothall UV-C Combo Sites 10 and 11. [Note: Site 15 was discontinued due to poor efficacy in 2022.]

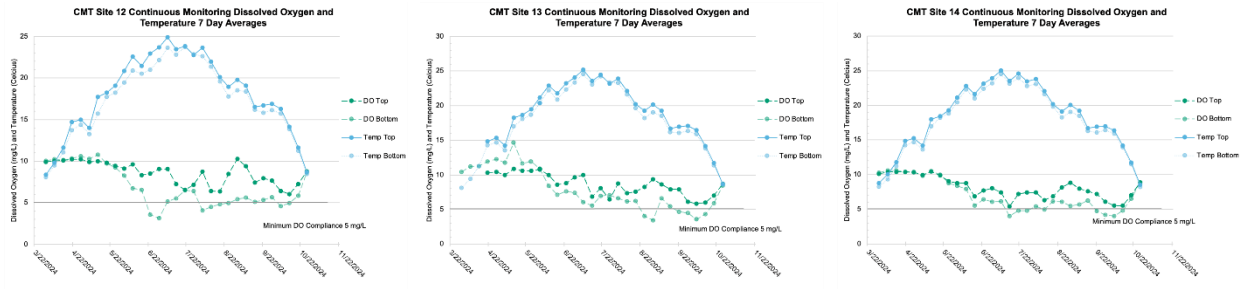


Figure 3-13. 2024 DO and Temperature top and bottom water column for 2022 Triclopyr UV-C Combo Sites 12, 13, and 14 [Note: Site 12 received UV-C treatment in 2024 only.]

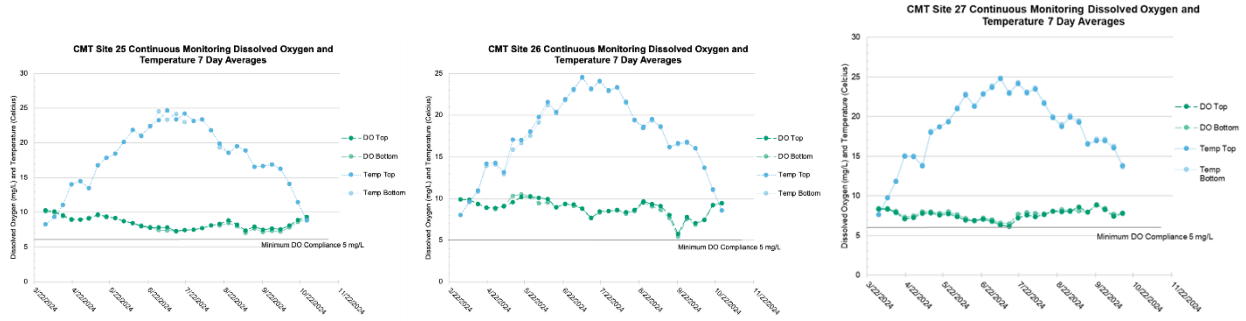


Figure 3-14. 2024 DO and Temperature top and bottom water column for LFA Sites 25, 26, and 27.

4.0 YEAR 3 GROUP B UV-C METHODS: NUTRIENT SUMMARY

Three types of "Group B" treatments were used in 2024: UV-C Spot treatments, BB, and DASH. These methods are described in detail in the Annual Report – Year 2 and Year 2 Efficacy Report. This section focuses on nutrient monitoring associated with the 2024 UV-C Spot treatment sites, compared with nutrients in Control sites.

In the following graphs, the yellow bar represents nutrient sampling within the specific UV-C Spot treatment site, and the other blue bars represent mean values of Control Sites 16, 17, and 18. Only Total P and Total N are presented here. All sampling data and graphs are available in Appendix Q. Directory of Tabular Data. Generally, UV-C treatments had variable effects on nutrient levels, including some elevated levels of Total N and Total Phosphorus. As in Year 1 and Year 2, nutrient levels in treatment and Control sites were consistently above target Lake Tahoe levels (WQOs) as indicated with gray lines on the graphs that summarize nutrient data.

4.1 Nutrients Associated with UV-C Spot Treatments in 2024

4.1.1 Sites 1, 2, and 3 (2022 Endothall UV-C Spot Treatment Sites)

The major trend in Total N and Total Phosphorous is that the UV-C Spot treatments in 2024 had variable effects on Total N, but appeared to have been associated more consistently with elevated Total P when compared with Control site levels (Figures 4-1 through 4-6). Elevated nutrient levels may be a result of decomposing UV-C exposed plants that had recovered between each UV-C treatment. The 2 to 4 weeks intervals between repeated UV-C treatments could provide sufficient recovery time for plants to begin to re-grow.

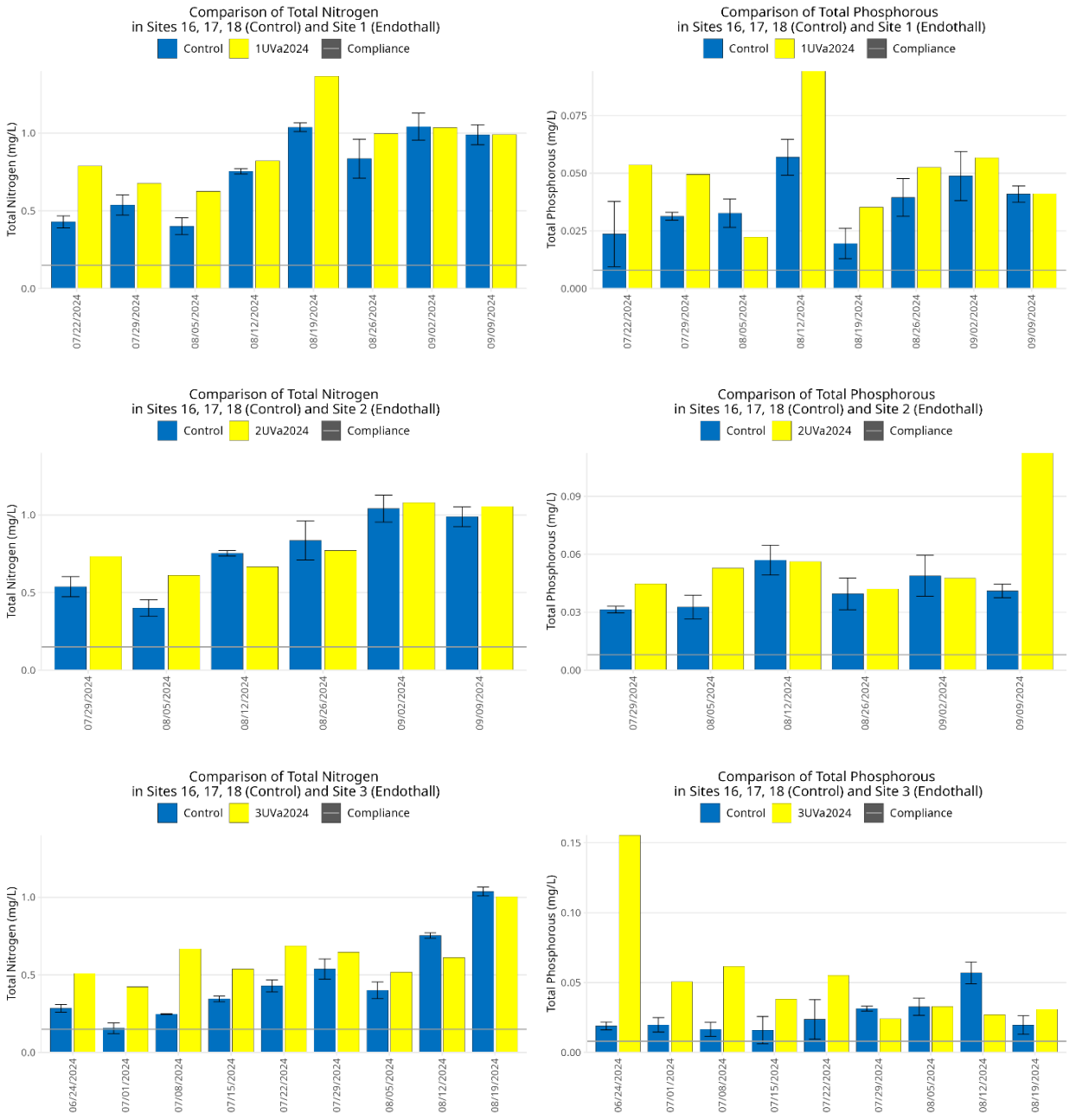


Figure 4-1. 2024 Total N and Total P in UV-C Spot areas at CMT 2022 Endothall Only Sites 1, 2, and 3 Blue bars are Control sites; Yellow bars are UV-C Spot areas.

4.1.2 Sites 5 and 9 (2022 Triclopyr Applications and 2024 UV-C Spot Treatment)

Elevated nutrient levels in Triclopyr Sites 5 and 9 were seen during 2022, but not as high as in Endothall Only Sites 1, 2, and 3, probably due to the selective control of Eurasian watermilfoil that left Coontail and some Curlyleaf pondweed intact. UV-C Spot treatments in 2024 at Sites 1, 2, and 3 showed elevated Total N and Total P levels. For example, in Site 5, Total N was over twice the level as in Control sites (Figure 4-2). In contrast to Site 5, Total N levels in Site 9 UV-C Spot treatments were not significantly elevated, but Total P was elevated in Site 9 (Figure 4-3).

