Welcome to the Cedar Lake Improvement Board

Regular Public Meeting

April 11, 2025

Board Members

Carolyn Brummund	Alcona County Commissioner
Jesse Campbell	Alcona County Road Commission Rep.
Dave Dailey	Greenbush Twp. Representative
Heather Tait	Oscoda Township Clerk
Terry Dutcher	Iosco County Commissioner
Fred Strauer	Iosco County Drain Commissioner
Rex Vaughn	Citizen Riparian Representative

Cedar Lake Improvement Board
Regular Public Meeting
Greenbush Township Hall
Greenbush, MI 48738
Friday, April 11, 2025
10:00 AM ET

Proposed Agenda

1. Call to Order.

2. Roll Call.

3. Conference Call Meeting Operating Protocol & Housekeeping.
    a. Audio only, video services not available.
    b. Please keep your phone muted until invited to speak by the Chair or during Public Comment.

4. Public Comment.

5. Approval of 4-11-2025 Agenda as Presented.

6. Review and Approve Minutes from the 3-7-2025 Regular Meeting.

7. Old Business.
    a. 2025 Aquatic Herbicide Treatment Contract.
        i. As instructed by Board motion, the proposed contract with SOLitude was reviewed and updated by the CLIB attorney and then presented to SOLitude for their signature on 3/21/25.
        ii. Solitude (Trina Duncan) signed the contract as presented with no changes on 3/26/2025 and the chair countersigned and returned a copy to SOLitude on 3/27/2025.
        iii. Due to the size of the contract file, only the signed contract is included in the Board Notebook. The signed contract and all the Exhibit documents are included in the emailed Board Packet and online at: https://cedarlakeib.org/meetings/
    b. Search for a new scribe.
        i. Update from Commissioner Brummund.
    c. Update on the Midwest Glacial Lakes Partnership 2025 Lake Conservation Grant.
        i. Original $84,310.00 grant application filed in January 2024.
        ii. For various reasons, the financial decision on the FY25 grants (due in August 2025) was delayed due to federal budget funding constraints at the US Fish & Wildlife Service (USFWS).
        iii. Our Michigan DNR contact, Joe Nohner, informed us on 4/7/2025 that the USFWS is now preparing to allocate the funding for the FY25 Lake Conservation Grant program.
        iv. Although not a notice of award, it is encouraging news that the long stalled FY25 grant program still has life and the final approval process has re-started. There is still hope. Stay tuned.

8. New Business.
    a. Kieser & Associates, Dr. Doug Pullman, Lake Manager, call-in to present the 2024 LakeScan© Reports.
        i. The Executive Summary is included in the Board Notebook.

Cont'd,

ii. Due to document size, the full reports for both the northern and southern portions of the lake are included in the emailed Board packet and online at https://cedarlakeib.org/meetings/ and at https://cedarlakewmp.net/aquatic-plants%2Ffisheries

b. Kieser & Associates, Mark Kieser, call-in to present the 2024 Hydrology Report.
   i. The Executive Summary, 2024 rainfall chart, and 2024 lake level chart are included in the Board Notebook.
   ii. Due to document size, the full report is included in the emailed Board packet and online at https://cedarlakeib.org/meetings/ and at https://cedarlakewmp.net/monitoring-reports

c. Review and approve bills that were paid since the 3-7-2025 meeting or are now due.
   i. Bloom Sluggett PC, professional services through 2/28/2025, Inv. 26193, $660.50 (paid).
   ii. Kieser & Associates, 2024/2025 LakeScan Contract, professional services, Inv. 25-037, $524.16, (new).
   iii. Kieser & Associates, 2024/2025 Watershed Consulting Contract, professional services, Inv. 25-038, $ 5,734.75, (new).
   iv. Michigan Millers Insurance Company, General Liability Insurance Renewal, Acct. # CL0044967P, $477.99 (new).
   v. Michigan Millers Insurance Company, Directors & Officers Liability Insurance Renewal, Acct. # S0101541, $470.00 (new).
   vi. SOLitude Lake Management, 2025 EGLE Aquatic Nuisance Control Permit Fee, Inv. PSI153454, $1,782.00 (new).

9. Public Comment.

10. Next Regular Meeting Date: Friday, July 11, 2025, at 10 AM in Greenbush.

11. Adjournment.

Cedar Lake Improvement Board Regular Public Meeting
Public Access Instructions

Friday, April 11, 2025, at 10:00 AM ET

CONFERENCE CALL-IN INFORMATION:

To join the conference call, participants should call 302-202-1110 & enter Conference Code: 639770

Cedar Lake Improvement Board Meeting Minutes
Regular Public Meeting
Greenbush Township Hall
Greenbush, MI 48738
Friday, March 7, 2025, 10:00 AM

1. Call to order 10:05 AM

2. Board Roll Call: Present---Brummund, Campbell, Dailey, Tait, Hardy (Iosco County Alternate for Dutcher), Vaughn, Strauer. There was a quorum.
Total of one guest in person and one online.

3. Online Meeting operating protocol and housekeeping reviewed for audio only, video unavailable.

4. Public Comment: N/A.

5. Approval of 3-7-25 agenda: Motion to approve the agenda as amended (Rev. 1) made by Brummund/Dailey. All ayes, motion carried.

6. Approval of minutes from 2-14-25 Regular Board Meeting: Motion to approve minutes of the 2-14-25 Regular Board Meeting as presented made by Dailey/ Tait. All ayes: motion carried.

7. Old Business

a. The Chair gave an update on Consumers Energy (CE) request for a new utility easement on the west side of Cedar Lake Road on CLIB property. After presentation of historical easement records dating back to 1933 by the CLIB to Patrick W. Laverty, Project Manager – Real Estate – Northeast Michigan, CE has "removed the requirement for an additional easement for the project as the original easement from 1933 covers the work that is needed." The EGLE permit has already been issued to CE. No further action by CLIB is required. The email correspondence thread with CE is included in the board packet.

b. 2025 Aquatic Herbicide Treatments Bids: At this time Doug Pullman, Lake Manager is not available by phone. Motion to move to #8 New Business until Pullman is available to join us by phone made by Strauer/Brummund. All ayes, motion carried.

8. New Business

a. Review and approve bills that were paid since the 2-14-25 meeting or are now due:
Motion made to accept the bills as presented made by Dailey/Brummund. Roll Call Vote. All ayes,
Motion carried. The bills in question are:

i. Kieser & Associates, 2024-2025 Watershed Consulting Contract, professional services, Inv. 24-020, $2,562.50 (new)
ii. Kieser & Associates, 2024-2025 LakeScan Contract, professional services, Inv. 24-016, $2,768.44 (new)
iii. Rex Vaughn, reimbursement for copy paper, $4.70 ($9.79 less a $5.00 overpayment on a previous reimbursement) (new)
iv. Rex Vaughn, reimbursement for printer toner, $159.94 (new)
v. Rex Vaughn, reimbursement for postage, $8.75 (new)

Doug Pullman is now available by phone for discussion regarding 2025 Aquatic Treatment Bids.

7. Old Business

b. 2025 Aquatic Herbicide Treatments Bids discussion with Dr. Doug Pullman, Lake Manager. The updated Bid Tabulation is in the board packet. Three out of seven invited bidders submitted proposals. The bids received are from SOLitude, PLM and LakePro. Although the LakePro bid was properly received, the bid does not comply with the Request for Bids Work Specifications, Paragraph 12 (deep-water injection). Motion to disqualify LakePro bid because bid does not comply with the requirements regarding deep-water injection was made by Brummund/Tait. Roll Call Vote. All ayes. Motion carried. Digital copies of all three bids received are included in the board packet and notebook. Dr. Pullman reviewed his Bid Score Card and Evaluation form in detail with the Board. The Bid Score Card and Evaluation form is included in the Board info packet and notebook: Pullman's recommendation was to select SOLitude as the 2025-2027 Aquatic Applicator. Much discussion regarding the findings and procedures for preparation of treatment. Tait would like an attorney to review the contract and there was discussion of making it a five-year contract. Motion to award the contract for the 2025-2027 Aquatic Herbicide Treatment to Solitude made by Brummund/Dailey. Roll Call Vote. All ayes. Motion carried. Motion to authorize the Chair to prepare the contract for SOLitude and to sign the contract after review by an attorney made by Tait/Strauer. Roll Call Vote. All ayes. Motion carried.

Motion to alter the agenda to move items 7.c./d/e. to the last business item made by Hardy/Vaughn. Roll Call Vote. All Ayes. Motion carried.

f. Update on the search for a new Scribe and Fiduciary: Commissioner Brummund reported no candidate has been found yet, search continues.

c. Request for a motion to go into closed session: Motion to request a closed session to consider material exempt from disclosure under the Michigan Freedom of Information Act, being a privileged letter from the Lake Board's attorney, pursuant to Section 8(1)(h) of the Open Meetings Act was made by Dailey/Brummund. Roll Call Vote. 6 ayes, Tait recused herself. Motion carried. Tait did not attend the closed session.

d. Motion to return to open session was made by Dailey/Brummund. Roll Call Vote. Six ayes, Tait recused. Motion carried.

e. Motion that there is no action required on Item 7e as listed on the 3/7/25 Meeting Agenda under Old Business made by Dailey/Brummund. Roll Call Vote: 6 ayes, Tait recused. Motion carried.

9. Public Comments: n/a

10. Next Regular Meeting Date: Friday, April 11, 2025, at 10 AM, Greenbush Township Hall.

11. Adjournment: 12:06 p.m. Motion to adjourn made by Vaughn/Strauer. All ayes. Motion carried.

CONTRACT AGREEMENT

This is a Contract Agreement (the "Agreement"), by and between the CEDAR LAKE IMPROVEMENT BOARD, a Michigan statutory lake board, whose mailing address is PO Box 53, Greenbush, MI 48738, hereinafter referred to as the "CLIB", and Solitude Lake Management, LLC, whose address is 1253 Jensen Drive Suite 103 Virginia Beach, VA 23451, hereinafter referred to as "CONTRACTOR".

SCOPE OF WORK

1. CONTRACTOR shall be responsible for aquatic plant herbicide treatments on and in Cedar Lake, located in Alcona and Iosco Counties and also Greenbush and Oscoda Townships, State of Michigan. CONTRACTOR shall comply with all bidding requirements and specifications as set forth in a document generally referred to as "CEDAR LAKE IMPROVEMENT BOARD REQUEST FOR QUALIFICATIONS AND BIDS for AQUATIC PLANT HERBICIDE TREATMENTS OF CEDAR LAKE IOSCO COUNTY & ALCONA COUNTY MICHIGAN INVITATION FOR BIDS (a/k/a the "RFB") attached hereto as Exhibit "1". Further, the scope of work must include all items as set forth in the RFB under the headings "Instructions to Bidders" and "Bidder Requirements and Work Specifications" and shall also include the application as generally set forth in CONTRACTOR'S proposal in response to the RFB, attached hereto as Exhibit "2". Special emphasis is placed on Paragraph 12 of the Work Specifications in the RFB concerning the watercraft utilized for direct injection of herbicides well below the surface of the water. In treatment areas selected by the consulting engineering firm for CLIB, Kieser and Associates (the "Lake Manager"), CLIB requires that the CONTRACTOR utilize suitable watercraft (air-boat preferred) equipped with a "spike" system for direct injection of herbicides below the surface of the water. The system must be approved by the Lake Manager. No other substitute will be used.

CONSIDERATION

2. CONTRACTOR shall receive payment from CLIB as consideration for the services as specified in this Agreement (i.e. as listed in Exhibit "2"). Upon the completion of each service, a written lake itemized invoice must be provided to the CLIB immediately following each

treatment or other service. The format of the invoice must materially match the example in Exhibit "3" (as attached hereto) presenting all the information requested by the CLIB. The Lake Manager will review, approve, and forward the invoice to the CLIB for formal approval and payment. In Year 1 of this contract, the amount invoiced for each service or treatment will be priced according to the Contractor Bid Form Worksheets included in Appendix A, Parts 1 through 6, of the responsive bid on behalf of the CONTRACTOR. For each application event, the Lake Manager will specify the location and acreage, and the consensus decision of the management team (the CLIB, the Lake Manager, and the CONTRACTOR) for the chemicals to be used and the application rate per acre that will be made. The CONTRACTOR agrees that the unit prices named in the Contractor Bid Form Worksheets will be used, and invoiced amounts will be calculated based upon unit volume or weight, application rate per acre, and total acres treated. For the second and third year of this contract, the CONTRACTOR will submit to the CLIB by February 1st new Contractor Bid Form Worksheets for each coming year.

TERM OF AGREEMENT

3. The term of this Agreement shall commence when this Agreement is signed by both parties hereto and shall continue for three (3) years and until completion of the above stated Scope of Work is performed by the CONTRACTOR. This Agreement is a (3) year annually renewable contract incorporating the content and spirit of the bid specifications. The contract will only renew annually if both parties agree in writing on the costs for the coming year before the end of February of each contract year. Lack of mutual agreement on costs by the end of February of each contract year will be cause for the contract to terminate for the remaining 3-year life (or portion thereof) of the contract. However, this Agreement may be terminated without cause, by any party hereto, upon ninety (90) days prior written notice to the other party at the addresses as provided for herein. In the event that this Agreement is terminated early, pro-rated compensation will be paid to the CONTRACTOR for services performed to the date of termination.

CONTRACT DOCUMENTS

4. The documents which form the basis for this Agreement between CLIB and CONTRACTOR (and are hereby incorporated as part of this Agreement) are as follows:

A. This Agreement.

B. The Invitation for Bids (Exhibit "1").

C. The responsive bid on behalf of the CONTRACTOR (Exhibit "2").

D. Itemized Invoice Information Standards (Exhibit "3")

STANDARD OF PERFORMANCE

5. CONTRACTOR agrees to engage in the work as described herein and perform the same in a manner to be commonly expected of someone performing the services as generally described below and herein. CONTRACTOR shall always provide such services to the CLIB in a timely, reasonable and workmanlike fashion.

INSURANCE

6. CONTRACTOR agrees to assume the responsibility for the jobs and services as described above and herein, and shall maintain at or above the following insurance coverage:

The Contractor shall furnish at its own expense insurance coverage including worker's compensation, general liability, and pollution liability. Coverages must be at or above the minimum amount of $1,000,000 for each occurrence of bodily injury, at or above the minimum $1,000,000 for each occurrence of property damage, and at or above the minimum $1,000,000 for each occurrence of pollution. Said general liability insurance shall include evidence that Contractor's general liability insurance policy will cover Contractor's liability, as it relates to the application of herbicides and pesticides. The general liability insurance obtained must name the CLIB as an additional insured. Certificates of the insurance coverage shall be delivered to the CLIB within 10 days of the date of this Agreement. These certificates shall clearly indicate that the provisions of the applicable policy comply with the above requirements. If the policies confirmed by such certificates will expire prior to the termination of this Agreement, then certificates for renewals must be delivered to the CLIB not less than 30 days prior to the expiration date. Failure to provide certificates of the required insurances to the CLIB will void the Agreement.

GENERAL TERMS AND CONDITIONS

7. Indemnification by the CONTRACTOR: The CONTRACTOR shall indemnify, reimburse, protect and hold harmless the CLIB, its employees and agents for, from and against any and all liability, claims, causes of action, demands, losses, damages, costs and expenses (including attorney fees) for any liability or loss, including accidents, injury, death, or damages to any person or property, related in any way to the performance of this Agreement, including matters that result from accidental acts, negligent acts, errors or omissions, or the willful misconduct of the CONTRACTOR'S personnel or equipment. This provision shall survive the expiration or termination of this Agreement.

8. Independent Contractor. The CONTRACTOR acknowledges and agrees that it is an independent contractor and is not an employee of the CLIB. As such, the CONTRACTOR shall not be entitled to participate in any fringe benefit programs adopted by the CLIB, nor will the CONTRACTOR be reimbursed for any such expenses incurred. The CONTRACTOR shall be responsible for paying all of its own taxes on monies received for providing services under this Agreement.

9. Modifications. Any modifications to this Agreement or additional obligations assumed by either party in connection with this Agreement, shall be binding only if evidenced in a writing signed by each party or an authorized representative of each party.

10. Authority to Contract. Each party warrants and represents that it has authority to enter into this Agreement and to make it binding.

11. Binding Parties. The statements herein shall bind all heirs, successors, and assigns of both parties, as well as the parties themselves.

12. Survival. All conditions and requirements herein shall survive the completion of the CONTRACTOR'S services on this project and the termination of services for any cause.

13. Governing Law. The services provided by this Agreement will be performed and the Agreement shall be deemed to have been made in Alcona County, Michigan. Venue shall be in Alcona County, Michigan. It is acknowledged and agreed that this Agreement was entered into, and services are to be provided in Alcona County & Iosco County by both parties hereto. The CONTRACTOR conducts business activities in Alcona County & Iosco County, and has responded to an advertisement, and has submitted a bid for this work, in Alcona County & Iosco

County. Based upon this, and to the extent possible, both parties consent to the jurisdiction of the courts of Alcona County, State of Michigan.

14. Severability. If any provision of this Agreement is deemed to be invalid by a court of competent jurisdiction, it shall not affect the other remaining valid provisions hereof.

15. Notices. Any notices to be sent to either party are to be sent to those addresses as set forth in the first paragraph of this Agreement.

16. Incorporation of Agreements. This document is to be a total incorporation of all agreements and representations of and between each party hereto with respect to the subject matters of this Agreement to the exclusion of any prior verbal representations.

17. Assignability. Any rights provided for in this Agreement, to any party hereto, are not assignable.

18. Conflict of Documents. Any conflict between the terms of any of the contract documents shall be resolved as follows: First, the terms of this Agreement shall prevail over any other document. Second, when this Agreement document is not involved, then the next document to be given priority is in fact the Request for Bid (the RFB). Third, the documents that the CONTRACTOR submitted to CLIB, being its response to the aforementioned RFB, shall be given priority.

19. Anti-Discrimination. The CONTRACTOR shall comply with all state and federal anti-discrimination laws and shall provide its services in a nondiscriminatory manner to the end that no person, on the ground of race, color, religion, sex, age, handicap, disability, or national origin, shall be excluded from using the facilities or obtaining the services provided thereon, or otherwise be subjected to discrimination under any program or activities provided thereon.

20. No Joint Venture. Nothing contained in the contract documents will make, or will be construed to make, the parties hereto partners or joint venturers with each other. Neither will anything in these contact documents render, or be construed to render, either of the parties hereto liable to any third party for the debts or obligations of the other party hereto.

21. Failure of CLIB to Insist on Compliance. The failure of CLIB to insist, in any one or more instances, upon strict performance of or with any of the terms, covenants, or conditions of this Agreement or the contract documents shall not be construed as a waiver or relinquishment of the rights of CLIB to insist on the future performance of any such terms covenants, or conditions,

but the obligations of the CONTRACTOR with respect to such future performance shall continue in full force and effect.

22. Drafting; Construction. This document has been executed in duplicate, but shall constitute one contract. This document shall also be deemed jointly drafted by the parties.

Cedar Lake Improvement Board

Dated: _____, 2025

_____

By: _____
Its: Chairman

Solitude Lake Management, LLC

Dated: March 26, 2025

Trina L. Duncan

By: Trina L. Duncan
Its: Business Manager

Exhibit "1"

CEDAR LAKE IMPROVEMENT BOARD
REQUEST FOR QUALIFICATIONS AND BIDS
for
AQUATIC PLANT HERBICIDE TREATMENTS
OF CEDAR LAKE
IOSCO COUNTY & ALCONA COUNTY
MICHIGAN

INVITATION FOR BIDS

The Cedar Lake Improvement Board is accepting sealed bids for aquatic plant herbicide treatments on Cedar Lake in Iosco and Alcona Counties in the State of Michigan for three (3) years (2025 through and including 2027).

Sealed bids shall be submitted by ***US Mail*** to:

2025-2027 Aquatic Herbicide Treatment Program
Cedar Lake Improvement Board
PO Box 53
Greenbush, MI 48738

Sealed bids must arrive by ***US Mail*** before 5:00 PM on Thursday, February 13, 2025. Emailed bids and bids received after the deadline will not be considered. Public Bid opening is scheduled for 10 AM on Friday, February 14, 2025, at the regular CLIB Meeting at the Greenbush Township Hall.

For questions please contact:

Rex Vaughn
CLIB Chairman
Email (preferred): rvaughn@tir.com
Mobile: 810-516-6686

General Information for the Bidder

1. Cedar Lake is located in T.23N.-R.9E., Sections 15, 10, and 3 of Oscoda Township in Iosco County and T.25N.-R.9E., Sections 34, 27, and 22 of Greenbush Township in Alcona County in the State of Michigan. The lake is 1,075 acres in size. Annual treatment areas generally are less than 200 acres per year. Cedar Lake retains an independent professional limnologist Lake Manager who will direct, specify, and approve all treatment plans for Cedar Lake.
2. The following definitions will be used throughout this document:
    a. The Lake: Cedar Lake.
    b. The Board: Cedar Lake Improvement Board (aka CLIB).
    c. The Lake Manager: Professional limnologist retained by the Board.
    d. The Contractor: The entity that is awarded a contract by the Board.
    e. The Contract: The resulting agreement between the Board and the Contractor based on this bidding process.
    f. EGLE: State of Michigan Department of Environment, Great Lakes, and Energy.

Instructions to the Bidder

1. The bidder shall examine the specifications and related documents attached and fully examine the Lake to familiarize themselves with all site conditions. The bidder shall make all necessary investigations to thoroughly inform themselves regarding past and present lake conditions including the EGLE Permits issued to previous Contractors using the EGLE MiEnviro Portal, Waterbody: WB-2127.

2. The bidder will also examine all lake treatment LakeScan™ Reports posted on the Board web site:

https://cedarlakewmp.net/aquatic-plant-management

3. No plea for ignorance of existing conditions shall be accepted. Failure or omission of any bidder to examine these documents or become acquainted with existing conditions shall in no way relieve them from any obligation with respect to their bid or any resulting contract.

4. The CLIB assumes no responsibility or liability for any costs incurred by the contractor prior to signing of an agreement. Total liability of the CLIB is limited to the terms and conditions of any contract resulting from this RFP.

5. If a bidder finds omissions or discrepancies in the bid documents, they shall immediately notify the CLIB so that the CLIB can issue an addendum to all bidders.

6. Sealed bids must be submitted on the Bid Forms provided in this packet including Appendix A and Appendix B. All bid amounts must be shown as figures and written in ink or typewritten together with all other data as required and shall be legally signed with the complete address of the bidder.

7. The bid amounts shall be all inclusive and there shall be no additional charges. The prices named shall include all taxes in effect on the bid date. The bidder has included all Michigan sales and use taxes currently imposed by legislative enactment and as administered by the Michigan Department of Revenue on the bid date.

8. The Bid Form plus Appendix A and Appendix B must be fully completed and executed when submitted. Incomplete bids will not be considered.

9. Each bidder shall complete the Bidder Résumé and submit it with their Bid Form.

10. Each bid must be submitted in a sealed envelope bearing the following information clearly marked on the outside "Cedar Lake 2025-2027 Aquatic Herbicide Treatment Bid".

11. Bids may be withdrawn prior to the stated deadline. Modification of bids in writing will be considered if received prior to the deadline. Once the deadline has lapsed, bids shall remain firm for 90 days, within which the contract shall be awarded.

12. Bids shall be evaluated upon cost and experience of the bidder. The CLIB reserves the right to accept or reject any and all bids, to waive any bid irregularities that may be in the best interest of the CLIB, and to negotiate a contract that will best meet the needs of the CLIB and its lake residents.

13. Awards will be made to the lowest responsive and acceptable offer or as judged by the CLIB. The CLIB may modify this request for proposals at its sole and exclusive discretion by addendum.

14. Acceptance of a proposal does not constitute a contract. Subsequently discovered information or circumstances may prompt the CLIB to rescind acceptance of any proposal after it has been accepted, but before the CLIB has taken action to authorize the contract to be signed. The CLIB reserves the right to rescind its acceptance of a proposal by adopting an appropriate resolution rescinding acceptance of a proposal. At no time has a contract been formed until the CLIB has so acted, and the contracts signed by the authorized individuals.

15. By signing and submitting the bid forms, the bidder affirms that their proposal is a free, independent, and legitimate proposal and that they have not engaged in any collusive practices that would have discouraged others to bid or influenced the terms of this proposal or of any others. Any evidence of collusion among the bidders, or any prospective bidders, shall be grounds for disqualification of a bidder and the voiding of any resulting contract.

16. Submitted bids shall become property of the CLIB. Any and all documents produced under the terms of any resulting agreements shall remain property of the CLIB and shall be provided upon request.

Bidder Requirements

1. The Contractor must have a Pesticide Application Business License from the Michigan Department of Agriculture and Rural Development in Category 5 (Aquatic Pest Management).

2. All persons employed and utilized for treatments on the Lake must be Certified Commercial Applicators in Category 5 (Aquatic Pest Management) by the Michigan Department of Agriculture and Rural Development.

3. The Contractor must be able to obtain aquatic nuisance control permits from EGLE.

4. The Contractor shall furnish at their own expense insurance coverage including worker's compensation, general liability, and pollution liability. Coverages must be for the minimum amount of $1,000,000 for each occurrence of bodily injury, minimum $1,000,000 for each occurrence of property damage, and minimum $1,000,000 for each occurrence of pollution. Said general liability insurance shall include evidence that Contractor's general liability insurance policy will cover Contractor's liability, as it relates to the application of herbicides and pesticides. The general liability insurance obtained must name the CLIB as additionally insured. Certificates of the insurance coverage shall be delivered to the CLIB within 10 days of award of the Contract. These certificates shall clearly indicate that the provisions of the applicable policy comply with the above requirements. If the policies confirmed by these certificates will expire prior to the termination of this contract, certificates for renewals must be delivered to the CLIB not less than 10 days prior to the expiration date. Failure to provide certificates of the required insurances will void the Contract awarded by the CLIB.

Work Specifications

1. The Contract shall be binding on the parties and their successors and assigns; however, the Contractor shall not assign, subcontract, or otherwise transfer the work described and contracted herein without the express prior written consent of the CLIB and the Lake Manager. A violation of this term shall be considered a materials breach of the Contract.

2. The predominant aquatic invasive plants found in Cedar Lake have been Eurasian/Hybrids Water Milfoils, Curly-Leaf Pondweed, and Starry Stonewort (minor). Nuisance plants may also include Variable Water Milfoil, Naiad, Elodea, Wild Celery, Native Pondweeds, Chara, and others as described in the LakeScan™ Reports posted on the Board web site. Review of the LakeScan™ Reports by the contractor is considered mandatory. Invasive terrestrial Phragmites have also been found and treated along shorelines both above and below the ordinary high-water mark.

3. Pursuant to provisions of Part 33, Aquatic Nuisance Control, of P.A. 451 of 1994 (the Natural Resources and Environmental Protection Act), as amended, the Contractor will secure a permit from EGLE prior to any herbicide applications to the Lake. The permit application, in its entirety, shall be submitted to EGLE and to the CLIB within 10 working days of award of the Contract. In addition to aquatic plants, the permit application must also include provisions for treating invasive terrestrial Phragmites along the lake shoreline both above and below the ordinary high water mark.

4. The Contractor shall be responsible for all statutory notifications and postings. Copies of all notifications, postings, and mailings related to this project shall be provided to the Lake Manager and the CLIB for review and approval prior to distribution. No advertising for additional services offered by the Contractor to individual lakefront property owners will be allowed on any of the notifications or postings.

5. Areas and the number of acres to be treated will be specified in writing by the Lake Manager utilizing LakeScan™ AROS maps with GPS reference to MeasureMap Pro for on-water use (https://blueblinkone.com/apps.html). The Contractor shall coordinate their activities directly with the Lake Manager.

6. The intent of any resulting contract is to obtain clean, safe, proper, effective, and thoroughly professional undertaking of lake services. The successful bidder shall be competent, courteous, and orderly while on the job.

7. The Contractor shall only make professional visits and herbicide treatments to the Lake when authorized and as directed by the Lake Manager. Those visits include, but are not limited to, an annual pre-season on-water full lake survey with a CLIB representative, the Lake Manager, and the Contractor prior to Memorial Day.

8. The Contractor must schedule treatments to not restrict recreational water use (e.g. swimming, fishing) on Fridays, Saturdays, Sundays, Memorial Day, July 4th, Labor Day, or other special occasions as determined by the CLIB.

9. The Contractor must follow EGLE restrictions on the use of copper-based products during May and June. These restrictions will be listed in the EGLE Permit.

10. The Contractor must thoroughly wash all boats, motors, trailers, and herbicide equipment and ensure it is free of plant fragments and zebra mussels before launching into Cedar Lake.

10. All herbicides, algicides, adjuvants, and shade products applied to the Lake must be approved by EGLE. These products must be stored, transported, handled, and applied in a manner consistent with state regulations and manufacturer labels.

11. Treatments plans will be developed by the lake management team that is comprised of the contractor, the Lake Manager, and a representative of the CLIB. Plans are approved by the Lake Manager, accepted by the CLIB, and executed by the Contractor in the timeframe specified by the Lake Manager. If there is not adequate die-back of treated plants, the Contractor, at the Lake Manager's discretion, may be required to re-treat these plants at no additional cost to the CLIB.

12. There are several areas on Cedar Lake that will require the Contractor to deploy an application method that directly injects herbicides well below the surface of the lake while the watercraft is in motion (deep-water injection). The watercraft utilized by the Contractor must be equipped with such a system, and the system must be approved by the Lake Manager. A description of the deep-water injection system method utilized by the Contractor must be included in the Bid Form. Lack of such a direct deep-water injection system will result in disqualification of the bid.

13. If a fluridone treatment is required, the Lake Manager will be responsible for the Lake Management Plan. The Lake Manager will be responsible for collecting and shipping residue samples. The Contractor will be reimbursed for shipping costs, lab fees, and time at the Lake. The results of residue monitoring shall be faxed or e-mailed to the Contractor within 10 working days of sample date.

14. If residue samples for the use of Triclopyr or 2,4-D are required by the EGLE Permit, the Lake Manager will determine the number and location of residue samples. The Lake Manager will be responsible for collecting and shipping residue samples. The Contractor will assist the Lake Manager in collecting the samples and will be reimbursed for shipping costs, lab fees, and time at the Lake. The results of residue monitoring shall be faxed or e-mailed to the Contractor within 5 working days of sample date.

15. Upon the completion of work, the Contractor shall submit to the CLIB and the Lake Manager a detailed invoice immediately following each treatment or other service. The Lake Manager will review, approve, and forward the invoice to the CLIB for formal approval and payment.

BID FORM

BID DATE: _____, 2025

BID TO:

2025-2027 Aquatic Herbicide Treatment Program
Cedar Lake Improvement Board
PO Box 53
Greenbush, MI 48738

The undersigned bidder hereby declares that this bid is made in good faith and without fraud or collusion with any other bidder or any competitor.

The bidder has carefully read, examined, and understands the General Information, Instructions, Requirements, and Specifications for the proposed work. The bidder has investigated the lake and its condition to determine the character and difficulties attending the execution of the proposed work.

The bidder understands that the acreages listed are approximate and subject to change based upon lake surveys performed by the Lake Manager. For each application event, the Lake Manager will specify the location, acreage, chemicals to be used, and the application rate per acre. The bidder agrees that the unit prices named will be used and invoice amounts will be calculated based upon unit volume or weight, application rate per acre, and total acres treated.

All work described in the bid specifications and required for completion of the project shall be considered as incidental work unless designated as a pay item on the Bid Form. The CLIB assumes no responsibility or liability for any costs incurred by the Contractor prior to the signing of an agreement. Total liability of the CLIB is limited to the terms and conditions of the Contract resulting from this bid document.

The undersigned agrees that this bid shall be good for 90 calendar days after the scheduled closing time for receiving bids. Within that timeframe, the CLIB shall provide a written Notice of Award to the successful bidder. Within 10 days of the Notice of Award, the Contractor shall deliver the required certificates of insurance described in the “Bidder Requirements”. In the event the contract and certificates of insurance are not provided within the time set, the CLIB reserves the right to void the Notice of Award and the Contract.

Upon receipt of the written Notice of Award, the bidder shall enter into a formal three (3) year annually renewable contract with the CLIB incorporating the content and spirit of the bid specifications. The contract will renew annually only if both parties agree in writing on the costs for the coming year. Lack of mutual agreement on costs will be cause for the contract to terminate for the remaining life of the contract.

The bidder understands the CLIB reserves the rights to reject any or all bids, to waive any irregularities in the bidding, and to award the contract to other than the low bidder.

The bidder proposes and agrees, upon acceptance of the bid, to contract with the CLIB, incorporating the content and spirit of the bid specifications. The bidder will provide all necessary equipment, products, personnel, and transportation necessary to execute the work referred to in this invitation to bid. Furthermore, the bidder agrees to perform all work in the manner and time prescribed and according to the requirements of the Lake Manager and the CLIB.

The undersigned, having familiarized themselves with the Instructions to Bidders and the Work Specifications, hereby proposes to perform everything required and to provide and furnish all of the labor, materials, equipment, and all utility and transportation services necessary to perform and complete all the work required for aquatic herbicide treatments of Cedar Lake in a workmanlike manner, all in accordance with the specifications, and at prices as listed in the worksheets located in Appendix A and Appendix B.

The undersigned, by execution of this document, certifies that he/she is the representative of the firm named as the bidder and that he/she is authorized to execute this bid on behalf of the said firm.

SIGNATURE: _____

NAME: _____

(Printed)

TITLE: _____

COMPANY NAME: _____

COMPANY ADDRESS: _____

_____

_____

TELEPHONE: _____

FAX: _____

E-MAIL _____

DATE: _____

Bidder Résumé

In order to expedite the award of this contract, the bidder is required to provide the following information to demonstrate prior experience with similar work to that described on Cedar Lake.

Bidder: _____Company Name)

A. Please provide a list of applicators employed by your company and their respective dates of certification by the Michigan Department of Agriculture.

B. In 2024, how many lakes in the various size categories listed below did you treat with herbicides?

- 100 to 500 Acres: _____Lakes
- >500 Acres: _____Lakes

C. Please list on a separate sheet all of the equipment to be utilized for the herbicide treatments at Cedar Lake. Include a complete description of the deep-water injection system method used to comply with Work Specifications, Paragraph 12.

D. Please provide a maximum of three references of previous work. For each project, provide a contact person with phone number and include:

- Lake Name
- County
- Surface Acreage
- Treatment Area Acreage
- Target Plants
- Herbicides Applied

SIGNATURE: _____DATE_____

NAME : _____

(Printed)

TITLE: _____

SOLITUDE LAKE MANAGEMENT

Bid Documents for Aquatic Herbicide Treatments of

Cedar Lake

Iosco & Alcona Counties, Michigan

Submitted by:

Dave Brown
Operations Manager
SOLitude Lake Management, LLC

3390 N State Road, Suite D
Davison, MI 48423
(810) 618-2043 P
www.solitudelakemanagement.com

SOLITUDE
LAKE MANAGEMENT

February 13, 2025

2025 - 2027 Aquatic Herbicide Treatment Program
Cedar Lake Improvement Board
PO Box 53
Greenbush, MI 48738

Dear Cedar Lake Improvement Board,

Thank you for giving SOLitude Lake Management the opportunity to bid on the Nuisance Aquatic Plant Control for Cedar Lake, Iosco & Alcona Counties for 2025 - 2027. We look forward to continuing our relationship with your board and the residents of your lake.

SOLitude's integrated environmental management approach takes into consideration the interactions and relationships between the lake ecosystem and aquatic management. This holistic approach delivers the most efficient and effective treatment methods for your environment. We understand that each body of water is an environment of its own, and thus requires a treatment of its own. SOLitude stands ready to execute effect treatments in a timely manner as part of your consultant's overall lake management strategy.

Thank you again for inviting SOLitude Lake Management the opportunity to bid on this project. Our goal is for you and this lake community to enjoy the recreational and aesthetic values of their lake each and every day of summer. If you have any questions, please don't hesitate to call or send me an email.

Best regards,

Dave Brown
Operations Manager
(810) 618 - 2043
dave.brown@solitudelake.com

Company Name: SOLitude Lake Management, LLC

MI Locations: 3390 N State Road, Suite E, Davison, MI 48423
2249 Reum Rd, Suite 2, Niles, MI 49120
12315 Cleveland Street, Suite E, Nunica MI 49448

Operations for this project will work out of our Davison office with support from our Nunica office, if necessary.

Sales Contact: Mitch Hiler, Business Development Consultant, (616) 335-1975, mitch.hiler@solitudelake.com

Operations Contact: Dave Brown, Operations Manager, (810) 618 - 2043, dave.brown@solitudelake.com

Insurances: Upon award of the contract, a certificate of insurance will be provided with the lake board listed as a certificate holder. SOLitude Lake Management's insurance coverages include:

Commercial General Liability	$5,000,000 per occurrence / $5,000,000 general aggregate
Automotive Liability	$3,000,000 combined single limit
Umbrella Liability	$5,000,000 per occurrence / $5,000,000 general aggregate
Worker's Compensation	$2,000,000 each accident

References

Contact Name	Phone Number	Lake Name	County	Surface Area	Treatment Acreage	Target Plants	Herbicides Applied	EGLE ANCP Permit #
Tim Belanger	(248) 854-7146	Merritt Lake	Lapeer	54	39.5	Eurasion Water Milfoil, Nuisance Natives, Starry Stonewort, Macroalgae,Filamentous Algae	Tribune, Aquathol K, Stingray, Cutrine Plus, Hydrothol 191, Propeller, ProCellaCOR EC, AquaNeat, Habitat, Cygnet +	ANC9807478
Gary Christensen	(989) 709-8423	Lake Ogemaw	Ogemaw	437	275	Starry Stonewort, Eurasian Watermilfoil, Curly-leaf Pondweed, Vallisneria, Lillypads	Cutrine Plus, Propeller, Hydrothol 191, Tribune, Aquathol K, Stingray, Current, Habitat, AquaNeat, Cygnet +	ANC9807690
AJ Faught	(810) 513-7584	Lobdell Lake	Argentine / Deerfield	562.75	428.25	Macroalgae, Filamentous algae, Starry Stonewort, Eurasion Water Milfoil, Nuisance Natives	Tribune, Aquathol K, Stingray, Cutrine Plus, Hydrothol 191, Propeller, ProCellaCOR EC, AquaNeat, Habitat, Cygnet +	ANC9807517

Service Equipment:

24' Carolina Skiff Equipped with a Yamaha Outboard motor, 350 Gal subsurface boom spray system, Lowrance HDS Fish Finder

22' Custom modified flat hull boat equipped with Mercury outboard motor, 2x 125 Gal Conserve Subsurface injection system, broadcast spray system, Conserve Granular system, and Lowrance HDS Fish Finder

18' Custom Flat hull boat equipped with mercury outboard motor, 50 Gal Conserve Subsurface injection system, broadcast spray system, HumminBird Fish Finder, and Lowrance HDS Fish Finder

18' Carolina Skiff equipped with mercury outboard motor, 50 Gal broadcast spray system, subsurface injection, 2x 50 Lbs. Granular spreaders, and Lowrance HDS Fish Finder

20' Carolina Skiff equipped with mercury outboard motor, BioSonics sediment and depth plotter, and Lowrance HDS Fish Finder

21' Panther Airboat, equipped with a 50 gallon broadcast spray system, subsurface injection and a Lowrance ELITE fs 7 gps/fish finder

**Additional equipment available if needed*

BID FORM

BID DATE: February 13, 2025

BID TO:

2025-2027 Aquatic Herbicide Treatment Program
Cedar Lake Improvement Board
PO Box 53
Greenbush, MI 48738

The undersigned bidder hereby declares that this bid is made in good faith and without fraud or collusion with any other bidder or any competitor.

The bidder has carefully read, examined, and understands the General Information, Instructions, Requirements, and Specifications for the proposed work. The bidder has investigated the lake and its condition to determine the character and difficulties attending the execution of the proposed work.

The bidder understands that the acreages listed are approximate and subject to change based upon lake surveys performed by the Lake Manager. For each application event, the Lake Manager will specify the location, acreage, chemicals to be used, and the application rate per acre. The bidder agrees that the unit prices named will be used and invoice amounts will be calculated based upon unit volume or weight, application rate per acre, and total acres treated.

All work described in the bid specifications and required for completion of the project shall be considered as incidental work unless designated as a pay item on the Bid Form. The CLIB assumes no responsibility or liability for any costs incurred by the Contractor prior to the signing of an agreement. Total liability of the CLIB is limited to the terms and conditions of the Contract resulting from this bid document.

The undersigned agrees that this bid shall be good for 90 calendar days after the scheduled closing time for receiving bids. Within that timeframe, the CLIB shall provide a written Notice of Award to the successful bidder. Within 10 days of the Notice of Award, the Contractor shall deliver the required certificates of insurance described in the “Bidder Requirements”. In the event the contract and certificates of insurance are not provided within the time set, the CLIB reserves the right to void the Notice of Award and the Contract.

Upon receipt of the written Notice of Award, the bidder shall enter into a formal three (3) year annually renewable contract with the CLIB incorporating the content and spirit of the bid specifications. The contract will renew annually only if both parties agree in writing on the costs for the coming year. Lack of mutual agreement on costs will be cause for the contract to terminate for the remaining life of the contract.

The bidder understands the CLIB reserves the rights to reject any or all bids, to waive any irregularities in the bidding, and to award the contract to other than the low bidder.

The bidder proposes and agrees, upon acceptance of the bid, to contract with the CLIB, incorporating the content and spirit of the bid specifications. The bidder will provide all necessary equipment, products, personnel, and transportation necessary to execute the work referred to in this invitation to bid. Furthermore, the bidder agrees to perform all work in the manner and time prescribed and according to the requirements of the Lake Manager and the CLIB.

The undersigned, having familiarized themselves with the Instructions to Bidders and the Work Specifications, hereby proposes to perform everything required and to provide and furnish all of the labor, materials, equipment, and all utility and transportation services necessary to perform and complete all the work required for aquatic herbicide treatments of Cedar Lake in a workmanlike manner, all in accordance with the specifications, and at prices as listed in the worksheets located in Appendix A and Appendix B.

The undersigned, by execution of this document, certifies that he/she is the representative of the firm named as the bidder and that he/she is authorized to execute this bid on behalf of the said firm.

SIGNATURE: Trina L. Duncan
02/07/2025

NAME: Trina L. Duncan
(Printed)

TITLE: Business Manager

COMPANY NAME: SOLitude Lake Management, LLC

COMPANY ADDRESS: 3390 N. State Road, Suite D, Davison, MI 48423

TELEPHONE: (888) 480-5253

FAX:

E-MAIL dave.brown@solitudelake.com

DATE: 2/7/2025

Bidder Résumé

In order to expedite the award of this contract, the bidder is required to provide the following information to demonstrate prior experience with similar work to that described on Cedar Lake.

Bidder: SOLitude Lake Management, LLC Company Name)

A. Please provide a list of applicators employed by your company and their respective dates of certification by the Michigan Department of Agriculture.

B. In 2024, how many lakes in the various size categories listed below did you treat with herbicides?

- 100 to 500 Acres: 150 Lakes
- >500 Acres: 100+ Lakes

C. Please list on a separate sheet all of the equipment to be utilized for the herbicide treatments at Cedar Lake. Include a complete description of the deep-water injection system method used to comply with Work Specifications, Paragraph 12.

D. Please provide a maximum of three references of previous work. For each project, provide a contact person with phone number and include:

- Lake Name
- County
- Surface Acreage
- Treatment Area Acreage
- Target Plants
- Herbicides Applied

SIGNATURE: Trina L. Duncan DATE 02/07/2025

NAME : Trina L. Duncan
(Printed)

TITLE: Business Manager

Appendix A

Contractor Bid Long Form Worksheets

Contractor to complete all following worksheets in their entirety and return all sheets with their bid.

Table of Contents and Document Completion Checklist

Please use the Table of Contents as a Check List for All Line Items That You Have Completed in the Bid Docs.
Place a Checkmark on Each Item Completed in the Bid Docs.
Consideration is Given to Bidders Who Comprehensively Complete the Bid Document Forms

Part 1: Permit Fees, Notifications, Site Reviews and Other Associated Services

S1 ✓ Permit Fees
Permit Application Fees, Pass-Through Permit Costs

S2 ✓ Riparian Notifications and Communications (Required)
All costs required by permits or additional notifications

S3 ✓ Public Meetings (optional, may be no charge)
Q&A sessions and formal presentations

S4 ✓ On-Site Lake Condition Review
Attended by members of management team

Part 2: Improvement Agent Application

A1 ✓ Cost to Apply Liquid Applied (Liquids, Flowables, Wetable Powders) Agents, Less Than 5 Acres
A2 ✓ Cost to Apply Liquid Applied (Liquids, Flowables, Wetable Powders) Agents, More Than 5 Acres
A3 ✓ Cost to Apply Granular Agents, Less Than 5 Acres
A4 ✓ Cost to Apply Granularr Agents, More Than 5 Acres
A5 ✓ Cost to Simultaneously Apply Granular and Liquid Applied Agents, Less Than 5 Acres
A6 ✓ Cost to Simultaneously Apply Granular and Liquid Applied Agents, More Than 5 Acres

Part 3: Cost of Agents Applied as Liquids Including Applicable Taxes and Surcharges

List Cost of Intevention Agent or Combination Products by Unit Volume or Weight
Liquid Applied Agents Include Liquids, Flowables, Wetable Powders, and Sluried Agents
Please Place a Check Mark by Each Product Offered by Your Company.
Some of the Listed Intervention Agents May Not Be Approved for Use in Michigan.

