City of Lakewood

Waughop Lake Data Summary Report

2020 – 2024

February 2025

FINAL

TETRA TECH

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2020 – 2024

February 2025

PRESENTED TO

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TETRA TECH

EXECUTIVE SUMMARY

Location & Background:

Waughop Lake is a small lake in Lakewood, Washington, within the popular Fort Steilacoom Park. It is used for recreational activities such as fishing, bird watching, walking and jogging. Waughop Lake has a long history of harmful algae blooms (HABs) due to nutrient-rich sediments from past agricultural waste discharges (1900-1965), leading to poor water quality and frequent health advisories.

Lake Management Plan:

In 2014, the City of Lakewood, with funding from the Washington State Department of Ecology investigated the poor water quality condition of Waughop Lake and subsequently developed a lake management plan to address the lake's water quality issues. The plan proposed two main management action for consideration that would be implemented in two phases:

1. **Aluminum Sulfate (Alum) Treatment** – To remove phosphorus from the water and inactivate phosphorus in the sediments which fuel excess algae growth and HABs.
2. **Dredging** – Dredge the lake to remove phosphorus-rich sediments. This option was considered but ultimately not pursued due to cost and feasibility concerns.

Implementation of Alum Treatments:

The City established a policy to move forward with the implementation of alum treatments aimed at reducing phosphorus and HABs, thereby improving the lake's water quality. No additional actions were included in this policy besides the alum treatments.

- In 2019, Tetra Tech designed an alum treatment strategy to remove phosphorus from the lake's water column and inactivate phosphorus in the lake sediments, thereby reducing the potential for HABs and limiting the occurrence and severity of blooms.
- Three alum treatments were conducted:
    - **2020 (March & July):** Two high-dose applications (40 mg Al/L each, total 80 mg Al/L)
    - **2023 (June):** A third treatment at a lower dose (20 mg Al/L) based on water quality monitoring data.

Results & Findings:

Execution of the plan has led to effective management of HABs in Waughop Lake as the City's policy intended. The following area a summary of the results of the alum treatments that were implemented.

- **Effective Phosphorus Reduction:** The alum treatments significantly lowered phosphorus levels in the lake and subsequently reduced toxic algae blooms.
- **Harmful Algae Bloom Control:** No toxic algae blooms occurred in 2020, 2021, 2023 or 2024, a first in over a decade.
- **Cyanotoxin Reduction:** Only one low-level microcystin detection occurred in Waughop Lake, in 2022, and the concentration of microcystin was well below state recreational guidelines.
- **Challenges:** Despite improvements, external phosphorus loading (from groundwater or stormwater) and drastic lake level fluctuations during the summers contribute to additional nutrient issues.

- **Sustainability:** Water quality benefits from the 2020 treatments lasted into early 2022, but the 2023 treatment had shorter-lived effects.

Future Recommendations:

- Continue **long-term water quality monitoring** to adapt management strategies in the future.
- Further **phosphorus stripping or sediment inactivation treatments** may be necessary.
- Investigate **external phosphorus sources** (groundwater/stormwater) to guide future lake management.

Overall, the alum treatments have, in accordance with City policy, successfully improved control of toxic algae blooms in Waughop Lake. Ongoing management and monitoring, however, will be needed to maintain progress.

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
Alum	Aluminum sulfate
APAM	Aquatic plant and algae management
Chl	Chlorophyll *a*
City	City of Lakewood
DA	Dissolved aluminum
DO	Dissolved oxygen
Ecology	Washington Department of Ecology
ft	feet
HABs	Harmful algal blooms
kg	kilograms
m	meter
mg/L	Milligrams per liter
mg $CaCO_3$/L	Milligrams of calcium carbonate per liter
PCD	Pierce Conservation District
SRP	Soluble reactive phosphorus
TA	Total aluminum
TN	Total nitrogen
TP	Total phosphorus
µg/L	Micrograms per liter

1.0 INTRODUCTION

This report summarizes the water quality and sediment data collected from Waughop Lake from March 2020, prior to the application of aluminum sulfate (alum), through December 2024. Data summarized in this report was collected before, during, and after the 2020 and 2023 alum applications. The water quality and sediment data summarized in this report was collected by personnel from Tetra Tech, Inc., hired by the City of Lakewood (City), as well as staff from SOLitude Lake Management (alum applicator, formerly known as HAB Aquatics) and volunteer monitors organized by the Pierce Conservation District (PCD).

2.0 BACKGROUND

Waughop Lake is a small lake (33 acres) located in the City of Lakewood, Washington, approximately 42 miles south of Seattle, WA (Figure 1). Waughop Lake is the centerpiece of the popular Fort Steilacoom Park and is used for fishing, model boat racing, kayaking, canoeing, and bird watching. The shoreline area is heavily used by hikers, joggers, and dog walkers. There is a mile long asphalt perimeter walking path around the lake.

Waughop Lake has a mean depth of 7 feet (ft) (2.1 meters [m]) and an approximate volume of 271,365 m^3. Waughop Lake sits in a basin surrounded by slopes to the north, south, and west, with open flat meadows to the east. The lake's catchment area is approximately 497 acres with contributing surface drainage area of about 217 acres. The Pierce College campus covers about 66 acres. Residential properties covering approximately 130 acres lies southwest of the lake and are served by septic systems.

No creeks or other natural surface water channels flow into the lake. Stormwater runoff from a portion of Pierce College campus is conveyed through a pipeline to the lake. There are no natural or man-made outlets to the lake and water leaves the lake via seepage and evaporation. Waughop Lake is a glacial kettle lake that appears to be in direct contact with the shallow groundwater-flow system.

Waughop Lake has a long history of toxic cyanobacteria blooms, also referred to as harmful algae blooms (HABs). Health advisories issued by the Tacoma-Pierce County Health Department have been common for Waughop Lake during the past 15 years. In June 2010, the health department issued an advisory not to eat fish from the lake and for a short period of time in 2011, cyanobacteria toxin concentrations were so high that the lake was closed to all uses. Since 2007, toxicity data have been collected and maintained by Ecology on its Washington State Toxic Algae website. Of the 195 water samples collected from Waughop Lake from July 2007 to September 2018, 141 exceeded the state recreation guideline value for microcystin (6 µg/L, recently updated to 8 µg/L).

In 2014, the City received a grant from Ecology to develop a lake management plan for Waughop Lake. The City hired the consulting firm Brown and Caldwell, as well as the University of Washington Tacoma to conduct a monitoring program and develop a lake management plan. The goal of the management plan was to develop strategies to improve and protect the beneficial lake uses impaired by excess nutrients and cyanobacteria (Brown and Caldwell, 2017). Nuisance algae growth and cyanobacteria blooms in lakes are caused by excessive nutrient loading, particularly phosphorus. Phosphorus is typically the limiting nutrient for algae growth in western Washington lakes.

Waughop Lake's water quality problems likely began well over 100 years ago when the surrounding area was first used to raise livestock and grow crops for the nearby state mental hospital (Brown and Caldwell, 2017). Manure and other agricultural wastes were discharged into the lake from about 1900-1965 and likely contributed to the buildup of nutrient rich sediments (City of Lakewood, 2012; LaFontaine, 2012).