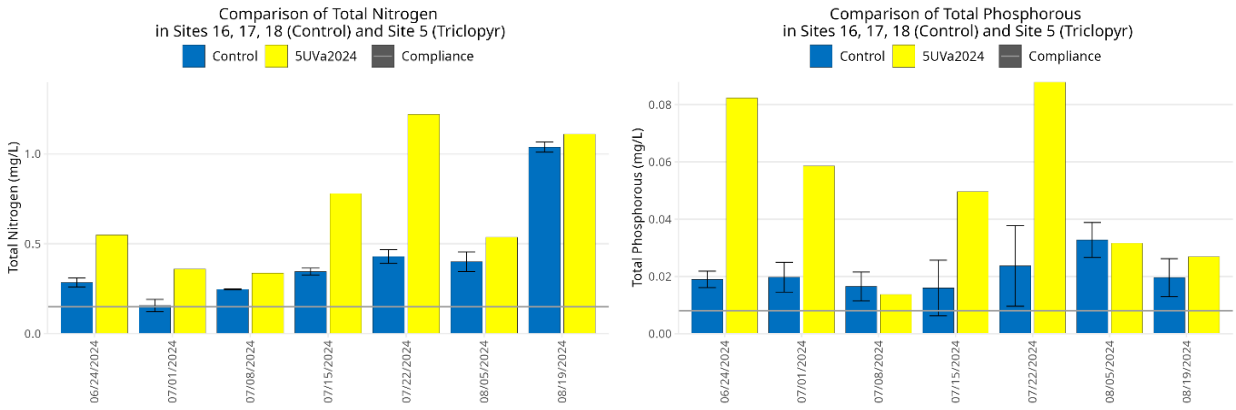


Figure 4-2. 2024. Total N and Total P in UV-C Spot area at 2022 Triclopyr Site 5.

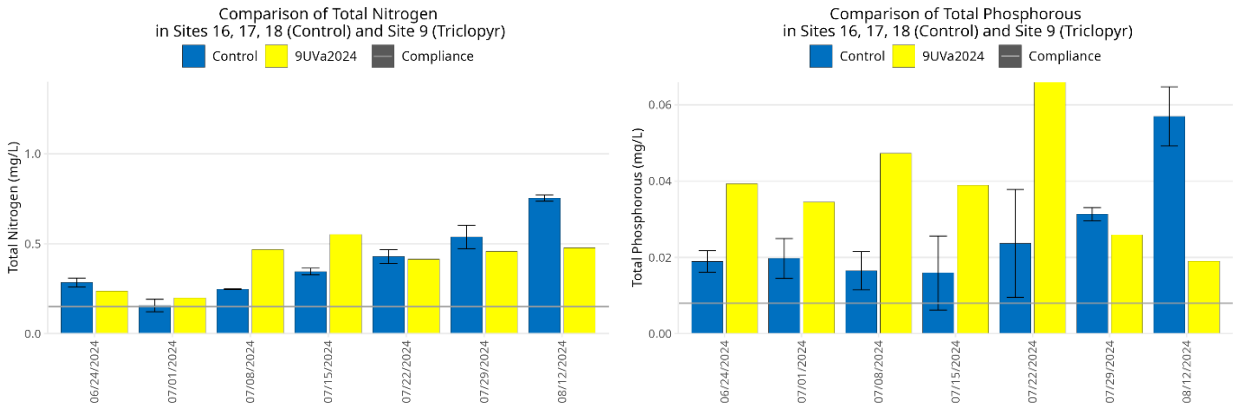


Figure 4-3. 2024 Total N and Total P in UV-C Spot areas at 2022 Triclopyr Only Site 9.

4.1.3 Site 26 (LFA UV-C Spot Treatment)

Fewer nutrient samples were taken in 2022 per protocol for LFA sites. The 2024 data shows that the UV-C Spot treatments had no effect on Total N or Total P levels compared with Control sites in 2024. The nutrient levels were lower than controls in 2022 but were similar to controls in 2023 (Figure 4-4).

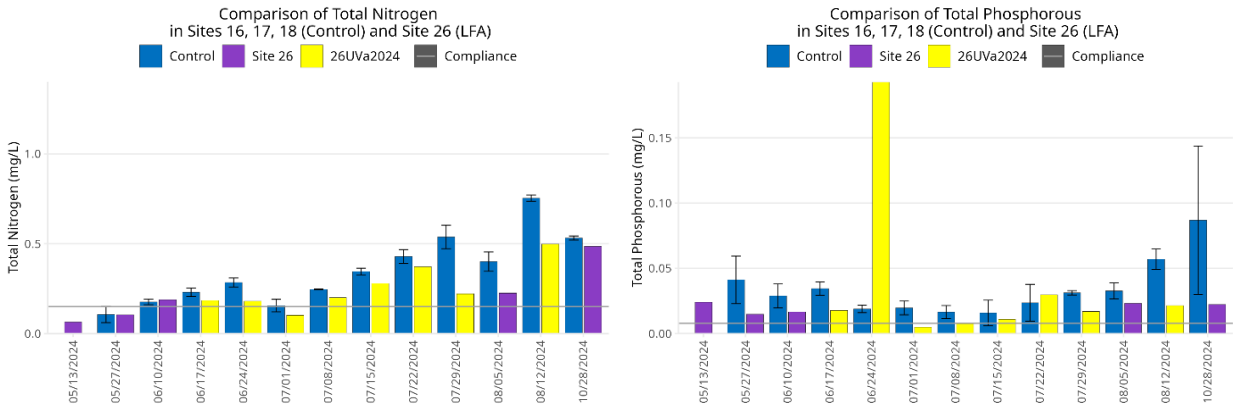


Figure 4-4. 2024 Total N and Total P in UV-C Spot/LFA area Site 26.

4.2 Nutrients Associated with Continuation of UV-C Group A methods (Whole site treatments and mid-channel only UV-C Combo Treatments)

UV-C Only treatments of entire sites began in 2022 and were continued in 2023 and 2024. However, UV-C treatments planned for the mid-channel areas of UV-C Combo sites were delayed until 2023. Therefore, the nutrient data associated with UV-C Combo treatments only pertains to 2023 and 2024.

4.2.1 Nutrients Associated with UV-C Only Sites

Monitoring for nutrients in UV-C Only sites (Sites 22, 23, 24) was scheduled based on UV-C treatment dates and typically began within 10-14 days after treatments ended. The following graphs show Total N and Total P. Other variables were measured, and that data is provided in Appendix Q. In UV-C Only Sites 22, 23, and 24, variable increases in Total P were seen at some sampling times in 2024 (Figures 4-5, 4-6, 4-7). Total P appears to be the nutrient most consistently increased by UV-C treatments even though the changes are highly variable over the treatment periods. As noted before, the gray lines on the graphs denote the WQOs.

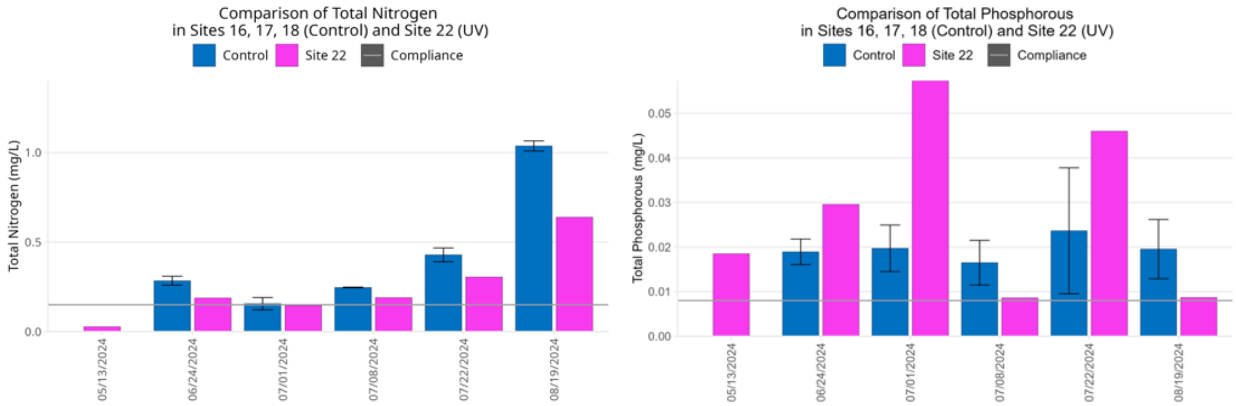


Figure 4-5. 2024. Total N and Total P in UV-C Only Site 22.

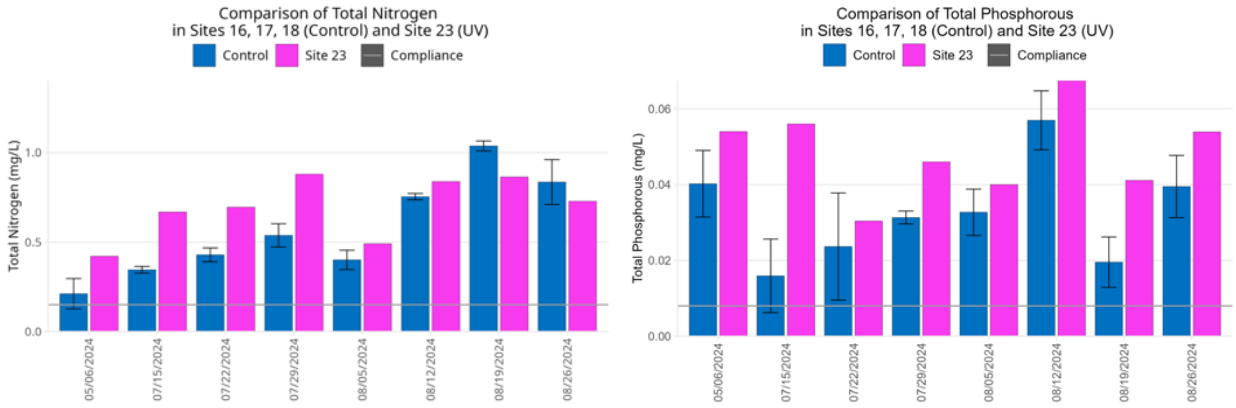


Figure 4-6. 2024. Total N and Total P in UV-C Only Site 23.