L1 ___ Bispyribac
L2 ✓ Carfentrazone
L3 ✓ Copper chelate + phosphorus binder
L4 ✓ Copper Chelate Algaecide
L5 ✓ Copper Chelate Ethanolamine
L6 ✓ Copper Chelate Ethylenediamine
L7 ✓ Copper Chelate Herbicide
L8 ✓ Copper Hydroxide
L9 ___ Copper Sulfate
L10 ✓ Diquat & Endothal
L11 ✓ Diquat Dibromide
L12 ✓ Endothall Amine
L13 ✓ Endothall Potassium Salt
L14 ✓ Florpyrauxifen-benzyl
L15 ___ Flumioxazin
L16 ✓ Fluridone
L17 ✓ Fluroxypyr
L18 ✓ Glyphosate
L19 ✓ Hydrogen Peroxide
L20 ✓ Imazamox
L21 ___ Imazapyr
L22 ___ Penoxsulam
L23 ___ Quinclorac
L24 ___ Topramazone
L25 ✓ Triclopyr Acld
L26 ___ Triclopyr, amine
L27 ✓ Trifloxysulfuron
L28 ✓ 2,4-D, Amine
L29 ___ 2,4-D Amine & Flumioxizin

Part 4: Cost of Granular Materials Per Pound Including Applicable Taxes and Surcharges

G1	✓	Copper Chelate (Ethanolamine)
G2	✓	Copper chelate (Ethylenediamine)
G3	✓	Endothall, Potassium Salt
G4	✓	Endothall, Amine
G5	✓	Fluridone
G6	✓	Triclopyr Triethylamine Salt
G7	✓	2,4-D Amine
G8	✓	2,4-D Amine & Triclopyr
G9	✓	2,4-D BEE, granular
G10		2,4-D IOE

Part 5: Dyes, Colorants, and Tracers

T1		Blue Liquid
T2		Black Liquid
T3		Red Tracer Liquid
T4		Other Liquid
T5		Blue Powder/Granule
T6		Black Powder/Granule
T7		Other Powder/Granule

Part 6: Biological Biocides and Nutrient Deactivation Agents

B1		Liquid Bacteria Amendment for Muck Control
B2		Wetable / Soluble Bacteria Amendment for Muck Control
B3		Liquid Bacteria Amendment for Water Clarification
B4		Wetable / Soluble Bacteria Amendment for Water Clarification
B5		Liquid Endocide
B6		Flowable, Wetable Powder, or Granular Endocide
B7		Liquid Biopesticide (USEPA Registered Bio-Pesticide)
B8		Flowable, Wetable Powder, or Granular Biopesticide (USEPA Registered Bio-Pesticide)
N1		Alum Nutrient Inactivation Agent
N2		Lanthanum Nutrient Inactivation Agent

Part 7: Chemical and Biological Adjuvants

		Activators
J11	✓	D-Limonine
J12	✓	Pine
J13	✓	Proteins
		Sinking and Sticking Agents (Polylmers and Emergent Plant Control Enhancements)
J21	✓	Liquid Adjuvant
J22	✓	Wetable / Powder Adjuvant
		Inverts
J31		Liquid Invert Agent

Part 1: Permit Fees, Notifications, Site Reviews and Other Associated Services

Service Description

S1 Permit Fees		Cost $US
Pesticide Application Permit Fees		$1,600.00
Launch Fees		No Charge
Other Permit Fees	Permit Preparation	$182.50

S2 Riparian Notifications and Communications	Cost $US
MI EGLE Required 7-Day Notice (include postage)	$1.00 per address
Notification of Other Entities or Agencies Required by Permit	No Charge
Day of Intervention Treatment Area Posting	No Charge
Day of Intervention Whole Lake Shoreline Posting	No Charge
Days Before Intervention Treatment Area Posting	$800.00
Day Before Intervention, Whole Lake Shoreline Posting	$1,000.00

S3 Public Meetings	Cost $US
Q & A Participation	$250.00 in-person
Formal Presenation	$500.00 in-person

S4 On-Site Lake Condition Review	Cost $US
Pre Intervention Review	$900.00
Post Intervention Review	$900.00

Part 2: Improvement Agent Application Cost

Service Description	Cost per Acre $US
A1 Cost to Apply Liquids to Less Than 5 Acres A single or cominatation of liquid, flowables, or wetable powder agents per acre	$115.00
A2 Cost to Apply Liquids to More Than 5 Acres A single or cominatation of liquid, flowables, or wetable powder agents per acre	$95.00
A3 Cost to Apply Granules to Less Than 5 Acres A single or cominatation of granular agents per acre	$150.00
A4 Cost to Apply Granules to More Than 5 Acres A single or cominatation of granular agents per acre	$115.00
A5 Cost to Simultaneously Apply Granules and Liquids to Less Than 5 Acres A single or cominatation of granular and liquid applied agents per acre	$190.00
A6 Cost to Simultaneously Apply Granules and Liquids to More Than 5 Acres A single or cominatation of granular and liquid applied agents per acre	$150.00

Part 3: Liquid Synthetic Biocide Cost Per Unit Volume Including Applicable Taxes and Surcharges

LakeScan™ Control Agent Codes		Control Agent	Brand Name	Unit Volume or Weight	Bid Cost Per Unit Volume or Weight Including all Taxes and Delivery $US
L1	1020	Carfentrazone	Stingray	1 gal.	$730.00 per gallon
L2	1040	Copper Sulfate Liquid	Old Bridge, dissolved	1 gal.	$2.12 per gallon
L3	1045	Copper Sulfate and Alum	SeClear G		$5.00 per pound
L4	1050	Copper Chelate Liquid Algaecide	Cutrine Plus or equivalent	1 gal.	$34.81 per gallon
L5	1080	Copper Chelate Emulsified Liquid	Cutrine Ultra or equivalent		$37.77 per gallon
L6	1110	Copper Chelate Combo	Komeen or equivalent		$44.20 per gallon
L7	1120	Copper Citrate Gluconate	Product not approved for use in Michigan		No Bid
L8	1150	Diquat Dibromide	Tribune of equivalent	1 gal.	$77.38 per gallon
L9	1170	Diquat Combo	AquaStrike	1 gal.	$99.17 per gallon
L10	1180	Endothall Salt Liquid	Aquathol-K	1 gal.	$107.63 per gallon
L11	1200	Endothall Amine Liquid	Hydrothol-191	1 gal.	$112.04 per gallon
L12	1270	Fluroxypyr	Product not approved for use in Michigan		No Bid
L13	1240	Fluridone Liquid	Sonar AS	1 qt.	$671.25 per quart
L14	1230	Flumioxazin Liquid	Clipper SC or equivalent	1 qt.	$450.26 per gallan
L15	1260	Florpyrauxifen-benzyl	ProcellaCOR EC	1 qt.	$2,222.48 per gallon
L16	1280	Glyphosate	RoundUp Custom	1 gal.	$55.70 per gallon
L17	1300	Imazamox	Clearcast	1 gal.	$383.03 per gallon
L18	1310	Imazapyr	Habitat	1 gal.	$124.55 per gallon
L19	1320	Penoxsulam	Galleon	1 gal.	$846.03 per gallon

Part 3: Liquid Materials Continued

LakeScan™ Control Agent Codes		Control Agent	Brand Name	Unit Volume or Weight	Bid Cost Per Unit Volume or Weight Including all Taxes and Delivery $US
L18	1350	Quinclorac	Product not approved for use in Michigan	1 gal.	No Bid
L19	1360	Topramazone	Oasis	1 gal.	$3,865.78 per gallon
L20	1370	Trifloxysulfuron	Product not approved for use in Michigan	1 gal.	No Bid
L21	1380	Triclopyr Amine Liquid	Renovate 3 or equivalent	1 gal.	$153.07 per gallon
L22	1410	Triclopyr Acid	Renovate 3 or equivalent	1 gal.	$153.07 per gallon
L23	1420	2,4-D Amine Liquid	Product not approved for use in Michigan	1 gal.	No Bid
L24	1470	2,4-D Combo	Product not approved for use in Michigan	1 gal.	No Bid

Part 4: Cost of Synthetic Granular Biocides Per Pound Including Applicable Taxes and Surcharges

LakeScan™ Control Agent Codes		Control Agent	Brand Name	Unit Volume or Weight	Bid Cost Per Unit Volume or Weight Including all Taxes and Delivery $US
G1	1030	Copper Sulfate	Old Bridge	1 lb.	$2.12 per pound
G2	1070	Copper Chelate Granular Algaecide	Cutrine Plus Granular	1 lb.	$4.18 per pound
G3	1100	Copper Chelate Granular Herbicide	Harpoon Granular	1 lb.	$2.72 per pound
G4	1190	Endothall Salt Granular	Aquathol Super K	1 lb.	$27.78 per pound
G5	1210	Endothall Amine Granular	Hydrothol 191 Granular	1 lb.	$5.30 per pound
G6	1250	Fluridone Granular	Sonar One	1 lb.	$45.78 per pound
G7	1400	Triclopyr Amine Granular	Renovate OTF or equivalent	1 lb.	$6.72 per pound
G8	1440	2,4-D Granular	Sculpin G	1 lb.	$4.19 per pound
G9	1470	2,4-D Combo	Renovate Max G	1 lb.	$5.45 per pound
G10	1450	2,4-D BEE Granular	Navigate	1 lb.	$5.84 per pound
G10	1460	2,4-D IOE Granular	Product not approved for use in Michigan	1 lb.	No Bid

Part 5: Cost of Wetable or Slurried Materials Per Pound Including Applicable Taxes and Surcharges

LakeScan™ Control Agent Codes		Control Agent	Brand Name	Unit Volume or Weight	Bid Cost Per Unit Volume or Weight Including all Taxes and Delivery $US
D1	1010	Bispyribac	Tradewind	1 gal.	$1,001.67 per pound
D2	1030	Copper Sulfate	Old Bridge	1 lb.	$2.12 per pound
D3	1060	Copper Chelate Herbicide	Granular Product, not wettable or slurried	1 lb.	No Bid
D4	1085	Copper Chelate Algaecide	Granular product, not wetable or slurried	1 lb.	No Bid
D5	1260	Flumioxazin	Clipper or equivalent	1 lb.	$48.15 per pound
D6	1260	Hydrogen Peroxide	Phycomycin	1 lb.	$1.73 per pound

Part 6: Dyes, Colorants, and Tracers

LakeScan™ Control Agent Codes		Dye or Colorant	Brand Name	Unit Volume or Weight	Bid Cost Per Unit Volume or Weight Including all Taxes and Delivery $US
T1	1085	Blue Liquid	N/A	1 gal.	No Bid
T2	1085	Black Liquid	N/A	1 gal.	No Bid
T3	1085	Red Tracer Liquid	N/A		No Bid
T4	1085	Other Liquid	N/A	1 gal.	No Bid
T5	1085	Blue Powder/Granule	N/A	1 oz.	No Bid
T6	1085	Black Powder/Granule	N/A	1 oz.	No Bid
T7	1085	Other Powder/Granule	N/A	1 oz.	No Bid

Part 7: Biological Agents, Endocides & Biocides

LakeScan™ Control Agent Codes		Biological Agent	Brand Name	Unit Volume or Weight	Bid Cost Per Unit Volume or Weight Including all Taxes and Delivery $US
		Sediment Mineralization			
B1	1030	Liquid Bacteria Amendment		1 gal.	No Bid
B2	1060	Wetable / Soluble Bacteria Amendment		1 lb.	No Bid
		Water Clarification			
B3		Liquid Bacteria Amendment		1 gal.	No Bid
B4		Wetable / Soluble Bacteria Amendment		1 lb.	No Bid
		Endocide			
B5		Liquid Bacteria Amendment		1 gal.	No Bid
B6		Wetable / Soluble Bacteria Amendment		1 lb.	No Bid
		Biocide (USEPA Registered Bio-Pesticide)			
B7		Liquid Bacteria Amendment		1 gal.	No Bid
B8		Wetable / Soluble Bacteria Amendment		1 lb	No Bid
		Nutrient Inactivation Agent			
N1		Alum		1 lb.	No Bid
N2		Lanthanum		1 lb.	No Bid

Part 8: Chemical and Biological Adjuvants

LakeScan™ Control Agent Codes		Adjuvant	Brand Name	Unit Volume or Weight	Bid Cost Per Unit Volume or Weight Including all Taxes and Delivery $US
		Activators			
J11	1030	D-Limonine	Cygnet Plus	1 gal.	$23.67 per gallon
J12		Pine	Will be priced upon product selection by the limnologist	1 lb.	No Bid
J13		Proteins	AMP	1 lb.	$99.30 per gallon
		Sinking and Sticking Agents (Polylmers and Emergent Plant Enhancements)			
J21		Liquid Adjuvant	PolyAn	1 gal.	$50.82 per gallon
J22		Wetable / Soluble Adjuvant	Will be priced upon product selection by the limnologist	1 lb.	No Bid
		Inverts			
J31		Liquid Invert Agent	Will be priced upon product selection by the limnologist	1 gal.	No Bid

Appendix B
Contractor Short Form Bid Worksheet

Contractor to complete the following worksheet in its entirety and return the sheet with their bid.

Item	Target Plant	Application Rate	Quantity	Price per Acre	Total
2,4-D Ester (e.g. Navigate)	Eurasian Milfoil	150 lbs./ acre	10 Acres	$763.00	$7,630.00
2,4-D Ester (e.g. Navigate) + Chelated Copper Algicide	Eurasian Milfoil	100 lbs./acre +1 gal./acre.	40 Acres	$646.00	$25,840.00
Triclopyr Dry	Eurasian Milfoil	160 lbs./ acre	10 Acres	$935.00	$9,350.00
Diquat Dibromide + Endothal Salt	Eurasian Milfoil CurlyLeaf Pondweed Nuisance Natives	1.0 gal./acre each agent	40 Acres	$280.00	$11,200.00
Diquat Dibromide	Eurasian Milfoil CurlyLeaf Pondweed Nuisance Natives	1.0 gal./ acre	40 Acres	$154.00	$6,160.00
		2.0 gal./ acre	40 Acres	$223.00	$8,920.00
Flumioxazin	CurlyLeaf Pondweed Nuisance Natives	2.0 lbs./ acre	10 Acres	$238.00	$2,380.00
Flumioxazin + Diquat Dibromide	Nuisance Natives	1.6 lbs./ acre + 1.0 gal/ acre	10 Acres	$265.00	$2,650.00
Aquathol K	Curly-Leaf Pondweed Nuisance Natives	1.0 gal. / acre	10 Acres	$180.00	$1,800.00
		2.0 gal./ acre	10 Acres	$270.00	$2,700.00
Glyphosate	Water Lilies Phragmites	6.0 pints/ acre	5 Lots (1600 ft2 per lot)	$53.00	$265.00
Chelated Copper Algicides	Algae Control	3.6 gal./ acre	40 Acres	$127.00	$5,080.00
ProcellaCOR EC + Diquat Dibromide	Eurasian and Hybrid Milfoils	16 oz./acre + 1 gal./acre	40 Acres	$583.00	$23,320.00
Add Carfentrazone as Adjuvant to any liquid or granular mix.	Eurasian and Hybrid Milfoils	6 oz./acre	40 Acres	$34.22	$1,369.00
Add AMP Adjuvant to any liquid or granular mix.	Eurasian and Hybrid Milfoils	1 gal./ acre	40 Acres	$99.30	$3,972.00
Add Chleated Copper as an Adjuvant to any liquid or granular mix.	Nuisance Species	1 gal./acre	40 Acres	$37.70	$1,508.00
			MDEQ Permit Fee	100 + Acres	$1,760.00
				Grand Total	$115,904.00

Exhibit “3”
Itemized Invoice Information Standards

Table 1: An example of what data must absolutely be included in invoicing for services rendered.

HERBICIDE APPLICATION

TREATMENT DATE: _____ CREW MEMBERS: _____

TARGET NUISANCE	TmtZ	ACRES	AGENT COMBO ABBREV.	CONTROL AGENT	QUANTITY	UNIT	TMT METHOD	COST PER ACRE
Ebrid	31.x	61	Nav+Cu	Navitrol	150	lbs	Surface Spray &	$120
				Cutrine Plus	1	gal	Spreader	
Val	32.x	83.24	CF+Cu	Carfentrazone	0.125	gal	Spikes	$390
				Flumioxazin	2	lbs		
Ebrid	33.x	0	TP-C	Diquat	1	gal	Sub-Surface	$295
				Aquathol	1	gal	Injection	
				Cutrine +	1	gal		
				Carfentrazone	0.125	lbs		
Ebrid Val	34.x	0	TP-CF	Diquat	1	gal	Spikes &	$410
				Aquathol	1	gal	Surface Spray	
				Cutrine +	1	gal		
				Carfentrazone	0.125	lbs		
				Flumioxazin	2	lbs		
Algae	35.x	0	Algae	Cutrine +	1	gal	Weighted Hose	$120
				Hydrothol	0.25	gal		
				Phoslock	100	lbs		

Exhibit “3”

Table 2: An example of what data must absolutely be included in invoicing for services or tasks rendered.

TASK INVOICING

TASK DESCRIPTION	COST PER UNIT	TOTAL UNIT	TOTAL CHARGE
Permit Prep			$100
Permit Cost (Pass Through)			$1,850
Posting			N/C
7 - Day Notice Charge	1	500	$500
Pre-Posting			$600

KIESER & ASSOCIATES
ENVIRONMENTAL SCIENCE & ENGINEERING

A Summary of Findings from LakeScan™
Guided Surveys and Analysis of:

Cedar Lake North

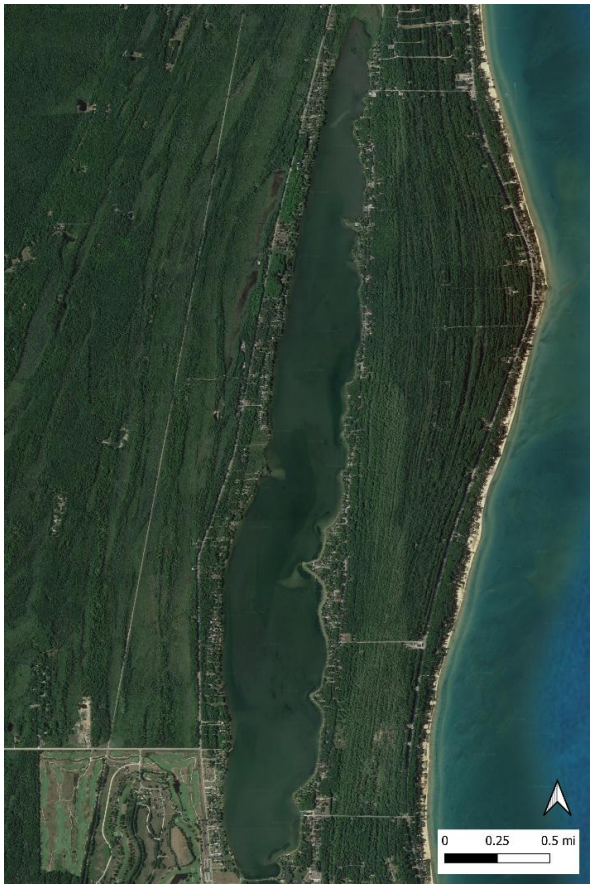
Alcona and Iosco Counties

2024 DATA AND ANALYSIS SUMMARY REPORT WITH MANAGEMENT RECOMMENDATIONS

February 25, 2025

Submitted by:

Natalie Crum, Project Manager
Dr. G. Douglas Pullman, PhD, Senior Ecological Adviser
and
Mark S. Kieser, Senior Scientist
Kieser & Associates, LLC



Executive Summary

Kieser & Associates, LLC (K&A) conducted vegetation monitoring on Cedar Lake North (Alcona and Iosco Counties, MI) during the summer of 2024 using LakeScan™ assessment methods. The purpose of these efforts was to assess aquatic vegetation during the summer recreational season in the context of nuisance conditions and management needs/outcomes. LakeScan™ methods combine detailed field data collection with mapping capabilities and whole-lake analyses based on established scientific metrics to score various lake conditions. This approach allows lake managers to readily and consistently identify successful lake management activities, highlight potential issues requiring intervention, and gather critical planning information necessary to improve the ecological and recreational conditions of the lake.

To summarize the overall findings on the lake in 2024, assessed LakeScan™ metrics were averaged across the early and late-season vegetation surveys, revealing that Cedar Lake North met the optimal management goals for all metrics in 2024 (Table ES-1). These findings illustrate improving trends from the conditions observed in 2023, which fell short of the management goals for the Shannon biodiversity index and recreational nuisance presence. These findings additionally indicate that the lake is improving in both species and structural diversity and that nuisance conditions are declining. The high Shannon morphology and biodiversity scores show that the species in the lake are both diverse in type and structure, contributing to greater habitat suitability for aquatic organisms. The consistently high average Floristic Quality Index suggests a high distribution of desirable native plant species and a low distribution of undesirable invasive species. The Algal Bloom Risk rating for Cedar Lake North is "low" reflecting the small proportion of agricultural and urban land use draining to the lake.

Table ES-1 – Summary of lake analysis metrics.

LakeScan™ Metric	2024 Average	Management Goal
Species Richness	20	n/a
Shannon Biodiversity Index	10.2	> 8.8
Shannon Morphology Index	9.0	> 6.3
Floristic Quality Index	26.7	> 20
Recreational Nuisance Presence	7%	< 10%
Algal Bloom Risk	Low	Low

The Cedar Lake North early-season LakeScan™ survey was conducted on Monday, July 1, 2024. The most common native species observed during the survey were *Chara* (*Chara sp.*), broadleaf pondweed (*Potamogeton amplifolius)*, Richardson's pondweed *(Potamogeton richardsonii),* and common bladderwort (*Utricularia vulgaris L.*). Broadleaf pondweed and Richardson's pondweed were observed at moderate densities around the lake, typically not dense enough to cause any nuisance concerns, except in AROS 370-375, 384, 385, 398, 321, and 341-342, which had broadleaf pondweed growing to the surface.

The aquatic invasive species observed during the early-season survey were hybrid Eurasian watermilfoil (*Myriophyllum spicatum x sibiricum*), *Phragmites* (*Phragmites australis*), and purple loosestrife (*Lythrum salicaria L.*). Distribution of these species was minimal, with Eurasian watermilfoil found in single stand-

alone clusters in AROS 342, 343, and 350, *Phragmites* only observed at AROS 361, and purple loosestrife at AROS 340, 351, and 352.

The late-season LakeScan™ survey was conducted on Wednesday, August 7, 2024. The most common native species observed during the survey were, broadleaf pondweed, Richardson's pondweed, and rushes (*Juncus sp.*). In some shoreline AROS locations (321, 338, 347, 348, 371, 373, and 398), tall native pondweeds were growing to the surface which could have caused some minor recreational nuisance conditions, but the patches of pondweeds appeared to be less dense and continuous than what was observed during the early-season survey. The majority of dense native vegetation growth was noted in the excavated trenches (#500 AROS).

The aquatic invasive species observed during the 2024 late-season survey were hybrid Eurasian watermilfoil, *Phragmites*, and purple loosestrife. Eurasian watermilfoil was found in clusters in AROS 357, 358, 368, 567, 577, and 582. The emergent invasive species *Phragmites* and purple loosestrife were found in small clusters along the shoreline, with *Phragmites* at AROS 360, 361, and 364 and purple loosestrife across much of the shoreline.

Over the last five years, variable-leaf watermilfoil (*Myriophyllum heterophyllum)* and hybrid Eurasian watermilfoil coverage on Cedar Lake North have exhibited declining trends (Figure ES-1). Coverage of variable-leaf watermilfoil has decreased by 6% since 2020, remaining consistently under 10% coverage over the last five years (Figure ES-1). Although variable-leaf watermilfoil coverage has declined over the last five years, coverage did increase by roughly 0.4% in the last year, which while minor, might indicate a slight rebound of the species. Eurasian watermilfoil coverage has remained consistently under 1% over the past five years (Figure ES-1). While Eurasian watermilfoil coverages have remained minor across multiple years, the species did increase in coverage by 0.2% in the last year, indicating the possibility of a slight rebound of the species, which was not found during either survey in 2023. Despite slight increases in Eurasian watermilfoil and variable-leaf watermilfoil coverages in the last year, the coverage of these species remains minor and trends are decreasing, indicating that management activities are successfully controlling nuisance watermilfoil populations on a multi-year basis. If milfoil coverage continues to increase in future surveys, alternative management options may need to be explored.

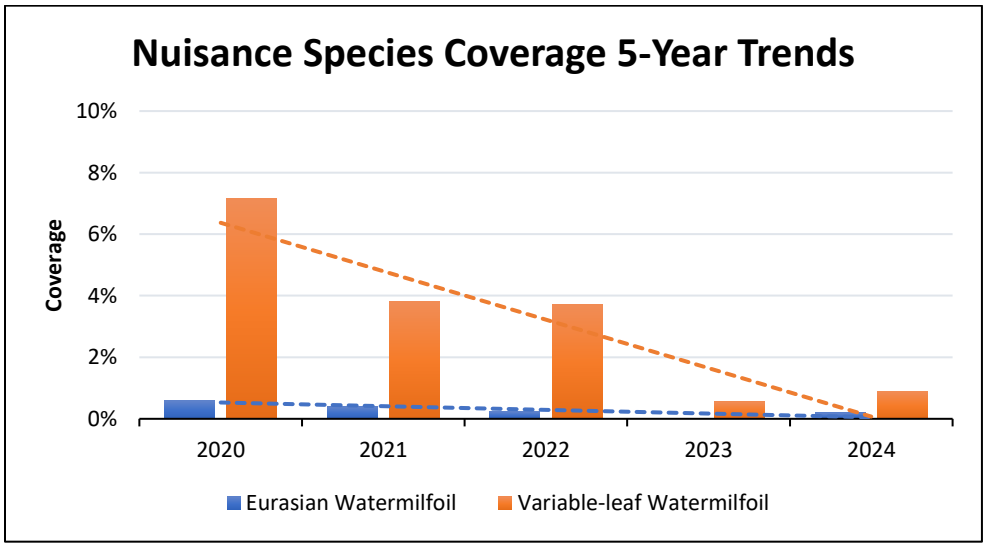


Figure ES-1 – Nuisance species coverage 5-year trends.

Based on 2024 findings, K&A recommends the following management considerations for 2025:

- **Continued management of Eurasian and Variable-leaf watermilfoil.**
    - Watermilfoil coverages have trended downward over the last five years with coverage in 2024 being less than 2%. Thus, current management interventions appear to be effective at suppressing growth and reducing the cumulative coverage of nuisance watermilfoil presence. Despite low coverages in 2024, both species displayed slight increases in coverages over the past year, indicating the possibility of species rebound. Therefore, it is recommended that the Cedar Lake Improvement Board continues exploring management options similar to the ones implemented in 2024 for treating nuisance watermilfoil conditions in the following years.
- **Continued ProcellaCOR applications to treat Eurasian watermilfoil in the northern trenches of Cedar Lake North**.
    - Recent ProcellaCOR applications in Cedar Lake North appear to have been an effective strategy for the management of nuisance hybrid Eurasian watermilfoil. Applications should continue through 2025 to determine if ProcellaCOR continues to be an effective means to control hybrid Eurasian watermilfoil. If coverage trends continue to increase, a re-evaluation of the current treatment regimen may be warranted.
- **Continued monitoring of the coverage and nuisance conditions of variable-leaf watermilfoil.**
    - The treatments in 2020 targeting nuisance variable-leaf watermilfoil were projected to have lasting effects for up to three years. Based on 2021 - 2024 LakeScan™ surveys, the 2020 treatments appear to have continually suppressed nuisance conditions, although the species did have a slight uptick in coverage from 2023 to 2024. It will be important to closely monitor the treatment areas to see if treatment results persist into 2025.
- **Continued monitoring of coverage and nuisance conditions of emergent invasive species.**
    - It will be crucial to monitor and document *Phragmites* coverage in Cedar Lake North following the treatment on September 18, 2024. Close monitoring will reveal the effectiveness of the treatment and inform if follow-up treatments are warranted. An additional on-the-ground survey of the treated areas might be pursued by the lake board to achieve reliable and accurate monitoring data on *Phragmites* populations.
    - Given the increasing shoreline distribution of purple loosestrife, it is recommended that the lake board consider the use of biocontrols over a few seasonal applications to manage the spread of the species. K&A has seen effective, self-sustaining populations of *Galerucella* beetles forage exclusively on purple loosestrife after three years of beetle releases.
- **Monitoring the coverage and nuisance conditions of native pondweed production.**
    - Nuisance pondweed production in Cedar Lake North has been increasing. Pondweeds resembling broad leaf pondweed and Richardson's pondweed may be aggressive hybrids that are increasing in cumulative cover. The Department of the Environment, Great Lakes, and Energy (EGLE) does not permit treatment of pondweeds in many of the nuisance areas in Cedar Lake North. Mechanical harvesting is not regulated in Michigan and can be used as an effective management strategy for nuisance pondweeds where navigation is impaired. This approach should be considered for use if there is a substantial increase in the nuisance production of hybrid native pondweeds.

Table of Contents

1.0. Introduction

Inland lakes are complex systems, and managing them for both ecological health and recreational enjoyment involves balancing goals that are sometimes at odds with one another. Successful lake management requires an understanding of the current ecological and recreational conditions of a lake, as well as how those conditions change over time. The LakeScan™ program combines a detailed data collection methodology with mapping capabilities and whole-lake analysis metrics backed by scientific literature. This analysis allows lake managers to identify successful lake management activities, as well as highlight potential issues requiring intervention. Appropriately targeted aquatic plant suppression can minimize weedy and nuisance species while allowing beneficial species to flourish at ecologically balanced levels supporting healthy lake conditions. This kind of adaptive management system provides a scientifically sound and consistent methodology to better manage lake ecological and recreational conditions.

The LakeScan™ analysis involves collecting data over two vegetation surveys during the critical summer recreational season. These surveys are based on a system where the lake is first divided into biological tiers (Table 1) and then further subdivided into Aquatic Resource Observation Sites (AROS; Figure 1). For each survey, field personnel record the density, distribution, and position in the water column of each aquatic plant species in each AROS, as well as noting any nuisance conditions. Dissolved oxygen profiles, temperature profiles, and Secchi depth are additionally recorded. Other water quality sampling can be included with surveys when requested.

Aquatic plant communities change over the course of a year, so the surveys are split into early and late-season observations. Early-season surveys are scheduled with the goal of taking place within 10 days of early-summer treatments to best observe treatment-targeted and non-targeted vegetation. Late-season surveys are scheduled to occur roughly two months after the early season survey. However, this scheduling is subject to weather and times of increased boat activity.

Table 1 – Biological Tier Descriptions.

Tier*	Description
2	Emergent Wetland
3	Near Shore
4	Off Shore
5	Off Shore, Drop-Off
6	Canals
7	Around Islands and Sandbars
9	Off Shore Island Drop-Off

*Tiers 1 and 8 are reserved for future use.

Figure 1 - Map of Aquatic Resource Observation Sites (AROS).

2.0. Lake and Watershed Characteristics

Location

Counties: Alcona and Iosco

Townships: Greenbush and Oscoda

Township/Range/Section(s): T25N and T24N, R9E Sections: 15, 22, 27, 34, and 3

GPS Coordinates: 44.528853, -83.331903

Morphometry

Total Area: 830 acres

Shoreline Length: 47,339 feet

Maximum Depth: 10 feet

Administrative Management

Management Authority: Cedar Lake Improvement Board

Years in LakeScan™ Program: 2003 to present

2.1. Algal Bloom Risk Level

K&A calculates an algal bloom risk level for each LakeScan™ lake based on the characteristics of its watershed. Agricultural and urban land uses contribute more phosphorus to receiving waters than grasslands or forested land uses; phosphorus being the limiting nutrient that drives algal blooms. Lakes with watersheds that have high proportions of land in agricultural and urban land uses are more likely to be at risk of algal blooms. Not all algal blooms contain cyanobacteria and their associated toxins (Harmful Algal Blooms or HABs). It is important to note that the risk factor reported here is based on a limited watershed analysis. Lakes at high risk of algal blooms should consider more in-depth studies that can identify possible watershed or in-lake improvements to mitigate the risk of HABs.

The algal bloom risk for Cedar Lake South is: **Low**

This risk is a reflection of the summary of watershed land-use composition for Cedar Lake North, which has minor inputs from urban and agricultural sources.

3.0. Dissolved Oxygen and Temperature Profiles

Secchi depth, dissolved oxygen and temperature data were collected during each vegetation survey. Secchi disk transparency is the depth at which a Secchi disk (a flat white or black and white platter, approximately 20 centimeters in diameter) suspended into a lake disappears from the investigator's sight. In general, the greater depth at which the Secchi disk can be viewed, the lower the productivity of the water body. Secchi depth readings of greater than 15 feet can be indicative of low productivity or

oligotrophic conditions.[1] Some variation in Secchi disk reporting may be a result of cloud cover, time of day, recent rain events, and recreational lake usage. Dissolved oxygen levels and temperature were measured by K&A using a YSI ProSolo dissolved oxygen meter, calibrated prior to use.

A sufficient supply of dissolved oxygen (DO) in lake water is necessary for most forms of desirable aquatic life. Colder waters contain more dissolved oxygen than warmer waters. In highly productive lakes, oxygen depletion can occur in deeper, unmixed bottom waters during warmer summer months. This decrease in oxygen is due in part to dead algae and other organic matter, such as leaves, grass and plant debris settling to the bottom of the lake and getting consumed, along with oxygen, by organisms in the sediment. DO depletion is most often observed in lake bottom waters during periods of temperature stratification in warmer summer months and, to a lesser degree, under winter ice cover conditions. Shallow lakes, like Cedar Lake, may not experience stratification and would not be expected to have as notable of oxygen depletion in the lake bottom waters compared to deeper bodies of water.

Secchi disk clarity on Cedar Lake North decreased from 9ft (clear to bottom) to 8.1ft between the early and late season surveys. This decrease in water clarity could likely be attributed to a slight increase in lake productivity later in the growing season and/or an increase in turbidity caused by sediment disturbance from swimming, boating, and other recreational activities increasing throughout the summer. The DO and temperature profiles remained consistent across the two surveys with no notable stratification, to be expected due to the shallow depths of the lake (Figures 2 and 3).

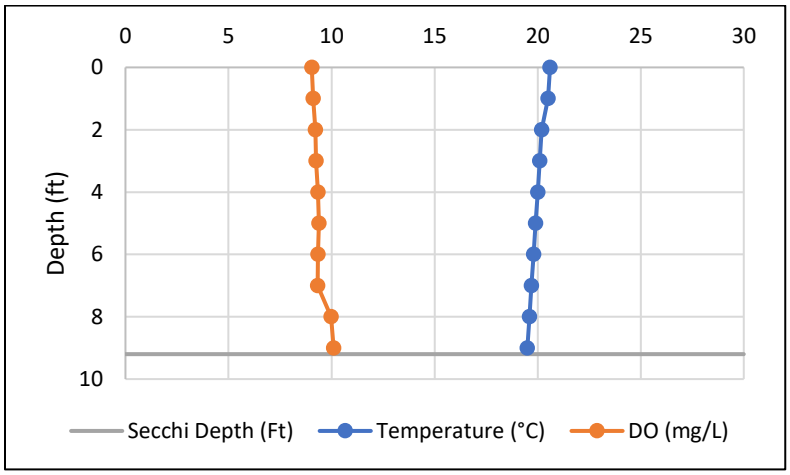


Figure 2 – Early-season survey (7/1/2024) dissolved oxygen and temperature profiles with Secchi depth, taken near AROS 521.

[1]US Geological Survey. 2012. "Water Quality Characteristics of Michigan's Inland Lakes, 2001-10." Scientific Investigations Report 2011–5233. Available online at: https://pubs.usgs.gov/sir/2011/5233/.

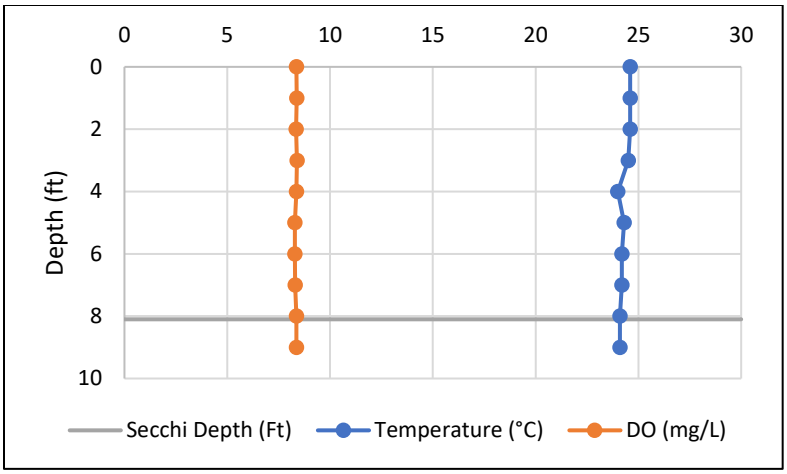


Figure 3 – Late-season survey (8/7/2024) dissolved oxygen and temperature profiles with Secchi depth, taken near AROS 521.

4.0. Aquatic Vegetation

4.1. Early-Season Survey

The Cedar Lake North early-season LakeScan™ survey was conducted on Monday, July 1, 2024. The weather throughout the survey was sunny with temperatures near 72°F and gentle northwestern winds around 3-5 mph. Visibility in the water column was great with a Secchi Disk reading of 9 feet, clear to the bottom. The survey occurred 13 days after the herbicide treatment on Tuesday, June 18, 2024.

A visual depiction of the data on all combined species observed in Cedar Lake North during the early-season survey is displayed using three-dimensional density, which reflects a combination of vegetation density, distribution and height observations for all species observed during the survey (Figure 4). Color-coding is provided for each AROS to spatially depict observed vegetation data. The colors range in a gradient from dark blue which depicts no vegetation observed, to yellow depicting medium density and distribution, to red which depicts high density and distribution of vegetation within the AROS.

The most common native species observed during the survey were *Chara*, broadleaf pondweed, Richardson's pondweed, and common bladderwort. *Chara* was the most commonly observed species and was found at moderate to high densities throughout a majority of observation areas. Broadleaf pondweed and Richardson's pondweed were observed at moderate densities around the lake, often flowering, but typically not dense enough to cause any nuisance concerns. In some shoreline AROS locations (370-375, 384, 385, 398, 321, and 341-342) tall broadleaf pondweed was growing to the surface which were noted as causing nuisance conditions. Variable-leaf watermilfoil was not observed throughout most of the survey, but was common throughout the shallow northern bay of the lake (Figure 5).

The only submerged aquatic invasive species observed in Cedar Lake North during the 2024 early-season survey was hybrid Eurasian watermilfoil. Eurasian watermilfoil was found in single stand-alone clusters in AROS 342, 343, and 350 and did not appear to be very hardy and was expected to drop from the water column on its own (Figure 6). Additionally, the emergent invasive species *Phragmites* and purple loosestrife were found along the shoreline, with *Phragmites* only at AROS 361, and purple loosestrife at AROS 340, 351, and 352, neither causing management concerns at the time of the survey (Figures 7 and 8).

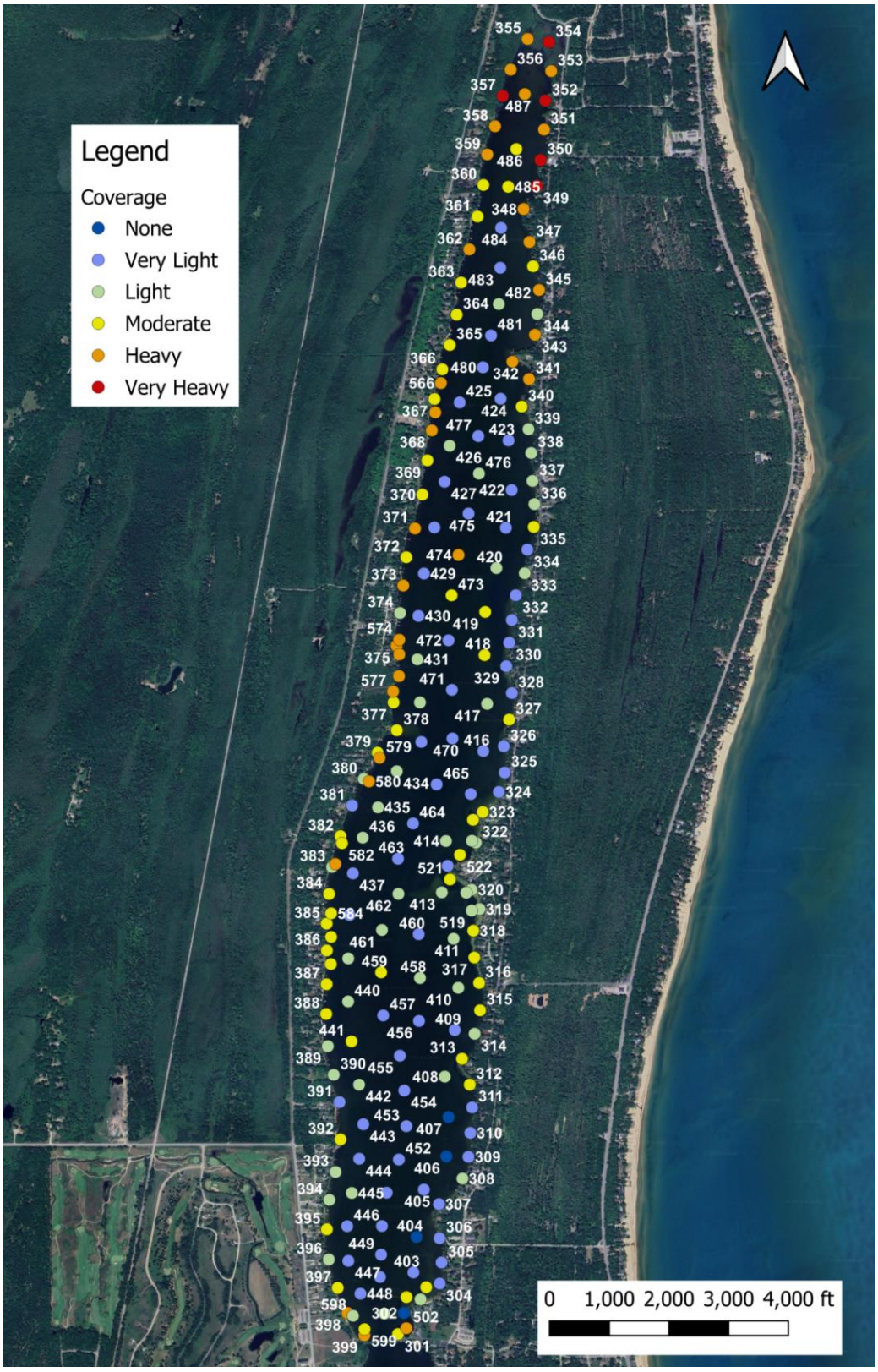


Figure 4 – Early-season survey (7/1/2024) vegetation 3D Density (a function of observed vegetation coverage, and height of all vegetation species).

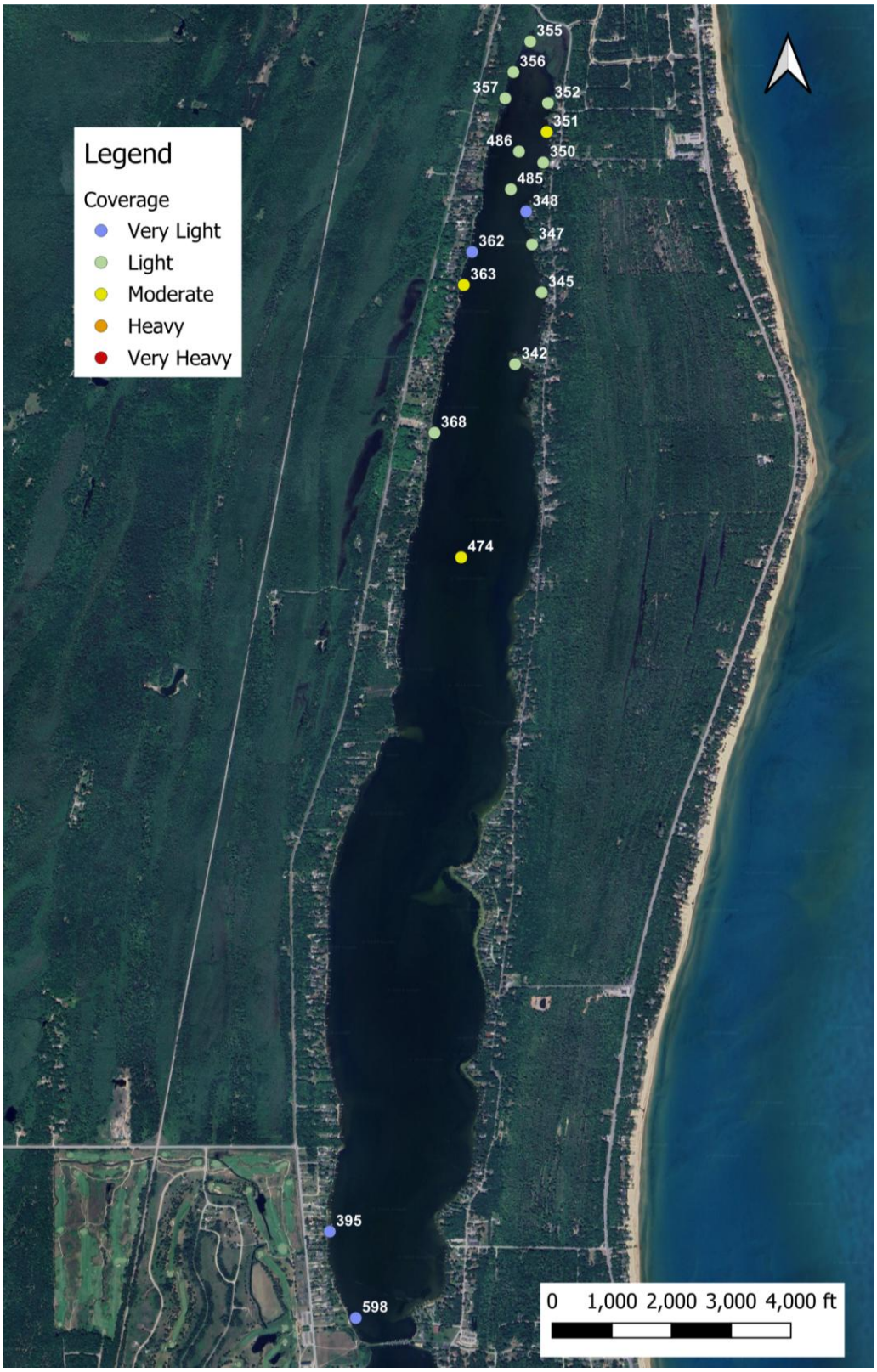


Figure 5 – Early-season (7/1/2024) Variable-leaf watermilfoil coverage (a combination of the LakeScan™ density and distribution observations).

Figure 6 – Early-season (7/1/2024) Eurasian watermilfoil coverage.

Figure 7 – Early-season (7/1/2024) Phragmites coverage.

Figure 8 – Early-season (7/1/2024) purple loosestrife coverage.

4.2. Late-Season Survey

The Cedar Lake North late-season LakeScan™ survey was conducted on Wednesday, August 7, 2024. The weather throughout the survey was sunny with temperatures around 77°F and southeastern winds around 8-12 mph. Visibility in the water column was good with a Secchi Disk reading of 8.1 feet.

A visual depiction of the data on all combined species observed in Cedar Lake North during the late-season survey is displayed using three-dimensional density (Figure 9). The most common native species observed during the survey were *Chara*, broadleaf pondweed, Richardson's pondweed, and rushes. In some shoreline AROS locations (321, 338, 347, 348, 371, 373, and 398) tall native pondweeds were growing to the surface which could cause some minor recreational nuisance conditions. Vegetation growth was the densest in the excavated trenches (#500 AROS) which were typically dominated by *Chara*, wild celery (*Vallisneria americana Michaux),* broadleaf pondweed, and Richardson's pondweed. Similar to conditions observed in the early-season survey, variable-leaf watermilfoil was not commonly observed during the survey, but was found at light coverages in the shallow northern bay of the lake (Figure 10).

The only submerged aquatic invasive species observed in Cedar Lake North during the 2024 late-season survey was hybrid Eurasian watermilfoil. Eurasian watermilfoil was found in clusters in AROS 357, 358, 368, 567, 577, and 582 (Figure 11). The milfoil that was spotted in AROS 342, 343, and 350 in the early-season survey was not observed at the time of the late-season survey. The emergent invasive species *Phragmites* and purple loosestrife were found along the shoreline, with *Phragmites* at AROS 360, 361, and 364. Purple loosestrife was flowering during the time of the survey making it more conspicuous. It was spotted in stand-alone pockets across much of the shoreline (Figure 12). Purple loosestrife was the densest and widely distributed in AROS 340, 352, 358, 360, 368, 376, 380, and 392 (Figure 13).