A monitoring program was conducted by University of Washington Tacoma from October 2014 – October 2015 and confirmed that phosphorus was the limiting nutrient for cyanobacteria blooms in Waughop Lake and that internal cycling of phosphorus from the enriched lake sediments to the water column was the largest source fueling cyanobacteria blooms (Brown and Caldwell, 2017). The lake management plan evaluated several potential lake management measures to reduce phosphorus and control cyanobacteria blooms. The lake management plan included a proposed phased approach for implementing the management measures outlined in the plan (Brown and Caldwell, 2017). This phased implementation approach included:

- Phase 1 which would consist of a whole-lake aluminum sulfate (alum) treatment to remove phosphorus from the water column and inactivate phosphorus in the sediments, thereby reducing the potential for cyanobacteria blooms. Phase 1 also included monitoring by the City to evaluate the effectiveness and longevity of the alum treatment and the collection of sediment data to refine construction cost estimates and support permit applications for dredging.
- Phase 2 would involve dredging of the lake to remove phosphorus-rich bottom sediment, provided that the City can secure the necessary funds and permits. Dredging was expected to be the most effective long-term measure for reducing phosphorus and subsequent cyanobacteria blooms but also by far the most expensive and challenging to implement.

The lake management plan also included a recommendation that the City evaluate whether a bottom aeration and vertical-mixing system would reduce phosphorus release from the bottom sediments and disrupt cyanobacteria growth in the water column.

The City explored the feasibility of dredging the lake and hired Tetra Tech, Inc. to review the information presented in the lake management plan and evaluate the feasibility of dredging to remove phosphorus-rich sediments from the lake. Tetra Tech, Inc. reviewed 4 dredging alternatives – 2 shallow dredging options and 2 deep dredging options. It was estimated that the dredging alternatives 50-year life cycle costs ranged from $7.9 to $34.5 million (in 2018 dollars) with a probability of success (phosphorus removal and HABs reduction) ranging from 20% to 90% over the 50-year period. The dredging alternative would also result in no direct use of the lake for a year or more and have significant impacts to recreation at Fort Steilacoom Park. Difficulties obtaining necessary permits for the dredging alternatives and adverse impacts to existing aquatic life were also anticipated.

Aeration and vertical-mixing systems to reduce phosphorus release from the bottom sediments and disrupt cyanobacteria growth were briefly evaluated. However, due to the shallowness of the lake, the decreasing water levels during the summer season, and the very loose bottom sediments, these systems would not have been appropriate. Waughop Lake is a shallow waterbody that mixes frequently, almost consistently, throughout the year, so aeration and/or a vertical-mixing system would not have significant changes on the current conditions in the lake.

The City decided to move forward with the implementation of a whole-lake alum treatment to inactivate sediment phosphorus and reduce phosphorus concentrations in the water column, and in 2018 hired Tetra Tech, Inc. to assist with the planning, design, and implementation of the treatment. An alum treatment was chosen due to its proven record of removing phosphorus from the lake water column and inactivating mobile phosphorus in lake sediments. A alum treatment was also determined to be cost effective and easily be adaptive based on changing lake water quality conditions. Other management alternatives, such as the dredging options, were orders of magnitude more expensive and more invasive to park visitors. While dredging was expected to be the most effective long-term measure for reducing phosphorus and HABs and may have provided a pathway to complete restoration, the City manages the lake from a public safety perspective and primary goal was to reduce the occurrence and intensity of toxic cyanobacteria blooms.

Figure 1. Map of Waughop Lake and Surrounding Area.

3.0 ALUM TREATMENT PLANNING AND DESIGN

3.1 ALUM OVERVIEW

Alum is a widely used chemical in wastewater and drinking water treatment facilities to clarify and remove impurities from water. In lakes, alum has been one of the most successfully implemented and effective in-lake treatments to reduce internal loading of phosphorus and remove phosphorus from the water column. Alum has been applied to well over 250 lakes worldwide and has been used for 50 years (Cooke et al., 2005, Brattebo et al., 2015, Huser et al., 2016).

Alum works by binding phosphorus from the water column and the sediment to aluminum. Alum is typically applied to the surface of a lake from a boat or barge equipped with nozzles or small hoses. In low-alkalinity lakes, like Waughop Lake, a buffer (sodium aluminate) is also used and simultaneously applied to the lake surface from separate nozzles or hoses. Alum and sodium aluminate are applied at a ratio that prevents major changes in lake pH during the application.

Alum hydrolyzes when it mixes with lake water and forms a white hydroxide floc that quickly settles to the lake bottom. The alum floc typically settles at a rate of 1.0 m per 6.5 minutes (Holz, James, and Barrow, 2021). As the

alum floc settles it removes soluble and particulate phosphorus from the water column through chemical binding of aluminum with phosphorus (also referred to as water column stripping). There is an immediate increase in water clarity following a properly dosed alum treatment due to the removal of algae and other particulate matter from the water column. The alum floc settles to the lake bottom and binds with sediment phosphorus in a form that is insensitive to anoxic conditions. That is, the phosphorus remains bound with aluminum even in low or zero dissolved oxygen, contrary to iron bound phosphorus. The floc condenses and settles into the lake sediments over time. As the floc settles it continues to bind phosphorus so long as binding sites are available.

Alum has been shown to be highly effective at reducing internal loading in both shallow (unstratified), as well as deep (stratified) lakes (Welch and Cooke, 1999; Cooke et al., 2005; Huser et al., 2016). The effectiveness at reducing whole-lake total phosphorus (TP) and sediment phosphorus release rate following an alum treatment averaged between 51 and 73% in six unstratified lakes and was maintained near that level to 5 to 11 years (Cooke et al., 2005). The 2004 treatment of Green Lake was still effective after 11 years (Welch et al., 2017).

Alum was used in Lake Ketchum (Snohomish County, WA) to successfully inactivate sediment phosphorus and eliminate internal phosphorus loading from lake sediments that were enriched by a legacy of inputs and runoff from a former dairy farm (Brattebo et al., 2017; Brattebo et al., 2024). The elimination of internal phosphorus loading lead to a reduction in toxic algae blooms, improved lake water quality, and restoration of both habitat and recreational activities. Small annual alum treatments began in 2016 at Lake Ketchum and have continued each year since, with the latest treatment occurring in March 2024. The goal of the small annual treatments is to neutralize the large inflow of phosphorus from the lake inlet that enters the lake each year with winter precipitation. The small annual alum treatments have consistently removed phosphorus from the Lake Ketchum water column each spring and prevented the occurrence of toxic cyanobacteria blooms (Figure 2). Alum is also used annually at Lake Oswego, Oregon, both to intercept and remove phosphorus from the inflow and to reduce phosphorus within the water column and reduce internal phosphorus loading (Rosenkranz, 2024).

Figure 2. Lake Ketchum Photographs Before and After Restoration.

3.2 ALUM TREAMENT DOSE DETERMINATION AND APPLICATION STRATEGY

In early 2019, Tetra Tech calculated the alum treatment dose for Waughop Lake based on sediment data obtained from the University of Puget Sound (Peterson, 2016) and the limited water column phosphorus data available for the lake. Working with the City, Tetra Tech developed a range of alum dosing alternatives and application strategies to be considered given the relative risks of obtaining the water quality goals for the lake

relative to the reduction of HAB events. The uncertainties at the time were based on a number of unknowns and uncontrollable conditions, such as groundwater phosphorus loading, lake recharge, and the reliability of the data collected to date.

Based on the limited sediment and lake data available at the time, the estimated phosphorus inactivation and water column stripping dose for Waughop Lake was 320 mg Al/L. That estimated dose was 8 to 16 times greater than the common dose used with the Puget Sound lakes region. The dose was based on the concentration of mobile phosphorus (loosely sorbed phosphorus and iron bound phosphorus) and one third of the concentration of biogenic phosphorus in the top 50 cm of the sediments. According to the sediment data from the University of Puget Sound, the average mobile phosphorus concentration in the top 50 cm was 735 mg/kg and the average biogenic phosphorus concentration was 379 mg/kg. These sediment concentrations varied slightly from results obtained from a core collected right before treatment in March 2020. The average mobile phosphorus concentration in the top 30 cm of the core collected in March 2020 was lower at 410 mg/kg however the average biogenic concentration was much higher at 1,373 mg/kg (Appendix A). The calculated alum dose based on the sediment data collected in March 2020 was lower, 230 mg Al/L, compared to the original calculated dose but still much greater than common doses used in the region. The lake TP concentration was assumed to be 69 µg/L for purposes of calculating the amount of aluminum needed to strip the phosphorus from the water column. It was determined based on cost, the uncertainty of the groundwater phosphorus loading dynamics, unknowns associated with lake recharge, and the variable matrix of the sediment, that the dose calculated may be more than was needed or may still require periodic maintenance doses to inactivate future phosphorus loading. Hence the large, 320 mg Al/L or 230 mg Al/L, dose was not recommended for Waughop Lake at that time.