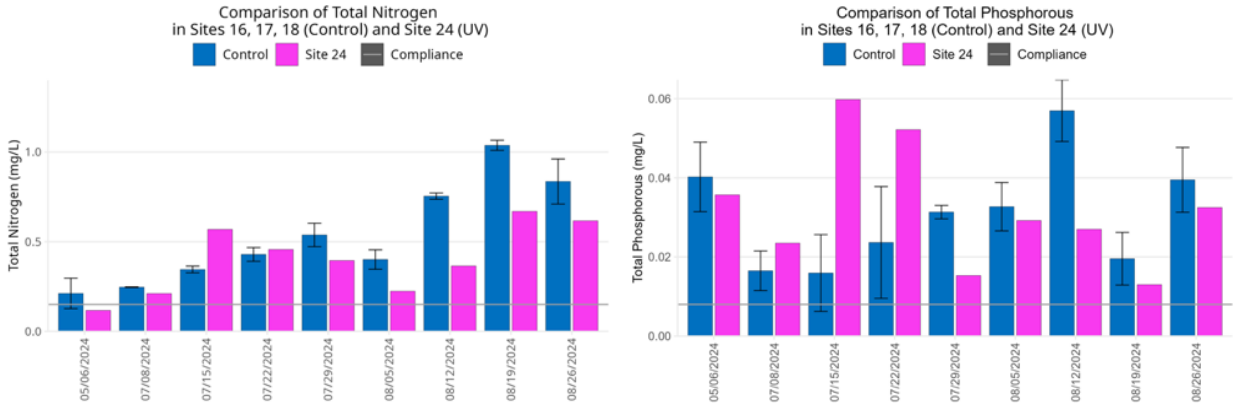


Figure 4-7. 2024. Total N and Total P in UV-C Only Site 24.

4.2.2 Nutrients in LFA Sites 25, 27

LFA is intended to reduce the availability of nutrients and thereby reduce the growth of algae (HABs) and potentially reduce availability of nutrients for AIP growth. Neither LFA Site 25 nor LFA Site 27 had a consistent effect on Total N or Total P in the water column (Figures 4-8 and 4-9). However, LFA Site 26 appears to have shown slightly reduced Total N and Total P (Figure 4-4).

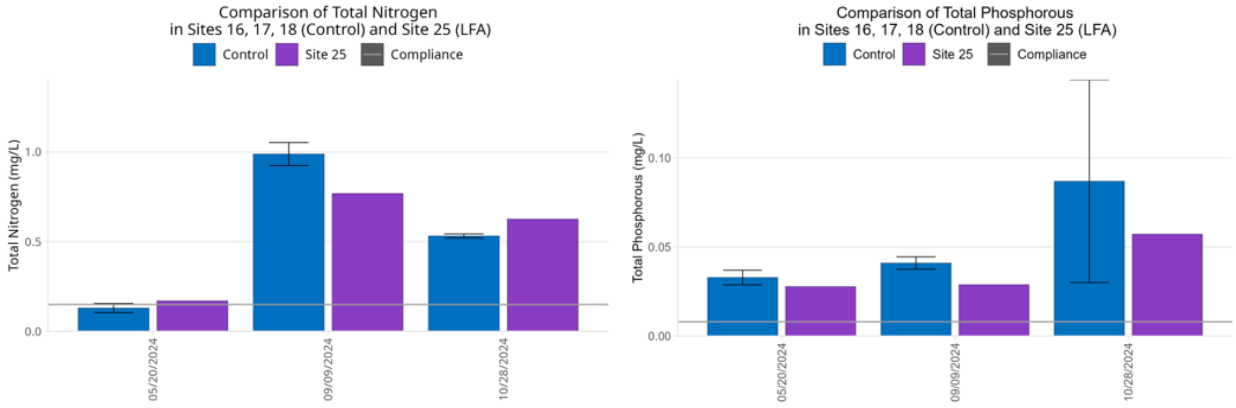


Figure 4-8. 2024. Total N and Total P at LFA Site 25 (West Lagoon).

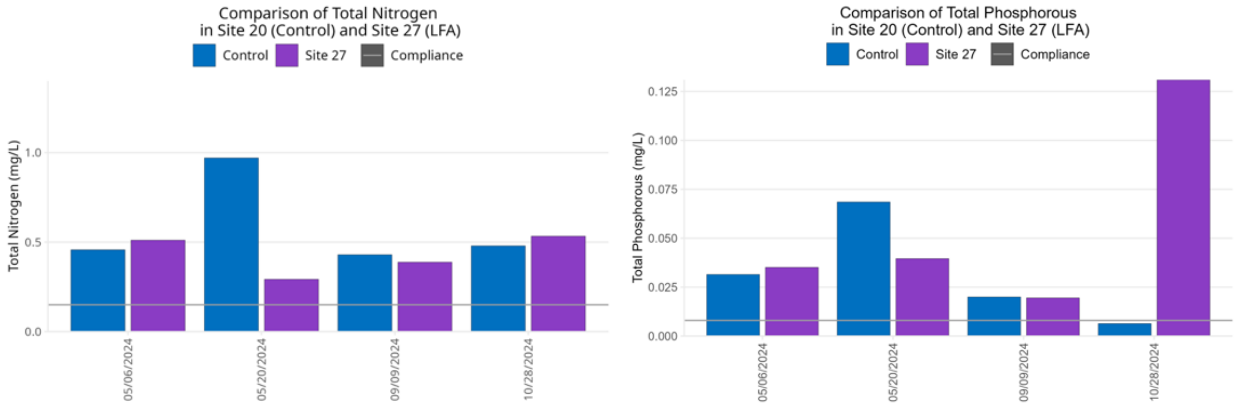


Figure 4-9. 2024. Total N and Total P at LFA Site 27 (Lake Tallac).

4.2.3 Nutrients in UV-C Combo (2022 Herbicide Applications) and Sequential UV-C (Post BB Removal) Sites

In 2022, UV-C treatments of designated “Combination herbicide and UV-C treatments” sites were not initiated due to lack of access for the UV-boats to these sites until early fall. Therefore, Year 2 (2023) was the first year in which UV-C was used at the UV-C Combo sites. However, UV-C was only used in the mid-channel areas of the UV-C Combo sites. Therefore, Year 3 (2024) was the second year that UV-C was used in these sites in mid-channel areas (dock end to dock end, not shore-to-shore). The only shoreline CMT treatments were localized herbicide application (Endothall or Triclopyr) made in 2022 (see Annual Report – Year 1).

The data in Figure 4-10 through Figure 4-14 summarize nutrient levels in the UV-C Combo sites and show that these treatments generally had no significant effect compared to Control sites on Total N except Site 11 and initially at Site 13. However, Total P was elevated in Sites 8, 10, and 11 in 2024, as well as initially at Site 13. Also, the Total N and Total P levels were above the WQO threshold in Control and UV-C Spot treatment sites.

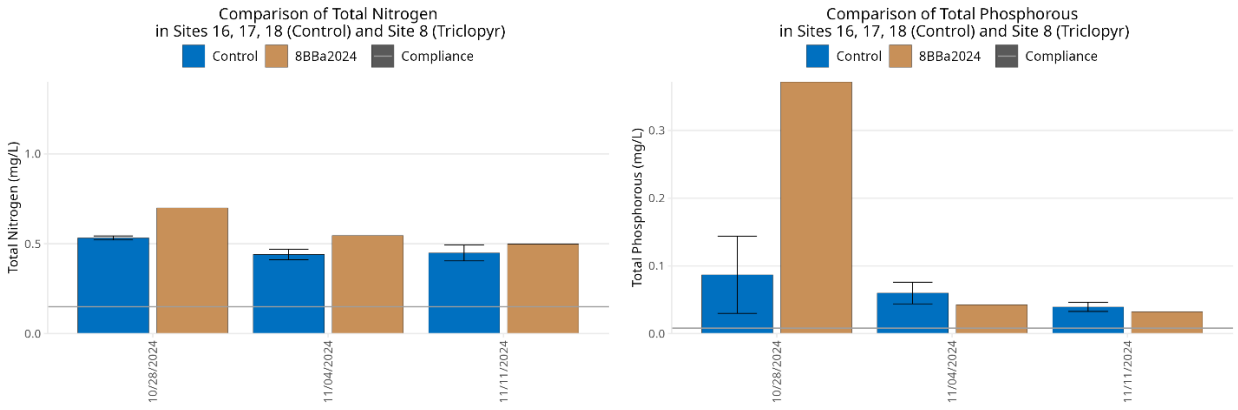


Figure 4-10. 2024. Total N and Total P in Site 8 after Sequential UV-C treatments following Bottom Barrier Removal. [Note: Dark tan bars show nutrients in the water column above the area where Sequential UV-C treatment was made.]

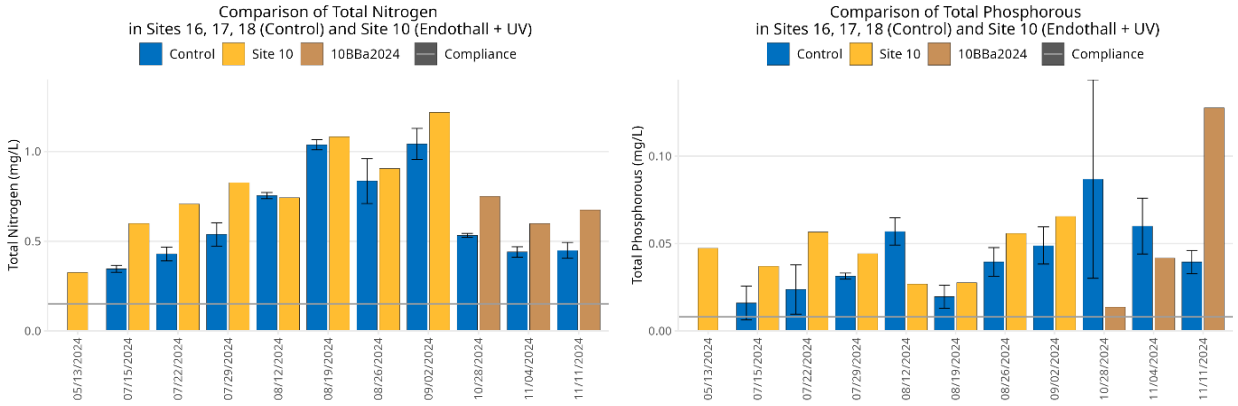


Figure 4-11. 2024. Total N and Total P in Combination UV-C Endothall Application (2022) Site 10. [Note: This is a continuation of a Group A UV-C method. Dark tan bars show nutrients in the water column above the area where Sequential UV-C treatments were made. Light tan bars show nutrients in water within the entire UV-C Combo Site 10.]