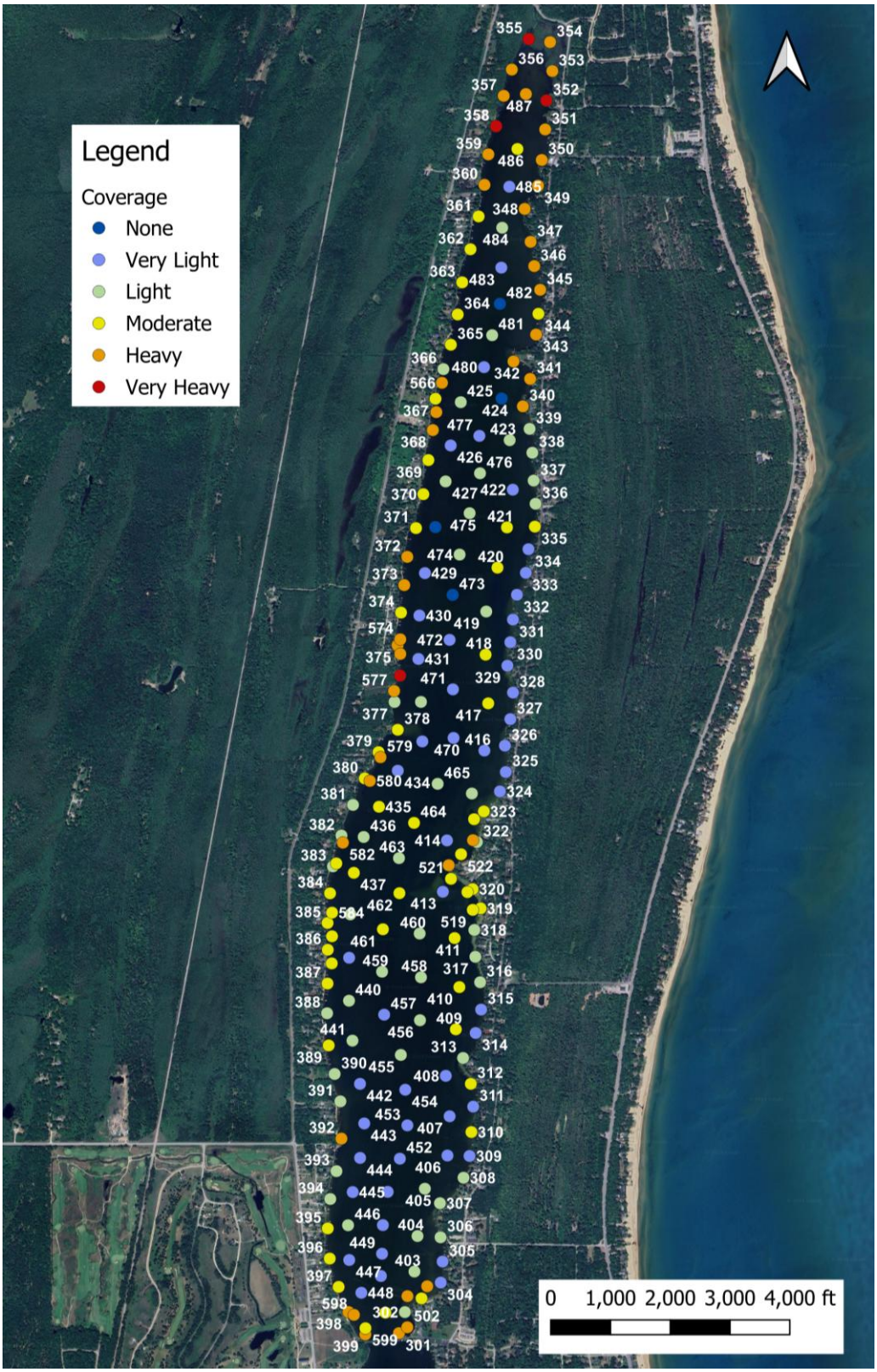


Figure 9 – Late-season survey (8/7/2024) vegetation 3D Density (a function of observed vegetation coverage, and height of all vegetation species).

Figure 10 – Late-season (8/7/2024) Variable-leaf Watermilfoil coverage (a combination of the LakeScan™ density and distribution observations).

Figure 11 – Late-season (8/7/2024) Eurasian watermilfoil coverage.

Figure 12 – Late-season (8/7/2024) Phragmites coverage.

Figure 13 – Late-season (8/7/2024) purple loosestrife coverage.

4.3. Summary Observations for Early and Late-Season Surveys

All aquatic plant species observed during the 2024 vegetation surveys were paired with their associated C-value and recorded for frequency, coverage, and dominance (Table 2). The Coefficient of Conservation, or C-Value, is a qualitative value ranging from 0 to 10 that is assigned to each species representing the estimated probability that it is likely to occur in an environment. A C-value of 0, is given to plants that may be found almost anywhere, while a C-value of 10 is applied to plants that are almost always restricted to high-quality natural areas.[2] 'Frequency' represents the percentage of survey sites (AROS) where a given species was found. 'Coverage' represents the lake bottom spatial cover observed for each species, represented as a percentage of available area. 'Dominance' represents the degree to which a species is more numerous than its competitors.

Table 2- Aquatic Plant Species Observed in 2024.

Common Name	C Value	Frequency		Coverage		Dominance	
		Early '24	Late '24	Early '24	Late '24	Early '24	Late '24
Eurasian Watermilfoil Hybrid	0	1.5%	3.0%	0.1%	0.3%	0.2%	0.5%
Green/Variable Watermilfoil	6	8.9%	4.0%	1.2%	0.6%	2.1%	1.0%
Common Bladderwort	6	34.2%	14.4%	2.3%	1.0%	4.1%	1.8%
Elodea	3	9.9%	0.0%	2.2%	0.0%	3.9%	0.0%
Naiad	6	15.8%	20.8%	1.9%	3.9%	3.5%	7.1%
Chara	7	97.5%	83.2%	18.7%	16.9%	33.3%	30.8%
Flat Stem Pondweed	5	1.0%	0.5%	0.1%	0.1%	0.2%	0.2%
Purple Loosestrife	0	2.5%	29.7%	0.2%	2.2%	0.3%	4.0%
Swamp Loosestrife	7	2.5%	0.0%	0.2%	0.0%	0.3%	0.0%
Richardsons Pondweed	5	37.6%	39.1%	6.7%	7.3%	12.0%	13.3%
Broadleaf Pondweed	6	62.4%	55.4%	7.0%	6.5%	12.4%	11.9%
Hybrid Pondweed	5	25.7%	25.2%	2.9%	2.9%	5.1%	5.3%
Sago Pondweed	3	6.4%	3.0%	1.2%	0.4%	2.1%	0.8%
Thin Leaf Pondweed	4	2.0%	3.5%	0.4%	0.4%	0.7%	0.8%
Wild Celery	7	26.2%	24.8%	3.0%	3.2%	5.3%	5.9%
Rush	8	24.8%	29.2%	2.3%	2.5%	4.1%	4.6%
Waterlily	6	11.9%	16.8%	1.8%	2.6%	3.2%	4.7%
Spadderdock	7	12.4%	16.3%	2.0%	2.2%	3.6%	4.1%
Arrow Arum	6	5.9%	5.0%	1.1%	0.6%	1.9%	1.2%
Cattail	1	7.4%	8.4%	0.9%	1.1%	1.6%	1.9%
Phragmites	0	0.5%	1.5%	0.0%	0.1%	0.1%	20.0%

[2] Michigan Department of Natural Resources Wildlife Division. (n.d.). Floristic Quality Assessment with Wetland Categories and Examples of Computer Applications for the State of Michigan.

4.4. LakeScan™ Metrics

Six important metrics for defining lake conditions are included in the LakeScan™ analyses, where early and late-season scores are averaged for a yearly score and compared against a management goal for each metric (Table 3). Management goals are based on median Michigan lake values (Shannon Biodiversity Index and Shannon Morphology Index), scientific literature (Floristic Quality Index), and professional judgement (Recreational Nuisance Presence and Algal Bloom Risk). Green shading in Table 3 highlights scores meeting management goals, while yellow and red highlights represent scores needing improvement, with red scores being further away from the optimal management goals potentially requiring a higher level of management attention. Descriptions of each of the six metrics are detailed below:

- **Species Richness** – the number of aquatic plant species present in the lake. More species are generally indicative of a healthier ecosystem, but not all species are desirable.
- **Shannon Biodiversity Index** – a measure of aquatic plant species diversity and distribution evenness, indicative of the stability and diversity of the plant community. Also known as the Shannon Expected Number of Species.[3]
- **Shannon Morphology Index** – a measure of aquatic plant morphology type diversity and distribution evenness, indicative of fish and macroinvertebrate habitat quality. This is calculated using morphology types instead of species.
- **Floristic Quality Index**[4] – a measure of the distribution of desirable aquatic plants. This index is used by Midwestern states for aquatic habitats, with higher scores indicative of increased biodiversity and a positive ratio of desirable versus undesirable aquatic plant species.
- **Recreational Nuisance Presence** – the percentage of survey sites that identified aquatic plants inhibiting recreational activities.
- **Algal Bloom Risk** – a calculated algal bloom risk level based on the characteristics of the lake watershed. Lakes with watersheds that have high proportions of land in agricultural and urban land uses are more likely to be at risk of algal blooms because these land uses contribute more phosphorus to receiving waters than grasslands or forests.

Table 3 – 2024 LakeScan™ Metric Results.

LakeScan™ Metric	Score Range	2024 Early Season	2024 Late Season	2024 Average	Management Goal
Species Richness	5 - 30	21	19	20	n/a
Shannon Biodiversity Index	1 -15	10.2	10.1	10.2	> 8.8
Shannon Morphology Index	1 - 10	9.1	8.8	9.0	> 6.3
Floristic Quality Index	1 - 40	27.6	25.7	26.7	> 20
Recreational Nuisance Presence	0 - 100%	9%	5%	7%	< 10%
Algal Bloom Risk	Low-High	n/a	n/a	Low	Low

*n/a = not applicable

[3] Hill, M. O. (1973). Diversity and evenness: a unifying notation and its consequences. *Ecology*, 54(2), 427-432.
[4] Nichols, S. A. (1999). Floristic quality assessment of Wisconsin lake plant communities with example applications. *Lake and Reservoir Management*, 15(2), 133-141.

The assessed LakeScan™ metrics for both the early and late-season surveys on Cedar Lake North met all management goals in 2024. These metrics also had very limited variability between the two surveys, indicating a high level of lake stability throughout 2024. Compared to 2023, which fell short of the management goals for the Shannon biodiversity index and recreational nuisance presence, the survey metrics from 2024 show improving trends. These findings indicate that the lake is improving in both species and structural diversity and that nuisance conditions are declining.

The high Shannon morphology and biodiversity indices indicate that the species in the lake are both diverse in type and structure, contributing to greater habitat suitability for aquatic organisms. The consistently high average Floristic Quality Index suggests a high distribution of desirable, native plant species and a low distribution of undesirable invasive species.

Over the past five years, the Floristic Quality Index on Cedar Lake North has exhibited a positive trend, indicating an increase in desirable, native plants and a decrease in undesirable, invasive aquatic species (Figure 14). Cedar Lake North Lake has met the FQI management score of 20 for the past the last five years, displaying a high level of floristic quality that is maintained from year-to-year by the current management regimen.

Figure 14 – Floristic Quality Index 5-Year Trend.

Despite Eurasian watermilfoil and variable-leaf watermilfoil coverage increasing slightly from 2023, the coverage of both species has generally declined over the past five years (Figure 15). Variable-leaf watermilfoil coverage on Cedar Lake North has decreased by 6% since 2020 and has remained consistently under 10% coverage throughout the last five years. Although variable-leaf watermilfoil coverage has generally declined over the last five years, coverage did increase by roughly 0.4% in 2024, which while minor, might indicate a rebound of the species. Eurasian watermilfoil coverage has remained consistently under 1% over the past five years. The species did increase in coverage by 0.2% in the last year, indicating a potential of a slight rebound of the species, which was not found during either of the 2023 surveys. Despite slight increases in Eurasian watermilfoil and variable leaf-watermilfoil coverages in the last year, the overall coverage of these species remains minor, indicating that management activities are successfully controlling nuisance watermilfoil populations.

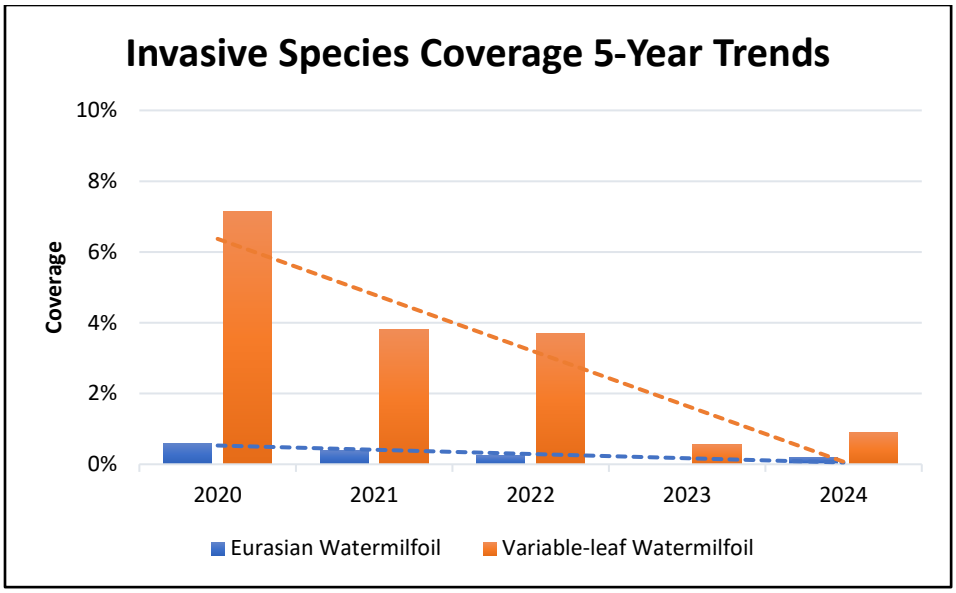


Figure 15 – Nuisance Species Coverage 5-Year Trends.

5.0. Lake Management

There are several species that typically become a nuisance in Michigan's inland lakes, these species are usually targeted for selective control to prevent them from becoming an aesthetic or recreational nuisance and to protect desirable plants that are part of healthy lake ecosystems. More information on common nuisance species in Michigan and their associated management options can be found in Appendix A. Treatment maps and data displaying acreage, herbicides, and targeted species for Cedar Lake North in 2024 can be found in Appendix B (note that the chemical tables provided in the ANC report are not split by North and South lakes).

A total of two chemical herbicide treatments were conducted by Solitude Lake Management on Cedar Lake North in 2024. The first chemical herbicide treatment took place on Tuesday, June 18, 2024, 13 days prior to the early-season survey. Solitude reported that the treatment targeted roughly 13.25 acres using treatment applications that target hybrid Eurasian watermilfoil, curly-leaf pondweed, starry stonewort (*Nitellopsis obtusa*), and algae using Tribune, Cutrine Plus, ProcellaCOR, and Hydrothol 191. The treatment areas were primarily relegated to the excavated trenches on the western edge of the lake; Hydrothol 191 was only used in the northern-most trench.

It is important to note that the "species targeted" descriptors provided by Solitude and included in Appendix B Figure B3 include curly-leaf pondweed and starry stonewort as treated species for the June 18th treatment despite neither of the species being noted in the lake for over a decade. Future species treated references provided by the applicator should be made consistent with pre-season survey findings and mutually-agreed upon target species, for accuracy in reporting. Where new invasive species are suspected by the applicator, immediate notification to K&A should otherwise be made and treatments recommendations discussed.

The second and final chemical herbicide treatment occurred on September 18, 2024, targeting roughly 1.25 acres of *Phragmites* and 4.5 acres of hybrid Eurasian watermilfoil. The treatment regimen targeted species using Tribune, Cutrine plus, Habitat, Aquaneat, and Cygnet plus.

During the early-season survey, which occurred 13 days after the first herbicide treatment, Eurasian watermilfoil was found at 0.1% coverage and grew slightly to 0.3% by the late-season. Both coverages of Eurasian watermilfoil were higher in 2024 than what was observed in 2023 which had 0% coverage across both surveys. However, this species has still maintained low and manageable levels of coverage at less than 1%, indicating a general multi-year success of herbicide treatments on managing the spread of hybrid Eurasian watermilfoil in Cedar Lake North (Figure 16).

Variable-leaf watermilfoil had higher coverages than the Eurasian watermilfoil with 1.2% coverage in the early season and 0.6% in the late season. The slight decline of the species from the early to late-season surveys and the relatively low overall coverages of less than 2%, further demonstrates the effectiveness and long-term success of the treatment regimen for variable-leaf watermilfoil.

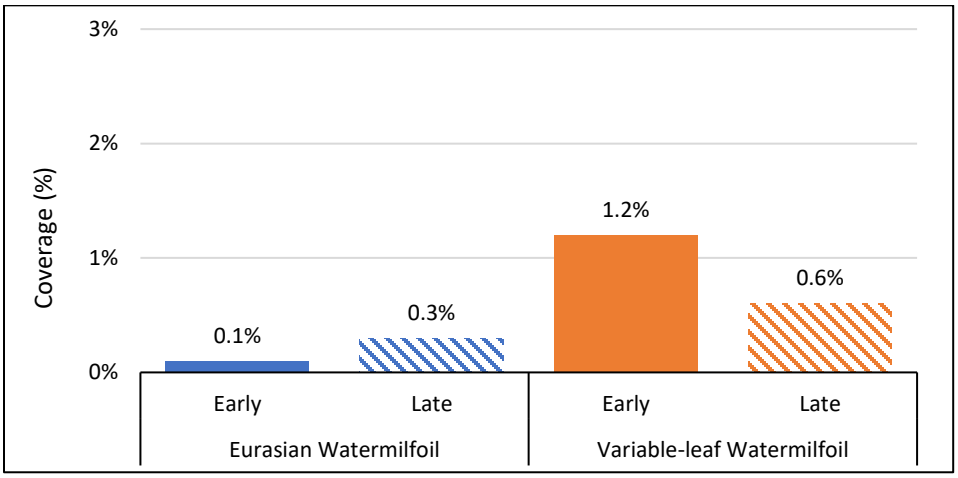


Figure 16 – Changes in coverage across both surveys for targeted species.

5.1. Management Recommendations

Watermilfoil coverages have trended downward over the last five years with coverage in 2024 being less than 2%. Thus, current management interventions appear to be effective at suppressing growth and reducing the cumulative coverage of nuisance watermilfoil presence. Despite low coverages in 2024, both species displayed slight increases in coverages over the past year, indicating the possibility of species rebound. Therefore, it is recommended that the Cedar Lake Improvement Board continues exploring management options similar to the ones implemented in 2024 for treating nuisance watermilfoil conditions in the following years.

Recent ProcellaCOR applications in Cedar Lake North appear to have been an effective strategy for the management of nuisance hybrid Eurasian watermilfoil. Applications should continue through 2025 to determine if ProcellaCOR continues to be an effective means to control hybrid Eurasian watermilfoil. If coverage trends continue to increase, a re-evaluation of the current treatment regimen may be warranted.

The treatments in 2020 targeting nuisance variable-leaf watermilfoil were projected to have lasting effects for up to three years. Based on 2021-2024 LakeScan™ surveys, the 2020 treatments appear to have continually suppressed nuisance conditions, although the species did have a slight uptick in coverage from 2023-2024. It will be important to closely monitor the treatment areas to see if treatment results persist into 2025.

It will be crucial to monitor and document *Phragmites* coverage in Cedar Lake North following the treatment on September 18, 2024. Close monitoring will reveal the effectiveness of the treatment and inform if follow-up treatments are warranted. An additional on-the-ground survey of the treated areas might be pursued by the CLIB to achieve reliable and accurate monitoring data on *Phragmites* populations.

Given the increasing shoreline distribution of purple loosestrife, it is recommended that the lake board consider the use of biocontrols over a few seasonal applications to manage the spread of the species. K&A has seen effective, self-sustaining populations of *Galerucella* beetles forage exclusively on purple loosestrife after three years of beetle releases.

Nuisance pondweed production in Cedar Lake North has been increasing. Pondweeds resembling broad leaf pondweed and Richardson's pondweed may be aggressive hybrids that are increasing in cumulative cover in the lake. The Department of the Environment, Great Lakes, and Energy (EGLE) does not permit treatment of pondweeds in many of the nuisance areas in Cedar Lake North. Mechanical harvesting is not regulated in Michigan and can be used as an effective management strategy for nuisance pondweeds. This approach should be considered for use in 2025 if there is a substantial increase in the nuisance production of hybrid native pondweeds.

6.0. Appendices

6.1. Appendix A: Information About Nuisance and Aquatic Invasive Species

Algal Blooms

Blue green algae blooms are becoming increasingly common in Michigan. Blooms can appear as though green latex paint has been spilled on the water, or resemble an oil slick in enclosed bays or along leeward shores. Blue green algae blooms are usually temporal events and may disappear as rapidly as they appear. Blue green algae blooms are becoming more common for a variety of reasons; however, the spread and impact of zebra mussels has been closely associated with blooms of blue green algae.

Figure A1 - Example blue green algae images from the 2019 LakeScan™ field crew.

Blue green algae are really a form of bacteria known as cyanobacteria. They are becoming an important issue for lake managers, riparian property owners and lake users because studies have revealed that substances made and released into the water by some of these nuisance algae can be toxic or carcinogenic. They are known to have negative impacts on aquatic ecosystems and can potentially poison and sicken pets, livestock, and wildlife. Blue green algae can have both direct and indirect negative impacts on fisheries. Persons can be exposed to the phytotoxins by ingestion or dermal absorption (through the skin). They can also be exposed to toxins by inhalation of aerosols created by overhead irrigation, strong winds, and boating activity.

Approximately one half of blue green algae blooms contain phytotoxins, and this is determined through lab testing. It is recommended that persons not swim in waters where blue green algae blooms are conspicuously present. Specifically, persons should avoid contact with water where blooms appear as though green latex paint has been spilled on the water, or where the water in enclosed bays appears to be covered by an “oil slick”. Pets should be prevented from drinking from tainted water. Since blue green algae toxins can enter the human body through the lungs as aerosols, it is suggested that water containing obvious blue green algae blooms not be used for irrigation in areas where persons may be exposed to it.

Blue green algae are not very good competitors with other, more desirable forms of algae. They typically bloom and become a nuisance when resources are limiting or when biotic conditions reach certain extremes. Some of the reasons that blue green algae can bloom and become noxious are listed below:

TP and TN: The total phosphorus (TP) concentration in a water resource is usually positively correlated with the production of suspended algae (but not rooted plants, i.e. seaweed). Very small amounts of phosphorus may result in large algae blooms. If the ratio of total nitrogen (TN) to total phosphorus is low (<20), suspended algae production may become nitrogen limited and noxious blue green algae may dominate a system because they are able to "fix" their own nitrogen from atmospheric sources. Other common and desirable algae are not able to do this.

Biotic Factors: Zebra mussels and zooplankton (microscopic, free-floating animals) are filter feeding organisms that strain algae and other substances out of the lake water for food. Studies have shown that filter-feeding organisms often reject blue green algae and feed selectively on more desirable algae. Over time, and given enough filter feeding organisms, a lake will experience a net loss in "good" algae and a gain in "bad" blue green algae as the "good" algae are consumed and the "bad" algae are rejected back into the water column. This is one of the most disturbing factors associated with the invasion and proliferation of zebra mussels. Lakes that are full of zebra mussels may not support the production of "good" algae and experience a partial collapse of the system of "good" algae that are necessary to support the fishery.

Eurasian Watermilfoil and Hybrids:

Background: Anecdotal evidence suggests that hybrid milfoil has been found in Michigan inland lakes for a long time (since the late 1980's). University of Connecticut professor Dr. Don Les was the first to determine that there were indeed, Eurasian watermilfoil and northern watermilfoil hybrids in Michigan based on samples sent to his Connecticut lab by Dr. Douglas Pullman, Aquest Corp. in 2003. Experience has proven that it is usually not possible to determine whether the milfoil observed is either Eurasian or hybrid genotype. However, because they play such similar roles in lake ecology, they are simply "lumped together" and referred to collectively as Eurasian watermilfoil. Eurasian watermilfoil is a very common nuisance in many Michigan inland lakes.

Management: Lake disturbance, such as weed control, unusual weather, and heavy lake use can destabilize the lake ecosystem and encourage the sudden nuisance bloom of weeds, like Eurasian watermilfoil. Eurasian watermilfoil is an ever-present threat to the stable biological diversity of the lake ecosystem. Species selective, systemic herbicide combinations have been used to suppress the nuisance production of Eurasian watermilfoil and support the production of a more desirable flora. However, it is becoming much more resistant to herbicidal treatment and herbicide resistant Eurasian watermilfoil and hybrid watermilfoil has been observed in many lakes throughout the Midwest.[5,6] Continued chemical applications can select for herbicide resistant plants, resulting in hybrid watermilfoil.[7] Some research suggests this resistance can be defeated with the use of microbiological system treatments. Milfoil community genetics are dynamic and careful monitoring is needed to adapt to the expected changes in

[5] Berger, S. T., Netherland, M. D., & MacDonald, G. E. (2015). Laboratory documentation of multiple-herbicide tolerance to fluridone, norflurazon, and topramazone in a hybrid watermilfoil (*Myriophyllum spicatum× M. sibiricum)* population. Weed Science, 63(1), 235-241.

[6] Netherland, M. D., & Willey, L. (2017). Mesocosm evaluation of three herbicides on Eurasian watermilfoil (*Myriophyllum spicatum*) and hybrid watermilfoil (*Myriophyllum spicatum x Myriophyllum sibiricum*): Developing a predictive assay. J. Aquat. Plant Manage, 55, 39-41.

[7] Netherland and Willey, 2017

the dominance of distinct milfoil genotypes. Some of these genotypes may be more herbicide resistant than others and treatment strategies must be adjusted to remain effective in different parts of the lake.

Figure A2 - Example Eurasian Watermilfoil and Hybrids images from the 2019 LakeScan™ field crew.

Starry Stonewort

Background: Starry stonewort, a macroalgae native to northern Eurasia, invaded North American inland lakes after becoming established in the St. Lawrence Seaway/Great Lakes system. Though not positively identified in a Michigan inland lake until 2006, by Aquest Corporation in Lobdell Lake, Genesee County, starry stonewort has likely been present in Michigan's inland lakes since the late 1990's. Since then, this invasive species has spread throughout Michigan. Able to spread by both fragmentation and asexual reproduction, starry stonewort has thrived in Michigan's high-quality oligotrophic and mesotrophic lakes, particularly those with marl sediments. Once established, this opportunistic species will bloom and crash and impose a very significant and deleterious impact on many ecosystem functions. Bloom and crash events are unpredictable and can happen at any time of the year. In some years starry stonewort can become a horrendous nuisance while it can be inconspicuous in others. It can comingle with other similar species and be very difficult to find when it is not blooming.

Management: Starry stonewort is capable of growing to extreme nuisance levels and can significantly impact important ecosystem functions. This species is difficult to control due to its asexual reproductive structures (bulbils) which embed in lake sediments.[8] While many strategies have been employed to manage starry stonewort, no single strategy has emerged as a panacea for controlling infestations.

Diver-assisted suction harvesting (DASH) or diver-assisted hand-pulling of small starry stonewort infestations could reduce populations over time.[9] While these methods can be effective and have high specificity, they are expensive, labor-intensive strategies that require long-term commitment.[10] These strategies may not be viable for large-scale infestations, however, due to their labor-intensive nature

[8] Glisson, W. J., Wagner, C. K., McComas, S. R., Farnum, K., Verhoeven, M. R., Muthukrishnan, R., & Larkin, D. J. (2018). Response of the invasive alga starry stonewort (*Nitellopsis obtusa*) to control efforts in a Minnesota lake. Lake and Reservoir Management, 34(3), 283-295.

[9] Glisson et al., 2018.

[10] Larkin, D.J., Monfils, A.K., Boissezon, A., Sleithd, R.S., Skawinski, P.M., Welling, C.H., Cahill, B.C., and Karold, K.G. 2018. Biology, ecology, and management of starry stonewort (*Nitellopsis obtusa*; Characeae): A Red-listed Eurasian green alga invasive in North America. https://doi.org/10.1016/j.aquabot.2018.04.003

and their potential for increasing distribution of the target plant species through fragmentation during removal.

Starry stonewort chemical treatments using copper-, diquat-, flumioxazin, and endothall-based algaecides have produced mixed results and long-term management has yet to be achieved using chemical biocides alone.[11] While starry stonewort is susceptible to most selective algaecides, the dense mats of vegetation are very difficult to penetrate and provide reasonable biocide exposure. Consequently, multiple algaecide applications may be required to "whittle down" dense starry stonewort growth if the mats reach sufficient height.

Figure A3 - Example starry stonewort images from the 2019 LakeScan™ field crew.

Curly Leaf Pondweed

Background: Curly leaf pondweed is one of the world's most widespread aquatic plant species. Although it is found worldwide, curly-leaf pondweed is native to only Eurasia. The earliest verifiable records of the plant are from Pennsylvania in the 1840s, and has been found in Michigan since 1910. Curly leaf pondweed is currently found in inland lakes of 34 counties in Michigan, distributed both in the upper and lower peninsulas. [12] Scientific literature suggests that curly leaf pondweed is an aggressively growing species that often expands to nuisance levels when native plants are damaged.

Curly leaf pondweed can create problems such as recreational nuisances, ecological nuisances (by outcompeting native species and reducing light availability to other plants), and degraded fish spawning habitat. Curly leaf pondweed is easily detectable in early spring as it will be one of the few plants readily growing and the first submersed plant to reach the surface. This gives it a competitive advantage and can grow 4 to 5 feet tall before other plants begin germinating from the bottom sediments. As water temperatures rise in late June and early July, curly-leaf pondweed stems begin to die, break down, and can be completely gone by mid-July.[13]

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[11] Pokrzywinski, K. L., Getsinger, K. D., Steckart, B., & Midwood, J. D. (2020). Aligning research and management priorities for *Nitellopsis obtusa* (starry stonewort).

[12] MDEQ. (2018). "State of Michigan's Status and Strategy for Curly-leafed Pondweed (*Potamogeton crispus L.*)." Accessed online: <https://www.michigan.gov/documents/invasives/egle-ais-potamogeton-crispus_708948_7.pdf>.

[13] Hart, Steven, M. Klepinger, H. Wandell, D. Garling, L. Wolfson. (2000). "Integrated Pest Management for Nuisance Exotics in Michigan Inland Lakes." Accessed online: <https://www.michigan.gov/documents/invasives/egle-great-lakes-aquatics-IPM-manual_708904_7.pdf>.

Management: Like other invasive species, curly-leaf pondweed is difficult to control once established and is considered widespread in Michigan. Therefore, prevention of new populations in uninfected waters is the most economical management approach. Several herbicides have been shown to be effective at long-term control of curly-leaf pondweed, but eradication is difficult after establishment. Bottom barriers have shown effectiveness at combating curly-leaf pondweed in small areas, and mechanical harvesting of curly-leaf pondweed can be effective if timed and managed correctly.[14]

The most viable ways to control curly-leaf pondweed is through chemical and physical means after developing an integrated pest management plan. Early infestations may best be controlled by manual removal, diver-assisted suction harvesting (DASH), or benthic barrier use during spring before turions are produced. Aquatic herbicides including endothall, diquat, and flumioxazin are the most effective for general applications. Aquatic herbicides including flumioxazin and imazamox are effective for specific types of application and in specific environments. Chemical treatments are a part of a long-term integrated management plan as the turions are viable for at least 5 years and only diquat, fluridone, and some hormone treatments have shown a reduction of turion development in the laboratory.[15]

Figure A4 - Example curly leaf pondweed image from the 2021 LakeScan™ field crew.

[14] MDEQ, 2018.
[15] MDEQ, 2018.

6.2. Appendix B: Herbicide Applicator Data and Maps

Date of treatment (one per section): 6/18/2024							
Name of person applying chemical: Michael Rohlman							
Name of Company or NA if not applicable: Solitude Lake Management							
Effectiveness: ■ Good (70-100%) ☐ Fair (50-69%) ☐ Poor (less than 50%) ☐ Ineffective (0%)							
Chemical Brand Used	EPA Registration Number	Method of Application	Application Rate (10 lbs./acre, etc.)	Treatment Area Size: (Acres)	Average Depth (Feet)	Total Amount (4 gallons, 10 lbs., etc.)	For Control of: (Plant and/or Algae names)
Tribune	100-1390	Surface Spray/Sub Surface Injection	1 gal/acre	7.5	3	7.5 gal	Eurasion Water Milfoil/Curlyleaf Pondweed
Cutrine Plus	67690-93	Surface Spray/Sub Surface Injection	.33 gal/acre-foot	7.5	3	7.5 gal	Macro-algaeStarry Stonewort
Hydrothol 191	70506-175	Surface Spray/Sub Surface Injection	1.33 pint/acre-foot	4.5	3	2.25 gal	Macro-algaeStarry Stonewort
Procellacor EC	67690-80	Surface Spray/Sub Surface Injection	25.6 fl oz/acre-foot	10.25	6	1574 oz	Eurasion Water Milfoil
Tribune	100-1390	Surface Spray/Sub Surface Injection	1 gal/acre	10.25	6	10.25 gal	Eurasion Water Milfoil/Curlyleaf Pondweed
Cutrine Plus	67690-93	Surface Spray/Sub Surface Injection	.17 gal/acre-foot	8.75	6	8.75 gal	Algae
Aquathol K	70506-176	Surface Spray/Sub Surface Injection	1 gal/acre	3	3	3 gal	Curly-leaf Pondweed

Figure B1 – Solitude Lake Management Aquatic Nuisance Control (ANC) treatment report for Cedar Lake, Alcona and Iosco counties, on June 18, 2024.

Date of treatment (one per section): 9/18/2024							
Name of person applying chemical: Michael Rohlman							
Name of Company or NA if not applicable: Solitude Lake Management							
Effectiveness: ■ Good (70-100%) ☐ Fair (50-69%) ☐ Poor (less than 50%) ☐ Ineffective (0%)							
Chemical Brand Used	EPA Registration Number	Method of Application	Application Rate (10 lbs./acre, etc.)	Treatment Area Size: (Acres)	Average Depth (Feet)	Total Amount (4 gallons, 10 lbs., etc.)	For Control of: (Plant and/or Algae names)
Tribune	100-1390	Surface Spray	2 gal/acre	4.5	3	9 gal	Eurasion Water Milfoil
Cutrine Plus	67690-93	Surface Spray	.33 gal/acre-foot	4.5	3	4.5 gal	Algae
Habitat	241-426-67690	Foliage Spray	2 pint/acre-foot	1.25	1	2.5 pint	Phragmites
Aquaneat	228-365	Foliage Spray	2 pint/acre-foot	1.25	1	2.5 pint	Phragmites
Cygnet Plus	N/A	Foliage Spray	.5 pint/acre-foot	1.25	1	.625 pint	Phragmites

Figure B2 – Solitude Lake Management Aquatic Nuisance Control (ANC) treatment report for Cedar Lake, Alcona and Iosco counties, on September 18, 2024.

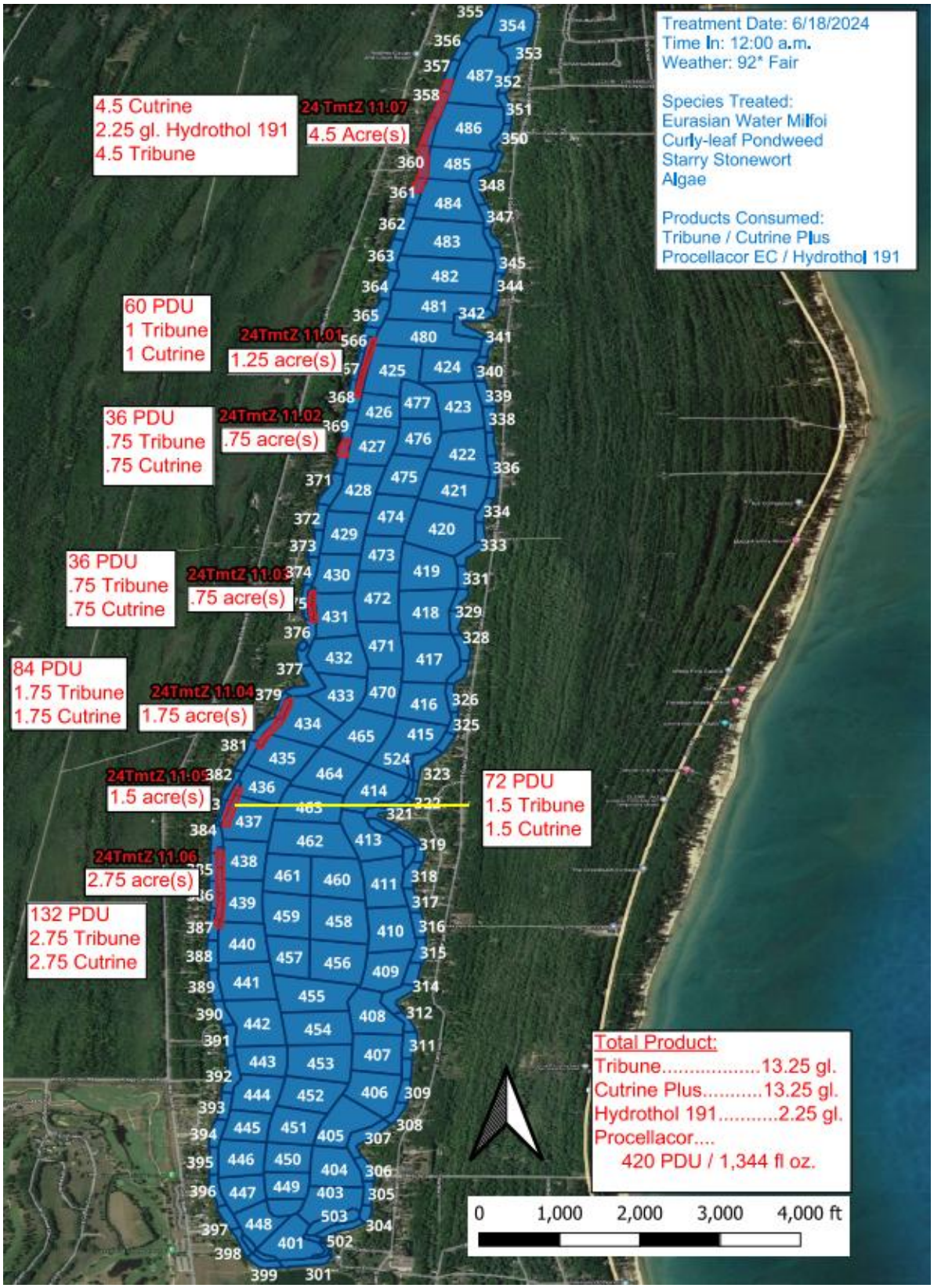

Figure B3 – Solitude Lake Management treatment map for Cedar Lake, Alcona and Iosco counties, on June 18, 2024.

Treatment Date: 9/18/2024
Time In: 12:00 P.M.
Weather: 78* Fair

Species Treated:
Eurasian Water Milfoil
Phragmites

Products Consumed:
Tribune
Cutrine Plus
Habitat
Aqua-neat
Cygnet Plus

Figure B4 – Solitude Lake Management treatment map for Cedar Lake, Alcona and Iosco counties, on September 18, 2024.

KIESER & ASSOCIATES
ENVIRONMENTAL SCIENCE & ENGINEERING

A Summary of Findings from LakeScan™
Guided Surveys and Analysis of:

Cedar Lake South

Iosco County

2024 DATA AND ANALYSIS SUMMARY REPORT WITH MANAGEMENT RECOMMENDATIONS

February 25, 2025

Submitted by:

Natalie Crum, Project Manager
Dr. G. Douglas Pullman, PhD, Senior Ecological Adviser
and
Mark S. Kieser, Senior Scientist
Kieser & Associates, LLC

Executive Summary

Kieser & Associates, LLC (K&A) conducted vegetation monitoring on Cedar Lake South (Iosco County, MI) during the summer of 2024 using LakeScan™ assessment methods. The purpose of these efforts was to assess aquatic vegetation during the summer recreational season in the context of nuisance conditions and management needs/outcomes. LakeScan™ methods combine detailed field data collection with mapping capabilities and whole-lake analyses based on established scientific metrics to score various lake conditions. This approach allows lake managers to readily and consistently identify successful lake management activities, highlight potential issues requiring intervention, and gather critical planning information necessary to improve the ecological and recreational conditions of the lake.

To summarize the overall findings on the lake in 2024, assessed LakeScan™ metrics were averaged across the early and late-season vegetation surveys, revealing that Cedar Lake South met the optimal management goals for all metrics in 2024 (Table ES-1). These findings illustrate stable year-to-year trends when compared to the conditions observed in 2023, which also met all LakeScan™ management goals. These results indicate that the lake continues to have favorable diversity in both species and structure and nuisance conditions are being managed effectively. The consistently high average Floristic Quality Index score on Cedar Lake South suggests a high distribution of desirable native plant species and a low distribution of undesirable invasive species. The Algal Bloom Risk rating for Cedar Lake South is "low" reflecting the small proportion of agricultural and urban land use draining to the lake.

Table ES-1 – Summary of lake analysis metrics.

LakeScan™ Metric	2024 Average	Management Goal
Species Richness	23	n/a
Shannon Biodiversity Index	10.7	> 8.8
Shannon Morphology Index	8.6	> 6.3
Floristic Quality Index	29.1	> 20
Recreational Nuisance Presence	9%	< 10%
Algal Bloom Risk	Low	Low

The Cedar Lake South early-season LakeScan™ survey was conducted in the afternoon of Monday, July 1, 2024 and completed in the morning of Tuesday, July 2, 2024. The most common native species observed during the survey were *Chara* (*Chara sp.*), broadleaf pondweed (*Potamogeton amplifolius)*, white waterlily (*Nymphaea odorata*), rushes (*Juncus sp.),* and Richardson's pondweed *(Potamogeton richardsonii)*. Broadleaf pondweeds were observed at moderate densities around the lake, typically not causing any nuisance concerns, except in AROS 256, 257, 268, 269, 276 where broadleaf pondweeds were growing to the surface.

The aquatic invasive species observed in Cedar Lake South during the 2024 early-season survey were hybrid Eurasian watermilfoil (*Myriophyllum spicatum x sibiricum*) and purple loosestrife (*Lythrum salicaria L.*). Eurasian watermilfoil was found in light clusters in AROS 239-242 and 260 and purple loosestrife was found at two shoreline locations (AROS 213 and 220).

The Late-season LakeScan™ survey was conducted in the afternoon of Wednesday, August 7, 2024 and completed in the morning of Thursday, August 8, 2024. The most common native species observed during the survey were *Chara*, broadleaf pondweed, white waterlily, naiad (*Najas sp*.), rushes, and Richardson's pondweed. Native pondweeds were observed at moderate densities around the lake, flowering in many locations, but typically not causing any nuisance concerns except in AROS 200-202, 268-270, 275-277, 222, 237, 231, and 239 where tall pondweeds growing to the surface were observed.

The aquatic invasive species observed during the 2024 late-season survey were hybrid Eurasian watermilfoil and purple loosestrife. Eurasian watermilfoil was found in light clusters in AROS 228 and 238. Purple loosestrife was found at many shoreline locations, but was typically only seen in light stand-alone clusters, not warranting any management recommendations at the time of the survey.

Over the last five years, variable-leaf watermilfoil (*Myriophyllum heterophyllum),* Eurasian watermilfoil, and starry stonewort (*Nitellopsis obtusa*) in Cedar Lake South have exhibited declining trends (Figure ES-1). Coverage of the variable-leaf watermilfoil has decreased by 2% since 2020 and has remained consistently under 3% throughout the last five years (Figure ES-1). Eurasian watermilfoil has remained consistently under 2% coverage over the past five years, but did have the same coverage as last year (0.25%), indicating that the species might have reached a stable population level or is exhibiting resistance to the current management regimen preventing lower coverages from being observed. Starry stonewort which was last found in 2022, was again not found during either survey in 2024, demonstrating the continued success of mitigating the rebound and spread of the species.

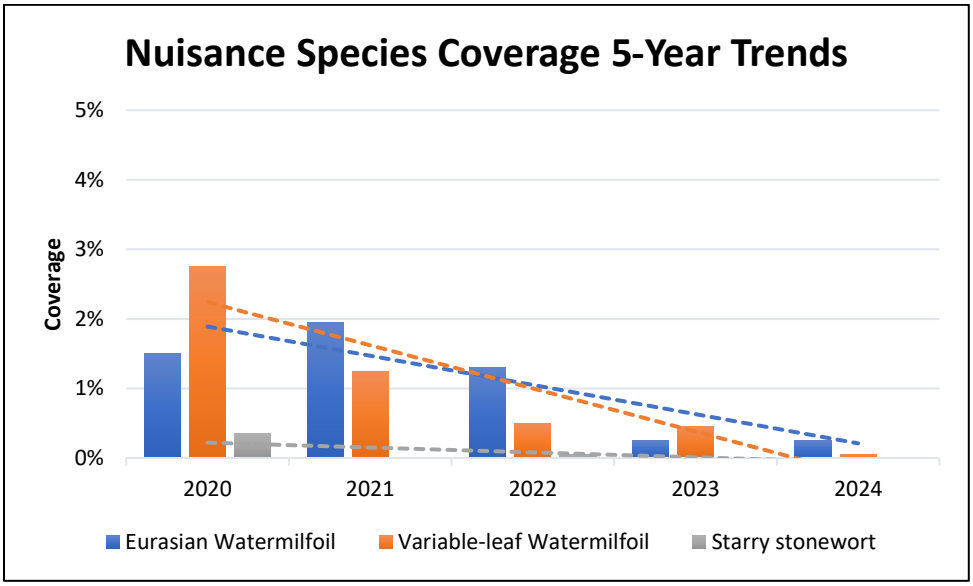

Figure ES-1 – Nuisance species coverage 5-year trends.

Based on 2024 findings, K&A recommends the following management considerations for 2025:

- **Continued management of Eurasian watermilfoil.**
    - Watermilfoil coverages have trended downward over the last five years with average coverage in 2022-2024 at less than 1%. Thus, current management interventions appear to be effective at suppressing growth and reducing the cumulative coverage of nuisance watermilfoil presence. Despite downward five-year trends, Eurasian watermilfoil populations might be stabilizing around 0.25%. While eradication of the species may be unlikely, a harsher management regimen might be explored. Therefore, it is recommended that the Cedar Lake Improvement Board continues exploring management options for effectively treating nuisance watermilfoil conditions in Cedar Lake South.
- **Continued monitoring of coverage and nuisance conditions of variable-leaf watermilfoil.**
    - The treatments in 2020 targeting nuisance variable-leaf watermilfoil were projected to have lasting effects for up to three years. Based on 2021-2024 LakeScan™ surveys, the 2020 treatments appear to have continually suppressed nuisance conditions. It will be important to closely monitor the treatment areas to see if treatment results persist into 2025.
- **Continued monitoring of coverage and nuisance conditions of lily pads and development of a management strategy.**
    - Anecdotes from lake users indicate that nuisance conditions of lily pad growth continue to persist in AROS 206 -211 and 272-276. Treatments in these areas can be conducted with 100 feet of the shoreline, any additional nuisance coverage of the lily pads beyond 100 feet may warrant harvesting which is not limited by distance from the shoreline. It is recommended that a harvesting feasibility study be considered in 2025 to address the growing problem of the lily pads in the lake.
- **Monitoring of coverage and nuisance conditions of native pondweed production.**
    - Nuisance pondweed production in Cedar Lake North has been increasing. Pondweeds resembling broad leaf pondweed and Richardson's pondweed may be aggressive hybrids that are increasing in cumulative cover in the lake. The Department of the Environment, Great Lakes, and Energy (EGLE) does not permit treatment of pondweeds in many of the nuisance areas in Cedar Lake North. Mechanical harvesting is not regulated in Michigan and can be used as an effective management strategy for nuisance pondweeds. This approach should be considered for use in 2025 if there is a substantial increase in the nuisance production of hybrid native pondweeds.
- **Purple loosestrife management considerations.**
    - Given the scattered shoreline distribution of purple loosestrife noted in Cedar Lake South with stand-alone clusters of this emergent wetland invasive species, consideration of voluntary riparian owner removal should be recommended as part of the updated Cedar Lake Watershed Management Plan. Whereas increasing stands noted in Cedar Lake North recommended for potential treatment with biocontrols, observations suggest that proper manual removal efforts along shorelines in Cedar Lake South could be sufficient to limit the growth and spread of this species.