The application dose and application strategy that was recommended was to proceed with a treatment dose of 120 mg Al/L applied over the course of three separate application events. The recommended dose was still 3 to 6 times greater than the average lake dose for the Puget Sound region, but it was based on the high sediment phosphorus concentrations and predicted to change the dynamics of the sediments and inactivate a significant amount of sediment phosphorus. Mobile sediment phosphorus concentrations in the lake are relatively high due to past practices of discharging manure and other agricultural wastes into the lake (Brown and Caldwell, 2017). Given lake and sediment conditions prior to treatment, it was recommended that the total alum dose (120 mg Al/L) be applied to the lake in three separate applications, at a dose of 40 mg Al/L, over the course of a year. The multiple applications were recommended to allow the sediment physical characteristics to change, become slightly denser, resulting in a more stable, less fluid lake bottom.

However, given the data variability and unknowns at the time, it was also recommended that the phosphorus inactivation program at Waughop Lake be adaptive and rely on additional data collected one and two years after the initiation of alum treatments. An adaptive program would enable an informed understanding of the degree to which the physical and chemical characteristics of the lake changed due to the alum treatments and allow for modifications to treatments based on actual lake responses. Ultimately, the adaptive program resulted in only two applications being completed in 2020 with a third, smaller application occurring in 2023.

4.0 ALUM TREATMENT IMPLEMENTATION

4.1 2020 ALUM TREATMENTS

Two whole-lake alum treatments, buffered with sodium aluminate, were conducted in 2020 to remove phosphorus from the water column and to inactivate the release of phosphorus from the lake sediments to reduce algal production. An early-season treatment was conducted from March 24th to March 25th, and a second application was conducted from July 14th to July 16th. Maps of treatment coverage from the March 2020 and the July 2020 applications are provided in Figure 3 and photos during treatment are shown in Figure 4. Photos of increased

clarity in the water column following the July treatment are shown in Figure 5. Samples for water quality analysis were collected by Tetra Tech staff before and after each treatment, and in-situ monitoring of dissolved oxygen (DO), conductivity, temperature, and pH were conducted prior to, during, and after treatment.

The alum treatments in March and July of 2020 had relatively high doses of 40 mg Al/L applied to the whole lake, for a total dose of 80 mg Al/L. As stated earlier, the targeted dose was determined based on available phosphorus loading and sediment phosphorus data and was designed to inactivate sediment phosphorus and strip the water column of phosphorus. Two of the planned 40 mg Al/L doses were applied in 2020. This strategy of phased application was recommended to allow the lake sediments to consolidate from their very fluid state and maximize the effectiveness of the treatment. This strategy also allows for adaptive management based on results from on-going water quality monitoring efforts.

Immediately following each alum treatment, there was a significant increase in water clarity due to the stripping of algae and particulate matter from the water column (Figure 5). Water clarity remained clear throughout the summer of 2020 due to the dramatic reduction in phosphorus concentrations and subsequent algal production. Waughop Lake did not experience a cyanobacteria bloom in 2020. The Washington State Toxic Algae monitoring program indicates that reoccurring toxic algae blooms were observed every year on record from 2007-2018 (King County, 2018).

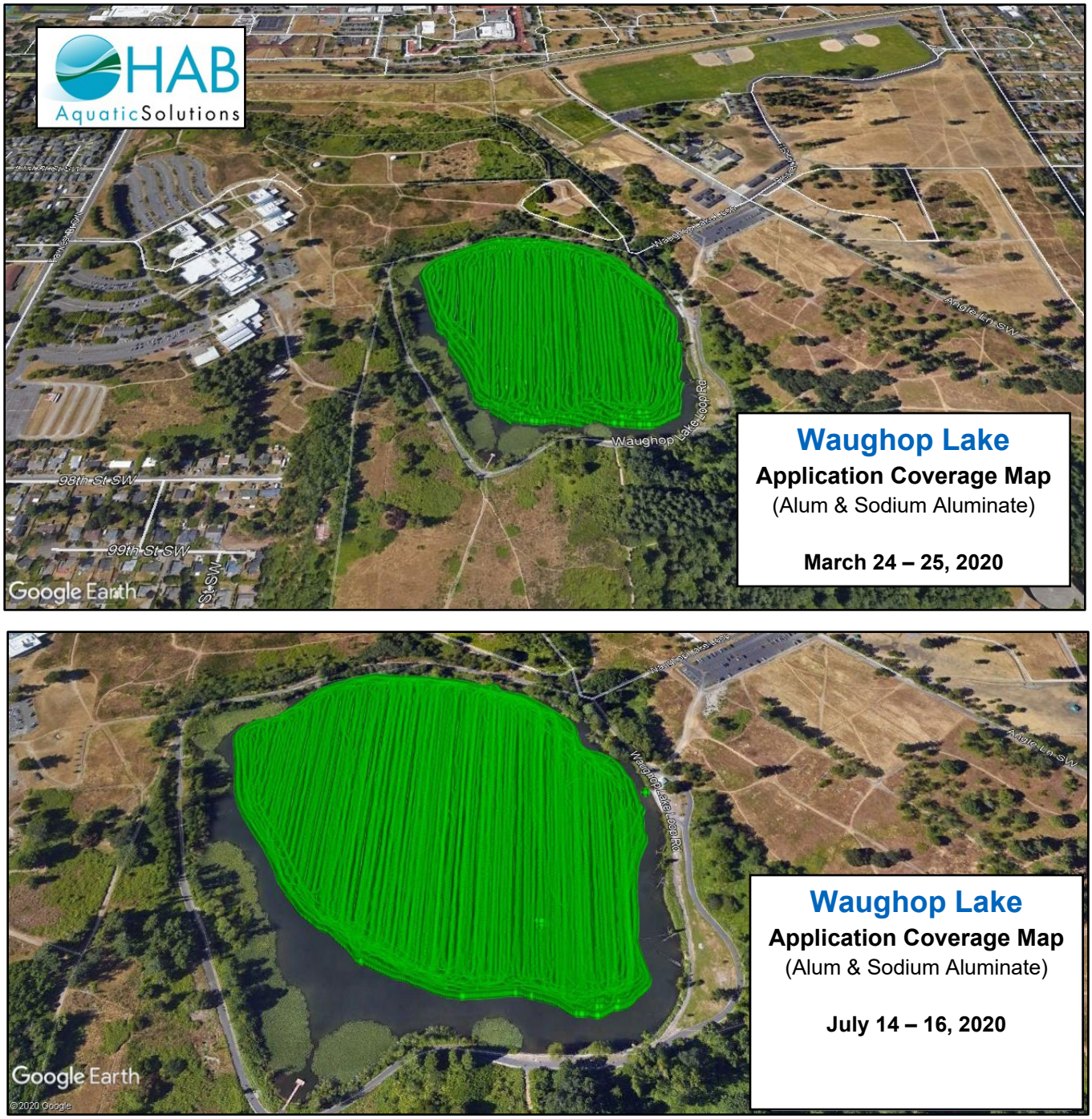

Figure 3. Phosphorus inactivation application coverage map for 2020 alum treatments in March (upper) and July (lower) at Waughop Lake. Both treatments in 2020 covered the whole lake within the depth capabilities of the application vessel. The difference in the green shaded area between March and July was due to much lower lake levels in July and decreased water volume.