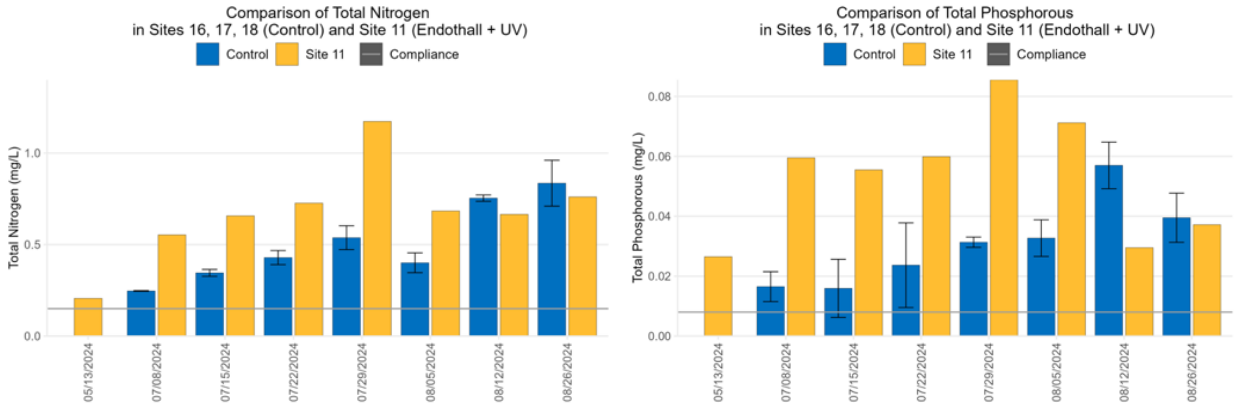


Figure 4-12. 2024. Total N and Total P in Combination UV-Endothall Application (2022) Site 11; continuation of Group A UV-C method.

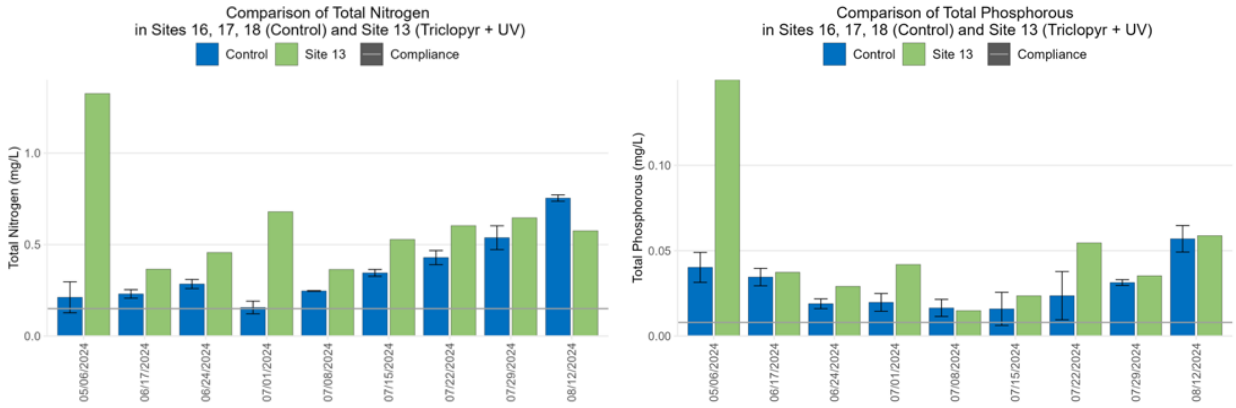


Figure 4-13. 2024. Total N and Total P in Combination UV-C Triclopyr Application (2022) Site 13; continuation of Group A UV-C method.

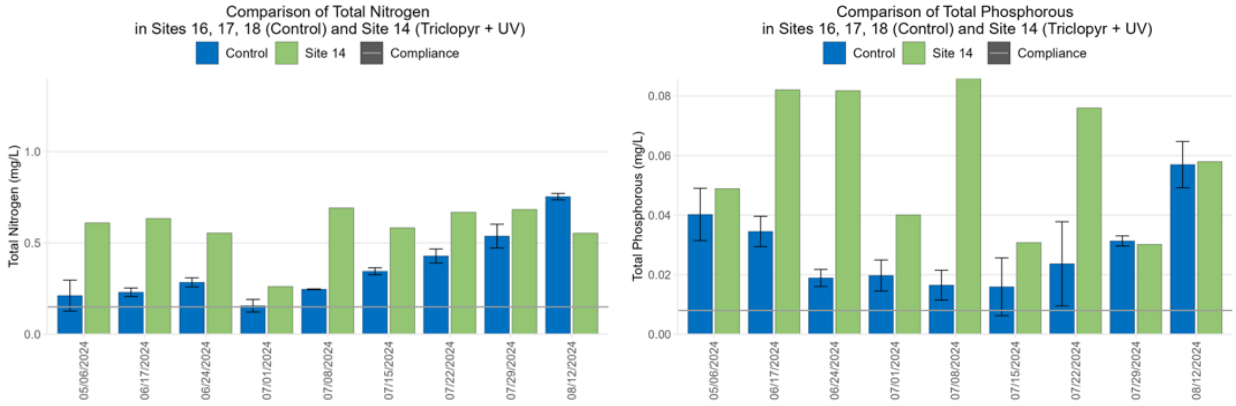


Figure 4-14. 2024. Total N and Total P in Combination UV-C Triclopyr Application (2022) Site 14; continuation of Group A UV-C method.

5.0 LFA TREATMENT SITES: MONITORING FOR CHANGES IN ORGANIC SEDIMENTS

LFA systems were installed in the Keys beginning in 2019 in Site 26 of the West Lagoon. The number of LFA sites increased to include Site 25 in the West Lagoon and Site 27 in Lake Tallac in 2022 (Figure ES-1). LFA is intended to reduce organic content ("muck" layer) in sediments and potentially reduce available nutrients that drive the growth of algae and cyanobacteria. Measuring the effect is difficult since the Keys lagoons have highly variable muck layers. This section of the report describes new approaches taken to determine if LFA reduces organic matter or is associated with reduced nutrients (Appendix I). However, since the assessments of LFA on organic sediments will continue through spring 2025, the final report on LFA effectiveness will be submitted as a supplementary report in June of 2025.

5.1 Use of "Sediment Target" Plates

The LFA system is designed to increase DO at the sediment/water interface and thereby accelerate degradation of accumulated sediment (muck). However, measuring unconsolidated sediment (muck) levels is problematic because the depth of this material is highly variable in the Keys lagoons and can be affected by boating and water currents, and often the "bottom" of the muck is difficult to determine reliably.

5.1.1 Purpose of the Sediment "Target"

The installation of fixed point (anchored) sediment collection "targets" provides a sampling area that can be repeatably observed by divers to determine how much sediment accumulates over several months or years. The intent of these installations was to detect changes in sediment using the hydroacoustic scanning system (Lowrance) or divers who could measure the sediment deposited on the targets. In addition, sediment mesh bags and staff gauges were installed as supplemental tracking methods to try to assess the effects that LFA may have on organic sediment degradation.

5.1.2 Metal Sediment "Target"

Galvanized steel targets were constructed from the galvanized "pegboard" fully described in the Year 2 CMT Annual Report. The pegboards were anchored by galvanized steel legs (two legs per target).

5.1.3 Installation of Sediment "Targets"

Divers placed two sizes of targets in two different locations in LFA Site 26 on August 30, 2022, and carefully pushed the target plates into the muck to the approximate level of the existing sediment/ muck layer. This provides a "baseline" condition where the metal plate was at the sediment surface but was not covered with muck. The location of the plates is provided in the Year 2 CMT Annual Report. The locations of the metal targets are shown below in Figure 5-1.

5.1.4 Sediment Accumulation

The amount (inches) of accumulated sediment on the metal target plates was measured on September 29, 2023, thirteen (13) months after installation, and on October 23, 2024, twenty-seven (27) months after installation of the metal sediment target plates. For both target plates, there appears to be about 50% to 70% loss of accumulated sediment on the targets between 2023 and 2024. Since the target plates will remain in place through 2025, additional data will be

collected in 2025 and provided in subsequent supplemental reports on LFA effects. The data collected to date are summarized in Table 5-1.

Table 5-1. Accumulated Sediment on Metal Target Plates in LFA Site 26 after 13 and 27 Months

Target Plate Location				
Site 26 North	**Date Measured:**	**Sedimentation Time (months)**	**Inches of Sediment**	**Cubic Feet of Sediment per Sqft**
Size: 10.7 sqft	9/29/23	13	4.75	0.39
	10/23/24	27	2.5	0.21
Site 26 South				
Size: 5.3 sqft	9/29/23	13	7.25	0.6
	10/23/2024	27	2.25	0.19