Table of Contents

1.0. Introduction

Inland lakes are complex systems, and managing them for both ecological health and recreational enjoyment involves balancing goals that are sometimes at odds with one another. Successful lake management requires an understanding of the current ecological and recreational conditions of a lake, as well as how those conditions change over time. The LakeScan™ program combines a detailed data collection methodology with mapping capabilities and whole-lake analysis metrics backed by scientific literature. This analysis allows lake managers to identify successful lake management activities, as well as highlight potential issues requiring intervention. Appropriately targeted aquatic plant suppression can minimize weedy and nuisance species while allowing beneficial species to flourish at ecologically balanced levels supporting healthy lake conditions. This kind of adaptive management system provides a scientifically sound and consistent methodology to better manage lake ecological and recreational conditions.

The LakeScan™ analysis involves collecting data over two vegetation surveys during the critical summer recreational season. These surveys are based on a system where the lake is first divided into biological tiers (Table 1) and then further subdivided into Aquatic Resource Observation Sites (AROS; Figure 1). For each survey, field personnel record the density, distribution, and position in the water column of each aquatic plant species in each AROS, as well as noting any nuisance conditions. Dissolved oxygen profiles, temperature profiles, and Secchi depth are additionally recorded. Other water quality sampling can be included with surveys when requested.

Aquatic plant communities change over the course of a year, so the surveys are split into early and late-season observations. Early-season surveys are scheduled with the goal of taking place within 10 days of early-summer treatments to best observe treatment-targeted and non-targeted vegetation. Late-season surveys are scheduled to occur roughly two months after the early season survey. However, this scheduling is subject to weather and times of increased boat activity.

Table 1 – Biological Tier Descriptions.

Tier*	Description
2	Emergent Wetland
3	Near Shore
4	Off Shore
5	Off Shore, Drop-Off
6	Canals
7	Around Islands and Sandbars
9	Off Shore Island Drop-Off

*Tiers 1 and 8 are reserved for future use.

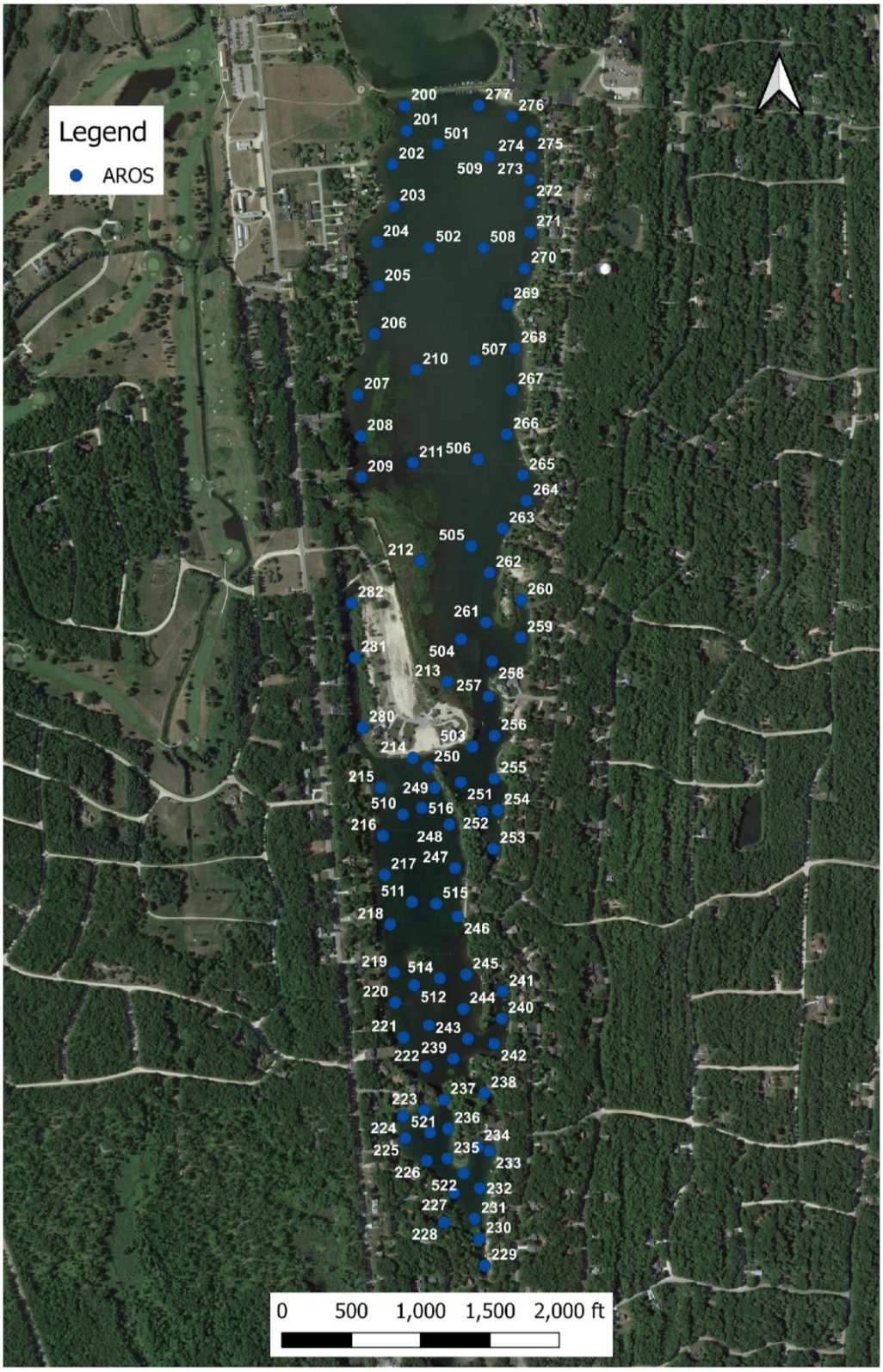

Figure 1 - Map of Aquatic Resource Observation Sites (AROS).

2.0. Water Quality

Location

County: Iosco

Township: Oscoda

Township/Range/Section(s): T24N, R9E Sections: 3 and 10

GPS Coordinates: N 44°29.79996’ W 83°20.04684

Morphometry

Total Area: 78 acres

Shoreline Length: 20,583 feet

Maximum Depth: 12 feet

Administrative Management

Management Authority: Cedar Lake Improvement Board

Years in LakeScan™ Program: 2003 to Present

2.1. Algal Bloom Risk Level

K&A calculates an algal bloom risk level for each LakeScan™ lake based on the characteristics of its watershed. Agricultural and urban land uses contribute more phosphorus to receiving waters than grasslands or forested land uses; phosphorus being the limiting nutrient that drives algal blooms. Lakes with watersheds that have high proportions of land in agricultural and urban land uses are more likely to be at risk of algal blooms. Not all algal blooms contain cyanobacteria and their associated toxins (Harmful Algal Blooms or HABs). It is important to note that the risk factor reported here is based on a limited watershed analysis. Lakes at high risk of algal blooms should consider more in-depth studies that can identify possible watershed or in-lake improvements to mitigate the risk of HABs.

The algal bloom risk for Cedar Lake South is: **Low**

This risk is a reflection of the summary of watershed land-use composition for Cedar Lake South, which has minor inputs from urban and agricultural sources.

3.0. Dissolved Oxygen and Temperature Profiles

Apart from vegetation data, secchi depth, dissolved oxygen and temperature data were additionally collected during each vegetation survey. Secchi disk transparency is the depth at which a Secchi disk (a flat white or black and white platter, approximately 20 centimeters in diameter) suspended into a lake disappears from the investigator's sight. In general, the greater depth at which the Secchi disk can be viewed, the lower the productivity of the water body. Secchi depth readings of greater than 15 feet can

be indicative of low productivity or oligotrophic conditions.[1] Some variation in Secchi disk reporting may be a result of cloud cover, time of day, recent rain events, and recreational lake usage. Dissolved oxygen levels and temperature were measured by K&A using a YSI ProSolo dissolved oxygen meter, calibrated prior to use.

A sufficient supply of dissolved oxygen (DO) in lake water is necessary for most forms of desirable aquatic life. Colder waters contain more dissolved oxygen than warmer waters. In highly productive lakes, oxygen depletion can occur in deeper, unmixed bottom waters during warmer summer months. This decrease in oxygen is due in part to dead algae and other organic matter, such as leaves, grass and plant debris settling to the bottom of the lake and getting consumed, along with oxygen, by organisms in the sediment. DO depletion is most often observed in lake bottom waters during periods of temperature stratification in warmer summer months and, to a lesser degree, under winter ice cover conditions. Shallow lakes, like Cedar Lake, may not experience stratification and would not be expected to have as notable of oxygen depletion in the lake bottom waters compared to deeper bodies of water.

Secchi disk clarity on Cedar Lake South was clear to bottom at around 8ft during both surveys, illustrating stability in water clarity throughout the summer of 2024 (Figures 2 and 3). The DO and temperature profiles remained consistent across the two surveys with no notable stratification, which is expected on Cedar Lake due to its shallow depths. Temperatures did increase by roughly 4 °C and DO decreased by nearly 2 mg/L between the early and late-season surveys, reflecting the warmer summer temperatures leading up to the late-season survey.

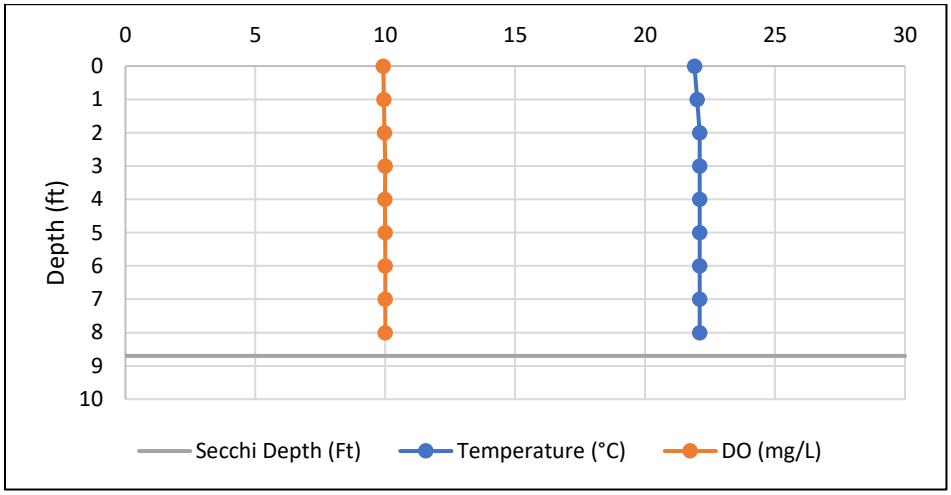

Figure 2 – Early-season survey (7/1/2024) dissolved oxygen and temperature profiles with Secchi depth, taken near AROS 214.

[1] US Geological Survey. 2012. "Water Quality Characteristics of Michigan's Inland Lakes, 2001-10." Scientific Investigations Report 2011–5233. Available online at: https://pubs.usgs.gov/sir/2011/5233/.

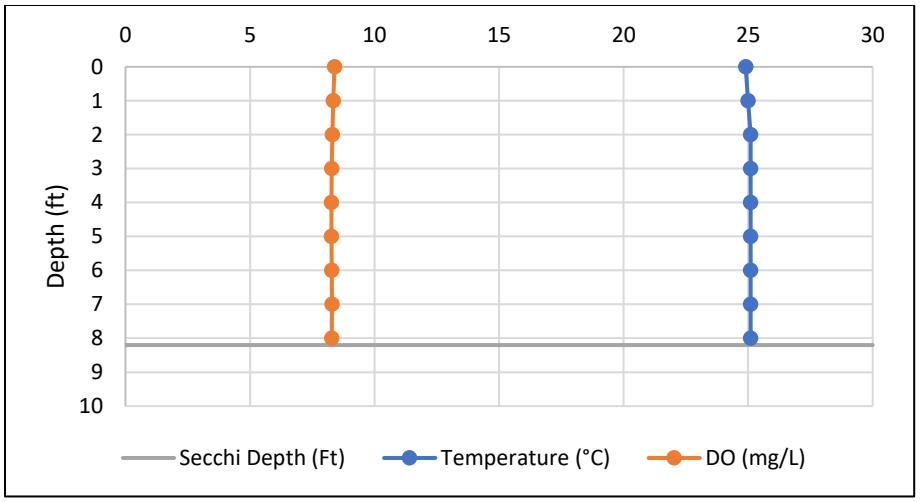

Figure 3 – Late-season survey (8/7/2024 and 8/8/2024) dissolved oxygen and temperature profiles with Secchi depth, taken near AROS 214.

4.0. Aquatic Vegetation

4.1. Early-Season Survey

The Cedar Lake South early-season LakeScan™ survey was conducted in the afternoon of Monday, July 1, 2024 and completed in the morning of Tuesday, July 2, 2024. The weather was sunny on Monday and overcast on Tuesday, with temperatures around 70°F for both days and southeastern winds ranging from 5-13 mph. Visibility in the water column was great with a Secchi Disk reading of 8.7 feet, clear to the bottom. The survey occurred 13 and 14 days after the scheduled herbicide treatment on Tuesday, June 18, 2024.

A visual depiction of the data on all combined species observed in Cedar Lake South during the early-season survey is displayed using three-dimensional density, which reflects a combination of vegetation density, distribution and height observations for all species observed during the survey (Figure 4). Color-coding is provided for each AROS to spatially depict observed vegetation data. The colors range in a gradient from dark blue which depicts no vegetation observed, to yellow depicting medium density and distribution of plant species, to red which depicts high density and distribution of vegetation within the AROS.

The most common native species observed during the early-season survey on Cedar Lake South were *Chara*, broadleaf pondweed, white waterlily, rushes, and Richardson's pondweed. *Chara* was the most commonly observed species, and was found at moderate to high densities throughout a majority of observation areas. Broadleaf pondweeds were observed at moderate densities around the lake, flowering in many locations, but typically not causing any nuisance concerns, except in AROS 256, 257, 268, 269, 276 which had tall broadleaf pondweed growing to the surface which could cause some minor recreational nuisance conditions.

The only submerged aquatic invasive species observed in Cedar Lake South during the 2024 early-season survey was hybrid Eurasian watermilfoil. Eurasian watermilfoil was found in light clusters in AROS 239-242 and 260 (Figure 5). Additionally, the emergent invasive species purple loosestrife was found at two

locations along the shoreline (AROS 213 and 220), not causing any management concerns at the time of the survey (Figure 6).

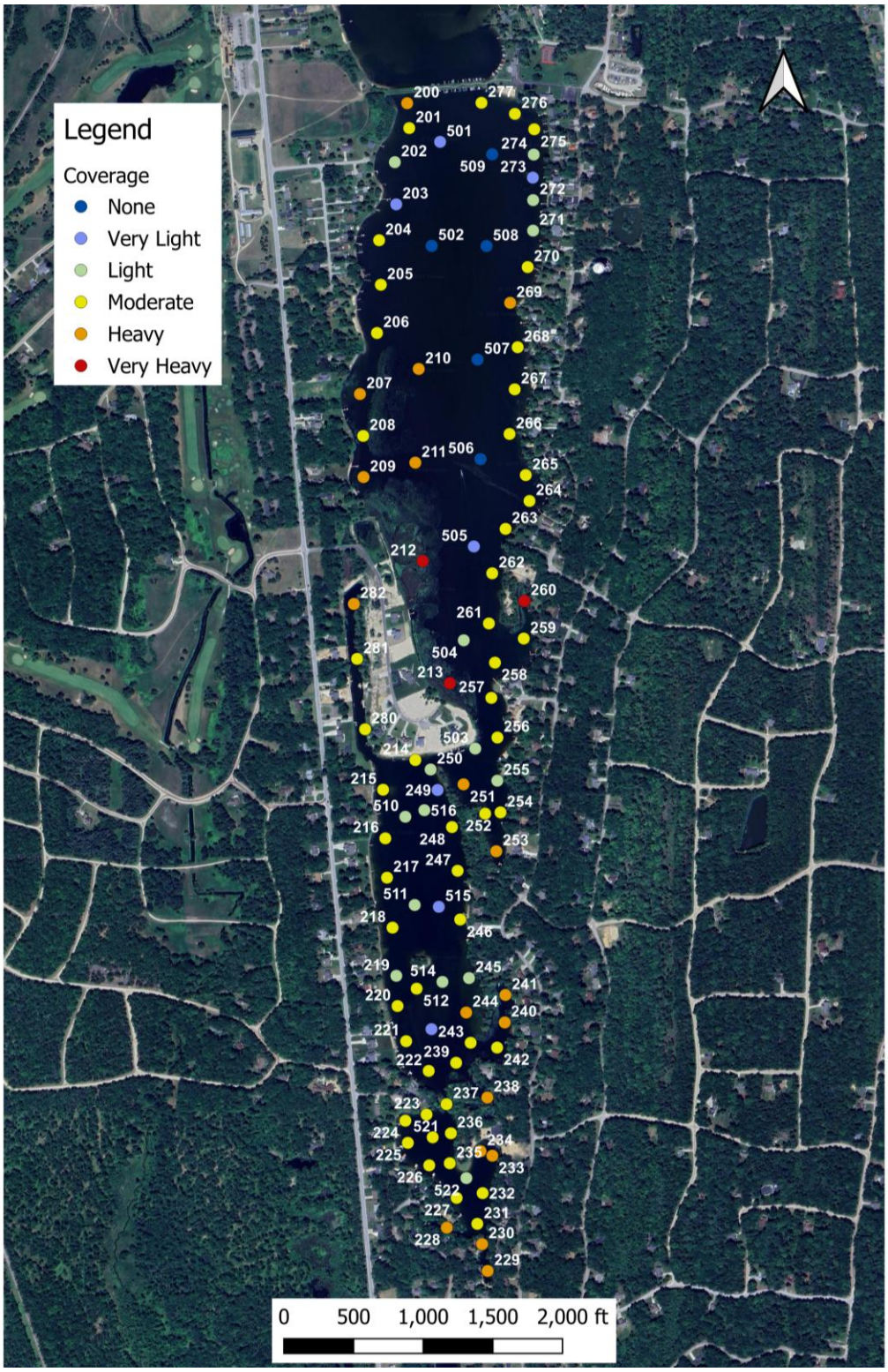

Figure 4 – Early-season survey (7/1/2024 & 7/2/2024) vegetation 3D Density (a function of observed vegetation coverage, and height of all vegetation species).

Figure 5 – Early-season (7/1/2024 & 7/2/2024) Eurasian watermilfoil coverage (a combination of the LakeScan™ density and distribution observations).

Figure 6 – Early-season (7/1/2024 & 7/2/2024) purple loosestrife coverage.

4.2. Late-Season Survey

The Cedar Lake South Late-season LakeScan™ survey was conducted in the afternoon of Wednesday, August 7, 2024 and completed in the morning of Thursday, August 8, 2024. The weather was sunny on both days, with temperatures around 78°F and southeastern winds ranging from 8 -12 mph. Visibility in the water column was great with a Secchi Disk reading of 8.2 feet, clear to bottom.

A visual depiction of the data on all combined species observed in Cedar Lake South during the late-season survey is displayed using three-dimensional density in Figure 7. The most common native species observed during the survey were *Chara*, broadleaf pondweed, white waterlily, naiad, rushes, and Richardson's pondweed. *Chara* was the most commonly observed species, and was found at moderate to high densities throughout a majority of observation areas. Native pondweeds were observed at moderate densities around the lake, flowering in many locations, but typically not causing any nuisance concerns, except in AROS 200-202, 268-270, 275-277, 222, 237, 231, and 239 which had tall pondweeds growing to the surface. Variable-leaf watermilfoil was only found in AROS 226 at the time of the survey (Figure 8).

The only submerged aquatic invasive species observed in Cedar Lake South during the 2024 late-season survey was hybrid Eurasian watermilfoil. Eurasian watermilfoil was found in light clusters in AROS 228 & 238 (Figure 9). The emergent invasive species purple loosestrife was flowering and more conspicuous at the time of the survey, and was found at many shoreline locations, but was typically only seen in light stand-alone clusters, not warranting any CLIB-led management recommendations (Figure 10).

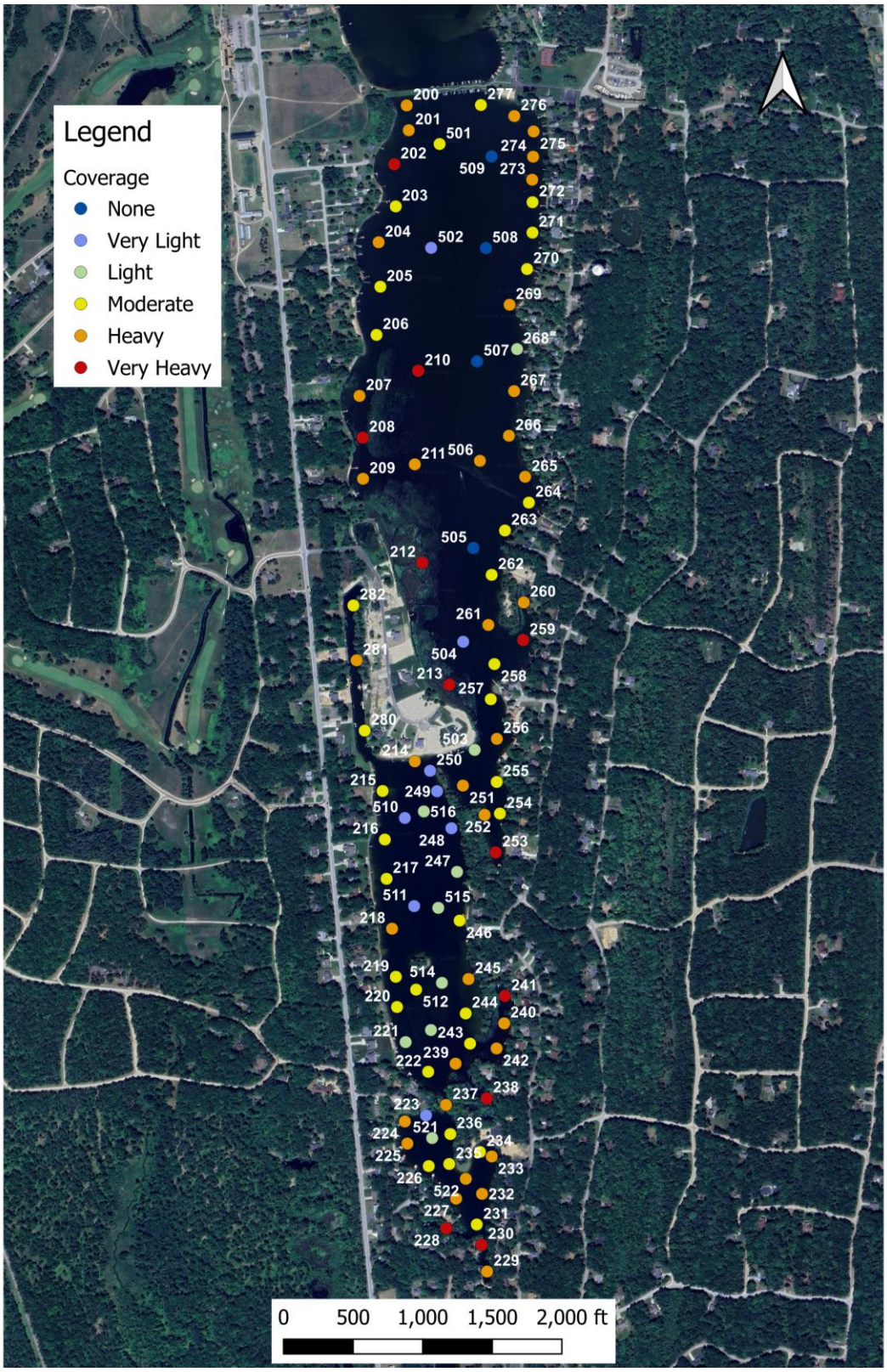

Figure 7 – Late-season survey (8/7/2024 & 8/8/2024) vegetation 3D Density (a function of observed vegetation coverage, and height of all vegetation species).

Figure 8 – Late-season (8/7/2024 & 8/8/2024) Variable-leaf watermilfoil coverage (a combination of the LakeScan™ density and distribution observations).

Figure 9 – Late-season (8/7/2024 & 8/8/2024) Eurasian watermilfoil coverage.

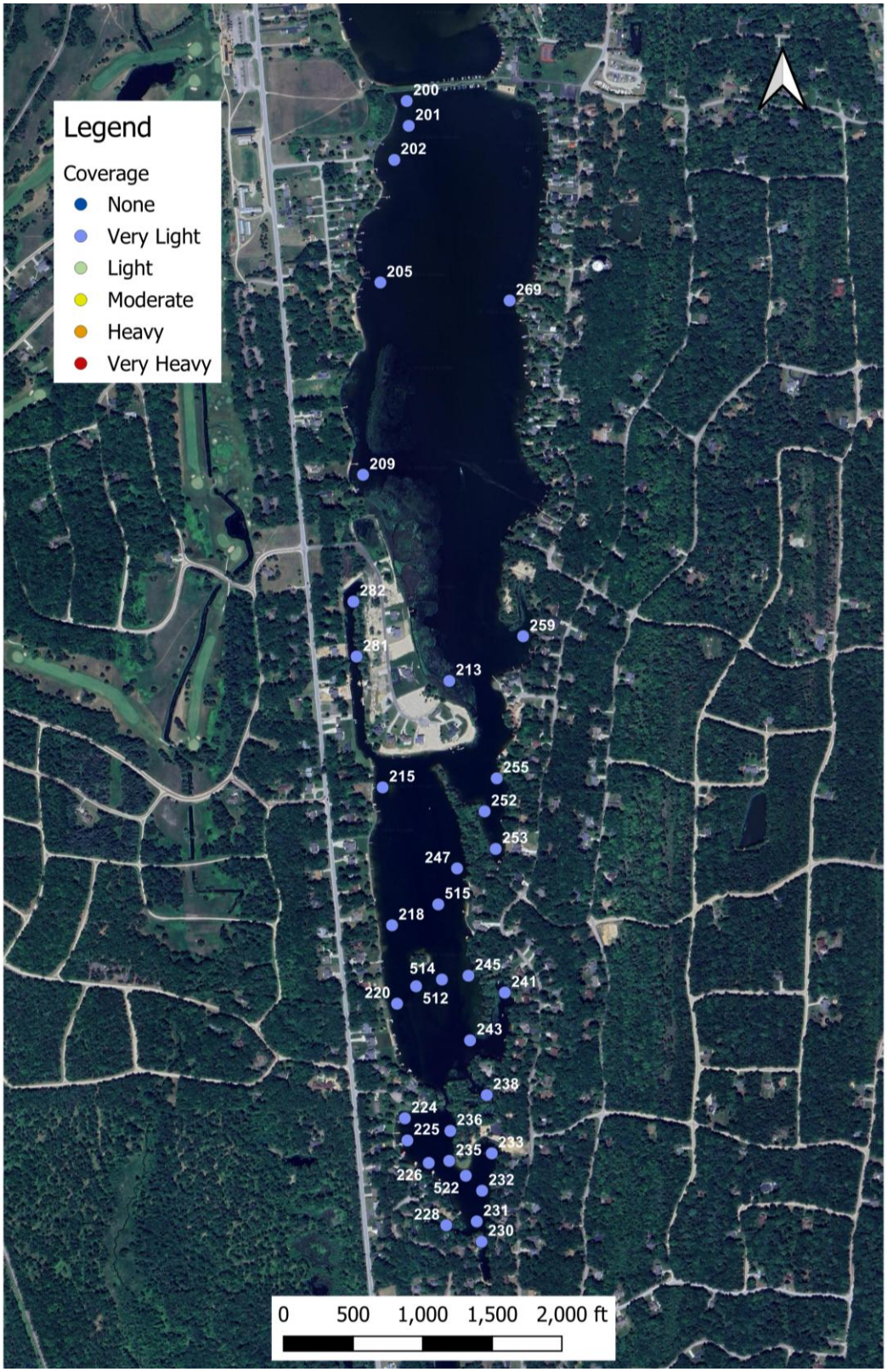

Figure 10 – Late-season (8/7/2024 & 8/8/2024) purple loosestrife coverage.

4.3. Summary Observations for Early and Late-Season Surveys

All aquatic plant species observed during the 2024 vegetation surveys were paired with their associated C-value and recorded for frequency, coverage, and dominance (Table 2). The Coefficient of Conservation, or C-Value, is a qualitative value ranging from 0 to 10 that is assigned to each species representing the estimated probability that it is likely to occur in an environment. A C-value of 0, is given to plants that may be found almost anywhere, while a C-value of 10 is applied to plants that are almost always restricted to high-quality natural settings.[2] 'Frequency' represents the percentage of survey sites (AROS) where a given species was found. 'Coverage' represents the spatial cover observed for each species, represented as a percentage of available area. 'Dominance' represents the degree to which a species is more numerous than its competitors.

Table 2- Aquatic Plant Species Observed in 2024.

Common Name	C Value	Frequency		Coverage		Dominance	
		Early '24	Late '24	Early '24	Late '24	Early '24	Late '24
Eurasian Watermilfoil Hybrid	0	5.1%	2.0%	0.3%	0.2%	0.5%	0.2%
Green/Variable Watermilfoil	6	0.0%	1.0%	0.0%	0.1%	0.0%	0.1%
Common Bladderwort	6	8.1%	7.1%	0.5%	0.4%	0.8%	0.5%
Elodea	3	1.0%	0.0%	0.1%	0.0%	0.2%	0.0%
Naiad	6	18.2%	63.6%	3.5%	14.6%	5.3%	16.0%
Chara	7	90.9%	91.9%	23.0%	18.8%	34.4%	20.5%
Flat Stem Pondweed	5	13.1%	8.1%	1.7%	1.4%	2.5%	1.5%
Water Star Grass	6	3.0%	0.0%	0.3%	0.0%	0.4%	0.0%
Purple Loosestrife	0	2.0%	36.4%	0.1%	2.3%	0.2%	2.6%
Swamp Loosestrife	7	5.1%	2.0%	0.3%	0.1%	0.5%	0.1%
Richardsons Pondweed	5	29.3%	50.5%	4.2%	7.6%	6.3%	8.3%
Broadleaf Pondweed	6	75.8%	70.7%	8.0%	9.0%	12.0%	9.9%
Hybrid Pondweed	5	16.2%	51.5%	2.0%	6.5%	2.9%	7.1%
Sago Pondweed	3	10.1%	12.1%	1.1%	1.5%	1.6%	1.7%
Thin Leaf Pondweed	4	5.1%	5.1%	0.6%	0.6%	0.9%	0.7%
Wild Celery	7	15.2%	34.3%	1.6%	4.2%	2.4%	4.6%
Rush	8	49.5%	45.5%	4.3%	3.8%	6.4%	4.1%
Waterlily	6	58.6%	63.6%	9.2%	10.0%	13.8%	11.0%
Spadderdock	7	20.2%	30.3%	2.7%	6.3%	4.1%	6.9%
Water Shield	6	1.0%	2.0%	0.1%	0.1%	0.1%	0.1%
Floating Leaf Pondweed	5	7.1%	9.1%	0.8%	1.1%	1.2%	1.2%
Smartweed	5	2.0%	3.0%	0.1%	0.2%	0.2%	0.2%
Arrow Arum	6	3.0%	7.1%	0.8%	1.1%	1.1%	1.2%
Iris	5	8.1%	0.0%	0.5%	0.0%	0.8%	0.0%
Cattail	1	11.10%	14.10%	1.10%	1.50%	1.60%	1.60%

[2] Michigan Department of Natural Resources Wildlife Division. (n.d.). Floristic Quality Assessment With Wetland Categories and Examples of Computer Applications for the State of Michigan.

4.4. LakeScan™ Metrics

Six important metrics for defining lake conditions are included in the LakeScan™ analyses, where early and late-season scores are averaged for a yearly score and compared against a management goal for each metric (Table 3). Management goals are based on median Michigan lake values (Shannon Biodiversity Index and Shannon Morphology Index), scientific literature (Floristic Quality Index), and professional judgement (Recreational Nuisance Presence and Algal Bloom Risk). Green shading in Table 3 highlights scores meeting management goals, while yellow and red highlights represent scores needing improvement, with red scores being further away from the optimal management goals potentially requiring a higher level of management attention. Descriptions of each of the six metrics are detailed below:

- **Species Richness** – the number of aquatic plant species present in the lake. More species are generally indicative of a healthier ecosystem, but not all species are desirable.
- **Shannon Biodiversity Index** – a measure of aquatic plant species diversity and distribution evenness, indicative of the stability and diversity of the plant community. Also known as the Shannon Expected Number of Species.[3]
- **Shannon Morphology Index** – a measure of aquatic plant morphology type diversity and distribution evenness, indicative of fish and macroinvertebrate habitat quality. This is calculated using morphology types instead of species.
- **Floristic Quality Index**[4] – a measure of the distribution of desirable aquatic plants. This index is used by Midwestern states for aquatic habitats, with higher scores indicative of increased biodiversity and a positive ratio of desirable versus undesirable aquatic plant species.
- **Recreational Nuisance Presence** – the percentage of survey sites that identified aquatic plants inhibiting recreational activities.
- **Algal Bloom Risk** – a calculated algal bloom risk level based on the characteristics of the lake watershed. Lakes with watersheds that have high proportions of land in agricultural and urban land uses are more likely to be at risk of algal blooms because these land uses contribute more phosphorus to receiving waters than grasslands or forests.

Table 3 – 2024 LakeScan™ Metric Results.

LakeScan™ Metric	Score Range	2024 Early Season	2024 Late Season	2024 Average	Management Goal
Species Richness	5 - 30	24	22	23	n/a
Shannon Biodiversity Index	1 -15	9.8	11.6	10.7	> 8.8
Shannon Morphology Index	1 - 10	7.9	9.3	8.6	> 6.3
Floristic Quality Index	1 - 40	30.4	27.7	29.1	> 20
Recreational Nuisance Presence	0 - 100%	5%	13%	9%	< 10%
Algal Bloom Risk	Low-High	n/a	n/a	Low	Low

*n/a = not applicable

[3] Hill, M. O. (1973). Diversity and evenness: a unifying notation and its consequences. *Ecology*, 54(2), 427-432.
[4] Nichols, S. A. (1999). Floristic quality assessment of Wisconsin lake plant communities with example applications. *Lake and Reservoir Management*, 15(2), 133-141.

The assessed LakeScan™ metrics for both the early and late-season surveys on Cedar Lake North met all management goals in 2024, except for the late-season recreational nuisance presence, which came close but ultimately fell short of the management goal of <10%. The increase in nuisance presence across the two surveys is likely reflective of the observed late-season pondweed growth. Apart from nuisance conditions, the metrics assessed in 2024 had limited fluctuations between the two surveys, indicating a high level of lake stability throughout the summer. These findings are additionally similar to those calculated in 2023, which also fell short of the recreational nuisance presence in the late-season survey, but ultimately met all management goals when averaged across the surveys. These similarities in survey observations from year-to-year indicate that the lake is approaching stability in both species and structural diversity and the presence of nuisance conditions.

The high Shannon morphology and biodiversity indices indicate that the species in the lake are both diverse in type and structure, contributing to greater habitat suitability for aquatic organisms. Both of these metrics improved across the 2024 surveys, indicating that the lake is trending towards higher species diversity, and therefore greater habitat suitability. The consistently high average Floristic Quality Index further reflects this trend, indicating a high distribution of desirable, native plant species and a low distribution of undesirable invasive species.

Over the past five years, the Floristic Quality Index on Cedar Lake North has exhibited a positive trend, indicating an increase in desirable, native plants and a decrease in undesirable, invasive aquatic species such as starry stonewort and Eurasian watermilfoil (Figure 11). Cedar Lake South has met the FQI management score of 20 each year for the past the last five years, indicating that a high level of floristic quality in the lake is being maintained by the current management regimen.

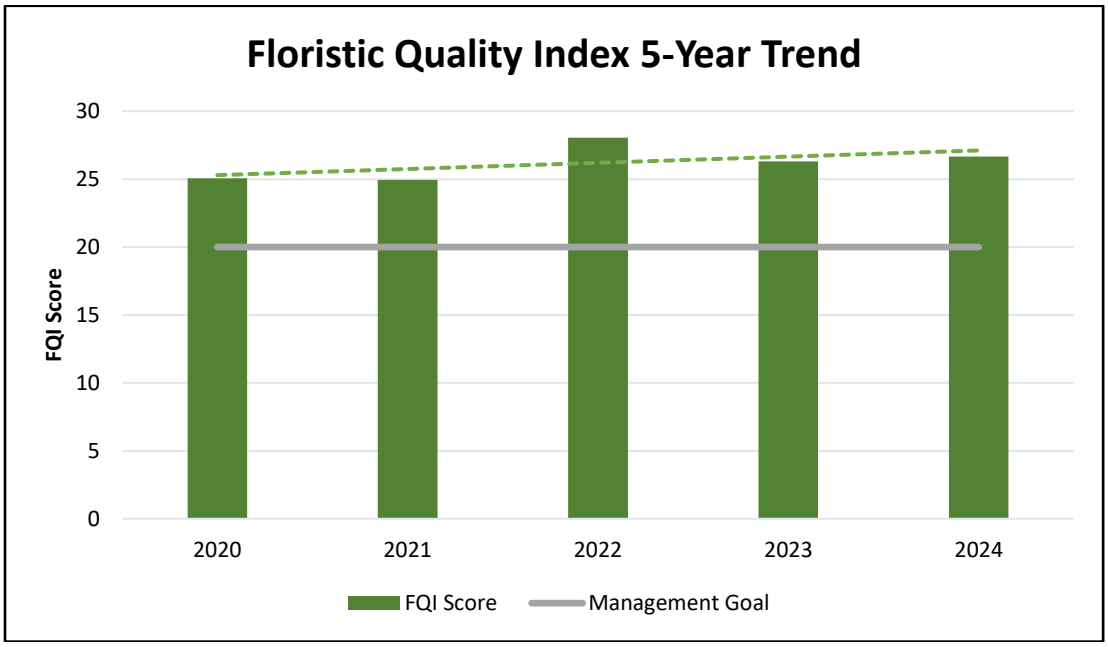

Figure 11 – Floristic Quality Index 5-Year Trend.

Over the last five years, variable-leaf watermilfoil, Eurasian watermilfoil, and starry stonewort in Cedar Lake South have exhibited declining trends (Figure 12). Coverage of variable-leaf watermilfoil has decreased by 2% since 2020 and has remained consistently under 3% throughout the last five years. Eurasian watermilfoil has remained consistently under 2% coverage over the past five years, but did have the same coverage as in 2023 (0.25%), indicating that the species might have reached a stable population level. While eradication of the species may be unlikely, a harsher management regimen might be explored to address this observed stabilization. Starry stonewort, which was last found in 2022, was again not found during either survey in 2024, demonstrating the continued success of mitigating the rebound and spread of the species. The overall coverage of all nuisance species in Cedar Lake South remains minor, indicating that management activities are successfully controlling nuisance species populations on a multi-year basis.

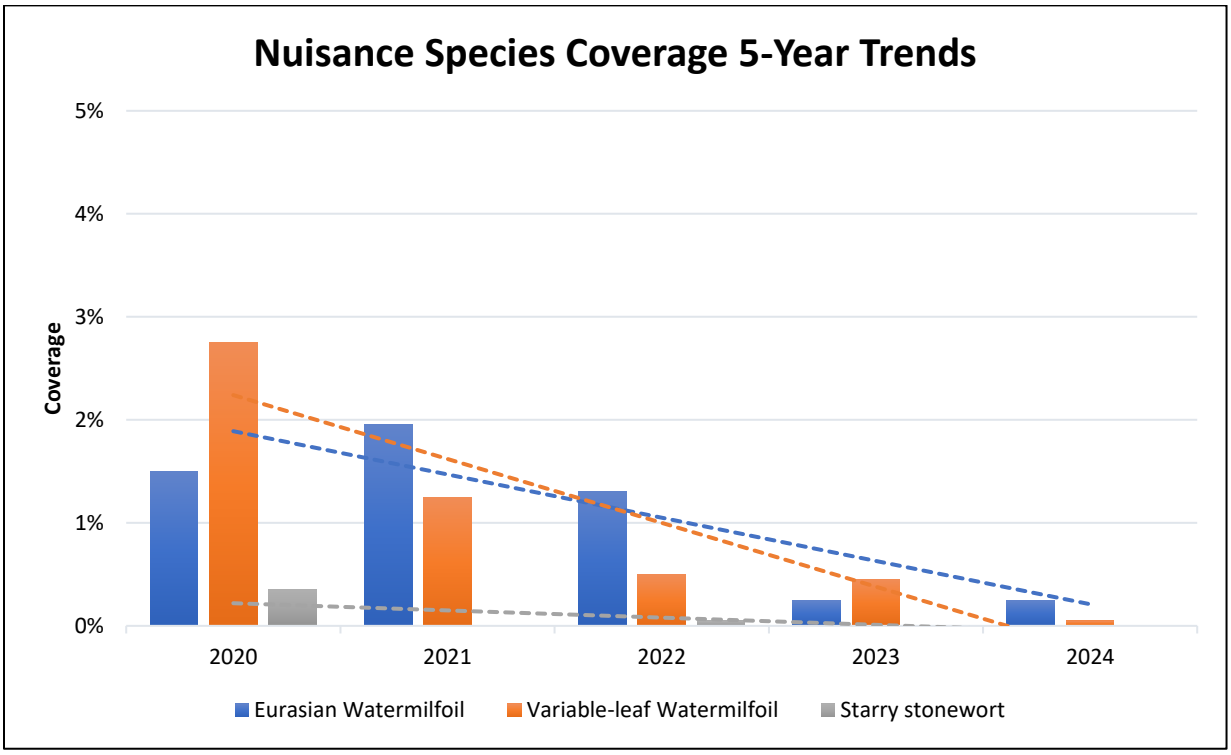

Figure 12 – Nuisance species coverage 5-year trends.

The Algal Bloom Risk rating for Cedar Lake South is "low" reflecting the small proportion of agricultural and urban land use draining to the lake.

5.0. Lake Management

There are several species that typically become a nuisance in Michigan's inland lakes, these species are usually targeted for selective control to prevent them from becoming an aesthetic or recreational nuisance and to protect desirable plants that are part of healthy lake ecosystems. More information on common nuisance species in Michigan and their associated management options can be found in Appendix A. Treatment maps and data displaying acreage, herbicides, and targeted species for Cedar Lake South in 2024 can be found in Appendix B (note that the chemical tables provided in the ANC report are not split by North and South lakes).

A total of two chemical herbicide treatments were conducted by Solitude Lake Management on the Cedar Lake South in 2024. The first chemical herbicide treatment took place on Tuesday, June 18, 2024, 13 and 14 days prior to the early-season survey. Solitude reported that the treatment targeted roughly 4.5 acres with treatment applications that target Eurasian watermilfoil, curly-leaf pondweed, starry stonewort, and algae using Tribune, Cutrine, Aquathol K, and ProcellaCOR. Aquathol K was only used in the shallow channel (AROS 280-282) to alleviate nuisance conditions. The second and final chemical herbicide treatment occurred on September 18, 2024. The treatment targeted roughly 0.25 acres of Eurasian watermilfoil using Tribune and Cutrine Plus in the southernmost channel of the lake.

It is important to note that the "species targeted" descriptors provided by Solitude and included in Appendix B Figure B3 include curly-leaf pondweed and starry stonewort as treated species for the June 18th treatment despite neither of the species being noted during surveys in the previous two years. Future species treated references provided by the applicator should be made consistent with pre-season survey findings and mutually-agreed upon target species, for accuracy in reporting. Where new invasive species are suspected by the applicator, immediate notification to K&A should otherwise be made and treatments recommendations discussed.

During the early-season survey, which occurred 13 and 14 days after the first herbicide treatment, Eurasian watermilfoil was found at 0.3% coverage and decreased slightly to 0.2% by the late-season. The average coverage of Eurasian watermilfoil was the same in 2024 compared to 2023 and the species has maintained low and manageable levels of coverage at less than 1% from 2022-2024, indicating multi-year success of current herbicide treatments on managing the spread of the hybrid Eurasian watermilfoil and repressing nuisance conditions (Figure 13).

Variable-leaf watermilfoil had lower coverages than Eurasian watermilfoil with 0% coverage in the early-season and 0.1% coverage in the late season. The relatively low coverages of less than 1% across both surveys, further demonstrates the effectiveness and long-term success of the current treatment regimen on managing nuisance variable-leaf watermilfoil conditions.

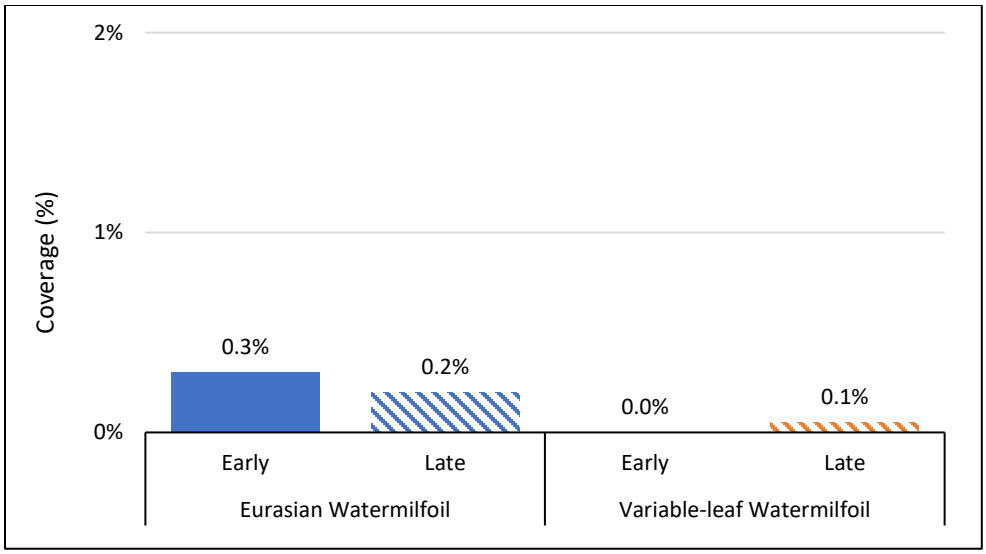

Figure 13 – Changes in coverage across both surveys for targeted species.

5.1. Management Recommendations

Watermilfoil coverages have trended downward over the last five years with average coverage in 2022-2024 at less than 1%. Thus, current management interventions appear to be effective at suppressing growth and reducing the cumulative coverage of nuisance watermilfoil presence. Despite downward five-year trends, Eurasian watermilfoil populations might be stabilizing around 0.25%. While eradication of the species may be unlikely, a harsher management regimen might be explored. Therefore, it is recommended that the Cedar Lake Improvement Board continues exploring management options for effectively treating nuisance watermilfoil conditions in Cedar Lake South.