Figure 4. Chemical distribution systems for 2020 alum treatments in March (left) and July (right) at Waughop Lake.

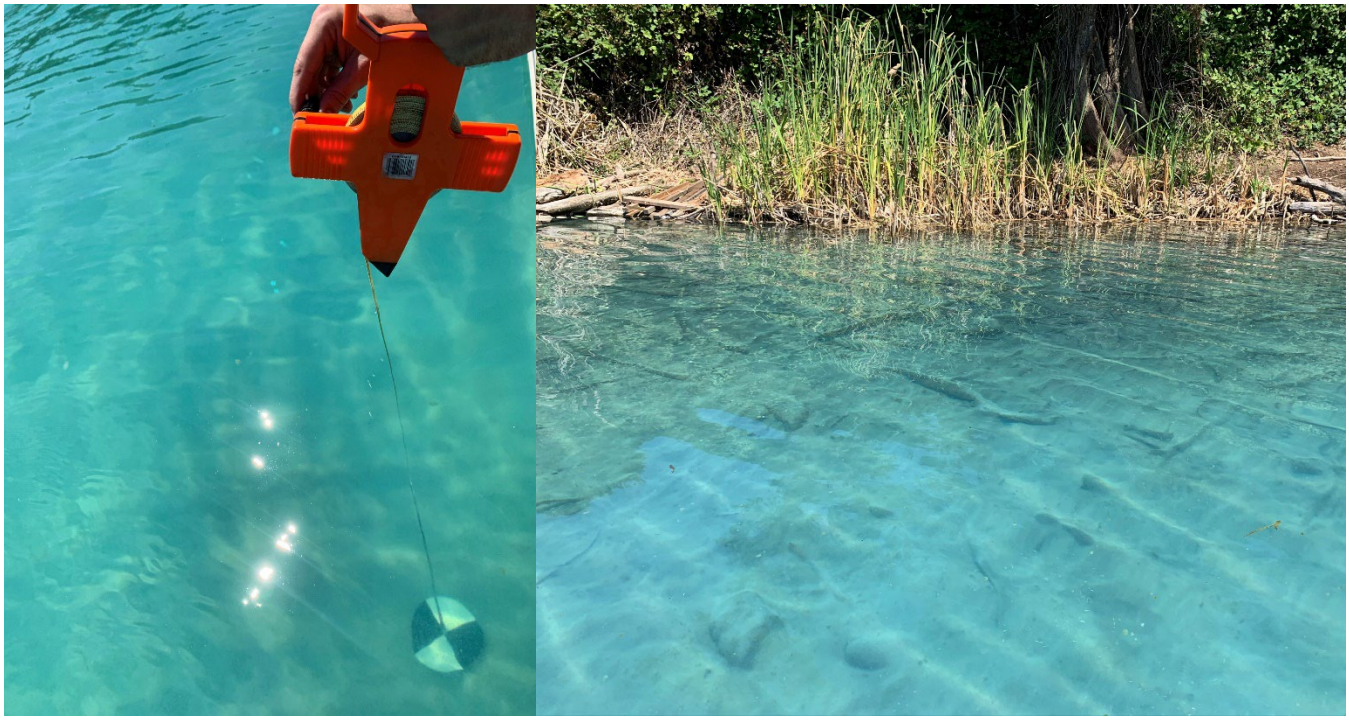

Figure 5. Water clarity to the lake bottom on July 15th, 2020 during alum treatment at Waughop Lake.

4.2 2023 ALUM TREAMENT

One whole-lake alum treatment, buffered with sodium aluminate, was conducted in 2023 to remove phosphorus from the water column and to continue to inactivate the release of phosphorus from the lake sediment to reduce algal production. The treatment was conducted on June 28th and 29th, 2023. Photos of the chemical distribution during the 2023 treatment are shown in Figures 6 and 7. A photo of increased water clarity in the water column immediately after treatment is shown in Figure 8. Samples for water quality analysis were collected by Tetra Tech staff before and after the treatment, and in-situ monitoring of dissolved oxygen (DO), conductivity, temperature, and pH were conducted prior to, during, and after treatment.

The alum treatment in June 2023 had a dose of 20 mg Al/L applied to the whole lake. The alum treatments in March and July of 2020 had relatively high doses of 40 mg Al/L each, for a total dose of 80 mg Al/L. The dose for the 2023 treatment was based on water quality data collected in 2021 and 2022. The original plan was to apply alum at a dose of 40 mg Al/L three times over the course of a year. However, based on the lake's positive response to the 2020 alum treatments, the City decided to postpone the third treatment until water quality conditions warranted an application. Total phosphorus and chlorophyll concentrations in Waughop Lake remained relatively low following the 2020 alum treatments and had begun to increase starting in the winter of 2021 and summer of 2022. Based on the increased TP, chlorophyll, and algal production the City decided to treat the lake with alum in June 2023 to reduce water column phosphorus concentrations and reduce the potential for HAB event occurrences and intensity during the summer of 2023.

A similar increase in water clarity was observed immediately following the June 2023 alum treatment. Similar to the applications in 2020, the increase in water clarity was due to the stripping of algae and particulate matter from the water column. Water clarity remained high through the summer (September 2023) before decreasing with increased algae production in October 2023. The effectiveness of the 2023 alum treatment was expected to be similar to that observed following the 2020 treatments, however, treatment effectiveness in 2023 was hindered by extreme low water levels and climatic conditions. These conditions enhanced water column mixing and phosphorus migration from lake sediments making both the phosphorus concentration and bio-availability greater, as seen with increased phosphorus concentrations in the fall and winter of 2023 (See Section 6.4).

Figure 6. Chemical distribution system for 2023 alum treatment in June at Waughop Lake.

Figure 7. Alum barge during application on second day of alum treatment in June 2023 at Waughop Lake.

Figure 8. Water clarity to the lake bottom on June 29th during alum treatment at Waughop Lake.

5.0 LAKE MONITORING

A water quality monitoring program was implemented to evaluate the short-term and long-term effects of the Waughop Lake alum treatments conducted in 2020 and 2023. The data obtained from the monitoring program was used to assess management progress relative to the reduction of HABs in Waughop Lake and to plan future lake management actions.

Tetra Tech staff conducted monthly monitoring from March through October 2020 and from May through October 2023. Additional monitoring was conducted by Tetra Tech in January and March 2021. Tetra Tech conducted quarterly monitoring following the June 2023 alum treatment in December 2023, March 2024, and June 2024. Additional in-situ monitoring was conducted before, during, and after the alum treatments in March 2020, July 2020, and June 2023. All in-situ monitoring included measurements of DO, conductivity, temperature, and pH at either one or two established monitoring station(s) (Figure 9). At the lake sites, these parameters were measured at 0.5-meter (m) intervals within the water column. Tetra Tech also recorded Secchi disk depth, or transparency, and lake water level during each monitoring event, and made observations on the weather and water conditions, as well as waterfowl and aquatic life observed at the time of sampling. Tables summarizing in-situ monitoring data collected by Tetra Tech are included in Appendix B.

In 2023, the City was also required to measure lake pH continuously during the alum treatment. Prior to the start of the alum treatment, on June 27th, Tetra Tech staff deployed a HOBO pH and temperature data logger from an old set of dock pilings near the northeast shoreline. The logger was deployed such that pH measurements were from about 0.5 m below the water surface. The logger remained in the lake and recorded pH and temperature measurements every 15 mins from shortly after noon on June 27th through 12:30 pm on June 30th.