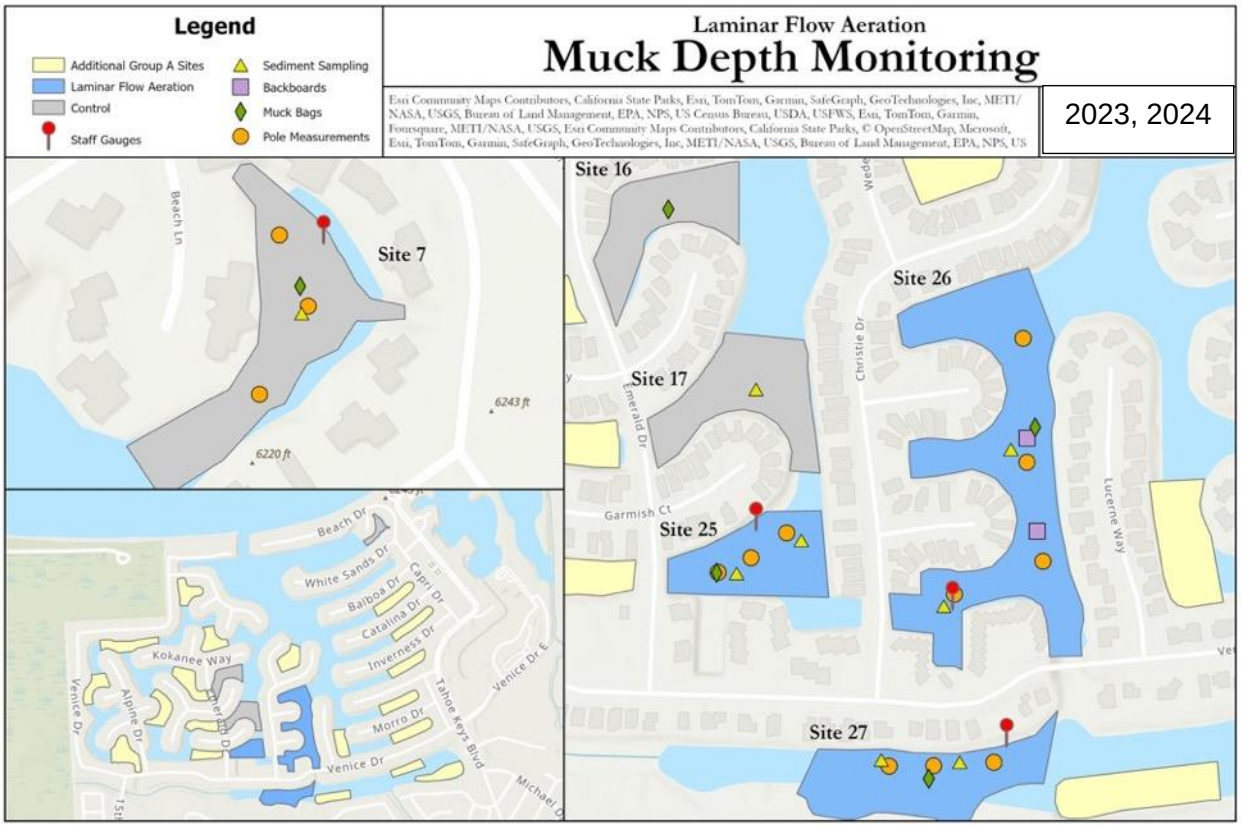


Figure 5-1. Location of Metal Sediment Target Plates, Sediment Mesh Bags, and Staff Gauges.

5.2 Use of Fine-Mesh Sediment Degradation Bags

As stated above, one of the primary goals of sustained use of LFA is to reduce the organic, sediment (muck) layer in the Tahoe Keys lagoons. Reduction of the muck organic matter (OM) and the potential reduction of sediment-available nutrients (N, P) could reduce the frequency and occurrence of Harmful Algal Blooms and possibly reduce Aquatic Invasive Plant (AIP) biomass. The deployment and twice-per year sampling and sediment analysis of fine mesh bags containing native organic sediments was fully described in the Year 2 CMT Annual Report.

In 2024, additional replicated mesh bag samples were retrieved and their contents analyzed for percent organic matter and nutrients as in Year 2 of the CMT. The list of mesh bags and their contents is provided in Table 5-2.

The sediment contents analysis is summarized in Figure 5-2. The percent organic matter was similar between sampling dates (4% OM). However, two changes were observed in mesh bag analysis: Absence of ammonia and reduced Total N in bags sampled in the fall. The presence of ammonia in spring may be due to over-wintering conditions: low DO and low biological activity. Similarly, the lower Total N in the fall may be due to microbial processes throughout the warmer summer months. Since this assessment of LFA effects will be continued through 2025, further results will be provided in a supplemental LFA report.

Table 5-2. Muck Bag Weight and Color Codes

Muck Collection Date	Site	Color Code	Volume (mL)	Weight (g)	Installation Date	Installed By
10/23/2023	26	Green	400	440	10/24/2023	MH, LA, KT
10/23/2023	26	Green	400	420	10/24/2023	MH, LA, KT
10/23/2023	26	Blue	400	480	10/24/2023	MH, LA, KT
10/23/2023	26	Blue	400	460	10/24/2023	MH, LA, KT
10/23/2023	26	Red	400	400	10/24/2023	MH, LA, KT
10/23/2023	26	Red	400	400	10/24/2023	MH, LA, KT
10/23/2023	25	Green	400	460	10/24/2023	MH, LA, KT
10/23/2023	25	Green	400	460	10/24/2023	MH, LA, KT
10/23/2023	25	Blue	400	460	10/24/2023	MH, LA, KT
10/23/2023	25	Blue	400	460	10/24/2023	MH, LA, KT
10/23/2023	25	Red	400	440	10/24/2023	MH, LA, KT
10/23/2023	25	Red	400	440	10/24/2023	MH, LA, KT
10/23/2023	27	Green	400	460	10/24/2023	MH, LA, KT
10/23/2023	27	Green	400	460	10/24/2023	MH, LA, KT
10/23/2023	27	Blue	400	460	10/24/2023	MH, LA, KT
10/23/2023	27	Blue	400	480	10/24/2023	MH, LA, KT
10/23/2023	27	Red	400	480	10/24/2023	MH, LA, KT
10/23/2023	27	Red	400	480	10/24/2023	MH, LA, KT
10/23/2023	7	Green	400	460	10/24/2023	MH, LA, KT
10/23/2023	7	Green	400	460	10/24/2023	MH, LA, KT
10/23/2023	7	Blue	400	420	10/24/2023	MH, LA, KT
10/23/2023	7	Blue	400	440	10/24/2023	MH, LA, KT
10/23/2023	7	Red	400	460	10/24/2023	MH, LA, KT
10/23/2023	7	Red	400	440	10/24/2023	MH, LA, KT
10/23/2023	16	Green	400	440	10/24/2023	MH, LA, KT
10/23/2023	16	Green	400	420	10/24/2023	MH, LA, KT
10/23/2023	16	Blue	400	440	10/24/2023	MH, LA, KT
10/23/2023	16	Blue	400	460	10/24/2023	MH, LA, KT
10/23/2023	16	Red	400	420	10/24/2023	MH, LA, KT
10/23/2023	16	Red	400	460	10/24/2023	MH, LA, KT

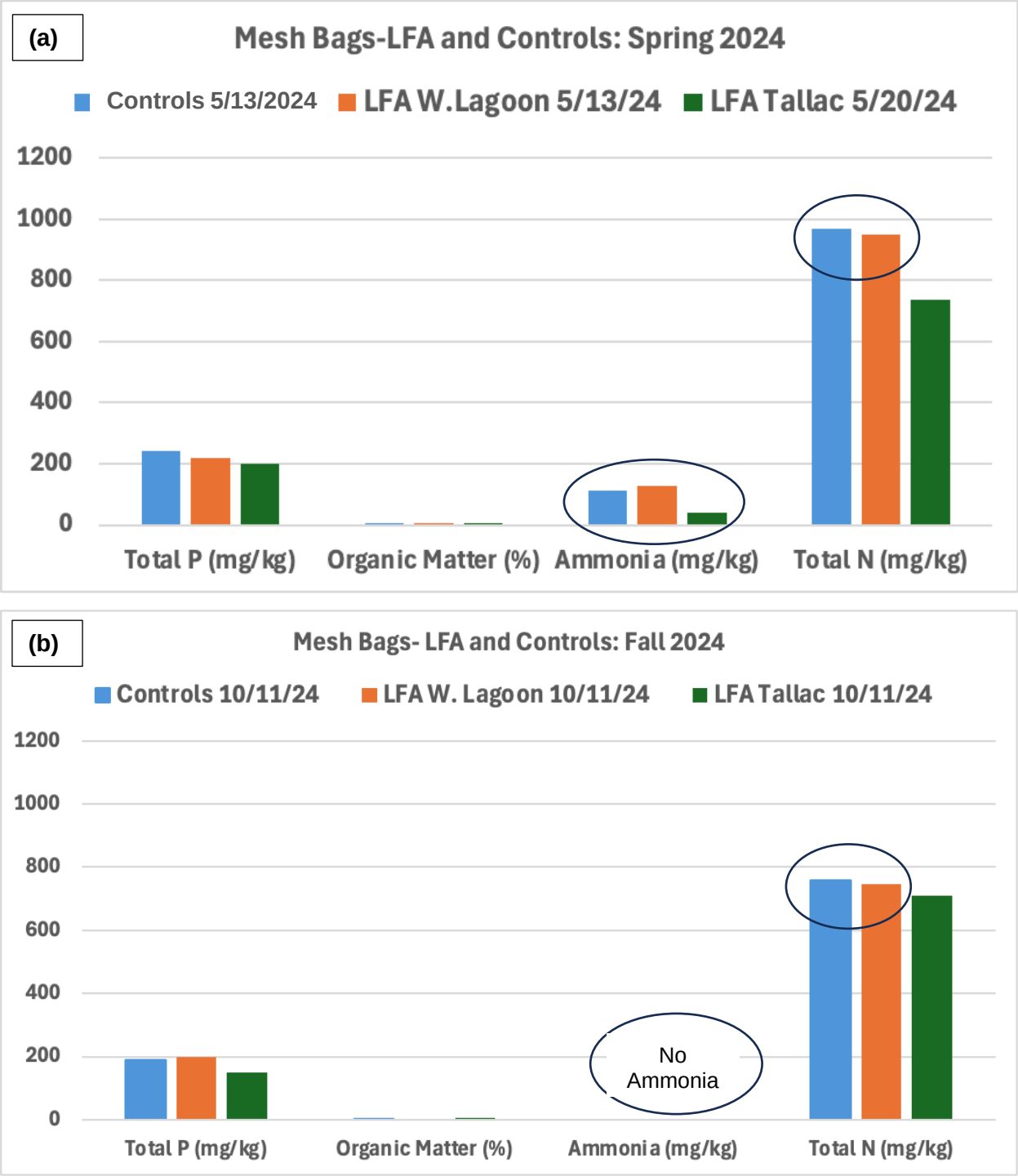


Figure 5-2. 2024. Analysis of Mesh Bag contents in LFA and Control sites in Spring (a) and Fall (b) [Note: Circles indicate significant changes in levels of ammonia and Total N between Fall and Spring.].