The treatments in 2020 targeting nuisance variable-leaf watermilfoil were projected to have lasting effects for up to three years. Based on 2021-2024 LakeScan™ surveys, the 2020 treatments appear to have continually suppressed nuisance conditions. It will be important to closely monitor the treatment areas to see if treatment results persist into 2025.

Anecdotes from lake users indicate that nuisance conditions of lily pad growth continue to persist in AROS 206 -211 and 272-276. Treatments in these areas can be conducted with 100 feet of the shoreline; any additional nuisance coverage of the lily pads beyond 100 feet may warrant harvesting which is not limited by distance from the shoreline. It is recommended that a harvesting feasibility study is considered in 2025 to address the growing problem of the lily pads in the lake.

Nuisance pondweed production in Cedar Lake North has been increasing. Pondweeds resembling broad leaf pondweed and Richardson's pondweed may be aggressive hybrids that are increasing in cumulative cover in the lake. The Department of the Environment, Great Lakes, and Energy (EGLE) does not permit treatment of pondweeds in many of the nuisance areas in Cedar Lake South. Mechanical harvesting is not regulated in Michigan and can be used as an effective management strategy for nuisance pondweeds. This approach should be considered for use in 2025 if there is a substantial increase in the nuisance production of hybrid native pondweeds.

Given the scattered shoreline distribution of purple loosestrife noted in Cedar Lake South with stand-alone clusters of this emergent wetland invasive species, consideration of voluntary riparian owner removal should be recommended as part of the updated Cedar Lake Watershed Management Plan. Whereas increasing stands noted in Cedar Lake North recommended for potential treatment with biocontrols, observations suggest that proper manual removal efforts along shorelines in Cedar Lake South could be sufficient to limit the growth and spread of this species.

6.0. Appendices

6.1. Appendix A: Information About Nuisance and Aquatic Invasive Species

Algal Blooms

Blue green algae blooms are becoming increasingly common in Michigan. Blooms can appear as though green latex paint has been spilled on the water, or resemble an oil slick in enclosed bays or along leeward shores. Blue green algae blooms are usually temporal events and may disappear as rapidly as they appear. Blue green algae blooms are becoming more common for a variety of reasons; however, the spread and impact of zebra mussels has been closely associated with blooms of blue green algae.

Figure A1 - Example blue green algae images from the 2019 LakeScan™ field crew.

Blue green algae are really a form of bacteria known as cyanobacteria. They are becoming an important issue for lake managers, riparian property owners and lake users because studies have revealed that substances made and released into the water by some of these nuisance algae can be toxic or carcinogenic. They are known to have negative impacts on aquatic ecosystems and can potentially poison and sicken pets, livestock, and wildlife. Blue green algae can have both direct and indirect negative impacts on fisheries. Persons can be exposed to the phytotoxins by ingestion or dermal absorption (through the skin). They can also be exposed to toxins by inhalation of aerosols created by overhead irrigation, strong winds, and boating activity.

Approximately one half of blue green algae blooms contain phytotoxins, and this is determined through lab testing. It is recommended that persons not swim in waters where blue green algae blooms are conspicuously present. Specifically, persons should avoid contact with water where blooms appear as though green latex paint has been spilled on the water, or where the water in enclosed bays appears to be covered by an “oil slick”. Pets should be prevented from drinking from tainted water. Since blue green algae toxins can enter the human body through the lungs as aerosols, it is suggested that water containing obvious blue green algae blooms not be used for irrigation in areas where persons may be exposed to it.

Blue green algae are not very good competitors with other, more desirable forms of algae. They typically bloom and become a nuisance when resources are limiting or when biotic conditions reach certain extremes. Some of the reasons that blue green algae can bloom and become noxious are listed below:

TP and TN: The total phosphorus (TP) concentration in a water resource is usually positively correlated with the production of suspended algae (but not rooted plants, i.e. seaweed). Very small amounts of phosphorus may result in large algae blooms. If the ratio of total nitrogen (TN) to total phosphorus is low (<20), suspended algae production may become nitrogen limited and noxious blue green algae may dominate a system because they are able to "fix" their own nitrogen from atmospheric sources. Other common and desirable algae are not able to do this.

Biotic Factors: Zebra mussels and zooplankton (microscopic, free-floating animals) are filter feeding organisms that strain algae and other substances out of the lake water for food. Studies have shown that filter-feeding organisms often reject blue green algae and feed selectively on more desirable algae. Over time, and given enough filter feeding organisms, a lake will experience a net loss in "good" algae and a gain in "bad" blue green algae as the "good" algae are consumed and the "bad" algae are rejected back into the water column. This is one of the most disturbing factors associated with the invasion and proliferation of zebra mussels. Lakes that are full of zebra mussels may not support the production of "good" algae and experience a partial collapse of the system of "good" algae that are necessary to support the fishery.

Eurasian Watermilfoil and Hybrids:

Background: Anecdotal evidence suggests that hybrid milfoil has been found in Michigan inland lakes for a long time (since the late 1980's). University of Connecticut professor Dr. Don Les was the first to determine that there were indeed, Eurasian watermilfoil and northern watermilfoil hybrids in Michigan based on samples sent to his Connecticut lab by Dr. Douglas Pullman, Aquest Corp. in 2003. Experience has proven that it is usually not possible to determine whether the milfoil observed is either Eurasian or hybrid genotype. However, because they play such similar roles in lake ecology, they are simply "lumped together" and referred to collectively as Eurasian watermilfoil. Eurasian watermilfoil is a very common nuisance in many Michigan inland lakes.

Management: Lake disturbance, such as weed control, unusual weather, and heavy lake use can destabilize the lake ecosystem and encourage the sudden nuisance bloom of weeds, like Eurasian watermilfoil. Eurasian watermilfoil is an ever-present threat to the stable biological diversity of the lake ecosystem. Species selective, systemic herbicide combinations have been used to suppress the nuisance production of Eurasian watermilfoil and support the production of a more desirable flora. However, it is becoming much more resistant to herbicidal treatment and herbicide resistant Eurasian watermilfoil and hybrid watermilfoil has been observed in many lakes throughout the Midwest.[5,6] Continued chemical applications can select for herbicide resistant plants, resulting in hybrid watermilfoil.[7] Some research suggests this resistance can be defeated with the use of microbiological system treatments. Milfoil community genetics are dynamic and careful monitoring is needed to adapt to the expected changes in

[5] Berger, S. T., Netherland, M. D., & MacDonald, G. E. (2015). Laboratory documentation of multiple-herbicide tolerance to fluridone, norflurazon, and topramazone in a hybrid watermilfoil (*Myriophyllum spicatum× M. sibiricum)* population. Weed Science, 63(1), 235-241.

[6] Netherland, M. D., & Willey, L. (2017). Mesocosm evaluation of three herbicides on Eurasian watermilfoil (*Myriophyllum spicatum*) and hybrid watermilfoil (*Myriophyllum spicatum x Myriophyllum sibiricum*): Developing a predictive assay. J. Aquat. Plant Manage, 55, 39-41.

[7] Netherland and Willey, 2017

the dominance of distinct milfoil genotypes. Some of these genotypes may be more herbicide resistant than others and treatment strategies must be adjusted to remain effective in different parts of the lake.

Figure A2 - Example Eurasian Watermilfoil and Hybrids images from the 2019 LakeScan™ field crew.

Starry Stonewort

Background: Starry stonewort, a macroalgae native to northern Eurasia, invaded North American inland lakes after becoming established in the St. Lawrence Seaway/Great Lakes system. Though not positively identified in a Michigan inland lake until 2006, by Aquest Corporation in Lobdell Lake, Genesee County, starry stonewort has likely been present in Michigan's inland lakes since the late 1990's. Since then, this invasive species has spread throughout Michigan. Able to spread by both fragmentation and asexual reproduction, starry stonewort has thrived in Michigan's high-quality oligotrophic and mesotrophic lakes, particularly those with marl sediments. Once established, this opportunistic species will bloom and crash and impose a very significant and deleterious impact on many ecosystem functions. Bloom and crash events are unpredictable and can happen at any time of the year. In some years starry stonewort can become a horrendous nuisance while it can be inconspicuous in others. It can comingle with other similar species and be very difficult to find when it is not blooming.

Management: Starry stonewort is capable of growing to extreme nuisance levels and can significantly impact important ecosystem functions. This species is difficult to control due to its asexual reproductive structures (bulbils) which embed in lake sediments.[8] While many strategies have been employed to manage starry stonewort, no single strategy has emerged as a panacea for controlling infestations.

Diver-assisted suction harvesting (DASH) or diver-assisted hand-pulling of small starry stonewort infestations could reduce populations over time.[9] While these methods can be effective and have high specificity, they are expensive, labor-intensive strategies that require long-term commitment.[10] These strategies may not be viable for large-scale infestations, however, due to their labor-intensive nature

[8] Glisson, W. J., Wagner, C. K., McComas, S. R., Farnum, K., Verhoeven, M. R., Muthukrishnan, R., & Larkin, D. J. (2018). Response of the invasive alga starry stonewort (*Nitellopsis obtusa*) to control efforts in a Minnesota lake. Lake and Reservoir Management, 34(3), 283-295.

[9] Glisson et al., 2018.

[10] Larkin, D.J., Monfils, A.K., Boissezon, A., Sleithd, R.S., Skawinski, P.M., Welling, C.H., Cahill, B.C., and Karold, K.G. 2018. Biology, ecology, and management of starry stonewort (*Nitellopsis obtusa*; Characeae): A Red-listed Eurasian green alga invasive in North America. https://doi.org/10.1016/j.aquabot.2018.04.003

and their potential for increasing distribution of the target plant species through fragmentation during removal.

Starry stonewort chemical treatments using copper-, diquat-, flumioxazin, and endothall-based algaecides have produced mixed results and long-term management has yet to be achieved using chemical biocides alone.[11] While starry stonewort is susceptible to most selective algaecides, the dense mats of vegetation are very difficult to penetrate and provide reasonable biocide exposure. Consequently, multiple algaecide applications may be required to "whittle down" dense starry stonewort growth if the mats reach sufficient height.

Figure A3 - Example starry stonewort images from the 2019 LakeScan™ field crew.

Curly Leaf Pondweed

Background: Curly leaf pondweed is one of the world's most widespread aquatic plant species. Although it is found worldwide, curly-leaf pondweed is native to only Eurasia. The earliest verifiable records of the plant are from Pennsylvania in the 1840s, and has been found in Michigan since 1910. Curly leaf pondweed is currently found in inland lakes of 34 counties in Michigan, distributed both in the upper and lower peninsulas. [12] Scientific literature suggests that curly leaf pondweed is an aggressively growing species that often expands to nuisance levels when native plants are damaged.

Curly leaf pondweed can create problems such as recreational nuisances, ecological nuisances (by outcompeting native species and reducing light availability to other plants), and degraded fish spawning habitat. Curly leaf pondweed is easily detectable in early spring as it will be one of the few plants readily growing and the first submersed plant to reach the surface. This gives it a competitive advantage and can grow 4 to 5 feet tall before other plants begin germinating from the bottom sediments. As water temperatures rise in late June and early July, curly-leaf pondweed stems begin to die, break down, and can be completely gone by mid-July.[13]

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[11] Pokrzywinski, K. L., Getsinger, K. D., Steckart, B., & Midwood, J. D. (2020). Aligning research and management priorities for *Nitellopsis obtusa* (starry stonewort).

[12] MDEQ. (2018). "State of Michigan's Status and Strategy for Curly-leafed Pondweed (*Potamogeton crispus L.*)." Accessed online: <https://www.michigan.gov/documents/invasives/egle-ais-potamogeton-crispus_708948_7.pdf>.

[13] Hart, Steven, M. Klepinger, H. Wandell, D. Garling, L. Wolfson. (2000). "Integrated Pest Management for Nuisance Exotics in Michigan Inland Lakes." Accessed online: <https://www.michigan.gov/documents/invasives/egle-great-lakes-aquatics-IPM-manual_708904_7.pdf>.

Management: Like other invasive species, curly-leaf pondweed is difficult to control once established and is considered widespread in Michigan. Therefore, prevention of new populations in uninfected waters is the most economical management approach. Several herbicides have been shown to be effective at long-term control of curly-leaf pondweed, but eradication is difficult after establishment. Bottom barriers have shown effectiveness at combating curly-leaf pondweed in small areas, and mechanical harvesting of curly-leaf pondweed can be effective if timed and managed correctly.[14]

The most viable ways to control curly-leaf pondweed is through chemical and physical means after developing an integrated pest management plan. Early infestations may best be controlled by manual removal, diver-assisted suction harvesting (DASH), or benthic barrier use during spring before turions are produced. Aquatic herbicides including endothall, diquat, and flumioxazin are the most effective for general applications. Aquatic herbicides including flumioxazin and imazamox are effective for specific types of application and in specific environments. Chemical treatments are a part of a long-term integrated management plan as the turions are viable for at least 5 years and only diquat, fluridone, and some hormone treatments have shown a reduction of turion development in the laboratory.[15]

Figure A4 - Example curly leaf pondweed image from the 2021 LakeScan™ field crew.

[14] MDEQ, 2018.
[15] MDEQ, 2018.

4.2. Appendix B: Herbicide Applicator Data and Maps

Date of treatment (one per section): 6/18/2024							
Name of person applying chemical: Michael Rohlman							
Name of Company or NA if not applicable: Solitude Lake Management							
Effectiveness: ■ Good (70-100%) ☐ Fair (50-69%) ☐ Poor (less than 50%) ☐ Ineffective (0%)							
Chemical Brand Used	EPA Registration Number	Method of Application	Application Rate (10 lbs./acre, etc.)	Treatment Area Size: (Acres)	Average Depth (Feet)	Total Amount (4 gallons, 10 lbs., etc.)	For Control of: (Plant and/or Algae names)
Tribune	100-1390	Surface Spray/Sub Surface Injection	1 gal/acre	7.5	3	7.5 gal	Eurasion Water Milfoil/Curlyleaf Pondweed
Cutrine Plus	67690-93	Surface Spray/Sub Surface Injection	.33 gal/acre-foot	7.5	3	7.5 gal	Macro-algaeStarry Stonewort
Hydrothol 191	70506-175	Surface Spray/Sub Surface Injection	1.33 pint/acre-foot	4.5	3	2.25 gal	Macro-algaeStarry Stonewort
Procellacor EC	67690-80	Surface Spray/Sub Surface Injection	25.6 fl oz/acre-foot	10.25	6	1574 oz	Eurasion Water Milfoil
Tribune	100-1390	Surface Spray/Sub Surface Injection	1 gal/acre	10.25	6	10.25 gal	Eurasion Water Milfoil/Curlyleaf Pondweed
Cutrine Plus	67690-93	Surface Spray/Sub Surface Injection	.17 gal/acre-foot	8.75	6	8.75 gal	Algae
Aquathol K	70506-176	Surface Spray/Sub Surface Injection	1 gal/acre	3	3	3 gal	Curly-leaf Pondweed

Figure B1 – Solitude Lake Management Aquatic Nuisance Control (ANC) treatment report for Cedar Lake, Alcona and Iosco counties, on June 18, 2024.

Date of treatment (one per section): 9/18/2024							
Name of person applying chemical: Michael Rohlman							
Name of Company or NA if not applicable: Solitude Lake Management							
Effectiveness: ■ Good (70-100%) ☐ Fair (50-69%) ☐ Poor (less than 50%) ☐ Ineffective (0%)							
Chemical Brand Used	EPA Registration Number	Method of Application	Application Rate (10 lbs./acre, etc.)	Treatment Area Size: (Acres)	Average Depth (Feet)	Total Amount (4 gallons, 10 lbs., etc.)	For Control of: (Plant and/or Algae names)
Tribune	100-1390	Surface Spray	2 gal/acre	4.5	3	9 gal	Eurasion Water Milfoil
Cutrine Plus	67690-93	Surface Spray	.33 gal/acre-foot	4.5	3	4.5 gal	Algae
Habitat	241-426-67690	Foliage Spray	2 pint/acre-foot	1.25	1	2.5 pint	Phragmites
Aquaneat	228-365	Foliage Spray	2 pint/acre-foot	1.25	1	2.5 pint	Phragmites
Cygnet Plus	N/A	Foliage Spray	.5 pint/acre-foot	1.25	1	.625 pint	Phragmites

Figure B2 – Solitude Lake Management Aquatic Nuisance Control (ANC) treatment report for Cedar Lake, Alcona and Iosco counties, on September 18, 2024.

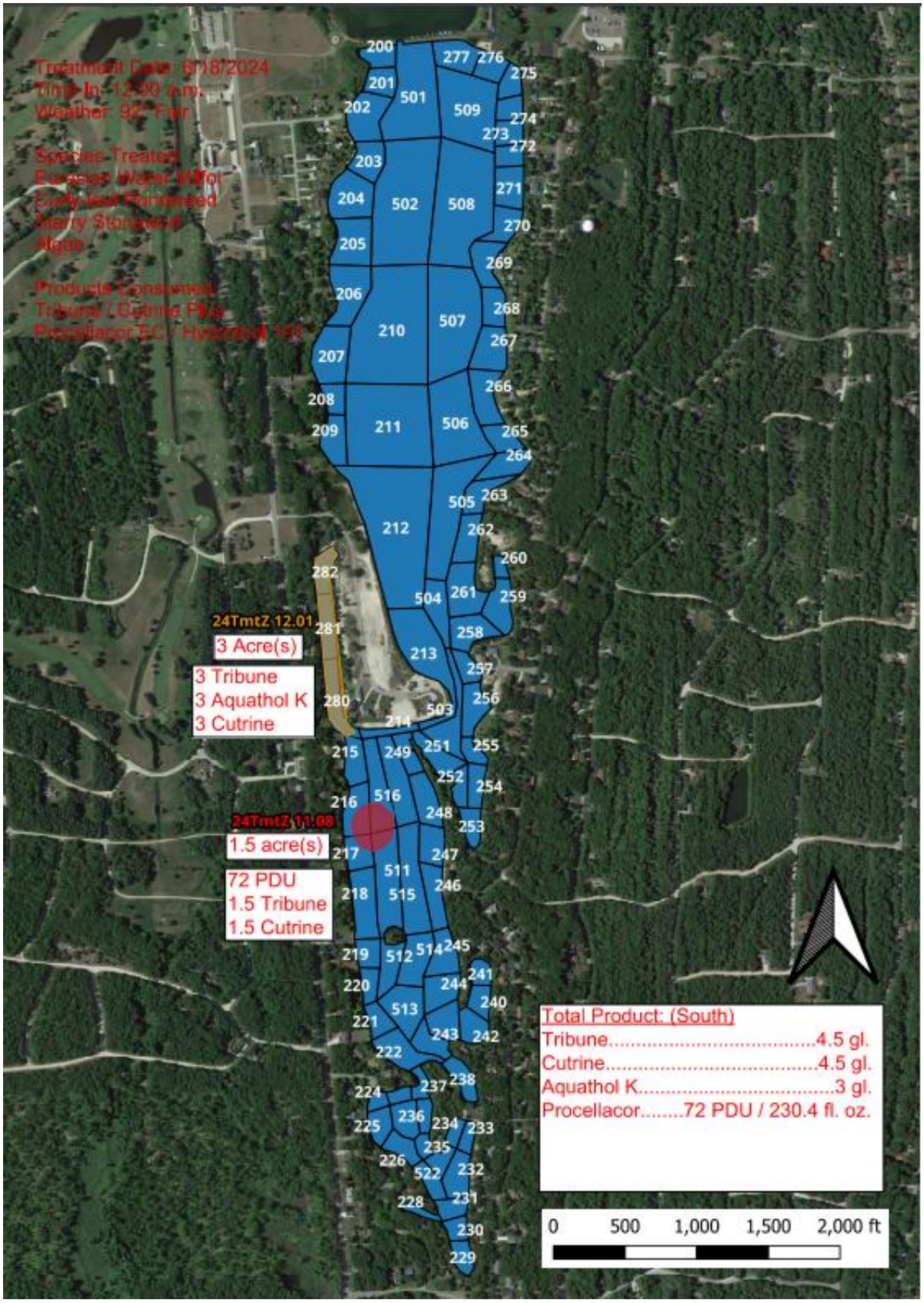


Figure B3 – Solitude Lake Management treatment map for Cedar Lake South, Iosco County, on June 18, 2024.

Treatment Date: 9/18/2024
Time In: 12:00 P.M.
Weather: 78* Fair

Species Treated:
Eurasian Water Milfoil

Products Consumed:
Tribune
Cutrine Plus

Figure B4 – Solitude Lake Management treatment map for Cedar Lake South, Iosco County, on September 18, 2024.

KIESER & ASSOCIATES
ENVIRONMENTAL SCIENCE & ENGINEERING

TECHNICAL MEMORANDUM

To:	Rex Vaughn Cedar Lake Improvement Board	**Date:**	April 4, 2025
From:	Mark Kieser, Senior Scientist John Jacobson, PE, Senior Engineer Kieser & Associates, LLC	**cc:**	Files
RE:	**Findings for 2024 Cedar Lake Groundwater/Surface Water Level Monitoring**		

This memorandum presents 2024 results compiled by Kieser & Associates, LLC (K&A) related to the ongoing water level monitoring program at Cedar Lake, Alcona and Iosco Counties, MI. K&A staff were authorized to continue management and oversight of ongoing data collection efforts in 2024 on behalf of the Cedar Lake Improvement Board (CLIB). The purpose of this long-term monitoring program is to best understand critical needs and relevant influences on water levels in Cedar Lake.

Desirable summer month water levels in Cedar Lake are a function of both rainfall and management strategies designed to support water level maintenance in dry summer months. These management strategies, as defined in the approved Cedar Lake Watershed Management Plan (WMP), relate to ongoing efforts to bolster water retention in the northwest cedar swamp throughout the year. The CLIB has implemented and expanded water level control efforts in the Cedar Lake watershed, as summarized in this report, since 2017, including:

1) The wetland berm, parallel just to the south of Sherman Creek, constructed in 2017 to retain water in immediately adjacent areas of the northwest cedar swamp on CLIB property, while reducing out-of-watershed losses through King's Corner Culvert.
2) Sherman Creek instream grade structure controls, designed and permitted in 2018 and constructed in Fall 2019, serve to further retain water levels in the cedar swamp. This serves to promote extended surface water inflows and enhanced groundwater volume inputs to Cedar Lake, bolster lake level management during open-water recreational periods, and enhance northern pike spawning wetland habitat under spring-time flow conditions. K&A and CLIB representatives continue to monitor and observe flow conditions around these structures to ensure they are operating as designed and to verify benefits under a range of spring snowpack and summer-time precipitation conditions.
3) The Cedar Lake outlet structure, designed by the Drain Commission to maintain the lake at the legal lake level of 608.20 feet, was reconstructed in September of 2020. Since March 2021, a year-round logger has measured the lake outlet water level. Ongoing concerns regarding the loss of water from the outlet structure have been voiced by Cedar Lake stakeholders. Streamflow data collected throughout the monitoring period suggests low-flow groundwater is likely the culprit of the continual trickle exiting through the lake outlet structure. Future monitoring efforts will continue to closely inspect the outlet structure and will guide any action needed to correct the loss of water through the structure.

This technical memorandum presents findings of these water level conditions as observed in Cedar Lake and its watershed in 2024 with discussions of implemented, ongoing, and potential future water level management strategies. Find all tables and figures referenced in the body of this memorandum published at the end of the memo narrative.

Program Background

A volunteer water level monitoring program was initially developed at select groundwater and surface water monitoring sites around Cedar Lake in 2004. Since then, water level monitoring efforts have expanded to include additional critical areas using automated water level logger equipment in lieu of intermittent volunteer measurements. The 2024 water level monitoring totaled 32 level loggers in operation around the Cedar Lake from March to November. The location and addresses of the sites of the level loggers are provided in Figure 1.

The combination of surface water stations, shallow piezometers, and deep piezometers allow and facilitate observations of the interactions between surface water, groundwater, and Cedar Lake water levels. Monitoring continued at Sherman Creek and Jones Ditch as well as within their contributing wetlands in 2024, to calculate estimated surface water flows into Cedar Lake.

Monitoring also continues at the wetland berm on CLIB property, constructed as part of the ongoing efforts to retain water levels in the cedar swamp. The berm's stone-laden spillway design allows overflows above an elevation of 611.50 feet, so as not to permanently alter historic high-water levels in the swamp or alter any historic flooding or outflow southward out of this area and out of the Cedar Lake watershed. This provides critical information regarding water retention improvements in the northwest cedar swamp, including those related to the Sherman Creek instream grade structures and stream flows into Cedar Lake.

Monitoring in 2024 also included instream level loggers deployed at new sites in Jones Ditch since 2022, including within the contributing wetland complex. The Jones Ditch data loggers will help further define the Jones Ditch wetland contribution of surface and groundwater to the lake following several structural changes in the last six years of monitoring. In 2018 the Alcona County Road Commission replaced the creek culvert during reconstruction on W Cedar Lake Road, affecting flow estimates through Jones Ditch during the 2018-2020 reporting period. K&A modified the flow equation in 2021 to more accurately quantify measured flow data. These recent data suggest that Jones Ditch, under certain conditions, may contribute more surface water to Cedar Lake than Sherman Creek, a discovery with implications for potential future engineering designs and management efforts in and along the northwest corner of Cedar Lake.

The estimated lifespan of the level loggers is ten years. Replacement of aged-out level loggers around Cedar Lake began in 2018, with all thirty-two level loggers since updated to ensure a high degree of confidence in the dataset. This includes three loggers replaced in 2017, eleven in 2019, eight in 2020, seven in 2021, and three new loggers deployed in 2022 at Jones Ditch and the Timberlakes property on the northwest and northeast sides, respectively, of Cedar Lake. K&A rigorously evaluates logger data each year to ensure accuracy in the dataset. Table 1 illustrates the current age and predicted lifespan of the Cedar Lake level logger regime.

2024 Precipitation and Water Level Data

Precipitation Analysis:

Historic summer precipitation totals for the Cedar Lake area presented in Figure 2 show 2024 summer precipitation information available from the Cedar Lake volunteer rain gauge. Rain gauge data, analyzed for quality against other weather stations in the area, Harrisville 2 NNE (USC00203628) and Oscoda Wurtsmith Airport (Station #14808), was the most representative localized data available. From 2016 to 2020, reported rainfall data present triangulated data from these weather stations and the near-lake rain gauge. The Lake Board's volunteer rain gauge was replaced in April 2020. Available data from 1998 to 2024 (minus 2006 with no local functioning rain gauges) reflect a 27-year summer average (June-September) of 11.9 inches of rainfall.

The 2011 Cedar Lake Augmentation Feasibility Study conducted by K&A revealed that 2.75 inches of precipitation during each summer month is necessary to avoid a lake level drop of 3-inches per month (June-September). As such, in any summer month that does not exceed the 2.75-inches-of-precipitation threshold, Cedar Lake can expect a drop in lake level of 3-inches or more. Since 2011, this summer precipitation threshold of 11-inches (i.e., 2.75 inches multiplied by 4 months) has guided lake-wide assessments of summer conditions and their effect on desirable lake levels. Ongoing management efforts aim to lower this threshold or augment the water budget of the Cedar Lake watershed to limit the impact of low summer precipitation on lake level.

Figure 2 presents the critical precipitation threshold among the 27-year summer precipitation average. While Cedar Lake precipitation met this critical threshold of 2.75 inches (to avoid lake-elevation drop) in June and July of 2024, the monthly total precipitation in July, August, and September fell below the respective 27-year average for each month. June 2024 precipitation totaled 3.88 inches, exceeding the monthly average. July monthly precipitation totaled 2.81 inches, just below average; August totaled 1.9 inches, the lowest since 2019; and September precipitation totaled 2.23 inches, just-below the monthly average. The resulting summer precipitation total was 10.82 inches, a below-average value indicative of a dry summer season.

Cedar Lake Water Elevation:

Figure 3 plots the estimated 2024 Cedar Lake water elevation from March to mid-November, with daily precipitation data recorded from the Cedar Lake volunteer rain gauge to visualize the importance of precipitation on lake elevation. When the lake elevation exceeds 608.20, flow over the Cedar Lake outlet weir will occur. Lake stakeholders historically define elevations above 607.2 ft (within one foot below the legal lake limit) as presenting "desirable conditions."

Early-spring snowmelt induced lower-than-normal lake levels in March, followed by rainfall in April and May bringing spring lake level conditions just above the legal lake level, with about 99% of lake outflows (35.33 MGal) occurring between March 15 – May 15, 2024. It should be noted that the new outlet structure controls the lake level elevation closer to the legal lake elevation and as such the lake elevation is at legal as monitoring begins in March. By late May, Cedar Lake water elevations had dropped below the legal lake level. Below-average summer rainfall amounts from July – September pushed Cedar Lake levels to continue falling through the summer recreation months. The lake level fell below the desired minimum lake elevation

threshold of 607.2 ft (1-ft below the legal level) in early-September and remained in this state to the end of the monitoring period in mid-November, reaching a minimum elevation of 606.5 ft.

Cedar Lake's mid to late-summer water levels followed a predictable pattern for a year with below-average summer rainfall. Periodic rises in summer lake elevation responded directly to rainfall and corresponding inflows from the Sherman and Jones wetlands well into the summer months. Both Sherman Creek and Jones Ditch flowed continuously until about mid-August despite less-than-average rainfall in July and August, underscoring the importance of water retention efforts implemented in the watershed.

Since construction of the Cedar Lake outlet structure in fall of 2020, Cedar Lake stakeholders have voiced concerns of an apparent constant "leak" of water coming from the outlet structure even when the lake elevation sits below the outlet weir of 608.20 ft. Site visits since 2021 confirm a very low flow of groundwater exiting through the north side of the outlet structure. K&A field staff periodically collected measurements of the velocity and channel area of the outlet structure, as well as downstream channel to understand the discharge of water flowing through the outlet structure during non-wet weather/weir overflow conditions. Based on low flow rates from the outlet structure box culvert, impacts on lake level associated with groundwater leakage into the box culvert can reasonably be described as negligible.

Figure 4 presents Cedar Lake outlet discharge data and calculated equivalent drops in Cedar Lake water elevations. Evaporation and discharge (leakage) to groundwater across the entirety of the lake's 1,050-acre surface area remain the leading causes of water losses from Cedar Lake during critical summer months. The average lake outflow in 2024 was 23,593 GPD, less than half of the average daily outflow over the past three years (since March of 2021) of approximately 70,000 GPD or 0.0002 ft/day in equivalent lake level.

Figure 4 also illustrates the relationship between summer precipitation and water elevation fluctuations with respect to the critical summer precipitation threshold, water level goals designed in the Cedar Lake WMP, and the legal lake level. The average summer-month water elevation of Cedar Lake in 2024 was 607.74 ft, less than the average level in 2023, a higher-rainfall year. Comparing the average summer-month lake level with the average summer-month rainfall shows some interesting trends, discussed in the next paragraph.

Following wetland augmentation implementations in Sherman Creek (2017-2020), average lake elevations increased despite a decline in average rainfall as compared to a decade earlier (2007-2010), showing the importance of such water retention efforts to improving lake levels. Average summer-month lake level in 2021, however, were much lower than average. This condition shows the important influence of winter snowfall and spring snowmelt amounts, which were far below average in early-spring 2021, causing reduced lake levels despite higher-than-average summer rainfall. Conditions from 2022-2024 show lake levels responding more normally to summer rainfall levels, but still lower than comparative summer-month rainfall years from 2017-2020. It should be noted that the new structure controls the winter and spring lake levels at an elevation closer to the legal lake elevation as opposed to pre-structure which allowed for additional lake levels above legal lake level.

Groundwater Levels and Gradients

Figures 5-18 present the 2024 groundwater elevation data from the groundwater monitoring Sites 1-12, as well as TL-2 and TL-Road, referenced with the estimated Cedar Lake water levels. Level loggers on the east side of Cedar Lake typically show groundwater elevations below the lake level, while those on the lake's west side show groundwater elevations above the lake level, showing in fine detail the surface and groundwater gradient movements in the watershed.

East Side of Cedar Lake

On the east-central section of Cedar Lake, at Sites 1 and 4 (Figures 5 and 8), level loggers continued to record groundwater elevations below Cedar Lake level, with no exceptions in 2024. With this gradient present throughout the summer, northeastward groundwater movement serves as a continual loss vector for Cedar Lake, well-documented since monitoring began.

Level loggers on the southeast section of Cedar Lake, at Sites 8, 9, 10, and 11 (Figures 12 – 15), report even steeper groundwater gradients consistently moving groundwater away from Cedar Lake, towards the southeast. This exemplifies the surface grades away from the lake and the groundwater-losing condition worsened by a subdrainage system designed to help keep house foundations and crawl spaces dry and residential septic systems functioning properly in the Lakewood Shores neighborhood.

K&A also installed two new stations in 2023 near the Timberlakes development on the lake's northeastern-most section, "TL Lake 2" (Figure 17) and "TL Road" (Figure 18). The goal for monitoring at these stations is to better understand northeasterly groundwater losses occurring near the Timberlakes residential development. Comparing these elevations and gradients to stations in the southeast allows for a comparison of the Timberlakes area to the Lakewood Shores residential district where subterranean drains already exist. Like the other eastern loggers (1, 4, and 8-10), TL Road showed a four to five ft loss in elevation compared to TL-2 which was within a ½-foot of the lake level throughout the year. This shows that a natural northeasterly groundwater gradient flow, away from the lake, already exists towards the Timberlakes district.

West Side of the Lake

On the southwest section of Cedar Lake, Site 3 (Figure 7) tracks the more-nuanced movement of shallow groundwater toward or away from Cedar Lake throughout the summer months. From mid-March to mid-June, shallow groundwater moved mostly toward Cedar Lake. Conversely, from mid-June to November, Site 3 shallow groundwater moved mostly away from Cedar Lake, except in response to occasional rain events which tilted gradients back toward the lake. This period of groundwater gradient tilting towards Phelan Creek (Van Etten Lake) shows water loss from Cedar Lake during the dryest summer months. Since construction of the wetland berm (2017) and instream Sherman Creek grade structures (2019), groundwater at Site 3 has periodically shown much greater contributions to Cedar Lake than were observed historically.

Similarly, prior to 2021, shallow groundwater at Site 6 (Figure 10) experienced intermittent flow patterns under dry or wet conditions, much like Site 3. Since 2021, groundwater has consistently moved towards Cedar Lake at this location, showing increased groundwater elevations resulting

from the 2017 and 2020 Sherman wetland improvements. Under near-average rainfall conditions in 2024, groundwater flows at Site 6 still showed a strong gradient of flow toward Cedar Lake.

Site 12 (Figure 16), installed in 2018 approximately 1,750 ft south of Sherman Creek and 85 ft southeast from the intersection of West Cedar Lake Road and King's Corner Road, further illustrates effects on groundwater gradients from the Sherman wetland improvements. As in years past, the groundwater at Site 12 was consistently 2-feet above lake level during spring and the gradient remained flowing toward the lake all summer, flattening out a bit by late-summer.

Site 7 (Figure 11), along the western lakeshore just north of Sherman Creek, also continues to reflect an increase in groundwater recharge in the spring months, as compared to years prior to 2021, resulting from the wetland water-retention improvements. Like Site 12, groundwater at Site 7 was consistently 1 to 2-feet above the lake level throughout the 2024 monitoring period. This phenomenon was not evident at this location prior to 2017 and the berm installation.

The cedar swamp complex northwest of Cedar Lake continues to contribute a critical supply of groundwater throughout the recreational season, from both the Sherman and Jones Ditch. On the northwest side of the lake nearest to Jones Ditch, Site 2 (Figure 6) shows groundwater levels above the lake elevation in both the shallow and deep wells with a natural gradient of shallow groundwater toward the lake throughout the monitoring period. Groundwater levels at Site 2 continue to consistently and closely-mirror surface water fluctuations at the Lake Outlet.

2024 Estimated Surface Flows

Water level loggers located in or near the Cedar Lake outlet, Sherman Creek, Jones Ditch, and the King's Corner culverts were used to monitor incoming and outgoing surface water discharge. Sherman Creek and Jones Ditch are critical vectors by which surface water flows from the northwest wetland complex into Cedar Lake. The King's Corner Road culvert historically diverted water from the southernmost portion of the wetland complex away from the Cedar Lake watershed to the south towards Phelan Creek and Van Etten Lake. The wetland enhancement berm constructed in 2017 serves to retain surface water in the Cedar Lake swamp and limit surface water losses through the King's Corner culvert. The new Cedar Lake outlet structure constructed in September 2020 functions to maintain the legal lake level of 608.2 feet. If the lake elevation exceeds this limit, water spills over the outlet and eventually drains to Lake Huron.

Efforts regarding water retention improvements in Sherman Creek were conducted in September 2019 with the implementation of three instream grade structures. Large stone instream grade structures were installed at approximately 50 ft, 100 ft and 150 ft upstream of the Sherman Creek culvert. These instream barriers serve to retain water in the northwestern wetland complex by slowing discharge rates into Cedar Lake during snowmelt and rain events in the spring. By lengthening the time needed for surface water in the wetland complex to reach Cedar Lake, the high flows present in spring can be extended into the summer when lake inputs become critically important for lake level.

Surface water discharge rates and total volumes associated with the full 2024 monitoring period at Jones Ditch, Sherman Creek, Cedar Lake outlet, and the King's Corner culvert are presented

in Figures 20, 21, 22, 23, and 24, respectively in addition to the wetland berm in Figure 25. All flow data are derived from water level stage-discharge relationships specific to each monitoring station that have been calibrated and validated using previous data collected on Cedar Lake. The discharge data and estimated total volumes are graphically displayed together in Figure 26.

The water level stage-discharge relationship for Jones Ditch was re-calibrated in 2018 following the installation of the new culvert that allowed increased flows under King's Corner Road. The stage-discharge equation was updated in 2021 to quantify the increased flow more accurately through the larger diameter culvert. New logger stations installed upstream and downstream of the culvert in 2022 helped to further refine the flow equation over time.

Surface Water Inflows and Outflows:

The following discussion of estimated surface water flows and volumes focuses on the late-spring to late-summer period of May 1 to September 30 to assess the impact of inflows and outflows on lake levels during the summer recreational months. Table 2 summarizes estimated inflow or outflow volumes for surface water stations from May-September of each year 2014-2024 for a decade of comparison.[1] Jones Ditch and Sherman Creek provide inflows of surface water into Cedar Lake from the northwest cedar swamp contributing area, while King's Corner culvert and the Lake Outlet represent surface water leaving the watershed, flowing toward Phelan Creek and Lake Huron, respectively.

From May 1 to September 30, 2024, inflows for Jones Ditch and Sherman Creek totaled 260.4 million gallons (MGal) and 253.0 MGal, respectively. Flows from both creeks slowed to a trickle, with only some periodic flows, by August of 2024. Inflow volumes from these two sources were less in 2024 than the previous year due to lesser rainfall amounts. Comparing 2024 inflow volumes to 2015, a year with similar summer month rainfall prior to the Sherman Creek wetland enhancements and Jones Ditch culvert replacement, shows a marked increase in inflow volumes from both Sherman and Jones Ditch. This comparison confirms how inflow volumes have improved because of these wetland water retention and infrastructure improvement efforts.

Connectivity in the Jones Ditch wetland generally allows precipitation to runoff rather than being infiltrated as groundwater. This geomorphic feature and the larger surface area of the Jones Ditch wetland complex represent the difference in outflows between the Sherman Creek and Jones Ditch cumulative discharges. A small beaver dam exists in the upstream of Jones Ditch, which may have an effect of holding back water in the wetland and thereby reducing surface flows.

During the same May 1 – September 30 timeframe, 6.6 MGal discharged through the outlet from Cedar Lake. This cumulative discharge exited Cedar Lake between May 1 and June 1, 2024. For the remainder of the monitoring period, no surface water flowed over the outlet weir and the lake elevation remained below the legal lake limit of 608.2 ft.

The outflow volume that exited the Cedar Lake watershed through the King's Corner culvert during the May-September period totaled 0.05 MGal. This volume is the lowest observed to date, reflecting the overall low summer rainfall and retention improvements in the wetland. The

[1] Note that the 2023 hydrology report incorrectly presented 2023 flow volumes for a period of Mar 30 - Sep 30 (Table 2 in this 2024 report corrects these data to compare volumes for May 1 - Sep 30 only).

implementation of the wetland berm continues to retain water within the Sherman Creek wetland and limits losses through the King's corner culvert.

Surface Water Retention Design Implications:

The wetland berm continues to prove highly effective in limiting losses through the King's Corner culvert and out of the Cedar Lake watershed. The ratio of water volume passing through Sherman Creek versus King's Corner culvert has increased more than five times since installation of the wetland berm. Water elevations and flows through the wetland enhancement berm on the Lake Board parcel should continue to be closely monitored to definitively demonstrate additional long-term improvements to water retention in the wetlands via reductions to water volume lost through King's Corner culvert.

Sherman Creek cumulative discharge in 2024 (253 Mgal) was slightly lower than the historic 10-year average of 274.8 MGal. Snowpack and spring precipitation are the biggest factors in Sherman Creek contributions. Improvements to water retention bolstered by the wetland berm and instream grade structures prevent further decreases in the cumulative summer discharge in dry years such as 2024, extending the spring discharge period well-into July.

Figure 27 presents the surface/groundwater elevations at the Sherman Creek culvert and upstream wetland (Sherman 2) stations. These data are consistent with observations from previous years of improved water retention and storage in the wetland complex even in years of below-average precipitation. Figure 28 illustrates the 2024 water elevations at the wetland berm monitoring station, positioned at the upstream side of the berm spillway, compared to lake levels. Figure 29 compares water elevations at the wetland berm spillway, King's Corner culvert, and Sherman 2, located in the cedar swamp upstream of the Sherman Creek culvert. Figure 30 compares surface water flows and volumes for the 2024 monitoring season at the wetland berm spillway to outflows at King's Corner Culvert and inflows to Cedar Lake via Sherman Creek.

Surface water flowed through the wetland berm spillway from early spring to early summer, after which no flows occurred. Surface outflows through the spillway totaled 33 MGal from March 30 to June 15, while only 0.05 MGal flowed out of the watershed through King's Corner culvert. These data, in conjunction with previously discussed groundwater gradients on Cedar Lake's west side, show how 99% of berm spillway surface flows were absorbed into the ground before reaching the King's Corner culvert, indicating gains in groundwater flows to Cedar Lake.

These observations once again underscore the importance of precipitation as the ultimate factor in limiting substantial decline in lake level throughout the monitoring period. Continued monitoring is necessary to determine additional viable lake level augmentation strategies and improve on previously implemented projects and their effectiveness in maintaining Cedar Lake's water elevation within the desirable range.

Conclusions and Recommendations

Despite overall low precipitation levels during the monitoring period, improvements in water retention continue to prove effective in limiting outflow losses from the watershed as reported by previous years' findings. Water retention improvements have led to limiting outflows through King's Corner culvert as a percentage of the total Sherman Creek outflow (Sherman Creek and King's Corner culvert). King's Corner culvert routinely made up 20% of this flow prior to the installation of the wetland berm, after which this percentage now averages less than 2%.

Jones Ditch continues to supply an increased amount of discharge following the culvert replacement in 2018. The purchasing of the parcel through which Jones Ditch originates will allow the CLIB to continue to protect Jones Ditch and further improve connectivity between the northwest wetland complex and Cedar Lake. The piezometers placed in Jones Ditch in 2022 will continue to help K&A improve the current discharge-stage relationship and work to quantify incoming flows more accurately from Jones Ditch. These data monitoring efforts should help guide any future action in augmenting Jones Ditch to improve Cedar Lake water levels throughout the summer recreation months.

Precipitation, spring snow melt, and evaporation remain as the three dominant factors that influence the Cedar Lake elevation throughout the summer. Twenty-six years of rainfall data show how precipitation in the Cedar Lake area oscillates between multi-year periods of dryer and wetter years. While lake level has improved despite declining or stagnant precipitation totals in past years, drier conditions in the future may require new or novel management implementations. Planning and coordination by the CLIB and K&A should always consider emerging trends within the watershed and implement engineering design as needed. As such, K&A recommends the continuation of the hydrology monitoring program in 2025.

Recommendations for the 2025 Monitoring Program:

1. Identify additional hydraulic improvements for Sherman Creek and Jones Ditch areas including the maintenance of railroad culverts for watershed flows, and identify improvements to Sherman and Jones swamps to provide ecological improvements such as fish passage and flow management.

2. Further calibration of the Jones Ditch discharge equation with level data and wetland topographic data to determine volume control options for surface and groundwater flow enhancements.

3. Redeployment of groundwater piezometers in Sherman Creek, especially with potential grant funding for fish passage improvements at the creek mouth, to better assess flow and groundwater retention, particularly in light of fish passage assessments planned for 2026.

2024 Cedar Lake Hydrology Report: List of Tables and Figures.

Table 2. Comparison of Surface Water Volumes from May 1 to Sep 30, 2014 to 2024.