In 2020, water samples were collected for laboratory analysis before and after each alum treatment at depths of 1 m and 1.5 m. Monthly water quality samples were collected from March through October 2020 at a depth of 1 m.

Samples collected in January and March 2021 were collected at a depth of 1 m. Samples were initially collected at two stations, but due to the small size of the lake, data did not vary significantly between the stations and the second station was eventually excluded from sampling activities. All water samples collected in 2020 were analyzed to determine total phosphorus (TP), total nitrogen (TN(), alkalinity, sulfate, and chlorophyll *a* concentrations. Select samples were also analyzed for soluble reactive phosphorus (SRP), ammonia, total aluminum (TA), dissolved aluminum, total organic carbon (TOC) and dissolved organic carbon (DOC). All laboratory data reports are included in Appendix C.

In 2023, water samples were typically collected for laboratory analysis at 1 m depth below the water surface at the mid-lake station. Samples were collected for laboratory analysis at a depth of 0.5 m above the lake bottom during the sampling events immediately before and after the June 2023 alum treatment. Water samples were analyzed to determine TP, SPR, TN, nitrate+nitrite as nitrogen (NO3+NO2), alkalinity, sulfate, TA, DOC, hardness and chlorophyll concentrations. Select samples were also analyzed for dissolved aluminum. The Washington State Department of Ecology required additional analyses for chloride, calcium, magnesium, potassium, sodium, bicarbonate, carbonate, and total sulfides before and after the June 2023 alum treatment. All laboratory data reports are included in Appendix C.

Table 1 summarizes the monitoring events conducted by Tetra Tech in 2020, 2021, 2023, and 2024.

The PCD through volunteer lake monitors also conducted monthly monitoring events at Waughop Lake from May through October 2021 – 2024. The PCD measured water column temperature, DO, shallow pH, and Secchi disk depth each month and collected water samples at 1 m depth for analysis of TP, SRP, TN, chlorophyll, and occasionally sulfate, alkalinity, and total aluminum. The laboratory data from PCD's monitoring events are included within the data analysis for this report. The annual data summary reports prepared by PCD for 2021, 2022, and 2023, as well as the laboratory data reports for 2024, are included in Appendix D.

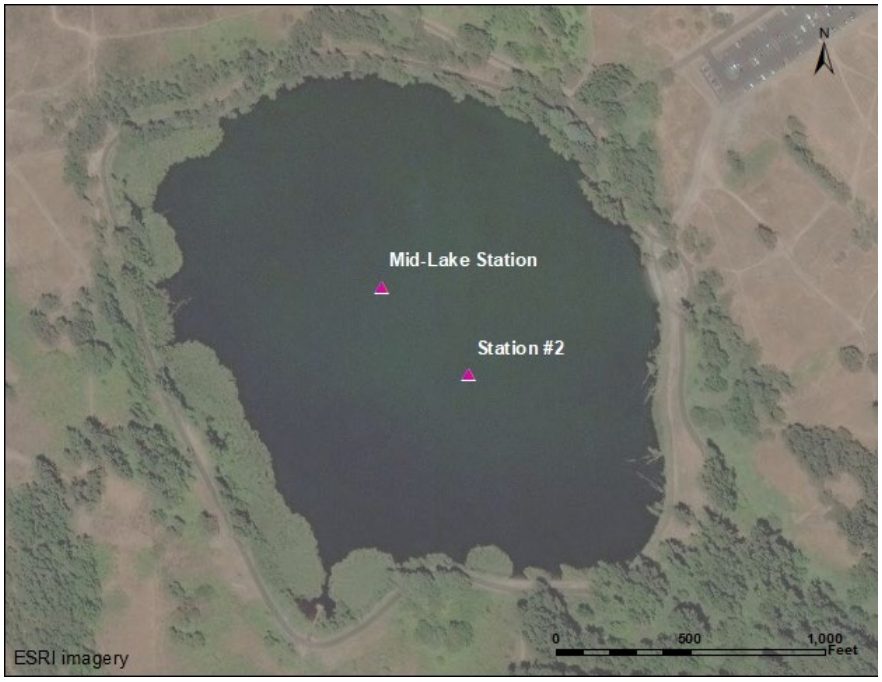

Figure 9. Waughop Lake Monitoring Locations.

Table 1. Tetra Tech Sampling Schedule at Waughop Lake, 2020 – 2024.

Date	Sample Depth(s)	Sampling Station(s)	Notes
3/23/2020	1 m, 1.5 m	Mid-Lake, Station #2	Pre-treatment
3/26/2020	1 m, 1.5 m	Mid-Lake, Station #2	Post-treatment
4/10/2020	1 m, 1.5 m	Mid-Lake, Station #2	Monthly
5/27/2020	1 m	Mid-Lake	Monthly
6/18/2020	1 m	Mid-Lake	Monthly
7/13/2020	1 m, 1.5 m	Mid-Lake, Station #2	Pre-Treatment
7/17/2020	1 m, 1.5 m	Mid-Lake	Post-Treatment
8/7/2020	1 m	Mid-Lake	Monthly
9/11/2020	1 m	Mid-Lake	Monthly
10/19/2020	1 m	Mid-Lake	Monthly
1/19/2021	1 m	Mid-Lake	Supplemental Monthly
3/17/2021	1 m	Mid-Lake	Supplemental Monthly
5/23/2023	0.5 m	Mid-Lake	Monthly
6/27/2023	1 m, 1.8 m	Mid-Lake	Pre-Treatment
6/29/2023	0.5 m, 1 m, 1.8 m	Mid-Lake, West Shore	Post-Treatment (aluminum only)
6/30/2023	1 m, 1.8 m	Mid-Lake	Post-Treatment
7/13/2023	1 m, 1.8 m	Mid-Lake	Post-Treatment & Monthly
8/15/2023	1 m, 1.5 m (sulfides only)	Mid-Lake	Monthly
9/14/2023	1 m, 1.5 m (sulfides only)	Mid-Lake	Monthly
10/11/2023	1 m	Mid-Lake	Monthly
12/12/2023	1 m, 1.8 m (sulfides only)	Mid-Lake	Quarterly
3/13/2024	1 m, 2 m (sulfides only)	Mid-Lake	Quarterly
6/27/2024	1 m, 2 m (sulfides only)	Mid-Lake	Quarterly (one year post treatment)

6.0 LAKE MONITORING RESULTS

6.1 WATER LEVEL & LAKE VOLUME

Water level in Waughop Lake was recorded during each monitoring event based on the installed gage. The lake gage measurements showed a steady decline of water level during the summer months for all years (Figure 10). In 2020, the lake level decreased from 6.1 feet (ft) in late March to a low of 3.55 ft in September. Similarly in 2021, the lake level decreased from 6.1 ft in mid-March to a low of 3.56 ft in September.

In 2022 water levels at the lake were much higher than in 2020 and 2021 but still showed a steady decrease throughout the summer months, decreasing from a high of 7.5 ft in May 2022 to a low of 4.75 ft in November. Water levels in 2023 also decreased from a high of 5.57 ft in May to a low of 3.0 ft in mid-October. The first monitoring event in 2023 was not until May so water level during early spring of 2023 is unknown. In 2024, the lake level decreased from 5.68 ft in March to 3.0 ft in October.

The water level in Waughop Lake usually increases steadily during the winter months before declining during the summer months. However, during the summers of 2023 and 2024 water level was much lower than recorded in previous years (Figure 10). Minimum water levels in 2020, 2021, and 2022 were 3.55 ft, 3.56 ft, and 4.75 ft, respectively, 0.5 to 1.75 ft higher than in 2023 and 2024. Maximum water levels typically observed in the spring were also lower in 2023 and 2024 compared to previous years. March water level in 2024 was a half-foot lower than water levels observed in March 2020 and 2021.