6.0 EXAMPLES OF 2024 GROUP B TREATMENTS EFFECTS ON AIP

The details of AIP and native plant occurrences and abundance are provided in the CMT Year 3 Appendix E. However, some examples of this data are instructive and help provide an initial overview of the status of target AIP in the third year of the CMT. The metric used is RF, which is a ranking of the amount of all plants on a single rake sample. Usually, 30 rake samples were taken every 14 days in each CMT site. When Group B methods were applied early and frequently, they were found to reduce AIP abundance within the treated areas.

6.1 UV-C Only Sites 22, 23, and 24

Early and frequent use of UV-C can significantly reduce AIP abundance. If repeated UV-C treatments are delayed too long (for example several weeks), then plants may recover or the treated site may be re-infested by adjacent plants or by plant fragments. Figure 6-1 shows the effects of UV-C Only treatments on AIP where blue bars are untreated reference Control sites and purple bars show RF where UV-C treatments were made.

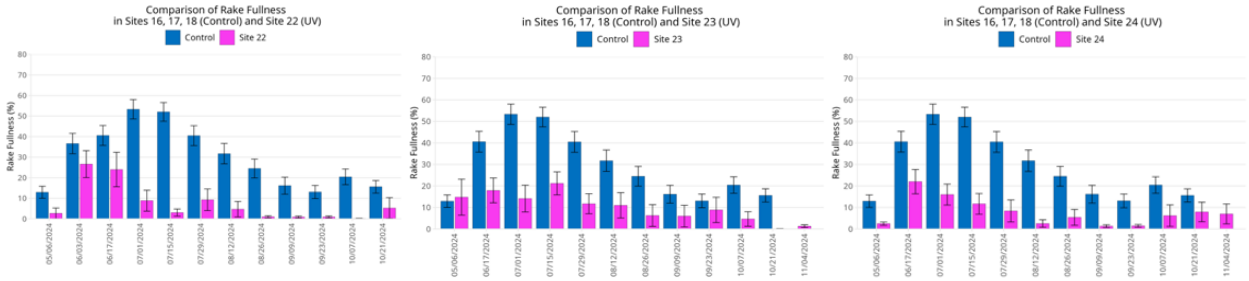


Figure 6-1. 2024 Effect of UV-C Only treatments on abundance of AIP.

6.2 UV-C Spot Treatment in LFA Site 26

LFA alone had no effect in reducing AIP, but LFA sites also exposed to UV-C showed much lower AIP abundance. Figure 6-2 compares RF within Site 26 LFA treatment areas, and LFA Site 26 with UV-C Spot treatments to Control sites RF. UV-C treated areas were almost consistently lower in AIP abundance than Control or UV-C untreated areas of Site 26.

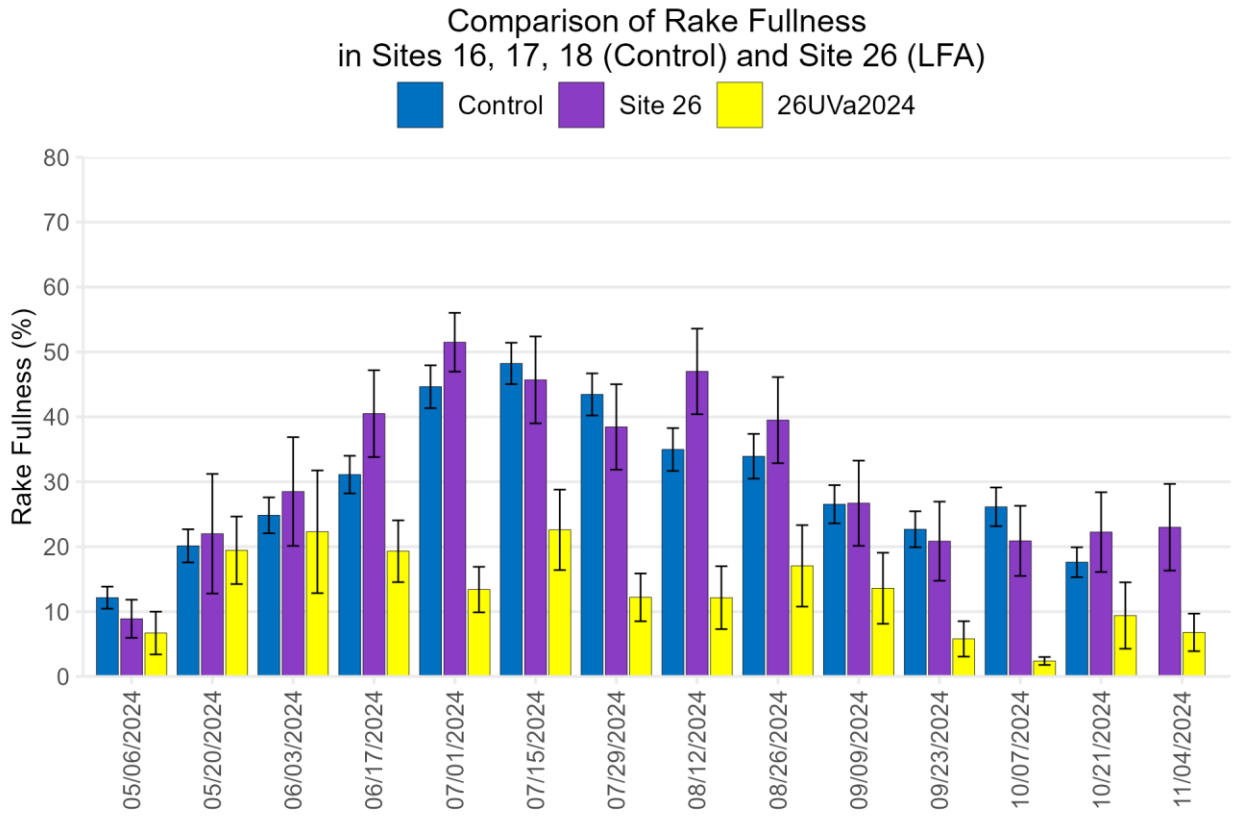


Figure 6-2. RF in LFA Site 26 in which a large area was exposed to UV-C Spot treatments.

6.3 DASH Treatments in Sites 13,14, 11

From July to November, DASH reduced AIP abundance by 75 to 90% compared to Control sites and compared to areas within these sites where DASH was not used.

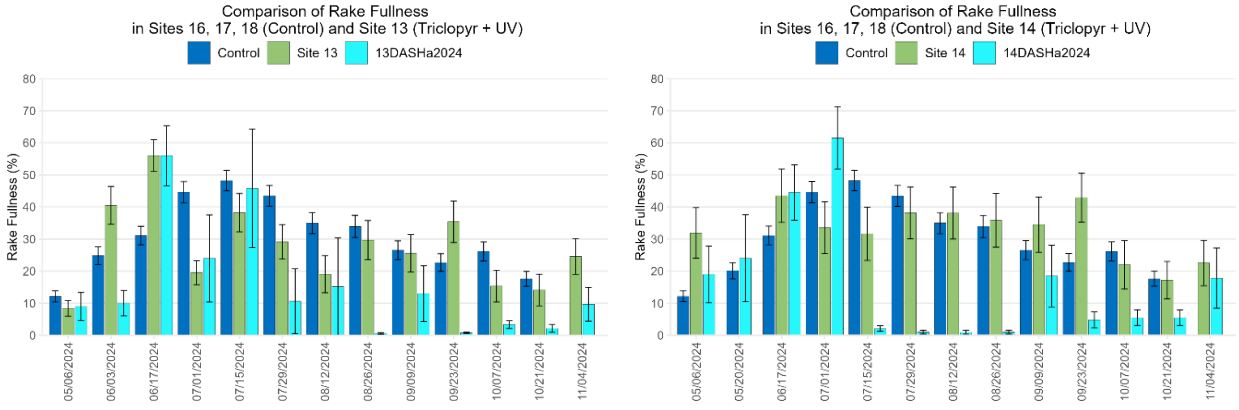


Figure 6-3. 2024 Effectiveness of DASH on AIP abundance in UV-C Combo sites. Note: DASH started 7/17 in Site 13 and the first post-DASH rake sample was 7/29. DASH started 7/15 in Site 14 and the first post-DASH Rake was the same day (7/15).

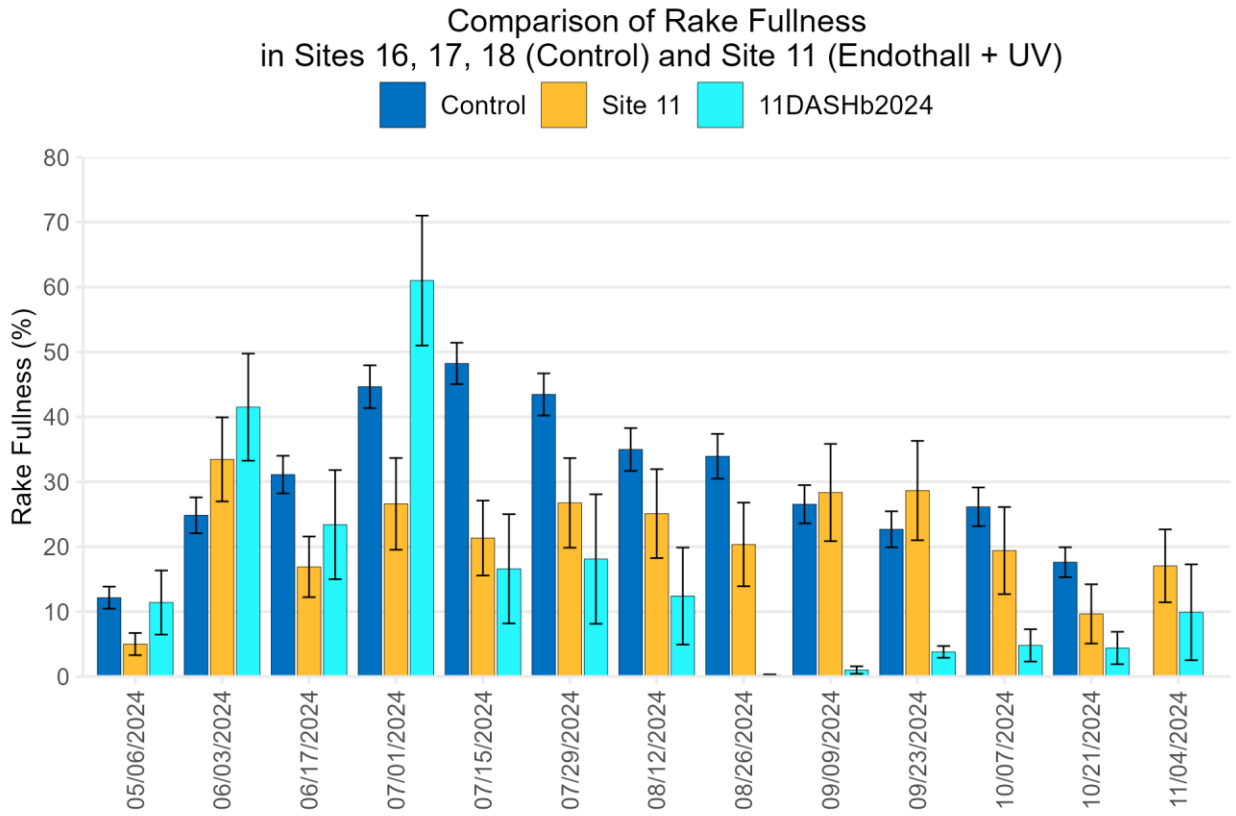


Figure 6-4. Effectiveness of DASH on AIP abundance in UV-C Combo Site 11 in 2024. DASH started 7/8 and the first post-DASH rake sample was 7/15.