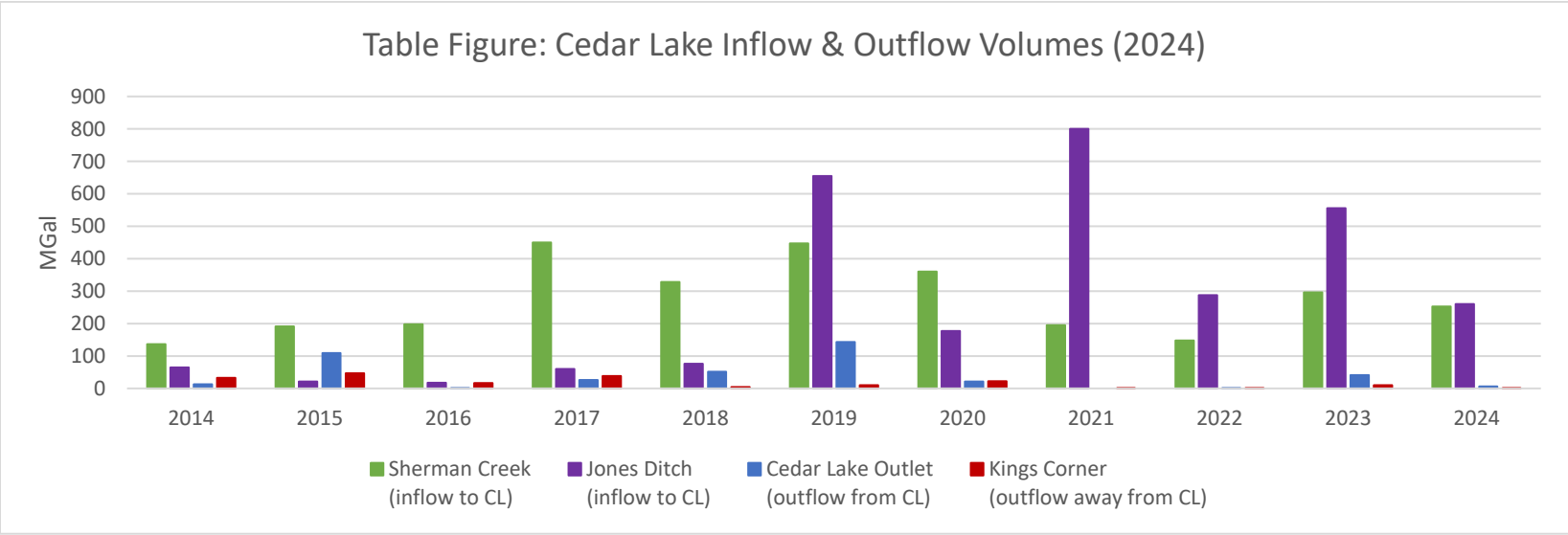
Site	Volume (MGal)										
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Sherman Creek (inflow to CL)	136.040	190.929	198.126	449.441	328.134	446.753	359.857	195.171	147.428	[4] 296.374	252.977
Jones Ditch (inflow to CL)	64.817	21.587	17.964	[1] 59.784	75.712	654.691	[3] 177.250	[3] 799.967	287.755	[4] 555.566	260.380
Cedar Lake Outlet (outflow from CL)	13.003	109.500	[2] 0.162	[2] 26.123	51.975	143.156	21.560	0.000	0.145	[4] 40.991	1.110
Kings Corner (outflow away from CL)	32.208	46.862	17.049	38.053	4.384	10.161	21.819	0.158	0.156	10.373	0.050

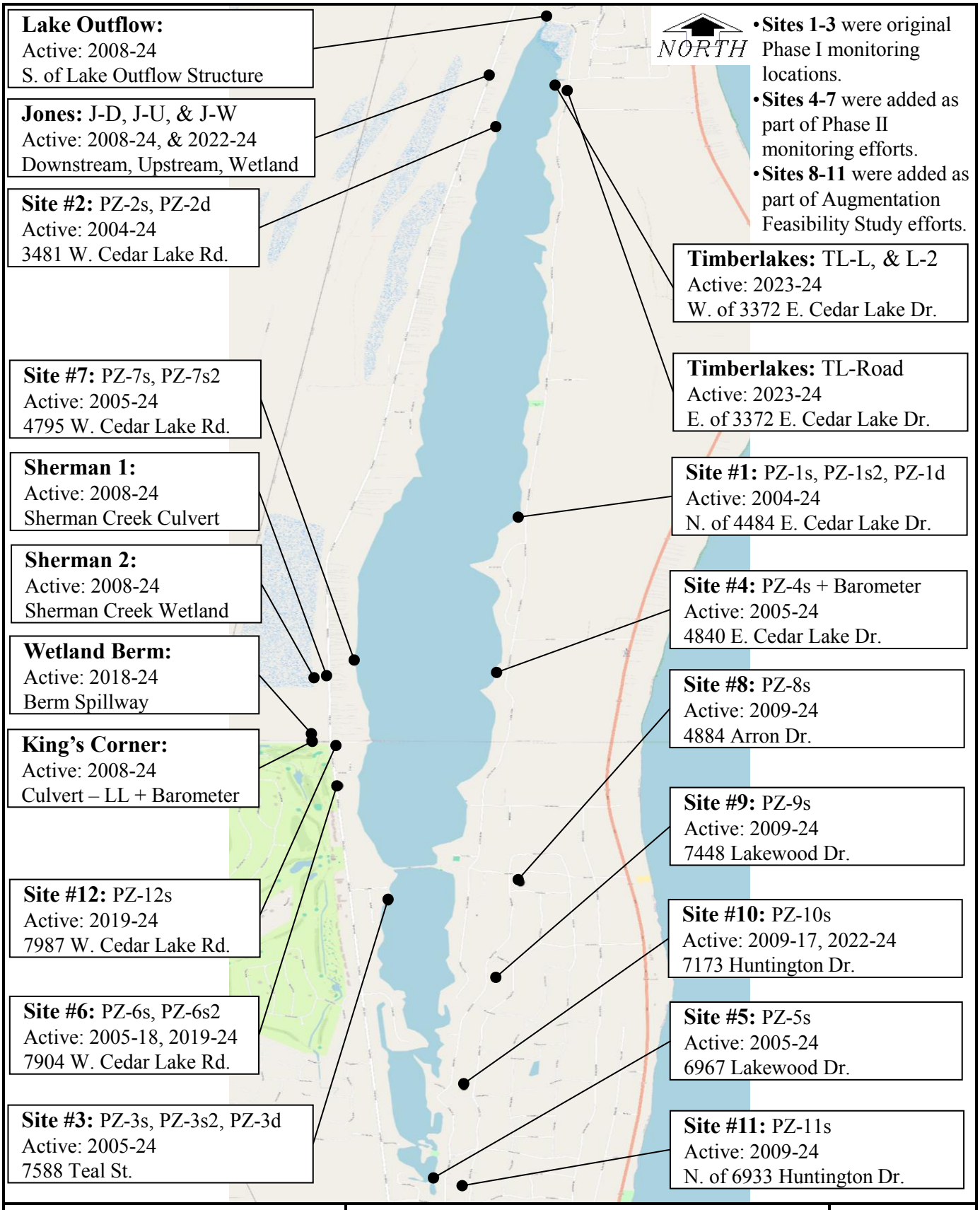
[1] Jones Ditch 2017 flows from 5/1/17 to 9/1/17 only.

[2] Lake elevations affected by presence of beaver dam upstream of Cedar Lake outlet, mechanically removed in fall 2017.

[3] Jones Ditch volume calculations affected by sediment accumulation resultant of beaver activity within Jones Ditch culvert after its replacement in 2018.

[4] 2023 table incorrectly reported 2023 flow volumes for a period of Mar 30 - Sep 30 (Table 2 corrects this to compare volumes for May 1 - Sep 30 only).





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Map of 2024 groundwater and surface water elevation monitoring sites with piezometers & level loggers, located around the perimeter of Cedar Lake.

FIGURE 1

Figure 2. Historic Summer (Jun - Sep) Precipitation Totals for Cedar Lake

(*Precipitation Sources:* Cedar Lake Rain Gauge, Alcona County, MI,
Harrisville 2 NNE (USC00203628), Alcona County, MI
Oscoda Wurtsmith Airport (Station #14808), Iosco County, MI

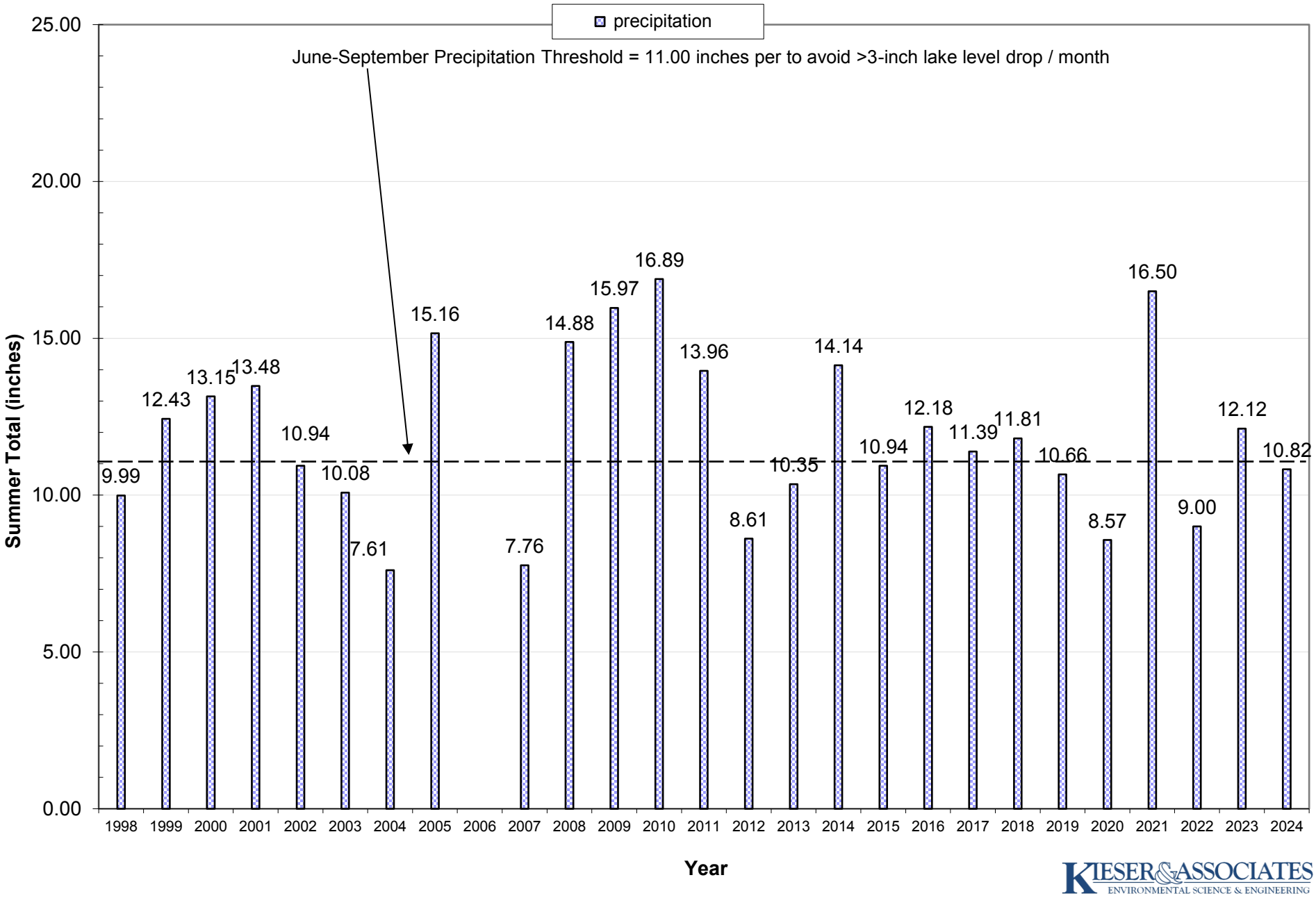

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Figure 3. 2024 Cedar Lake Elevation and Measured Rainfall

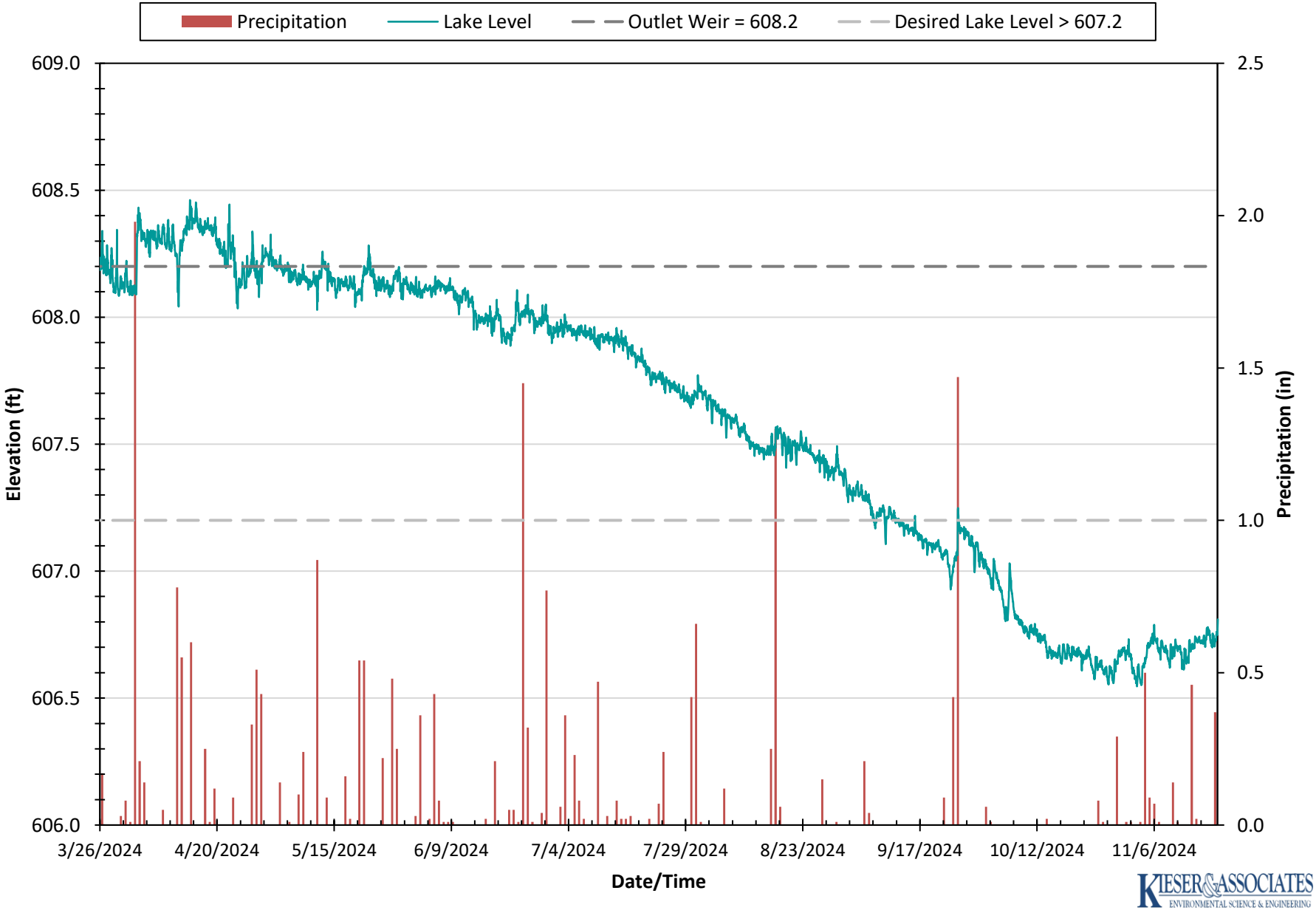

Figure 4. Cedar Lake Summer (Jun-Sep) Lake Level Fluctuations and Precipitation

Lake Level Minimum, Maximum, and Average Relative to Legal Lake Level (Outlet)

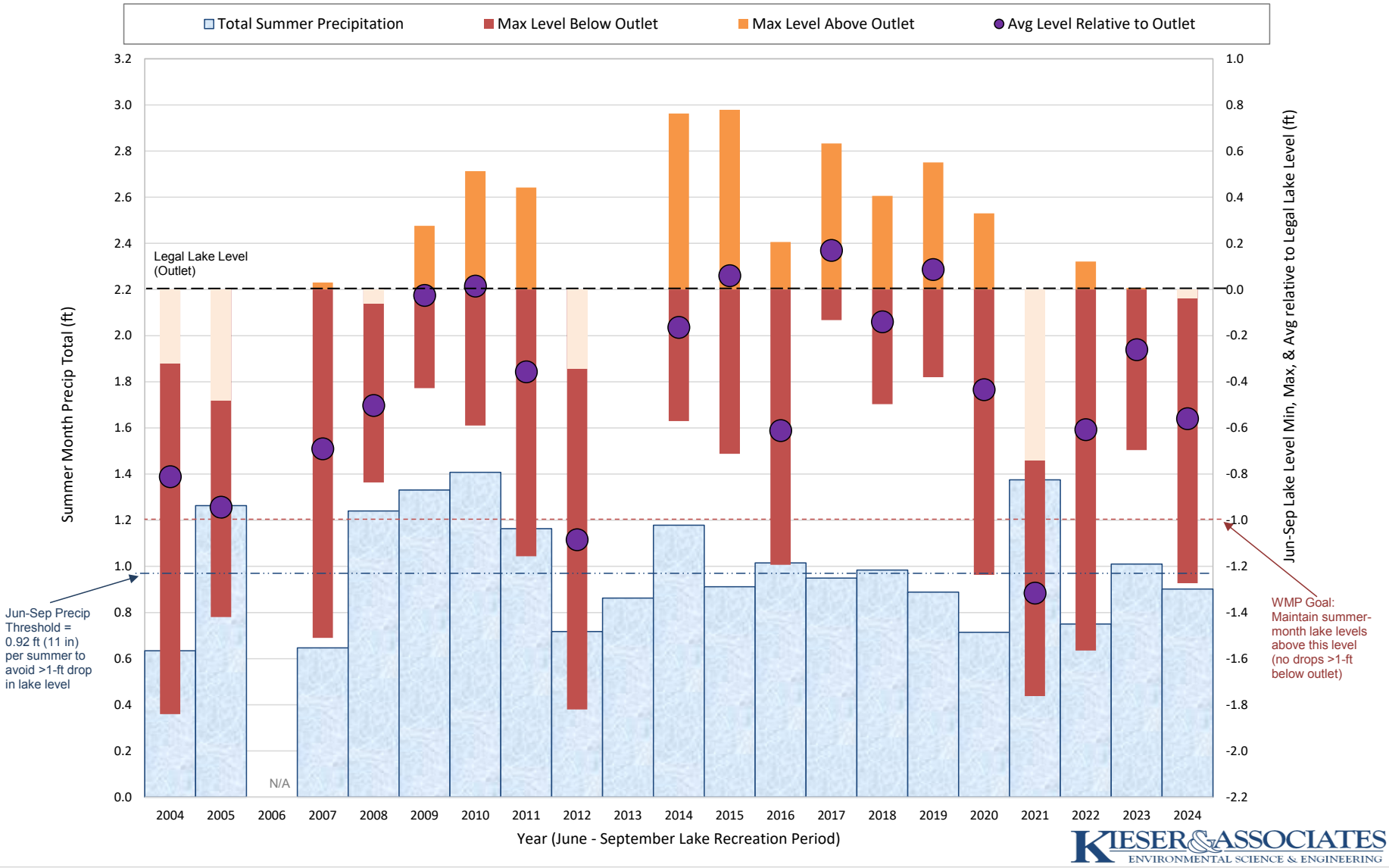

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Figure 5. 2024 Cedar Lake Groundwater / Surface Water Elevations (Site 1)

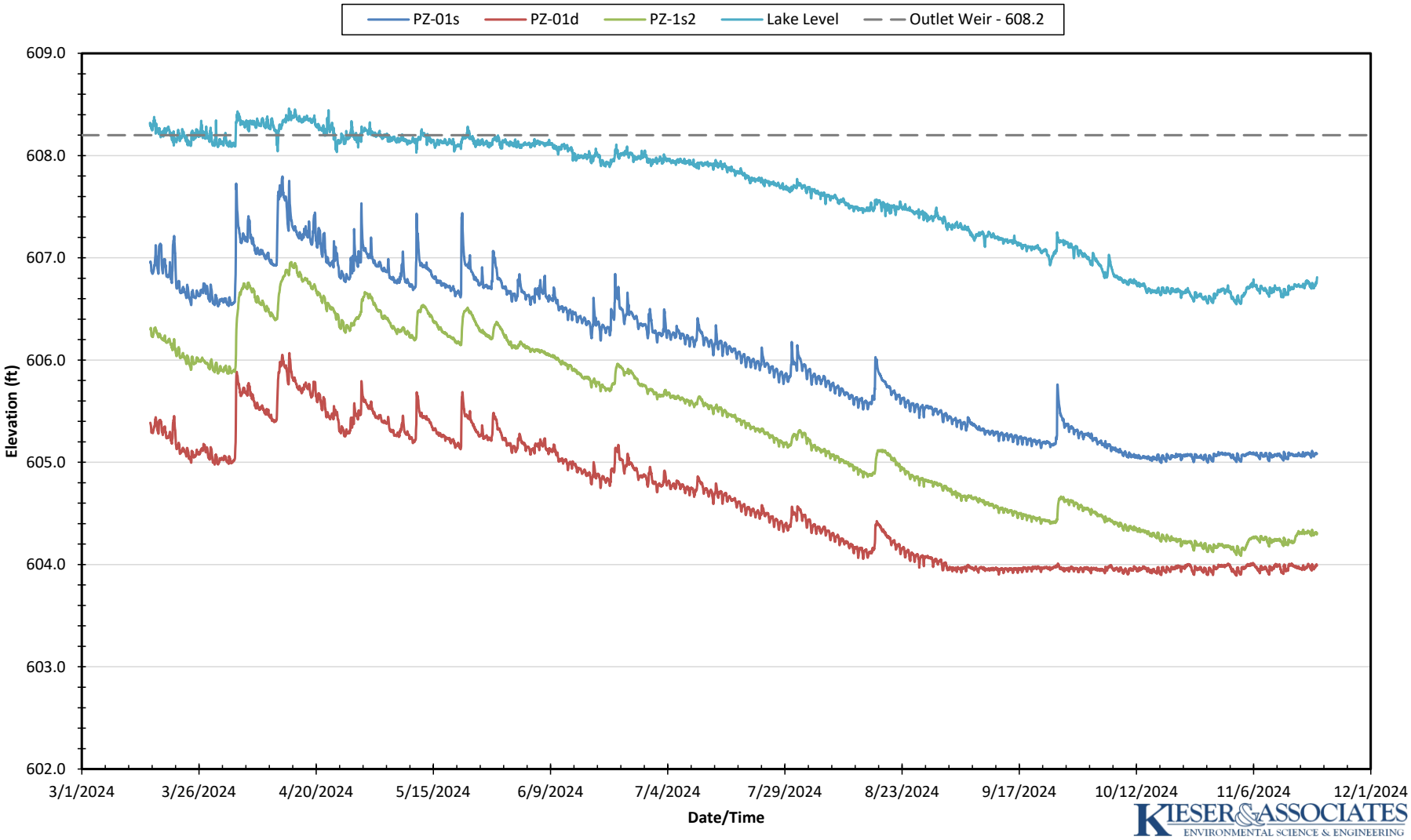

Figure 6. 2024 Cedar Lake Groundwater / Surface Water Elevations (Site 2)

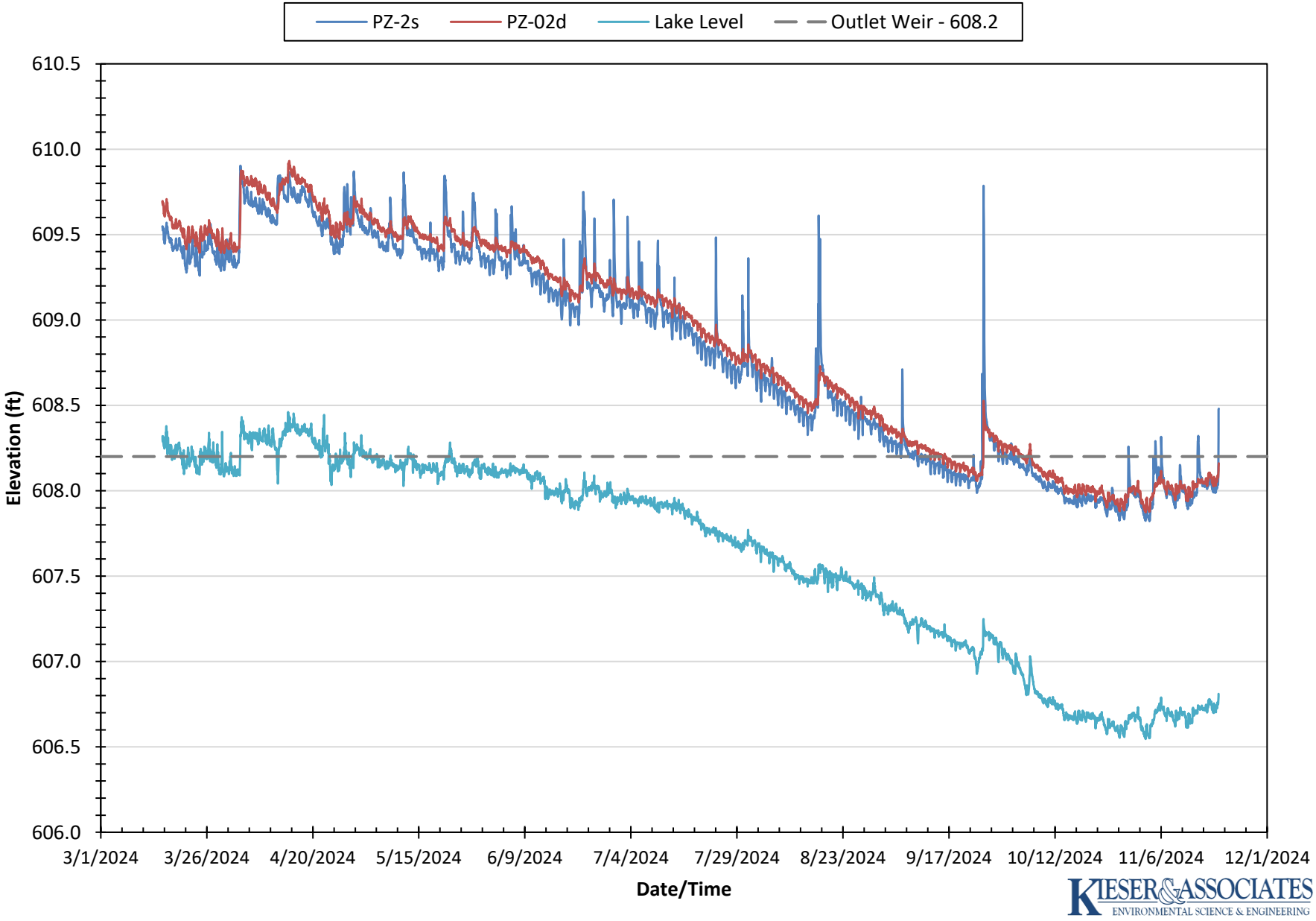

Figure 7. 2023 Cedar Lake Groundwater / Surface Water Elevations (Site 3)

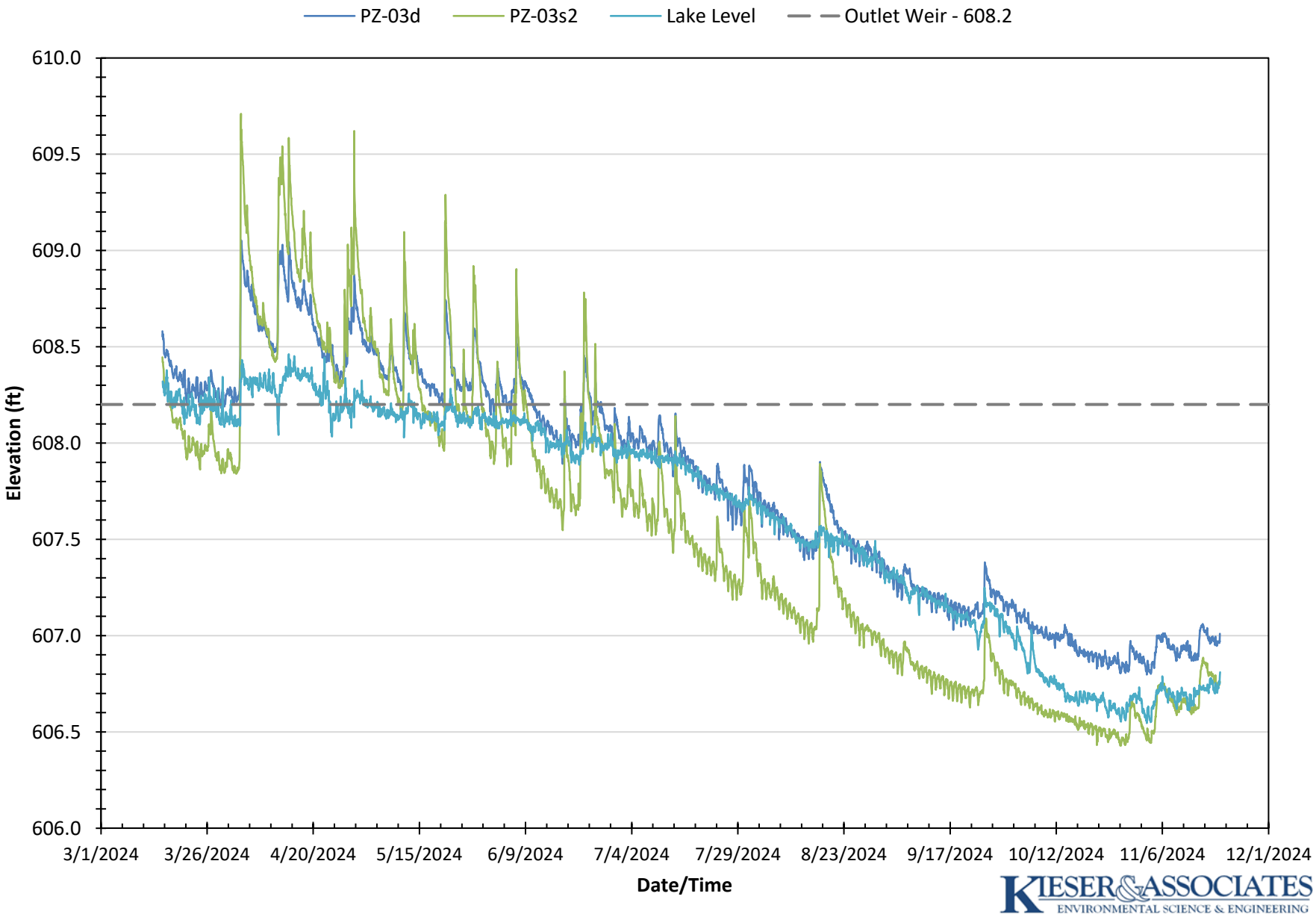

Figure 8. 2022 Cedar Lake Groundwater / Surface Water Elevations (Site 4)

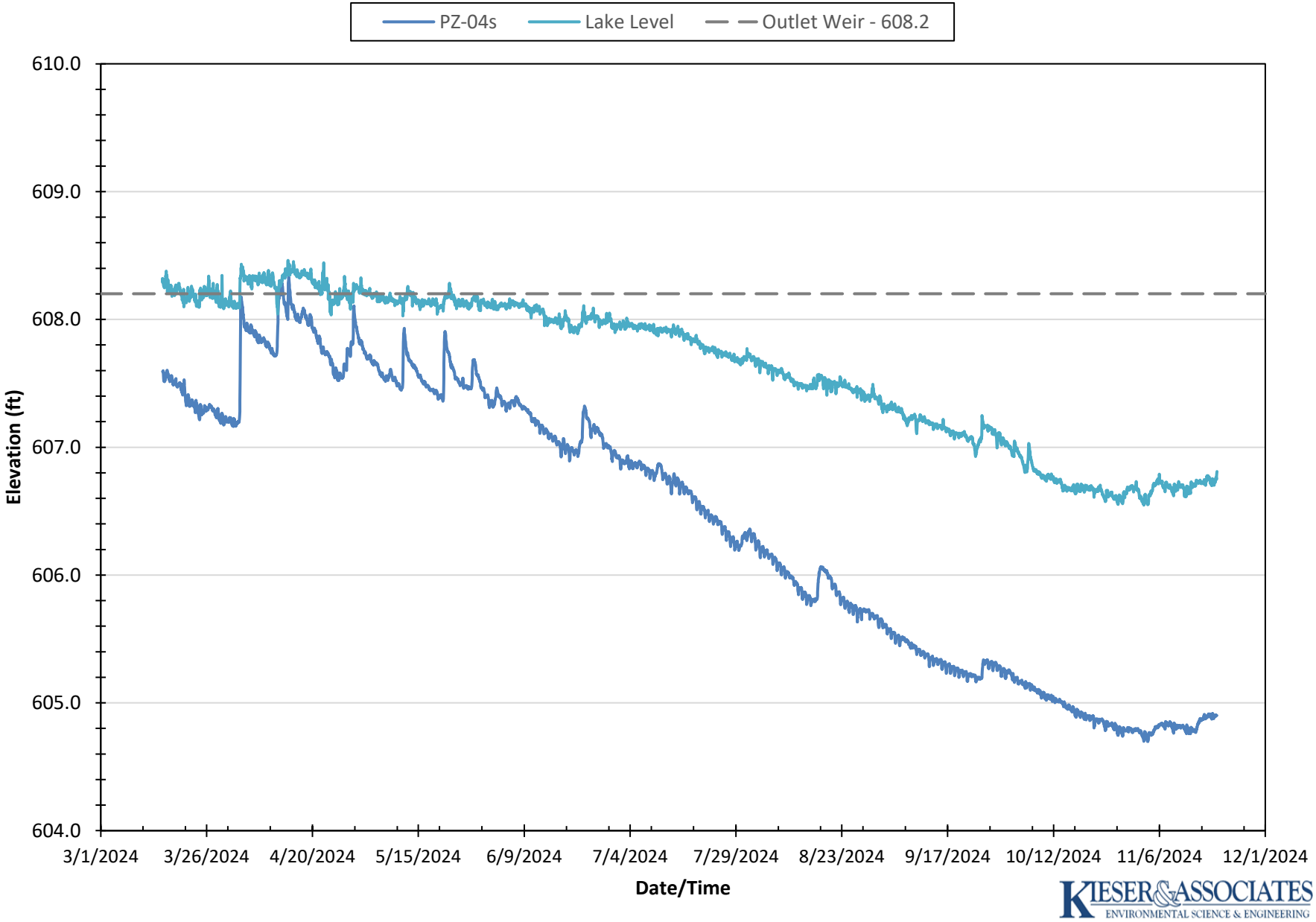

Figure 9. 2024 Cedar Lake Groundwater / Surface Water Elevations (Site 5)

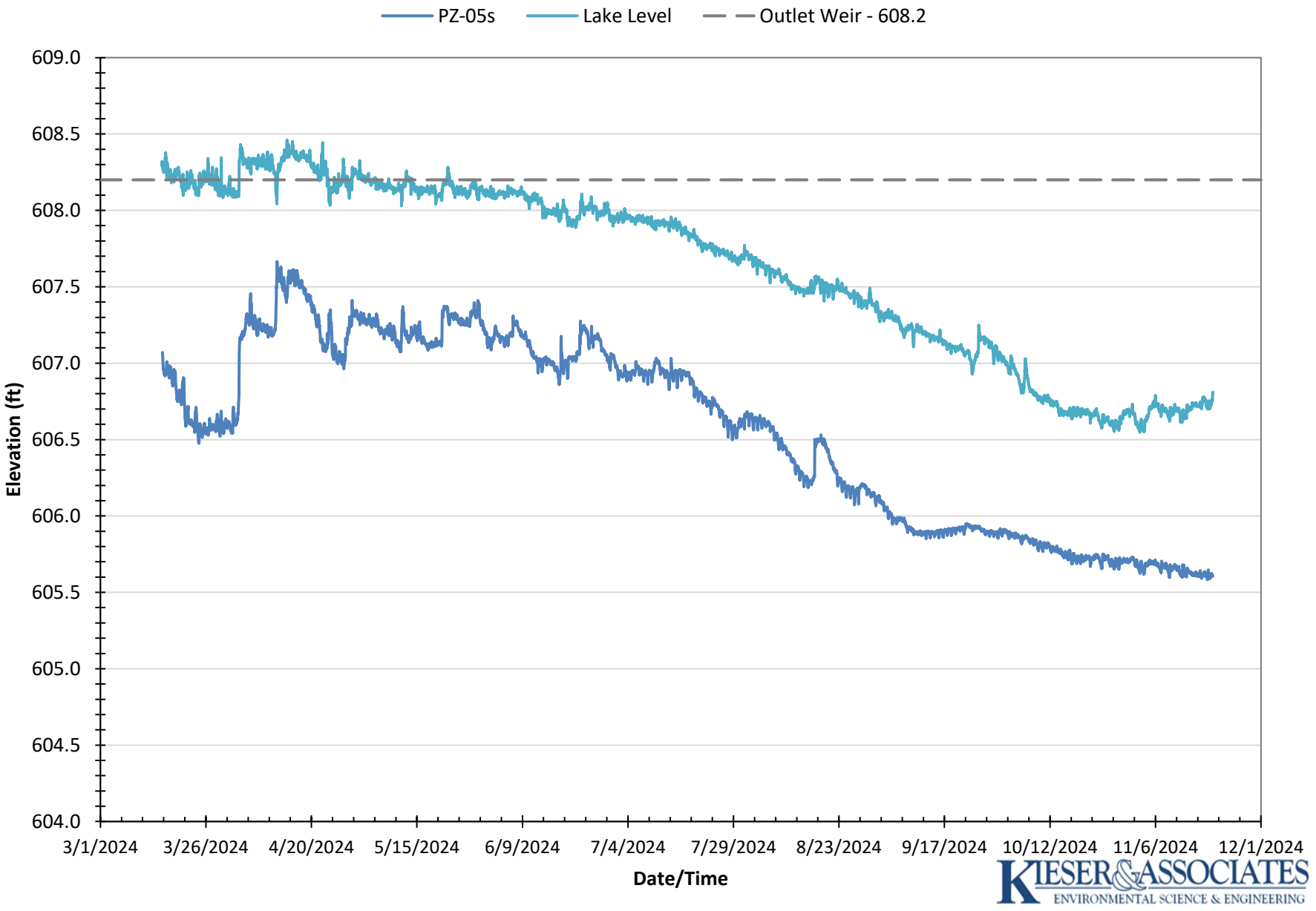

Figure 10. 2024 Cedar Lake Groundwater / Surface Water Elevation (Site 6)

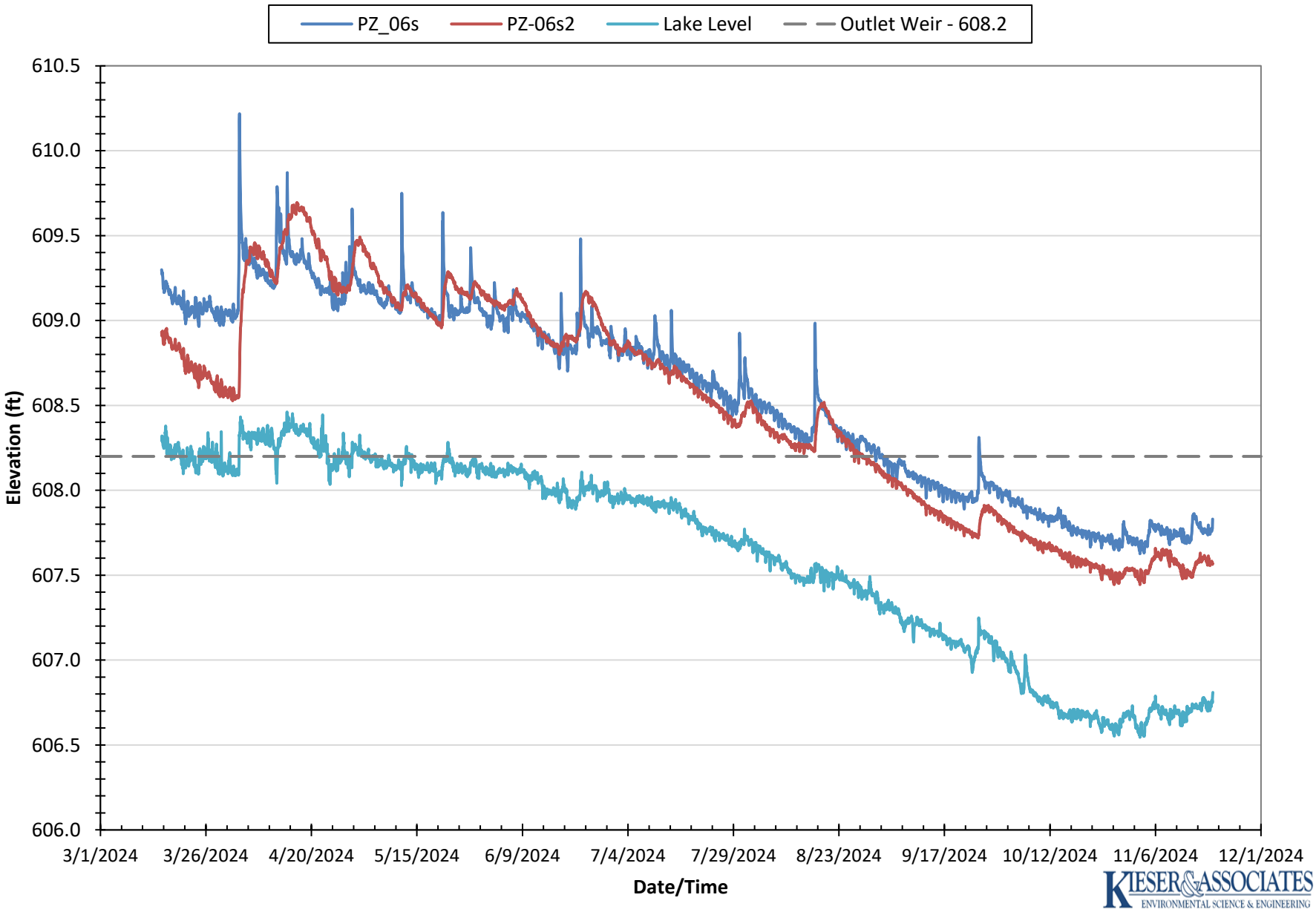

Figure 11. 2024 Cedar Lake Groundwater / Surface Water Elevations (Site 7)

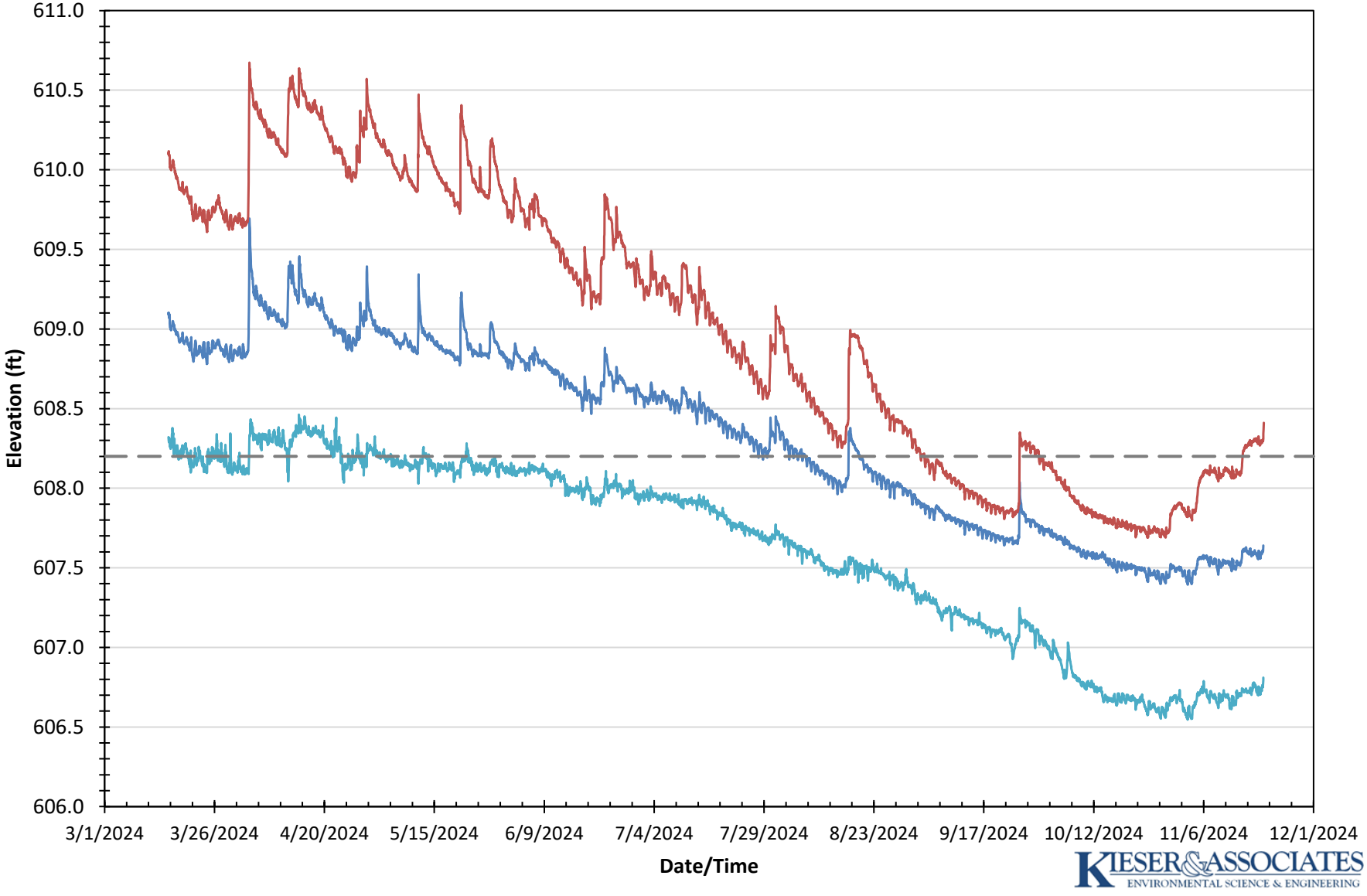

Figure 12. 2024 Cedar Lake Groundwater / Surface Water Elevations (Site 8)

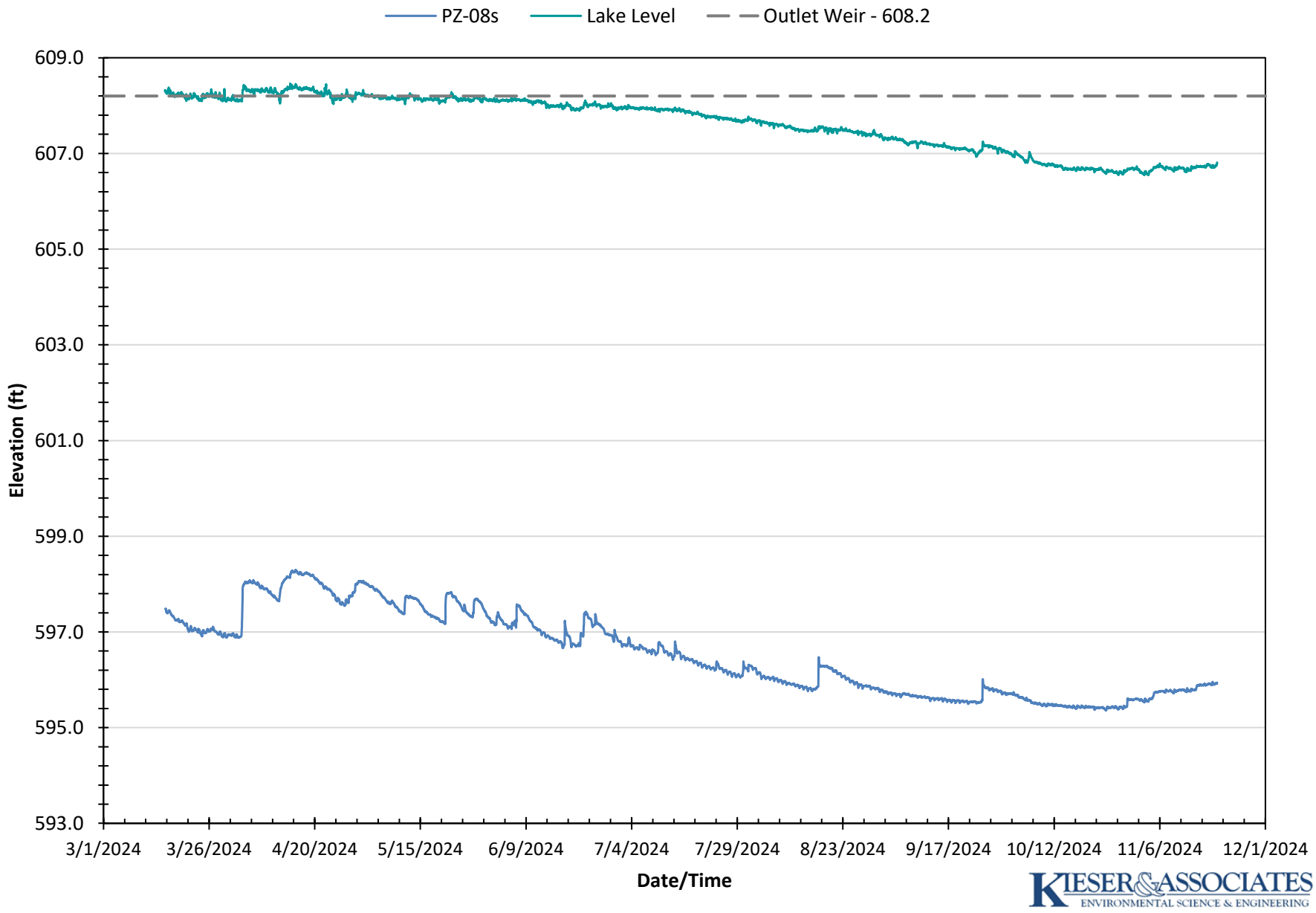

Figure 13. 2024 Cedar Lake Groundwater / Surface Water Elevations (Site 9)