A USGS groundwater monitoring test hole (site 471032122292701) is located approximately 4 miles east of Waughop Lake and has a record of field measurements of groundwater level in 2020 – 2024. A comparison of lake level in Waughop Lake and groundwater level at the USGS monitoring site indicates that there is a strong correlation between water level in Waughop Lake and local groundwater levels, as shown in Figure 10. The ground elevation at the USGS groundwater monitoring test hole is 272.76 ft NAVD88. Groundwater measurements at the test hole ranged from about 32.8 ft to 48.7 ft below ground surface during 2020 through 2024, or approximately 224.1 to 240 ft NAVD88. The elevation of the gage at Waughop Lake is unknown; however, based on LiDAR, the shoreline elevation is approximately 228 ft NAVD88. The difference in water level elevation at the two locations reflects the local groundwater flow patterns, with higher ground surface and groundwater elevations at the test hole site to the east (USGS, 2010). Unfortunately, there were only two field measurements of groundwater level at the test hole in 2023, during April and December, and only one measurement in 2024 in March, so we do not know how low the groundwater level in the test hole could have been during the summers of 2023 and 2024. Based on measurements collected in 2021, we can expect that groundwater levels during the summers of 2023 and 2024 were low.

Lake volume, which changes with decreasing and increasing water levels, was estimated using information on lake stage and corresponding change in lake storage that was included in the lake water budget summary in the lake management plan (Brown and Caldwell, 2017). The average change in lake storage, in ac-ft, per change in lake stage (ft) was estimated to be 33.5 ac-ft. It was assumed that lake volume at “full pool” was 220 ac-ft (271,365 m^3) and that “full pool” corresponded to a gage height of 6.1 ft. Using the gage height data collected by Tetra Tech personnel, as well as PCD volunteer monitors, lake volume was estimated for each sampling date (Figure 11).

Lake volume in the spring of 2020 and 2021 was at or near “full pool”, the assumed full volume of 220 ac-ft. In the spring of 2022, lake volume was well above “full poll” at about 260 ac-ft (Figure 11). Lake volume decreased over the summers of both 2020 and 2021 by about 38%. The decrease in lake volume during the summer of 2022 was slightly smaller than in previous years, decreasing by about 34% from the maximum volume observed in May of 267 ac-ft. In 2023 and 2024, lake volume did not reach “full pool” of 220 ac-ft according to the available data. In 2023, the earliest the lake level was observed was in May so the lake could have been higher earlier during the spring. Nevertheless, lake volume during the summer of 2023 decreased by 45%. In 2024, maximum lake volume occurred in March at 206 ac-ft and decreased by 44% over the summer (Figure 11). Lake volume in May 2024 was quite a bit less than lake volume in May 2023; 189 ac-ft vs. 211 ac-ft. Based on the lake level data and estimated lake volumes from 2020 through 2024, an overall trend in decreasing lake volume is apparent.

Major changes in lake volume significantly impact water quality. When lake volume decreases, nutrients, metals, salts, and other pollutants become more concentrated as there is less water to dilute them. Lower water levels and volume can also lead to increased sediment resuspension which causes turbidity, increased nutrient concentrations, and general disruption to the water column. Increased sediment resuspension can affect light penetration and in turn aquatic plant growth. Aquatic plant growth is also negatively impacted by fluctuating water levels and the resulting unstable littoral environment. Dramatic fluctuations in water level as observed in Waughop Lake can disrupt aquatic habitats and the littoral zone, affecting the distribution and abundance of plant and animal species.

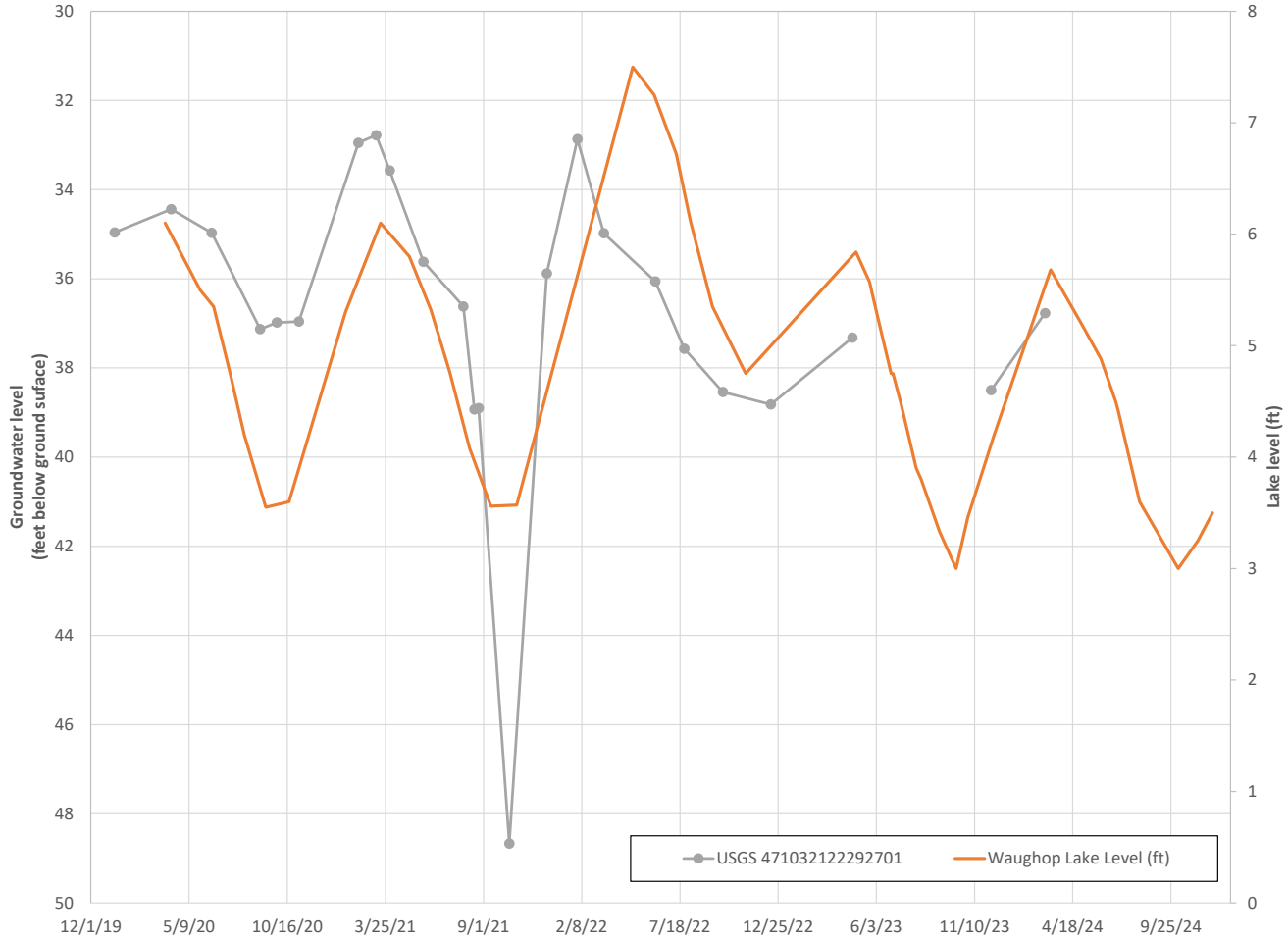

Figure 10. Water level in Waughop Lake and local groundwater level in 2020 – 2024.