7.0 HAB MONITORING AND RESULTS

The protocols for HAB monitoring in 2024 were the same as in 2022 and 2023 and are described in the QAPP. Fewer instances of HAB detection and lower cyanotoxin levels were present in 2024 compared with 2022 and 2023. The complete HAB record and responses to monitoring results are provided in Appendix R. HAB Data. Proper signage was installed as needed in response to cyanotoxin levels (Table 7-1).

Table 7-1. Summary of HAB-Related Signage Postings

Date	Summary of Posting(s)
7/24/2024	- Large caution signs posted at 15th street, Tahoe Keys Blvd, Beach and Harbor, and kayak launches - Small caution signs posted around Sites 13, 25, and 26 - Warning signs posted around Site 5 after Lahontan lab analysis results warranted “Warning” level public notices
11/4/2024	Due to results indicating non-detection + no visual HABs, all HAB signage was removed for winter

8.0 SUMMARY, IMPLICATIONS, AND RECOMMENDATIONS

(See Appendix E for details of efficacy results.)

8.1 Sustained Effects from Year 1 Group A Treatments

(1) Continued Group A methods and continued Group B methods were successfully implemented in 2024. New post-bottom barrier removal methods (Sequential DASH and UV-C Spot) were used to reduce re-growth or reinfestation of uncovered Bottom Barrier sites. Target AIP reductions achieved in 2022 with Group A herbicide treatments were mostly maintained into 2024 with follow-up Group B methods.

(2) Control of Eurasian watermilfoil was sustained in most of the original Endothall and Triclopyr sites. However, AIP generally were able to occupy nearshore areas not covered with water and not exposed to any CMT methods in 2022. Triclopyr applications appear to have been mostly effective in maintaining control of Curlyleaf pondweed into 2024 (e.g., Sites 8 and 9).

(3) UV-C Only methods were very effective in sustaining reduced AIP in 2024 in mid-channel areas due to early use and more frequent re-exposures to UV. Similarly, UV-C Spot treatments in mid-channel areas were effective, particularly when the areas were large (e.g. Sites 5 and 26). However, lack of access to, and control of shoreline areas with UV-C enables constant AIP infestations of nearshore areas and a continuing source of re-infestation of large, deep, mid-channel areas.

(4) As a continued Group A method, LFA had no effect on reducing AIP as noted in prior years' reports.

(5) The mobility of Coontail resulted in its expansion into previously treated areas and to occupy more of the vertical water column habitat. When Coontail is included in AIP biovolume, its high abundance and prevalence overshadows reductions in other AIP such as Eurasian watermilfoil and Curlyleaf pondweed. Assessment of efficacy must be based not only on AIP abundance but also on the responses of each target species to different control methods.

(6) Deeper water in 2024 (as in 2023) decreased light levels in deep areas and reduced some AIP abundance but also increased the advantage for Curlyleaf pondweed to outcompete for available light and habitat due to its early season 2024 'head start' on growth. Deeper water also appeared to favor expansion and abundance of Curlyleaf pondweed through the proliferation of fall-sprouted turions.

(7) DASH had variable effectiveness from good to partial control, which may be due to the combination of limited diver visibility and proximity of AIP re-infestation sources.

8.2 Nutrient Levels

General trends were observed in nutrient levels during Year 3 of the CMT:

(1) In 2024 (as in 2022 and 2023), all CMT sites including Control sites exceeded WQOs for Total N and Total P. UV-C Spot treatments generally had variable effects on nutrients, including some instances of elevated Total P levels.

(2) UV-C Only treatments in Sites 22, 23 and 24 also were associated with variable increases in Total N and more consistent, though transient increases in Total P.

(3) Most sites had periods of increased Total N in July, including Control sites.

(4) Most sites had an increase in Total N in the fall, aligning with plant senescence

8.3 Water Quality

The most consistent observed patterns in water quality included:

(1) Similarity in temperature values and patterns in 2022, 2023, and 2024 despite four feet deeper water in 2023, and an additional one-foot increase in water depth in 2024 (almost 5 feet total increase from 2022 to 2024).

(2) Turbidity was generally lower in 2024, but elevated levels were observed in mid-summer and late fall. Four instances of elevated turbidity occurred 24-hours post DASH treatment; however, follow-up measurements were taken until turbidity returned to pre-treatment conditions. No instances of elevated turbidity occurred in Bottom Barrier sites.

(3) DO was lowest in all bottom (near sediment) zones and was lowest in Lake Tallac during periods in which water was stratified (deep, cold water not mixing with higher DO surface water). This also occurred in 2023. However, LFA in Lake Tallac (Site 27) mitigated the low DO and in general provided a uniform mixing of the water column compared to areas not exposed to LFA.

(4) pH was elevated above WQOs due to plant growth, but maximum pH was lower in 2024, perhaps due to less aquatic plant abundance in 2024 in successfully treated areas (Year 1 herbicides, and Years 2 and 3 UV-C, Bottom Barriers, or DASH).

(5) LFA sites in the West Lagoon (i.e., Sites 25 and 26) had more stable DO and a more uniform temperature throughout the water column due to mixing driven by air-bubbling systems.

(6) UV-C did not affect water quality variables when compared with Control sites.

9.0 SUMMARY OF BMPS

9.1 Introduction and Context for BMPs for CMT Year 3 (2024)

Year 3 of the CMT focused on using non-herbicide “Group B” methods (BB, UV-C Spot treatments and DASH). Treatments in Year 3 also included continued use of Group A UV-C “full site” treatments and LFA. BMPs for these continued actions were the same as described for Year 1. The implementation of Group B methods BMPs and the associated monitoring for treatments newly employed in Year 3, or modified from Year 2 BMPs, are described in the following sections. All associated BMPs related to diver safety and field preparations were employed as in Year 2. As in Years 1 and 2, all treatment and monitoring activities were thoroughly coordinated and continually updated through weekly meetings of the Monitor Working Group (MWG). (Records of these meetings are provided in Appendix G).

9.2 Monitoring Activities Identical to Those Conducted in Year 1

For water quality monitoring (Temperature DO, pH, Turbidity, Conductivity, nutrients levels), BMPs documented in Year 1 were applied (see Appendix A). These BMPs included equipment calibrations, cleaning between sample sites or sample stations, coordination of monitoring crews and monitoring of fixed buoy locations and conditions. However, BMPs associated with Year 1 herbicide applications and herbicide/degradant and Rhodamine water tracer dye (RWT) monitoring were not applicable since no herbicides or RWT were used in Year 3.

9.3 Monitoring Activities Specific to Year 3 (Group B Methods Use)

For the implementation of Group B Methods, additional or modified monitoring activities and associated BMPs were used. Two specific additional monitoring activities were conducted in 2024 associated with Post-Bottom Barriers Removal “Sequential” UV-C and DASH treatments. When UV-C was used, water samples for nutrient analysis were taken after the Sequential UV-C treatments. During the Sequential DASH treatments, turbidity was measured to document if DASH elevated the turbidity in the original BB site.

9.4 Turbidity Measurements During DASH

Diver schedules were communicated with TKPOA monitoring crews to ensure that the baseline turbidity was recorded before DASH was started and continued monitoring results were relayed to divers and their support crew. A safe distance of 25 feet was maintained between DASH activity and monitoring to protect divers. Data and field forms were uploaded to Dropbox generally within 48 hours after completion of monitoring for each DASH event (i.e., for each DASH area).

9.5 Turbidity Measurements During Installation/Removal of BB

The BB dive crew provided the installation and removal schedules so that the TKPOA monitoring crews could obtain baseline turbidity (pre-installation and pre-removal) levels. Monitoring crews maintained 25 feet from diver activity to protect divers. Monitoring crews maintained communication with the dive crews so that, in the event of unacceptable increases in turbidity, dive activity could be paused. Dive crews notified and recorded the time when installation or removal activity was completed so that the monitoring crews could complete required turbidity measurements at the appropriate time intervals. Data and field forms were uploaded to Dropbox generally within 48 hours after completion of monitoring for each install or removal event.

9.6 Nutrient Sampling Following UV-C Spot Treatments

ESA monitoring crews were provided with the schedules for UV-C Spot treatments at least a week before treatments were started and ESA was notified when treatments ended so that water sampling for nutrients could be conducted as required. The records of UV-C Spot treatment dates, nutrient sampling dates and field forms were uploaded to Dropbox folders within 48 hours after completion of sampling in a day.