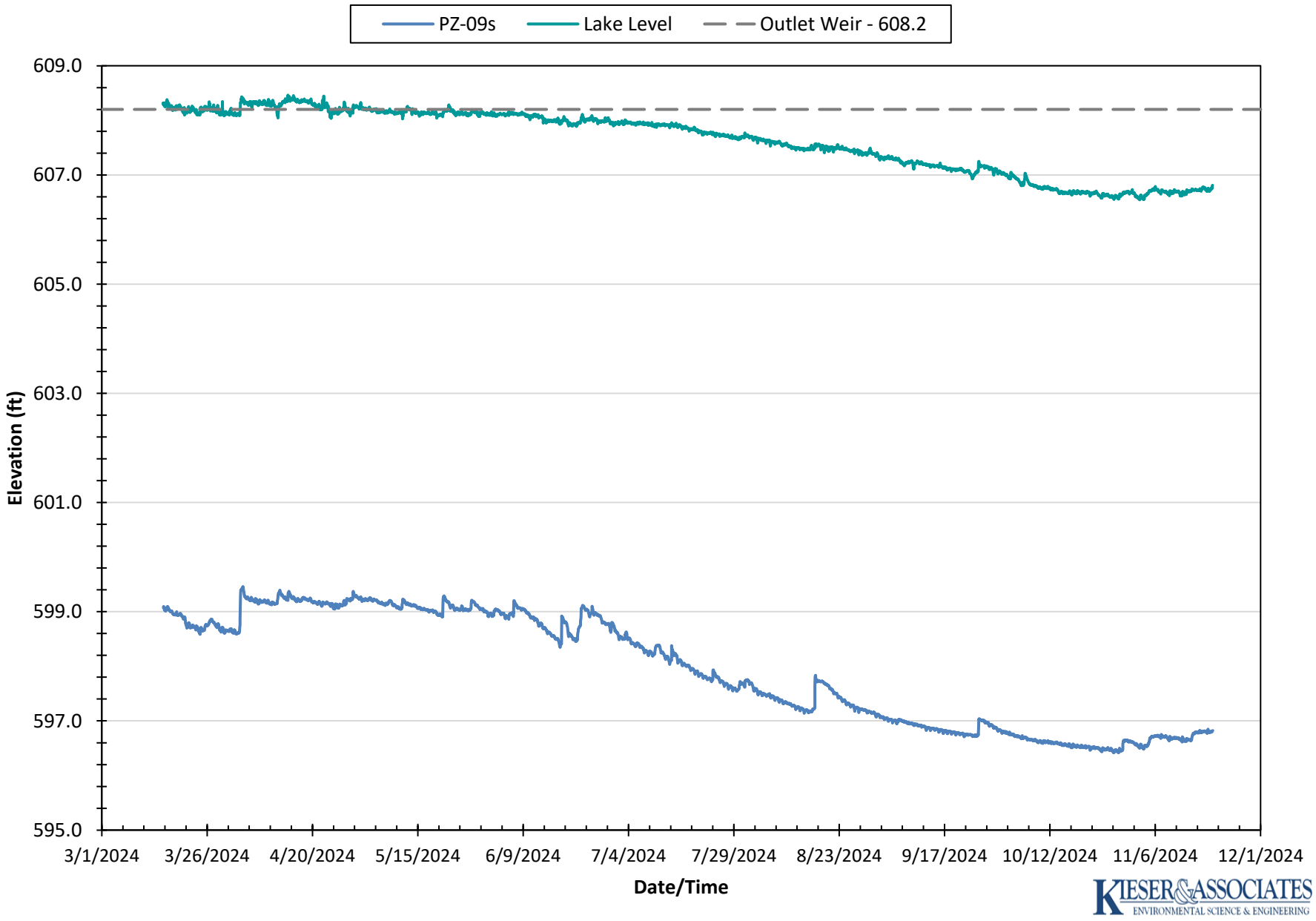

Figure 14. 2024 Cedar Lake Groundwater / Surface Water Elevations (Site 10)

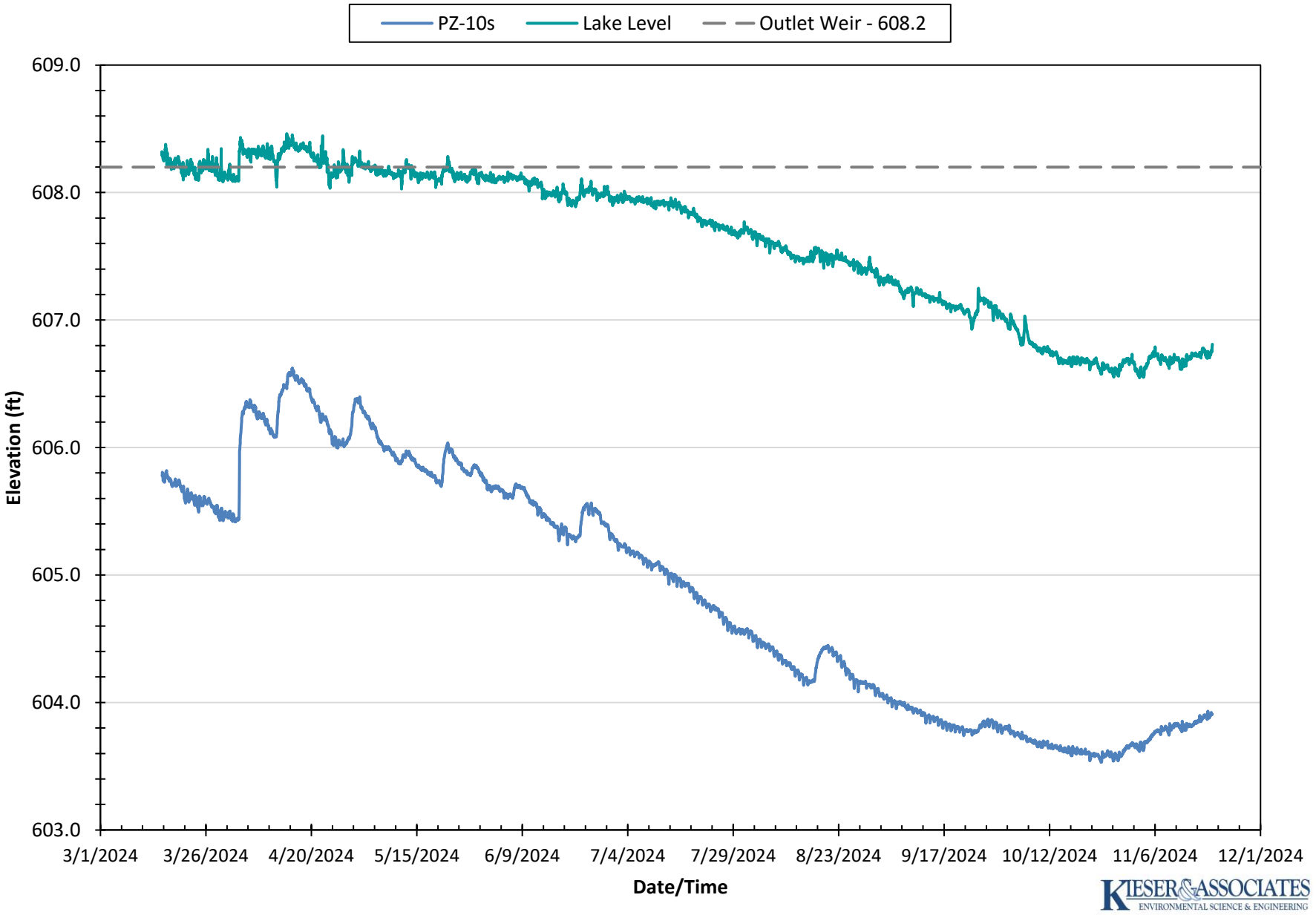

Figure 15. 2024 Cedar Lake Groundwater / SurfaceWater Elevations (Site 11)

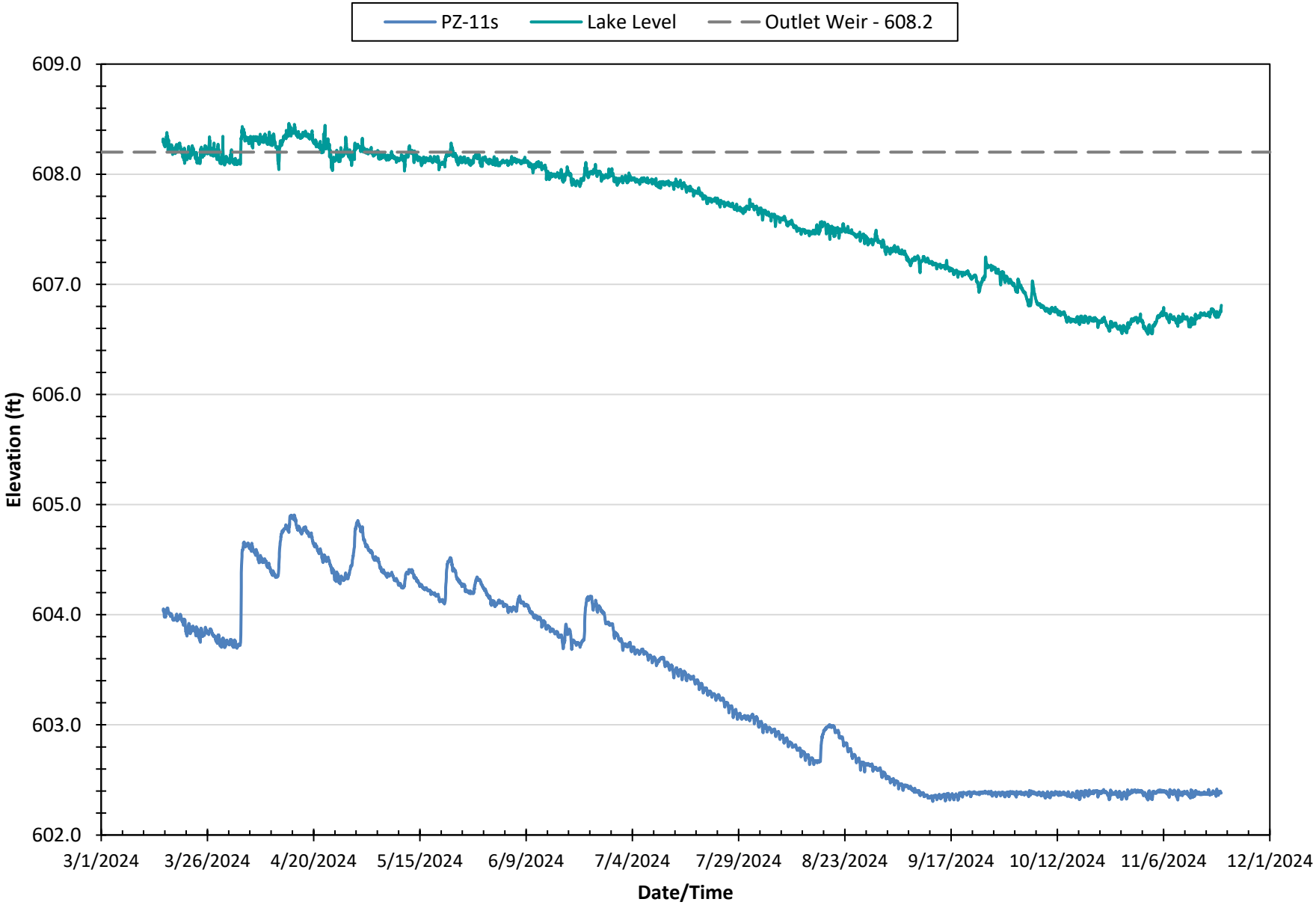

Figure 16. 2024 Cedar Lake Groundwater / Surface Water Elevations (Site 12)

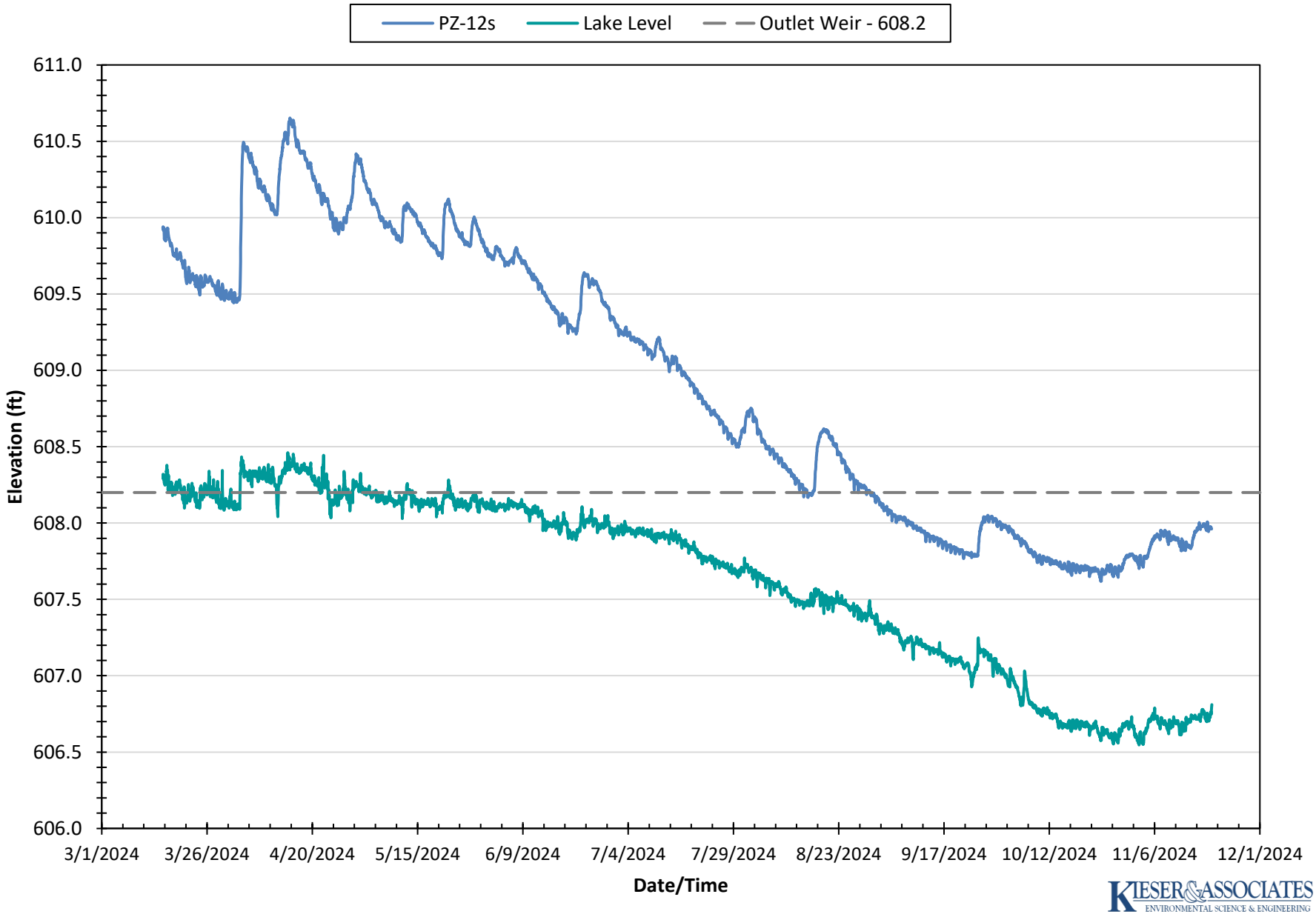

Figure 17. 2024 Cedar Lake Groundwater / Surface Water Elevations (TL Lake 2)

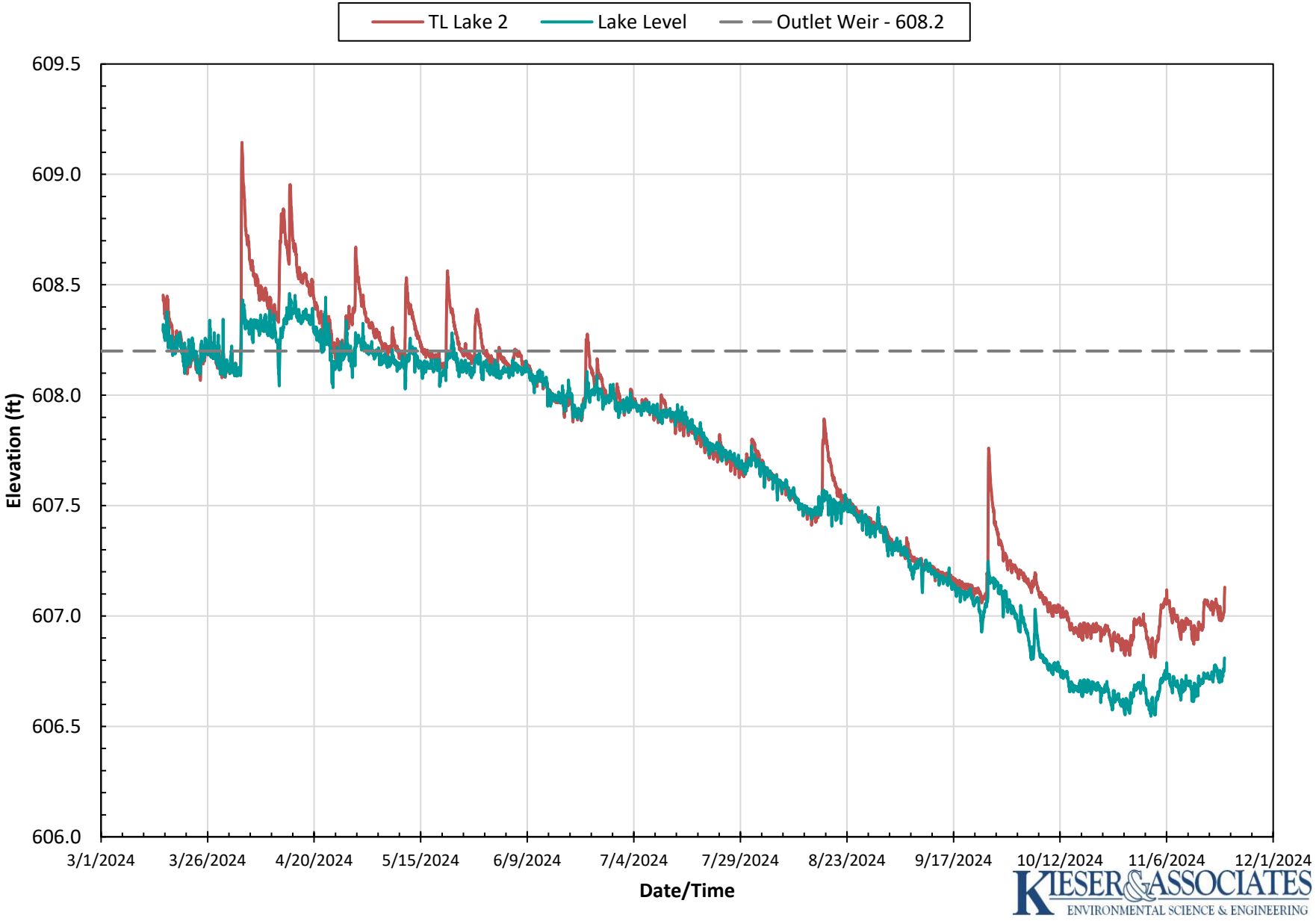

Figure 18. 2024 Cedar Lake Groundwater / Surface Water Elevations (TL Road)

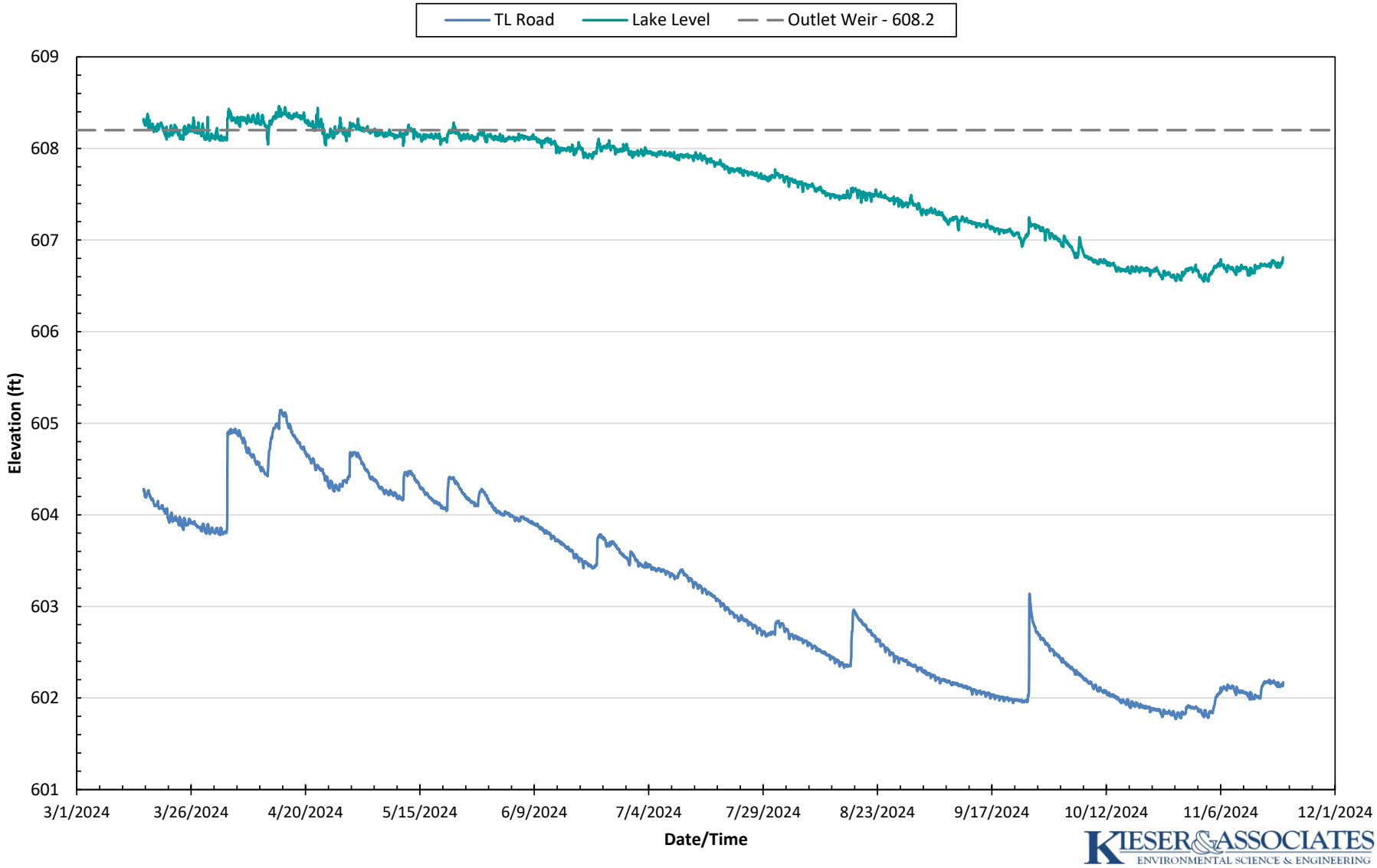

Figure 19. 2024 Cedar Lake Groundwater / Surface Water Elevations (King's Corner Area Loggers)

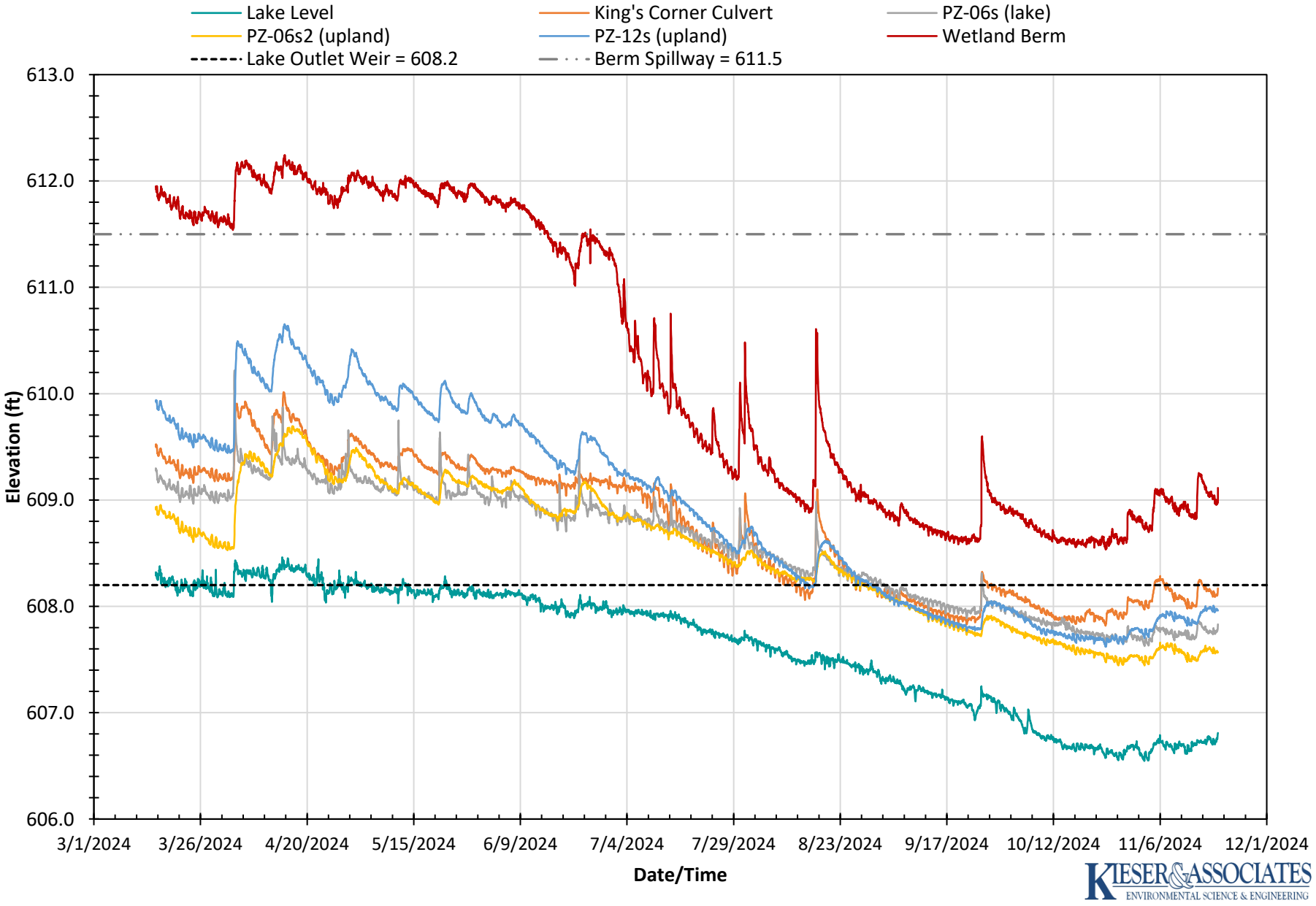

Figure 20. 2024 Jones Ditch Groundwater / Surface Water Elevations

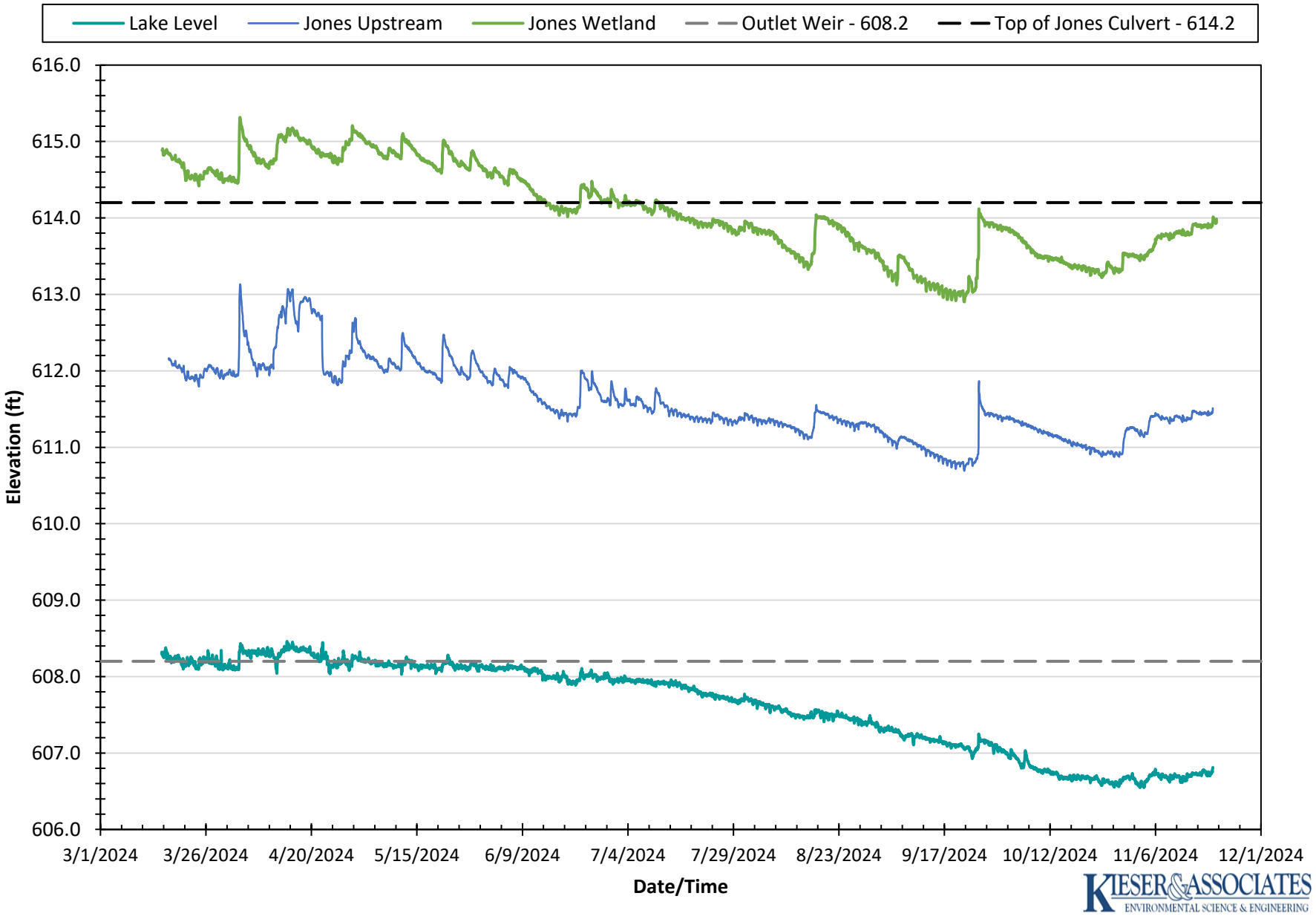

Figure 21. 2024 Estimated Jones Ditch Flows

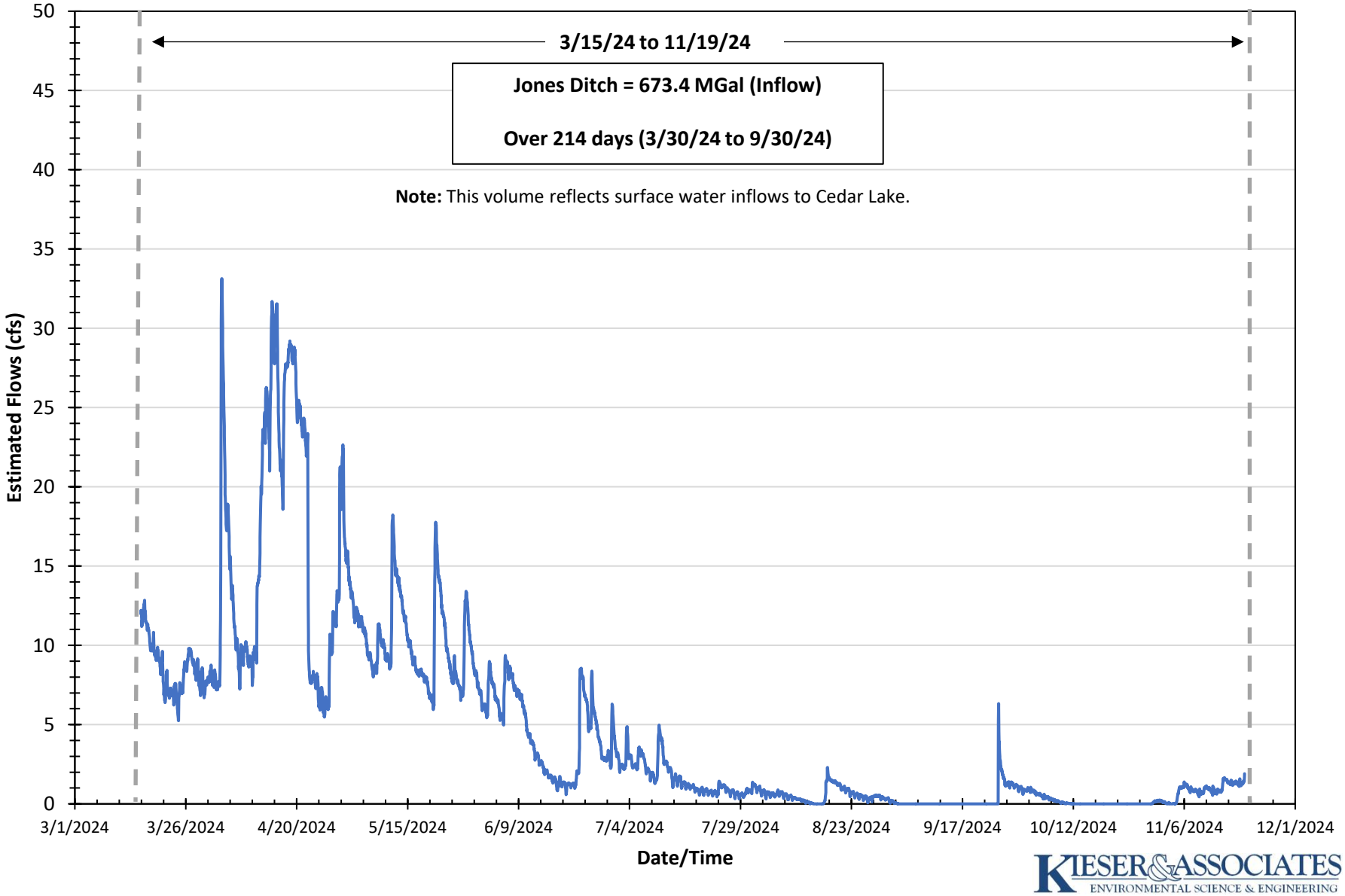

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Figure 22. 2024 Estimated Sherman Creek Flows

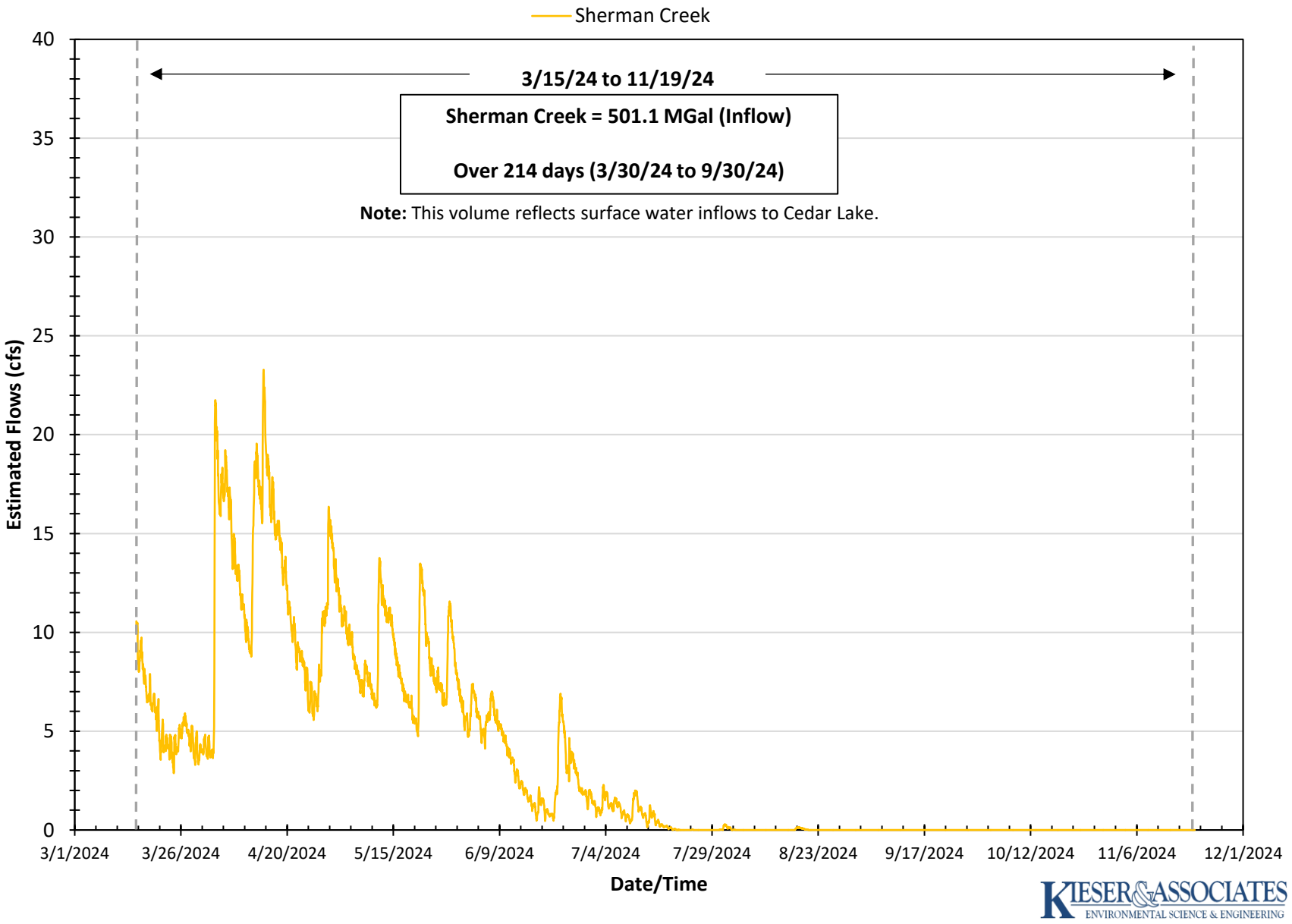

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Figure 23. 2024 Estimated Cedar Lake Outflows

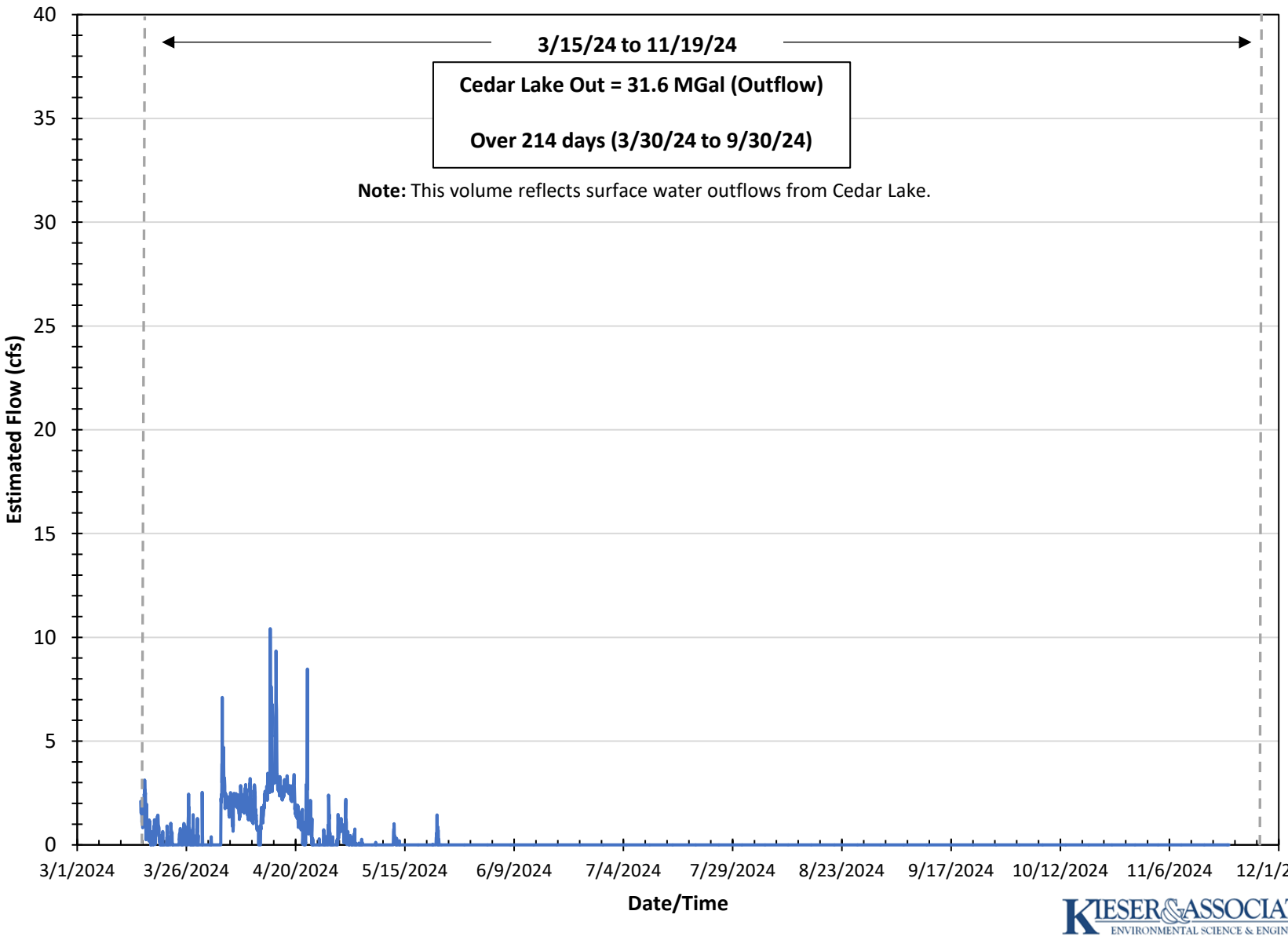

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Figure 24. 2024 Estimated King's Corner Outflow