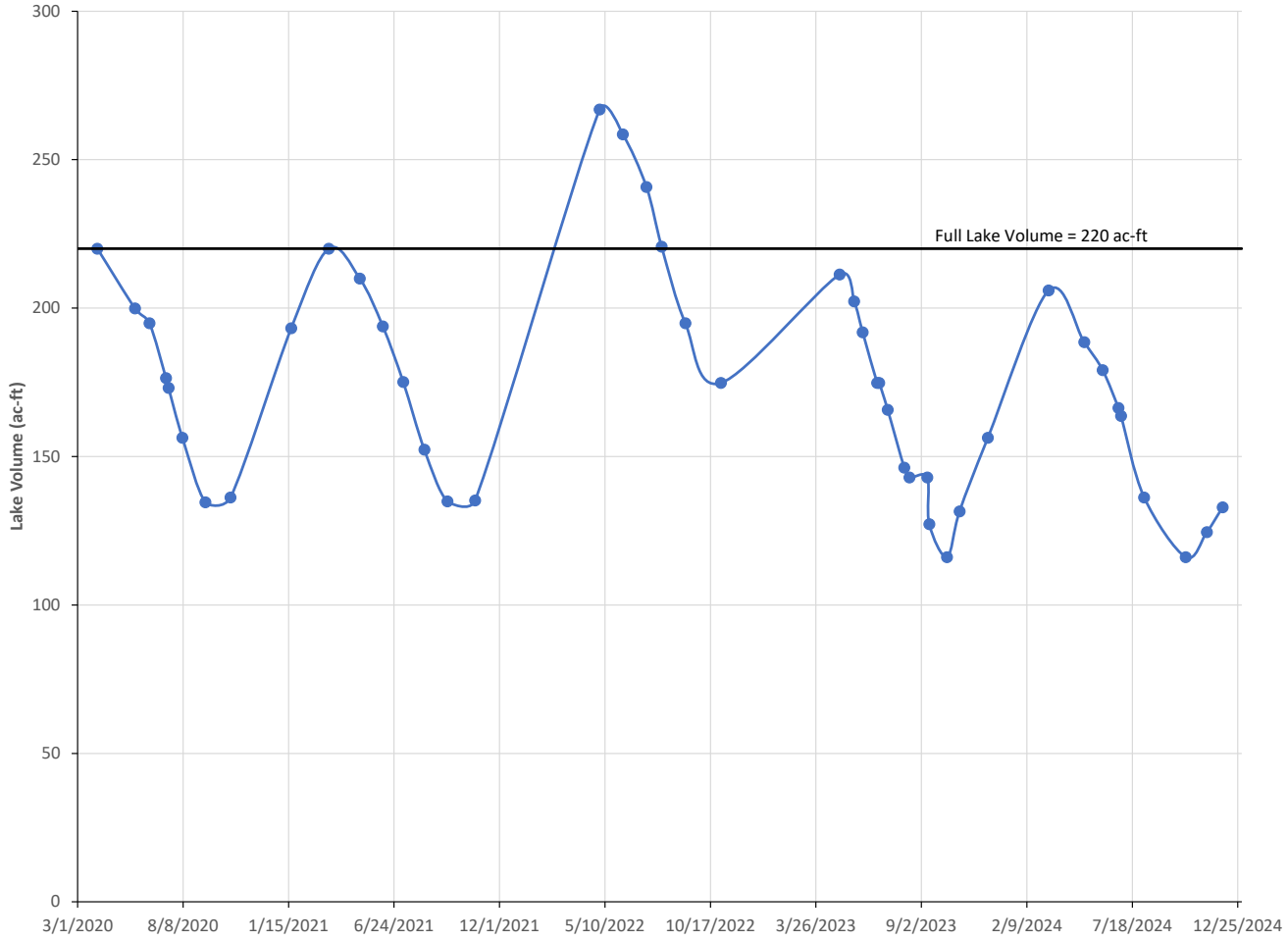

Figure 11. Estimated Waughop Lake volume in 2020 through 2024.

6.2 WATER TEMPERATURE, DISSOLVED OXYGEN, CONDUCTIVITY, AND PH

Tetra Tech collected profiles of water temperature, DO, conductivity, and pH. Measurements were recorded at 0.5-meter intervals at each station during their monitoring events in 2020, 2021, 2023, and 2024. In 2020 and January/March 2021, profiles started at the surface and ended 0.5 m above the bottom. In 2023 and 2024 profile measurements started at 0.5 m below the water surface and ending at 0.5 m above the bottom. Profile depths ranged from 1.45 to 2.5 meters deep at the mid-lake station depending on water level conditions. Due to the similarity in data across stations, profiles at the mid-lake station are considered representative of conditions at Waughop Lake and are discussed in detail below.

6.2.1 Water Temperature

Water temperatures at Waughop Lake in 2020 ranged from 9°C to 25.6°C at the mid-lake station. The warmest temperatures were observed in July while the coldest temperatures were observed in March. During the summer months (June through September), temperatures ranged from 20.1°C to 25.6°C. Temperature did not vary significantly throughout the water column, as Waughop Lake is a shallow lake that mixes frequently throughout the year (Figure 12). Water temperatures at the mid-lake station were colder in January 2021 (average 6.9°C

throughout the water column) than observed in March-October 2020. Temperatures in March 2021 were similar to those measured in March 2020, with average water temperature throughout the water column of 9.7°C versus 10.0°C, which was the average in March 2020. There was no stratification observed within the lake during the monitoring events in 2020 and 2021.

Water temperatures in May through December 2023 ranged from 7.2°C to 25.7°C at the mid-lake station. A similar range to temperatures observed in 2020. The warmest temperatures in 2023 were observed in August while the coldest temperatures were observed in December (Figure 13). During the summer months (June through September), temperatures ranged from 20.3°C to 25.7°C.

Water temperature at the mid-lake station in March 2024 averaged 7.6°C, which was colder than the average water column temperatures measured in March 2020 (10.0°C) and March 2021 (9.7°C). June 2024 water temperatures were also slightly cooler than temperatures in June 2023 (Figure 13). The average water column temperature in June 2024 was 21.4°C compared to 22.3°C in 2023. Water temperatures June 2020 however were cooler than both 2023 and 2024 with a water column average of 20.5°C.

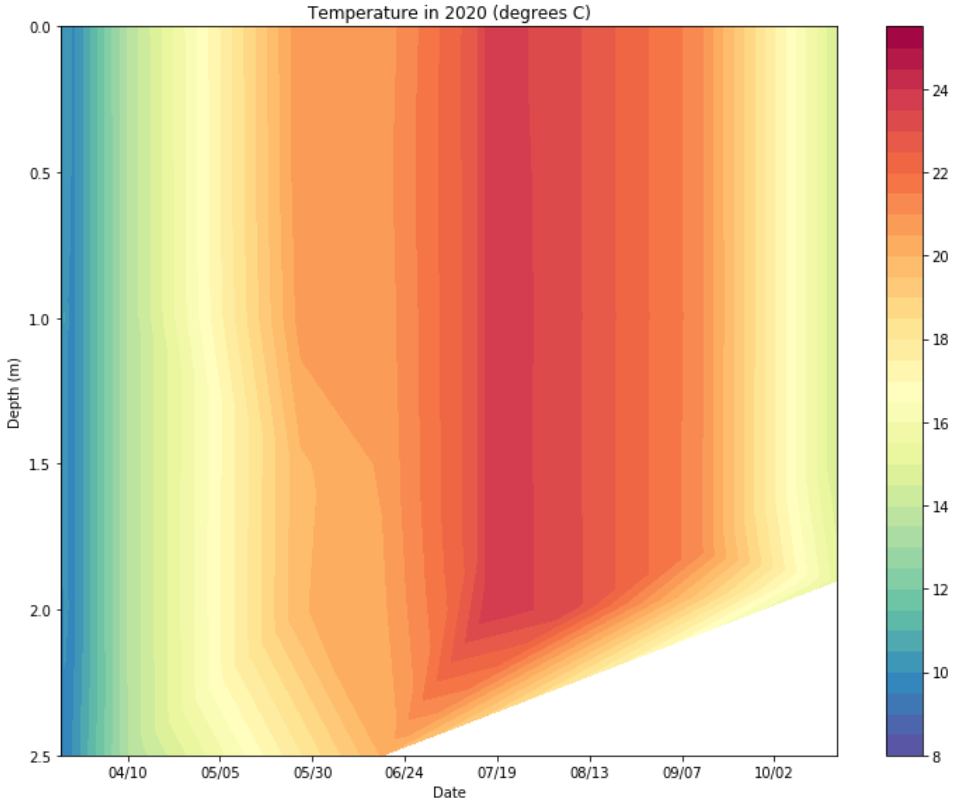

Figure 12. Water temperatures at Waughop Lake in 2020.