9.7 Macrophyte Surveys for Group B Treatments

Physical rake sampling BMPs were modified from Year 2 for the following reasons: (a) to ensure that adequate numbers of samples were taken in the relatively small Group B treated areas; and (b) to confirm that rake samples were taken accurately in the relatively small Group B areas. In addition to GPS-referenced boundaries, landmarks were also used to identify Group B areas. In Year 1, thirty (30) rake samples were taken in each CMT site at each sampling date; in Year 2, the number of rake samples taken within each Group B area increased (number per sq. ft) to provide representative data in these “sub-sites”, but a minimum of 4 rakes samples were taken regardless. The total number of samples in the overall CMT site was maintained at 30; therefore, outside the Group B treated area, the remaining number of samples per date was 30 minus the number of samples taken directly in the Group B area. For example, if 7 rake samples were taken within the Group B area, then 23 samples were taken within the rest of the Site outside the Group B area.

9.8 Photosynthetically Active Radiation (PAR) (Light Levels)

The instrument and spherical detector used to measure PAR are very sensitive to changes in incident natural light, such as variations caused by shadows, the angle of the sun, and the orientation of the PAR detector. To minimize the effects of these variables, the TKPOA crew conducted PAR monitoring within a 4-hour window around mid-day and carefully avoided shadows created by their boat by: 1) inserting the detector at the “sunny” side of the boat; 2) when possible, by avoiding sampling on days with patchy cloudiness; and 3) avoiding shadows from overhanging trees or shrubs. The PAR detector was mounted on a weighted frame to maintain correct and consistent orientation during measurements taken at 0.5 m depth intervals. To ensure consistent depth intervals, the cable supporting the detector system was marked in 0.5 m intervals (or finer increments). PAR data was uploaded to Dropbox within 48 hours after monitoring events.

9.9 Analysis for Nutrients in Sediment Used to Fill Fine-Mesh “Muck Bags” within LFA and Control Sites

TKPOA crews wore rubber or latex gloves to keep the muck samples free from the introduction of foreign materials. Multiple samples were collected in Control Site 16 using a Petite Ponar. The multiple muck samples were composited the same day using a small, pre-cleaned “cement” mixer to provide a more uniform source of “muck” used to fill each mesh bag. A consistent volume of muck (400 ml) was inserted in each muck bag and each bag was weighed and weights were recorded. Before weighing, the digital scale was tared to zero with an empty muck bag. Sets of bags intended to be anchored near the bottom of each LFA and Control site were color coded with zip-ties. Sub samples of the composited muck were placed in pre-labeled glass containers and shipped to a contract laboratory for analysis of nutrients and percent organic matter. Samples that were not shipped the same day were stored at 37 ^{o}C in the dark and shipped within 48 hours. Proper COCs accompanied the shipments.

9.10 BMPs Employed During Group B Treatments

9.10.1 DASH

Diver crews verified the coordinates of each DASH area by GPS locations and by landmarks. Divers reduced personal contact with the bottom and anchored barriers mainly by weights to minimize physically disturbing sediments. During DASH treatments, plants and plant fragments hand-removed by divers were carefully directed into the suction system, which deposited them into 3 mm large mesh bags ("socks") sealed around the outflow of the system. This mesh size was sufficient to trap small AIP fragments including turions produced by Curlyleaf pondweed. The capacity of the "sock' was continually observed, and DASH was temporarily paused while the "sock" was lifted, and its contents were deposited into 40-gallon containers. In addition, an onboard crew member continually removed "stray" floating fragments using a pole-mounted net (3 mm mesh). To ensure safety of divers, TKPOA installed signage on the Keys property and transmitted email updates to notify homeowners, renters, and visitors of the CMT activities. Owners of property within and adjacent to DASH and BB activity were notified directly in advance of these activities. Standard "Diver" warning signage was displayed, and boat crews were present to ensure the safety of divers. Note that, in 2024, sub-samples of plants removed by DASH were retained and the number of turions present were recorded.

9.10.2 UV-C Spot Treatments and UV-C Combo (Mid-channel Treatments)

The UV-C Spot treatments varied in size and proximity to shorelines. Georeferenced maps and polygons were generated by IRI that delineated the specific area exposed to UV-C. The polygons were used by the ESA crew to properly align macrophyte rake sampling. The UV-C crews recorded the locations and duration of UV-C treatments. The UV-C lamp arrays were checked regularly (weekly or bi-weekly), and lamps were cleaned or replaced as needed (usually mid-season) to maintain acceptable UV-C output. Schedules of treatments were provided to ESA monitoring crews with at least a week's notice before the UV-C Spot treatments and when UV-C Spot treatments were completed in a specific Group B area. Treatment polygons and example underwater videos were uploaded to Dropbox weekly.

9.10.3 BB Installation/Removal

Dates (schedules) for installation and removal of barriers were provided to ESA and TKPOA crews so that proper monitoring could be completed. The material used for BB was pre-cut and stationed at each BB area. Divers avoided contact with the bottom to minimize disturbance and turbidity. Divers ensured that barriers were properly anchored and that the GPS-referenced locations were uploaded to the Dropbox. In addition, divers physically labelled one corner of the barrier and recorded the dimensions of each barrier. Barriers were checked for integrity weekly or biweekly. For non-gas permeable materials, barriers had to be "burped" to release accumulated gases underneath. In some instances, small holes were made to provide escape of gases.

9.10.4 New Zealand mudsnails (NZMS)

NZMS were discovered in September of 2023 (TRPA 2023; CDFW 2023). Through the CMT Monitor Working Group (MWG), TRPA provided updates on NZMS locations based on TRPA-supported diver and topside field surveys and directed its contractor (ESA) to carefully check sampling gear (rakes, water collection devices) for snails and to thoroughly clean all gear when leaving and before entering CMT locations. TKPOA field staff and TKPOA contractors (Stratus Engineering Associates LLC; Hiuga Diving Co.) also followed this protocol.

TKPOA provided information to homeowners via its website and newsletters. A NZMS training for Field Staff was held on April 4, 2024 led by Emily Justice (TRPA) and Chris Kilian from Tahoe RCD. Guidance specific to CMT activities was presented. Staff from ESA, Stratus, Blankinship, IRI, SEA, Hiuga, and TKPOA attended.

10.0 ACKNOWLEDGEMENTS

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Pete Wolcott	Former Waterways Committee Chairman/ Board Member	Former Project Lead for TKPOA Board
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Melissa Thorme	Partner, Stoel Rives LLP	TKPOA Special Counsel
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Ben Cortez	Diver	Diver
Crista Sykes	Boat Operator	Boat Operator/ Diver
Dakota Gillespie	Deck Hand	Diver Support

11.0 REFERENCES

Links to previously published CMT-related documents are provided in Appendix A.

References for Use of Fine Mesh Bags (LFA effects on "muck"):

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References to Evaluating Aquatic Weed "nuisance" levels:

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Appendix A.

Links to CMT-Related Documents

Link provided to Lahontan Water Board.

Appendix B.

Final Lab Reports with COCs

(Index and single compiled PDF)

Link provided to Lahontan Water Board.

Appendix C.

Monitoring Frequencies and Locations

Link provided to Lahontan Water Board.

Appendix D.

Record of miniDOTs Issues

Link provided to Lahontan Water Board.

Appendix E.

Tahoe Keys Lagoons Macrophyte Control Efficacy Report (Year 3)

Link provided to Lahontan Water Board.

Appendix F.

Year 3 Treatment and Intervals Calendar

Link provided to Lahontan Water Board.

Appendix G.

Record of Project Meetings

Link provided to Lahontan Water Board.

Appendix H.

Documentation of Training, Qualifications, and Experience

- Diver Certifications for Hiuga Diving Co.
- TKPOA Certifications for Boating Safety
- List of Cultural Awareness Training Acknowledgement Signatures

Link provided to Lahontan Water Board.

Appendix I.

QAPP 2025 Update

Link provided to Lahontan Water Board.

Appendix J.

Calibration Logs

- IRI: Boat II 2024 Daily Monitoring Calibration Log
- IRI: Boat III 2024 Daily Monitoring Calibration Log
- Stratus: miniDOT Logger Calibration 2024
- TKPOA: YSI Dissolved Oxygen Calibration Logs
- TKPOA: YSI Weekly Calibration Logs

Link provided to Lahontan Water Board.

Appendix K.

Turbidity Data

Link provided to Lahontan Water Board.

Appendix L.

UVC Light Aquatic Invasive Plant Control Pilot Project-Summary of Treatment Field Activities for the 2024 Treatment Season

Link provided to Lahontan Water Board.

Appendix M.

Standard Operating Procedures (SOPs)

Link provided to Lahontan Water Board.

Appendix N.

Data Completeness Table and Evaluation

Link provided to Lahontan Water Board.

Appendix O.

List of Year 3 Correspondence with Permitting Agencies, TKPOA Homeowners, and Stakeholders

Link provided to Lahontan Water Board.

Appendix P.

QAQC Documentation

Link provided to Lahontan Water Board.

Appendix Q.

Directory of Tabular Data

(Folders organized by monitoring activity)

Link provided to Lahontan Water Board.

Appendix R.

HAB Data

Link provided to Lahontan Water Board.

Appendix S.

Spring 2024 Routine Ecotonal Report

Link provided to Lahontan Water Board.

Appendix T.

Fall 2024 Routine Ecotonal Report

Link provided to Lahontan Water Board.

Appendix U.

Directory of Raw Data

(Folders organized by monitoring activity)

Link provided to Lahontan Water Board.

Appendix V.

Catalog of Data Collection Binders

Link provided to Lahontan Water Board.

Appendix W.

Control Methods Test Field Day Report (Google Forms)

(Index and single compiled PDF)

Link provided to Lahontan Water Board.

Appendix X.

Instances of Elevated Water Quality Parameters

Link provided to Lahontan Water Board.

Appendix Y.

Treatment Maps

Link provided to Lahontan Water Board.

Appendix Z.

Biological Restoration Report and Certification

- Raw Data
- Tahoe Keys Lagoons Aquatic Weed Control Methods Test: Benthic Macroinvertebrates Summary Report
- Tahoe Keys Lagoons Control Methods Test Sediment Sampling Report

Link provided to Lahontan Water Board.

Appendix AA.

Tahoe Keys Lagoons Aquatic Weed Control Methods Test: Benthic Macroinvertebrates Summary Report

Link provided to Lahontan Water Board.

Appendix BB.

Tahoe Keys Lagoons Control Methods Test Sediment Sampling Report

Link provided to Lahontan Water Board.