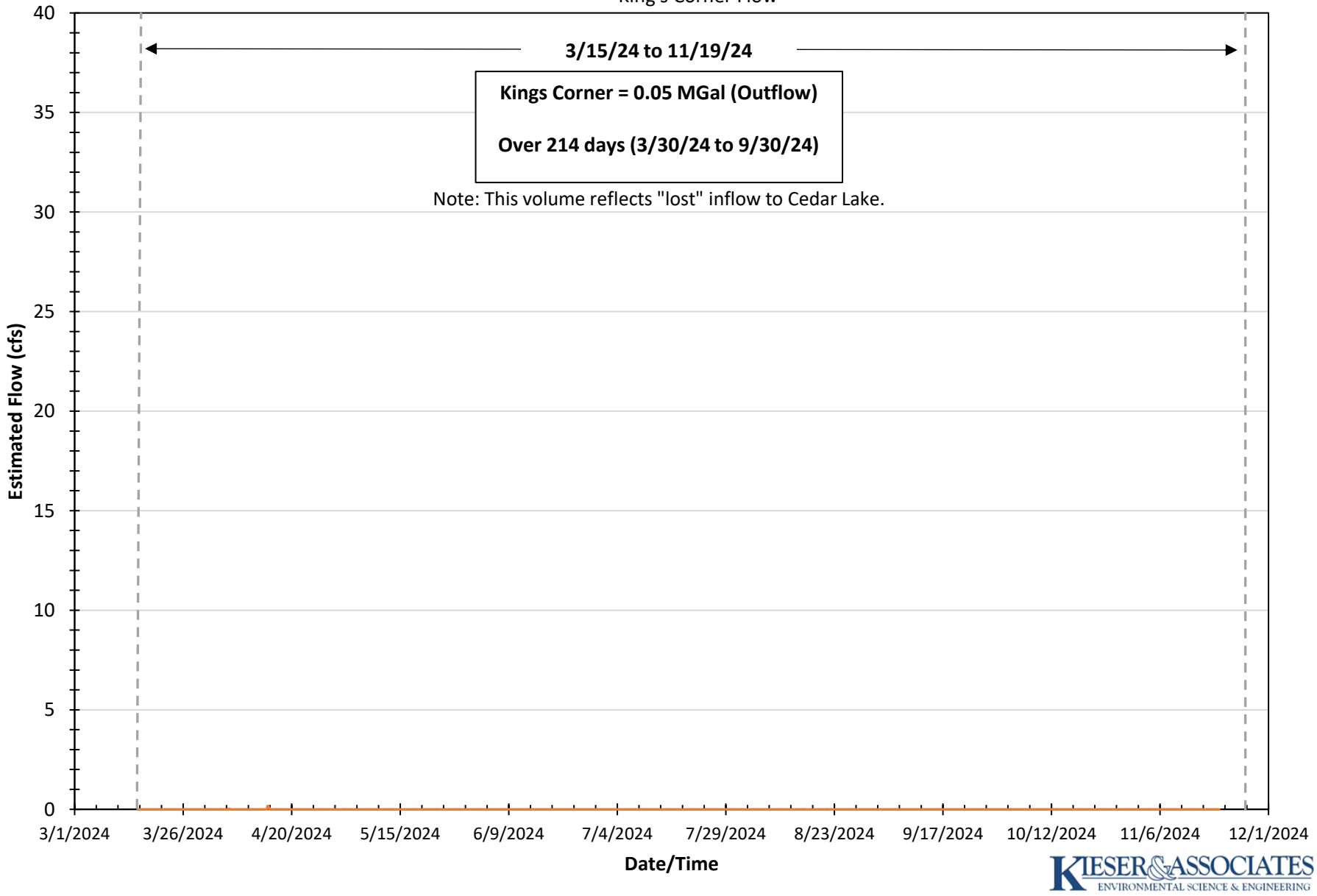


Figure 25. 2024 Estimated Wetland Berm Spillway Flows

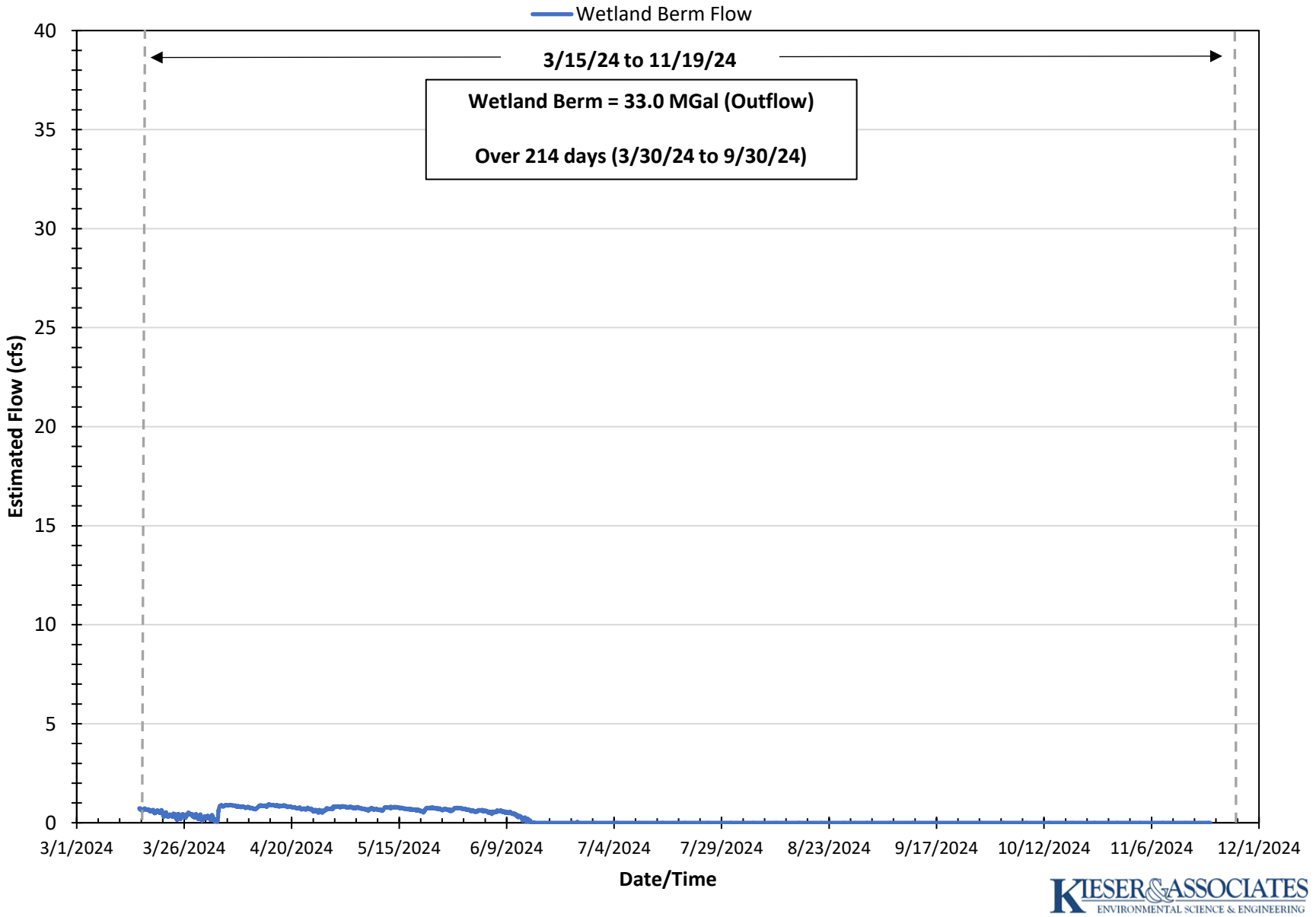


Figure 26. 2024 Estimated Cedar Lake Inflows/Outflows

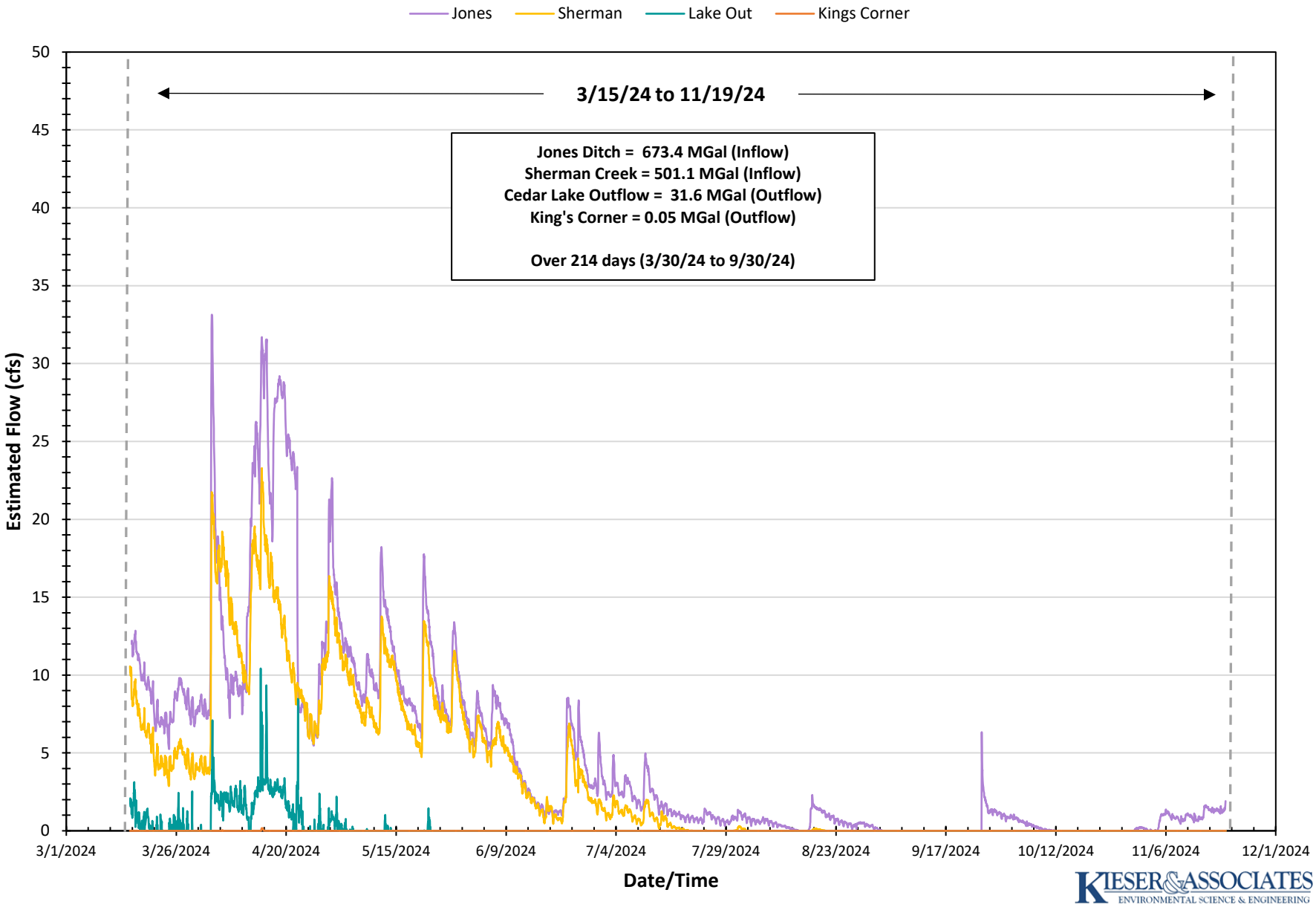


Figure 27. 2024 Sherman Creek Stations: Groundwater / Surface Water Elevations

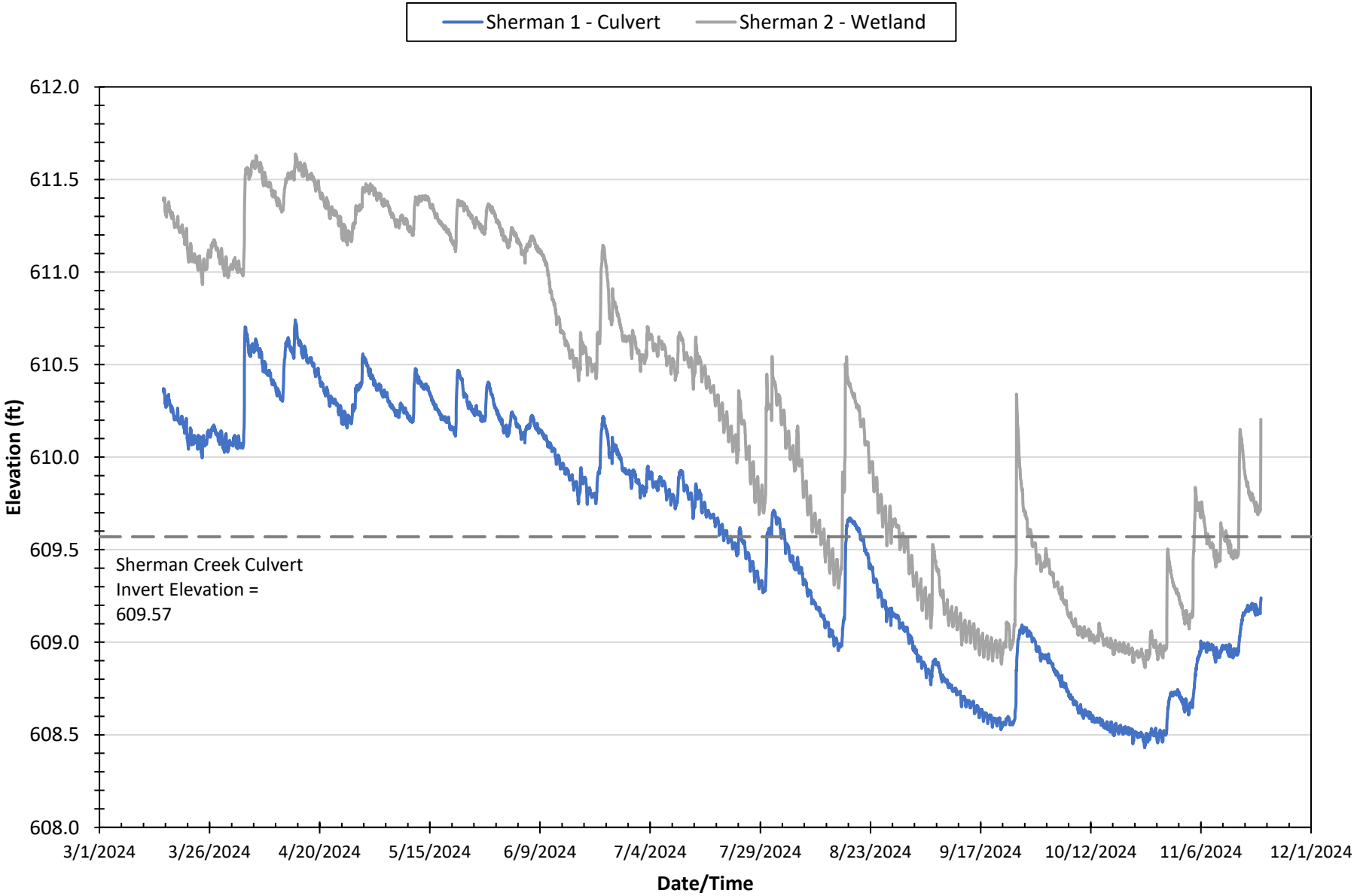


Figure 28. 2024 Cedar Lake Groundwater / Surface Water Elevations (Wetland Berm)

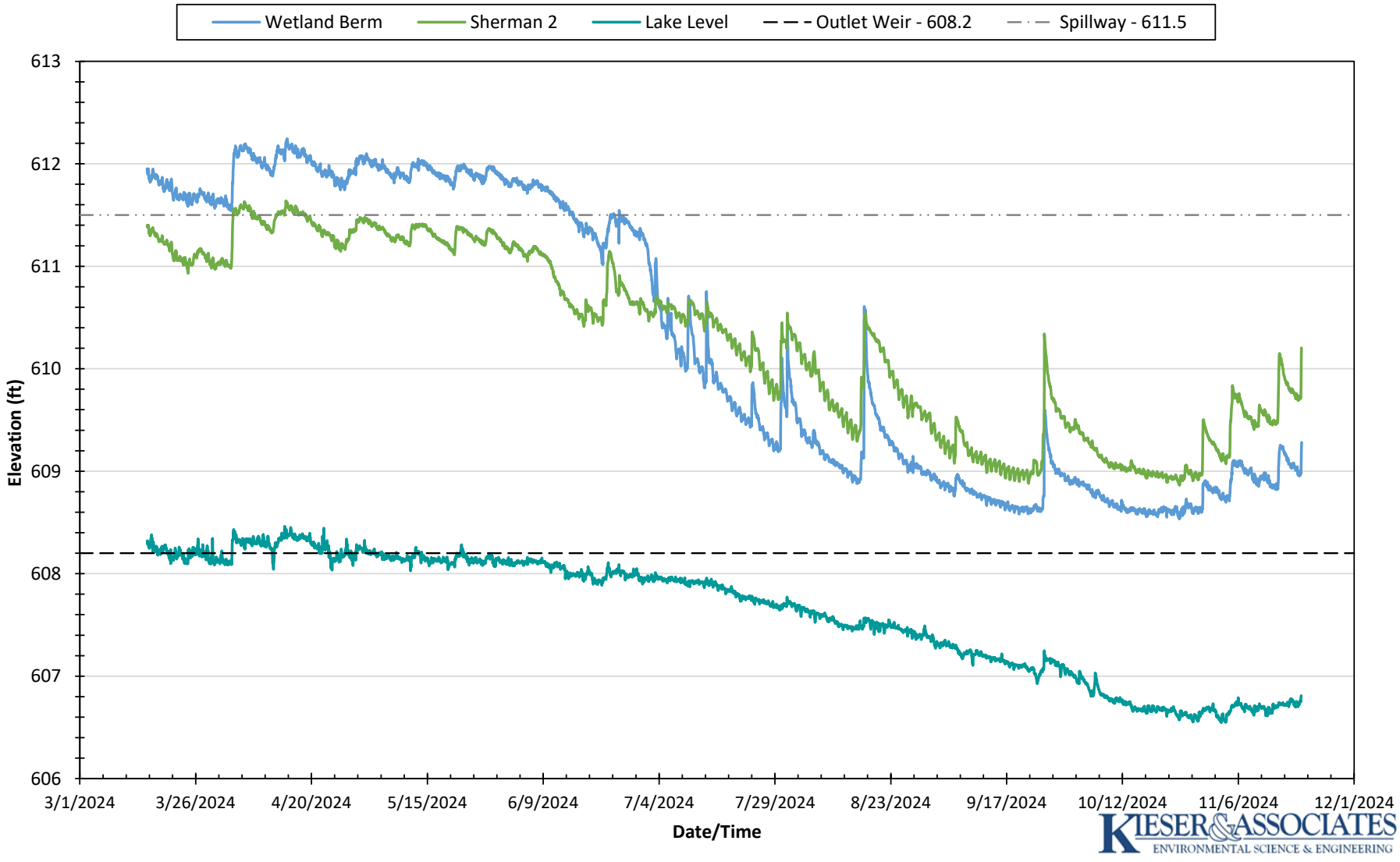


Figure 29. 2024 Cedar Lake Groundwater / Surface Water Elevations (Wetland Berm, King's Corner, and Sherman 2)

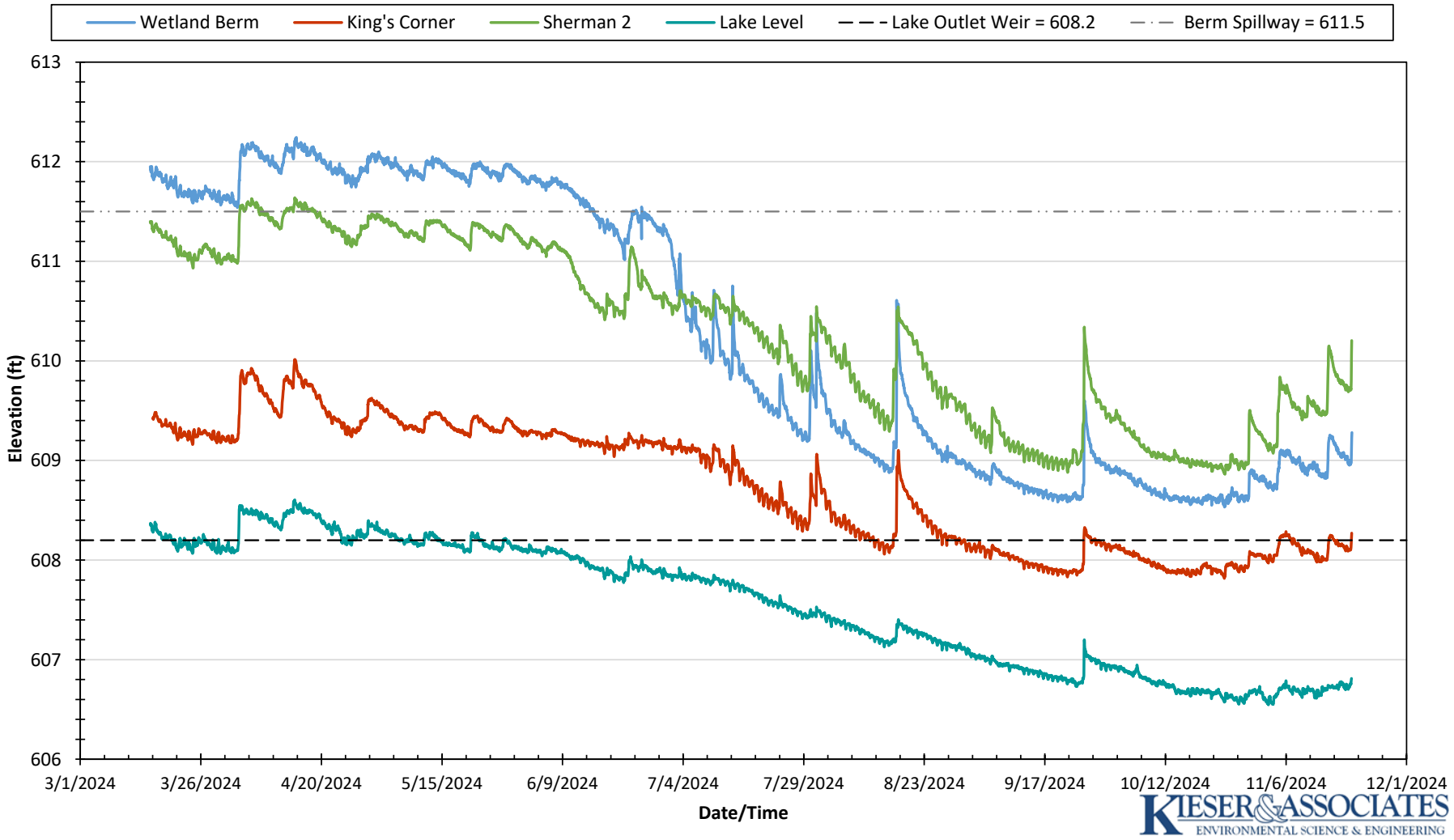


Figure 29. 2024 Cedar Lake Groundwater / Surface Water Elevations (Wetland Berm, King's Corner, and Sherman 2)

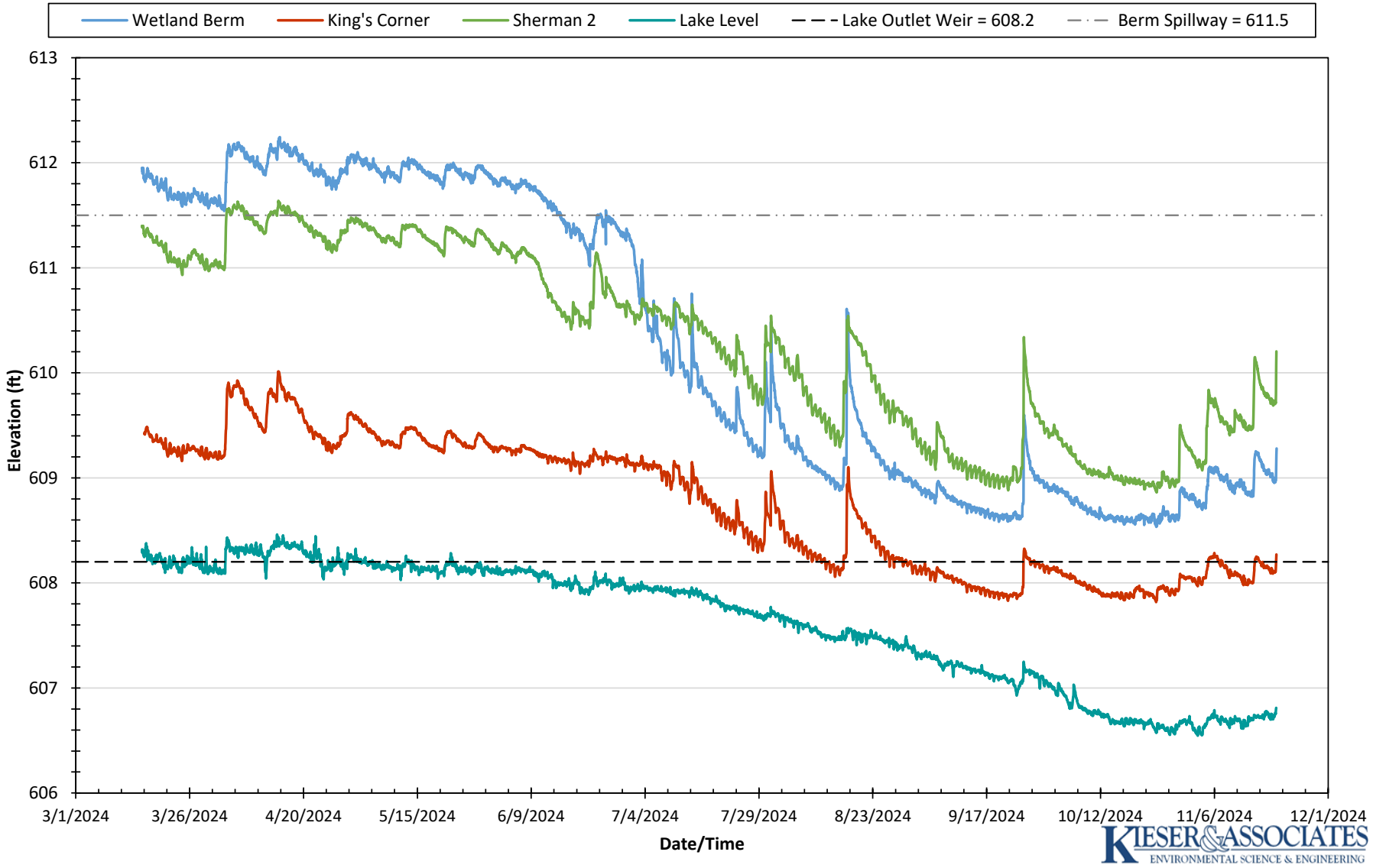
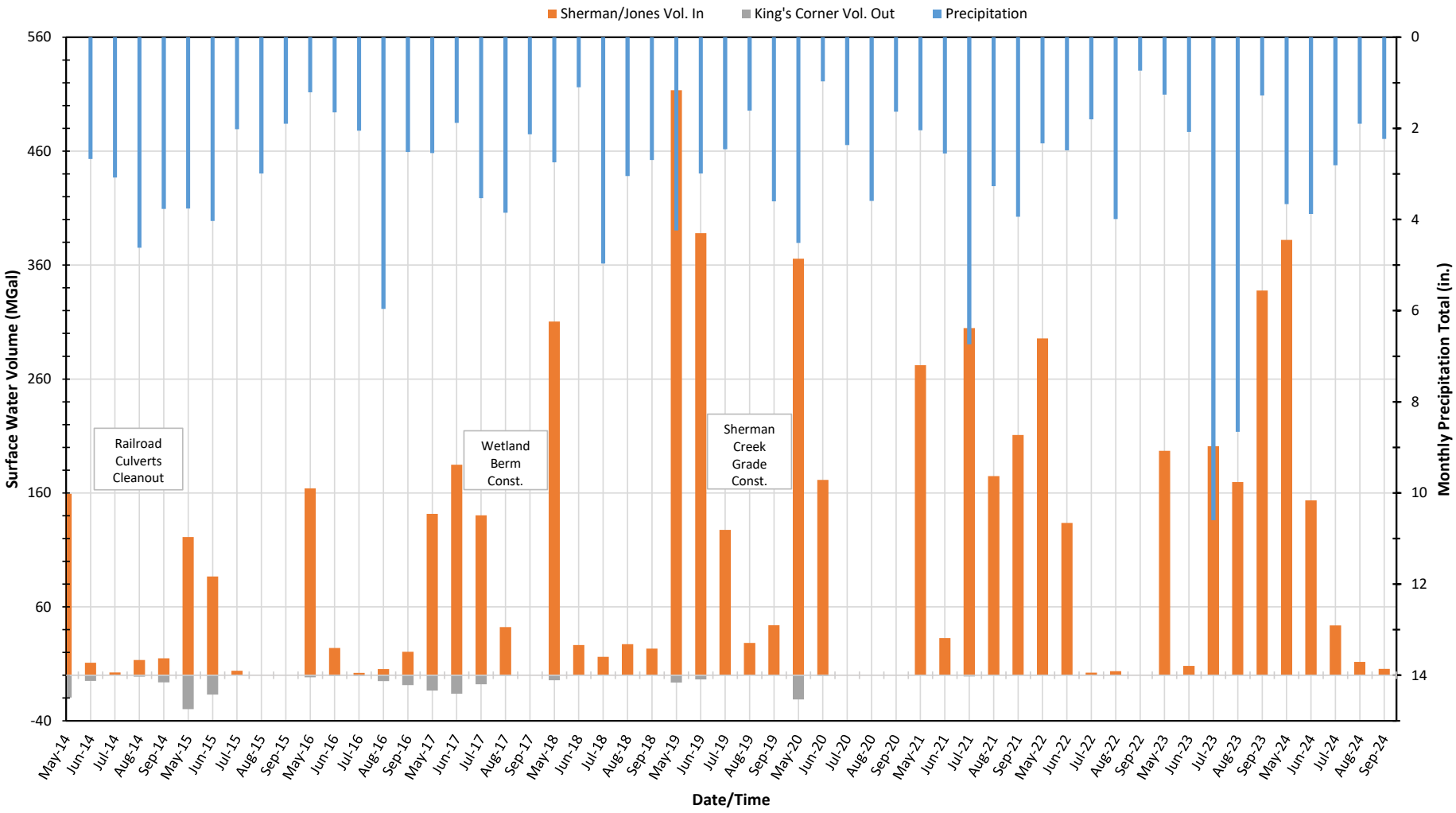


Figure 30. May- Sept, 2014-2024: Precipitation, Sherman/Jones Creek Combined Surface Water Volume into Cedar Lake, and King's Corner Water Volume Away from Cedar Lake



2014 May-Sep:	2015 May-Sep:	2016 May-Sep:	2017 May-Sep:	2018 May-Sep:	2019 May-Sep:	2020 May-Sep:	2021 May-Sep:	2022 May-Sep:	2023 May-Sep:	2024 May-Sep:
Precip: 14.14 in	***Precip:*** 14.70 in	***Precip:*** 13.39 in	***Precip:*** 13.93 in	***Precip:*** 14.55 in	***Precip:*** 14.90 in	***Precip:*** 13.08 in	***Precip:*** 18.54 in	***Precip:*** 11.33 in	***Precip:*** 23.88 in	***Precip:*** 14.48 in
Inflow Vol.: 200.9 MGal	***Inflow Vol.:*** 212.5 MGal	***Inflow Vol.:*** 216.1 MGal	***Inflow Vol.:*** 509.2 MGal	***Inflow Vol.:*** 338.3 MGal	***Inflow Vol.:*** 534.3 MGal	***Inflow Vol.:*** 383.5 MGal	***Inflow Vol.:*** 995.1 MGal	***Inflow Vol.:*** 435.2 MGal	***Inflow Vol.:*** 1,477.1 MGal	***Inflow Vol.:*** 1,121.2 MGal
King's Vol. Out: 32.2 MGal	***King's Vol. Out:*** 46.9 MGal	***King's Vol. Out:*** 17.1 MGal	***King's Vol. Out:*** 38.1 MGal	***King's Vol. Out:*** 4.3 MGal	***King's Vol. Out:*** 10.2 MGal	***King's Vol. Out:*** 21.8 MGal	***King's Vol. Out:*** 0.158 MGal	***King's Vol. Out:*** 0.156 MGal	***King's Vol. Out:*** 10.373 MGal	***King's Vol. Out:*** 0.050 MGal

Bloom Sluggett, PC

161 Ottawa Ave NW, Ste. 400
Grand Rapids, MI 49503
(616) 965-9340

March 6, 2025

Cedar Lake Improvement Board
Attn: Rex Vaughn, Chairperson
PO Box 53
Greenbush, MI 48738

Re: 19627-001
Cedar Lake Improvement Board

Enclosed is invoice 26193, which covers services through 2/28/2025. This invoice, dated 3/6/2025, is for $660.50. Prompt payment of your total balance is appreciated and is due 30 days from invoice date.

Billing Summary

Total for services rendered	$660.50
Total expenses	$0.00
Total previous balance	$1,355.00
Total payments and other transactions	$0.00
Balance Due	**$2,015.50**

If you have questions, please call us at (616) 965-9340. Thank you.

Enclosure

KIESER & ASSOCIATES
ENVIRONMENTAL SCIENCE & ENGINEERING

536 E. Michigan Avenue
Suite 300
Kalamazoo, MI 49007

Invoice

DATE	INVOICE #
4/2/2025	25-037

BILL TO:

Cedar Lake Improvement Board
Attn: Mr. Rex Vaughn
P.O. Box 53
Greenbush, MI 48738

P.O. NO.	TERMS
2024 LakeScan	Net 30

DESCRIPTION	QTY	RATE	AMOUNT
CEDAR LAKE LAKESCAN - 2024			
Task: Meetings - Invoicing 21%		524.16	524.16
Aquatic Herbicide Bid Reviews, by Dr. Doug Pullman			
This invoice is for professional services rendered through March 31, 2025, as related to Cedar Lake, 2024 LakeScan Services.			

Please remit payment to Kieser & Associates, LLC
For questions, please contact Becky Hough.

Total USD 524.16

Phone #	Fax #
(269) 344-7117	(269) 344-2493

KIESER & ASSOCIATES
ENVIRONMENTAL SCIENCE & ENGINEERING

536 E. Michigan Avenue
Suite 300
Kalamazoo, MI 49007

Invoice

DATE	INVOICE #
4/2/2025	25-038

BILL TO:

Cedar Lake Improvement Bd.
C/o Rex Vaughn
PO Box 53
Greenbush, MI 48738

P.O. NO.	TERMS
2024-2025	Net 30

DESCRIPTION	QTY	RATE	AMOUNT
Senior Scientist/ Principal - Task 1	0.25	205.00	51.25
Project Manager - Task 2	0.25	80.00	20.00
Field Manager - Task 3	8.25	80.00	660.00
Senior Scientist/ Principal - Task 3	1.25	205.00	256.25
Senior Scientist/ Principal - Task 4	0.25	205.00	51.25
Project Manager - Task 4	6.75	80.00	540.00
A&L Great Lakes Lab - Inv. # 0193626-IN - Task 4		147.00	147.00
Project Manager - Task 5a	16.5	80.00	1,320.00
Field Manager - Task 5a	16.5	80.00	1,320.00
Senior Scientist/ Principal - Task 5a	0.5	205.00	102.50
Mileage - to/from Cedar Lake, 3/27/25 - Task 5a.1	520	0.70	364.00
Field Manager - Task 5f	6	80.00	480.00
Senior Scientist/ Principal - Task 5f	0.25	205.00	51.25
Professional Engineer - Task 5f	2.25	165.00	371.25

This invoice is for professional services rendered through March 31, 2025, as related to the Cedar Lake Improvement Bd., 2024-2025 Services.

Please remit payment to Kieser & Associates, LLC
For questions, please contact Becky Hough.

Total USD 5,734.75

Phone #	Fax #
(269) 344-7117	(269) 344-2493

Kieser & Associates, LLC
Time by Job Detail
March 2025

Cedar Lake Improvement Bd. (2024)	Date	Name	Duration	Cost	Notes
Cedar Lake Improvement Bd. (2024): Task 1 - CLIB Meetings					
	03/04/2025	Kieser, Mark	0.25	51.25	CLIB meeting coordination
Total Cedar Lake Improvement Bd. (2024): Task 1:			**0.25**	**51.25**	
Cedar Lake Improvement Bd. (2024): Task 2 - CLIB Coordination					
	03/04/2025	Crum, Natalie	0.25	20.00	Updating website with Final reports
Total Cedar Lake Improvement Bd. (2024): Task 2:			**0.25**	**20.00**	
Cedar Lake Improvement Bd. (2024): Task 3 - Watershed Mgmt Plan (WMP) Update					
	03/17/2025	Kieser, Josh	4.25	340.00	Updating WMP text.
	03/25/2025	Kieser, Josh	4.00	320.00	Re-writing the WMP update based on SC updates
	03/14/2025	Kieser, Mark	1.25	256.25	SC Call
Total Cedar Lake Improvement Bd. (2024): Task 3:			**9.50**	**916.25**	
Cedar Lake Improvement Bd. (2024): Task 4 - Fisheries Habitat Analysis					
	03/19/2025	Kieser, Mark	0.25	51.25	Review of sediment data
	03/03/2025	Crum, Natalie	0.50	40.00	Coordinating for sediment analysis
	03/04/2025	Crum, Natalie	2.75	220.00	Prep, lable & ship sediment samples, & lab communications
	03/05/2025	Crum, Natalie	2.75	220.00	Reviewing current data and outlining potential report
	03/10/2025	Crum, Natalie	0.75	60.00	Outlining potential report format
	03/31/2025	A&L Great Lakes		147.00	Invoice# 0193626-IN, Soil Samples
Total Cedar Lake Improvement Bd. (2024): Task 4:			**7.00**	**738.25**	
Cedar Lake Improvement Bd. (2024): Task 5a - Hydrology-Logger Maint+ 2 Visit					
	03/06/2025	Crum, Natalie	2.75	220.00	Troubleshooting logger equipment issues
	03/26/2025	Crum, Natalie	0.75	60.00	Prepping for logger re-install
	03/27/2025	Crum, Natalie	12.50	1000.00	Re-installing loggers and travel

Kieser & Associates, LLC
Time by Job Detail
March 2025

Cedar Lake Improvement Bd. (2024)	Date	Name	Duration	Cost	Notes
	03/28/2025	Crum, Natalie	0.50	40.00	Unloading and organizing from logger re-installation
	03/05/2025	Kieser, Josh	1.00	80.00	Preparing loggers for 2025 deployment
	03/25/2025	Kieser, Josh	3.00	240.00	Final prep. including logger programming for pending install.
	03/27/2025	Kieser, Josh	12.50	1000.00	Logger Installations with N. Howard, & travel.
	03/25/2025	Kieser, Mark	0.50	102.50	Logger reinstall coordination
Total Cedar Lake Improvement Bd. (2024): Task 5a:			**33.50**	**2,742.50**	
Cedar Lake Improvement Bd. (2024): Task 5a.1 - Hydrology-Logger Maint+ 2 Visit- Direct Costs					
	03/27/2025	Mileage		364.00	Mileage to/from Cedar Lake, approx. 520 miles
Total Cedar Lake Improvement Bd. (2024): Task 5a.1:				**364.00**	
Cedar Lake Improvement Bd. (2024): Task 5f-Hydrology- Annual Reporting					
	03/10/2025	Kieser, Josh	1.50	120.00	Adjusting Figures for review.
	03/17/2025	Kieser, Josh	4.50	360.00	Logger Assessment
	03/06/2025	Kieser, Mark	0.25	51.25	Hydrology data recovery
	03/31/2025	Jacobson, John	2.25	371.25	Review of Hydraulic Report
Total Cedar Lake Improvement Bd. (2024): Task 5f:			**8.50**	**902.50**	
TOTAL: CEDAR LAKE IMPROVEMENT BD. (2024):			**59.00**	**5,734.75**	

a&lgreatlakes LABORATORIES
Scientists who don't mind getting dirty.™

3505 Conestoga Drive • Fort Wayne, IN 46808 • Phone (260) 483-4759 • Fax (260) 483-5274
Phone (260) 483-4759 • Fax (260) 483-5274
www.algreatlakes.com • lab@algreatlakes.com

Invoice

To:	Kieser & Associates LLC STE 300 536 E MICHIGAN AVE KALAMAZOO, MI 49007-5821

For	Kieser & Associates LLC Mark Kieser STE 300 536 E MICHIGAN AVE KALAMAZOO, MI 49007-5821

Account Number:	0047525
Customer P.O.	
Invoice Number:	0193626-IN
Terms	Net 30 Days
Invoice Date:	3/31/2025
Invoice Due Date:	4/30/2025

Attn: Mark Kieser

Date	Report No	S/O No	Identification	Ordered	Description	Unit Cost		Extended Cost	
						List	Your Cost	List	Your Cost
3/19/2025	F25072-0347	0720347	CEDAR LAKE	7.00	Soil Texture	21.00	21.00	147.00	147.00

	CURRENT PERIOD CHARGES	147.00

INSURED COPY
ACCOUNT BILL

MICHIGAN MILLERS INSURANCE

AGENCY:
21034
THE STERLING GROUP, INC
180 S RIPLEY BLVD
ALPENA, MI 49707

TELEPHONE: (989) 354-3185

PLEASE CONTACT YOUR AGENT WITH ANY QUESTIONS OR CONCERNS. THANK YOU.

BILLING NOTICE

CEDAR LAKE IMPROVEMENT BOARD
PO BOX 53
GREENBUSH MI 48738

ACCOUNT NUMBER	INVOICE DATE	PAYMENT DUE DATE	ACCOUNT BALANCE	CURRENT MINIMUM DUE
CL0044967P	03/25/25	04/17/25	477.00	477.00

CURRENT ACTIVITY

DATE PROCESSED	TRANSACTION	POLICY #	TRANSACTION EFFECTIVE DATES	AMOUNT
04/16/24	**NEW BUSINESS**	**C0130572 00**	**04/17/24 - 04/17/25**	**383.00**
04/22/24	**ACCOUNT ADJUSTMENT**			**15.00**
04/22/24	**PAYMENT ADJUSTMENT**			**-398.00**
02/20/25	**RENEWAL**	**C0130572 01**	**04/17/25 - 04/17/26**	**477.00**
	ACCOUNT BALANCE			**477.00**

SUMMARY

EFFECTIVE DATE	POLICIES BILLED		PAY PLAN	CURRENT BALANCE	MINIMUM DUE
04/17/25	**C0130572 01**	**COMMERCIAL PACKAGE POLICY**	**ANNUAL**	**477.00**	**477.00**
			ACCOUNT FEES	**0.00**	**0.00**
			TOTALS	**477.00**	**477.00**

MINIMUM PAYMENT DUE MUST BE RECEIVED IN OUR OFFICE ON OR BEFORE THE DUE DATE TO AVOID A $15 LATE FEE

TO PAY BY ELECTRONIC CHECK, CREDIT OR DEBIT CARD PLEASE GO TO WWW.MIMILLERS.COM

RETURN THIS PORTION WITH YOUR REMITTANCE

Payor: CEDAR LAKE IMPROVEMENT BOARD
PO BOX 53
GREENBUSH MI 48738

PLEASE MAKE CHECKS PAYABLE TO:
MICHIGAN MILLERS MUTUAL INS CO

MICHIGAN MILLERS DEPT 208301

P.O. BOX 55000
DETROIT MI 48255-2083

ACCOUNT NUMBER	CL0044967P
AGENCY NUMBER	21034
ACCOUNT BALANCE	477.00
PAYMENT DUE DATE	**04/17/25**
MINIMUM PAYMENT DUE	**477.00**

AMOUNT ENCLOSED $_____

INV04 1008

0120830167760044967800000000000004770000000477001

Pay in full
You always have the option of paying your ACCOUNT BALANCE in full. This will allow you to avoid installment fees. If you elect this option, please pay the ACCOUNT BALANCE from this invoice.

Payments
A payment made on an account with multiple policies will be applied to all policies billed on the account. An underpayment of the amount requested to be paid will result in all billed policies being underpaid. Overpayments will be proportionally applied to all policies with open balances on the account.

Installment Options
The CURRENT MINIMUM DUE is calculated based on the installment option(s) you selected. The CURRENT MINIMUM DUE may be altered if you change your policy, pay an amount other than the minimum due, or cause an additional fee to be assessed.

- Monthly - 20% is due the 1st month of the policy term and 10% is due in the 2nd through 9th months.
- Quarterly - 25% is due in the 1st, 4th, 7th, and 10th months of the policy term.
- Semi-Annual - 50% is due in the 1st and 7th months of the policy term.

Installments
A $7 installment fee will be added to each invoice beginning with the second invoice for the account.

Cancellation Fee
A $15 cancellation fee will be assessed each time cancellation is served for nonpayment of premium. A cancellation for nonpayment of premium will be served if minimum payment is not received by the PAYMENT DUE DATE.

Return Check Fee
A $25 fee will be assessed for any check that is returned to us by your bank.

New Business
Down payments received with an application are applied to the first installment due for the policy.

Endorsements (Policy Changes)
Additional premium endorsements are spread over unbilled installments. If no installments remain, the entire endorsement is to be paid by the PAYMENT DUE DATE.

Credit premium endorsements are spread back to the effective date of the endorsement. If an installment has already been paid, the portion of the endorsement affecting the installment previously paid will be credited on the next installment due. If no installments remain the credit will be transferred to other policies on the account. If no other policies are on the account or the account balance is less than zero, a refund will be issued to the policyholder.

Renewals
Your renewal premium will be billed with payment options. You need to make an installment payment or pay the account in full by the renewal effective date in order to continue coverage.

Cancellations
Cancellation credits will be applied to the account balance. If no other policies are on the account or the account balance is less than zero, a refund will be issued to the policyholder.

Tips
- Mail payment allowing sufficient time to reach us by the PAYMENT DUE DATE.
- The company will not hold post-dated checks. All checks will be processed the day they are received.
- To ensure proper credit to your account, please return the remittance stub on the bottom of this invoice with your payment.
- If payment is being made for multiple invoices, please return all remittance stubs and clearly indicate the amount to be applied to each stub.
- Please do not staple or paper clip your check to the remittance stub.
- Please do not include requests for changes to your policy with your payments. Notify your agent directly of any necessary changes, i.e.: address change, name changes, change of ownership, mortgage company changes, change of vehicle, change of coverage, etc.

MICHIGAN MILLERS INSURANCE

INSURED COPY
DIRECTORS & OFFICERS
PAY PLAN: ANNUAL

AGENCY:
21034
THE STERLING GROUP, INC
180 S RIPLEY BLVD
ALPENA, MI 49707

TELEPHONE: (989) 354-3185

PLEASE CONTACT YOUR AGENT WITH ANY QUESTIONS OR CONCERNS. THANK YOU.

BILLING NOTICE

CEDAR LAKE IMPROVEMENT BOARD
PO BOX 53
GREENBUSH MI 48738

ACCOUNT NUMBER	INVOICE DATE	PAYMENT DUE DATE	ACCOUNT BALANCE	MINIMUM PAYMENT DUE
S0101541	03/25/25	04/17/25	470.00	470.00

CURRENT ACTIVITY

DATE PROCESSED	TRANSACTION	POLICY #	TRANSACTION EFFECTIVE DATES	AMOUNT
03/25/24	**BALANCE ON LAST STATEMENT**			**460.00**
04/18/24	**PAYMENT ADJUSTMENT**			**-460.00**
02/20/25	**RENEWAL**	**S 0101541 02**	**04/17/25 - 04/17/26**	**470.00**
	ACCOUNT BALANCE			**470.00**

MINIMUM PAYMENT DUE MUST BE RECEIVED IN OUR OFFICE ON OR BEFORE THE DUE DATE TO AVOID A $15 LATE FEE

TO PAY BY ELECTRONIC CHECK, CREDIT OR DEBIT CARD PLEASE GO TO WWW.MIMILLERS.COM

DETACH ALONG THE PERFORATION BELOW

RETURN THIS PORTION WITH YOUR REMITTANCE

Insured: CEDAR LAKE IMPROVEMENT BOARD
PO BOX 53
GREENBUSH MI 48738

PLEASE MAKE CHECKS PAYABLE TO:
MICHIGAN MILLERS MUTUAL INS CO

MICHIGAN MILLERS DEPT 208301

P.O. BOX 55000
DETROIT MI 48255-2083

ACCOUNT NUMBER	S0101541
AGENCY NUMBER	21034
ACCOUNT BALANCE	470.00
PAYMENT DUE DATE	**04/17/25**
MINIMUM PAYMENT DUE	**470.00**

AMOUNT ENCLOSED $_____

INV02 0906

01208301833201015413200000000000047000000000470002

Pay in full
You always have the option of paying your ACCOUNT BALANCE in full. This will allow you to avoid installment fees. If you elect this option, please pay the ACCOUNT BALANCE from this invoice.

Installment Options
The MINIMUM PAYMENT DUE is calculated based on the installment option you selected. The MINIMUM PAYMENT DUE will be altered if you change your policy, pay an amount other than the minimum due, or cause an additional fee to be assessed.

- Monthly - 20% is due the 1st month of the policy term and 10% is due in the 2nd through 9th months.
- Quarterly - 25% is due in the 1st, 4th, 7th, and 10th months of the policy term.
- Semi-Annual - 50% is due in the 1st and 7th months of the policy term.

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A $7 installment fee will be added to each installment billed beginning with the second installment.

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A $15 cancellation fee will be assessed each time cancellation is served for nonpayment of premium.
A cancellation for nonpayment of premium will be served if minimum payment is not received by the PAYMENT DUE DATE.

Return Check Fee
A $25 fee will be assessed for any check that is returned to us by your bank.

New Business
Down payments received with an application are applied to the first installment due.

Endorsements (Policy Changes)
Additional premium endorsements are spread over the remaining unbilled installments. If no installments remain, the entire endorsement is to be paid by the PAYMENT DUE DATE.

Credit premium endorsements are spread back to the effective date of the endorsement. If an installment has already been paid, the portion of the endorsement affecting the installment previously paid will be credited on the next installment due. If no installments remain or the account balance is less than zero, a refund will be issued to the policyholder.

Renewals
Your renewal premium will be billed in advance of the effective date with payment options. You need to make an installment payment or pay the account in full by the renewal effective date in order to continue coverage.

Tips
- Mail payment allowing sufficient time to reach us by the PAYMENT DUE DATE.
- Do not send cash.
- The company will not hold post-dated checks. All checks will be processed the day they are received.
- To ensure proper credit to your account, please return the remittance stub on the bottom of this invoice with your payment.
- If payment is being made for multiple invoices, please return all remittance stubs and clearly indicate the amount to be applied to each stub.
- When making payment by mail, please use the return window envelope provided.
- If making payment at your agent's office, please bring all payment remittance stubs with you.
- Please do not staple or paper clip your check to the remittance stub.
- Please do not include requests for changes to your policy with your payments. Notify your agent directly of any necessary changes, i.e.; address change, name changes, change of ownership, mortgage company changes, change of vehicle, change of coverage, etc.

SOLITUDE
LAKE MANAGEMENT

INVOICE

Please Remit Payment to:
Solitude Lake Management, LLC
1320 Brookwood Drive
Suite H
Little Rock, AR 72202
Phone #: (888) 480-5253
Fax #: (888) 358-0088

Invoice Number: PSI153454
Invoice Date: 3/28/2025

Bill To:
Cedar Lake Improvement Board
PO Box 53
Greenbush, MI 48738

Ship To:
Cedar Lake Improvement Board
PO Box 53
Greenbush, MI 48738

Ship Via
Ship Date 3/28/2025
Due Date 4/27/2025
Terms Net 30

Customer ID 18536
P.O. Number
P.O. Date 3/28/2025
Our Order No.

Item/Description	Unit	Order Qty	Quantity	Unit Price	Total Price
Consulting (Permitting,Survey) One-Time Service Cedar Lake Improvement Board 00-01 PERMITTING		1	1	1,782.00	1,782.00

Amount Subject to Sales Tax 0.00
Amount Exempt from Sales Tax 1,782.00

Subtotal:	**1,782.00**
Invoice Discount:	0.00
Total Sales Tax	0.00
Payment Amount:	0.00
Total:	**1,782.00**