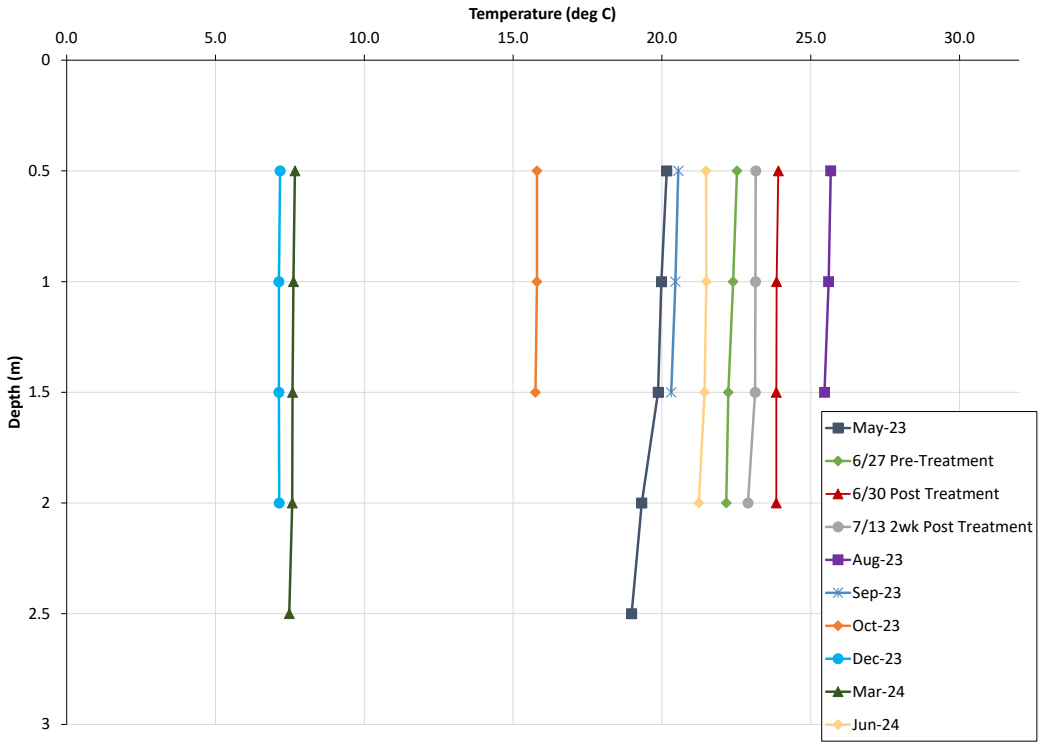

Figure 13. Water temperature profiles at Waughop Lake in 2023 and March/June 2024.

6.2.2 Dissolved Oxygen

Dissolved oxygen concentrations in 2020 and January/March 2021 ranged from 1.1 (near the bottom sediment) to 14 mg/L at the mid-lake station. Minimum DO occurred near the bottom of each profile, when the Hydrolab multi-parameter sonde was near the lake bottom. Excluding the bottom measurements, DO ranged from 7.4 to 14 mg/L, with an average of 10.7 mg/L, and did not vary significantly throughout the water column. The highest DO concentrations were observed prior to the first alum treatment in March and corresponded to maximum chlorophyll concentrations and high productivity. A decrease in DO was observed following each alum treatment. Higher DO concentrations in March and October 2020 are likely due to colder water temperatures, which increases the DO saturation level. DO concentrations in Waughop Lake during 2020 and January/March 2021 are shown in Figure 14.

Dissolved oxygen concentrations measured in 2023 and March/June 2024 ranged from 7.8 (0.5 m from the bottom) to 13.3 mg/L at the mid-lake station. Field crews did not collect DO concentrations near or within the sediment at the lake bottom in order to protect the monitoring equipment and calibration. Dissolved oxygen averaged 10.1 mg/L and did not vary significantly throughout the water column in 2023 (Figure 15). The highest DO concentrations were observed in December 2023 and March 2024 and corresponded to maximum chlorophyll concentrations and high productivity. Higher DO concentrations in December and March could also be due to colder water temperatures, which increases the DO saturation level. A decrease in DO was observed immediately following the June 2023 alum treatment but rebounded back to pre-treatment concentrations within 2 weeks post treatment.

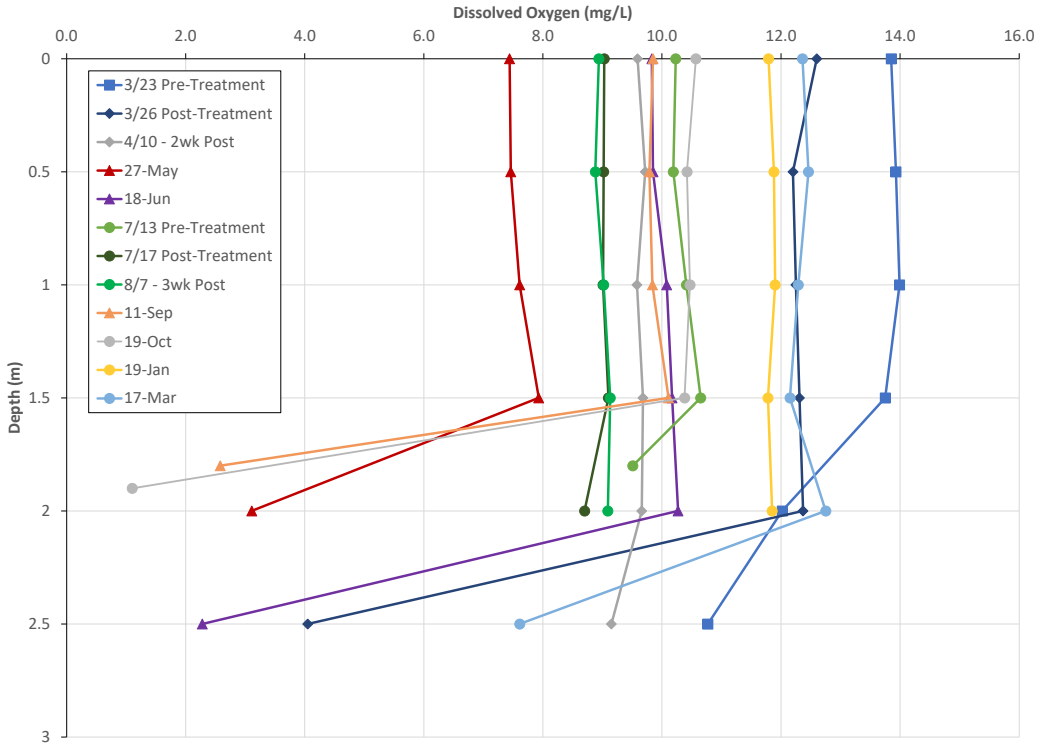

Figure 14. Dissolved oxygen profiles in Waughop Lake in 2020 and January/March 2021.

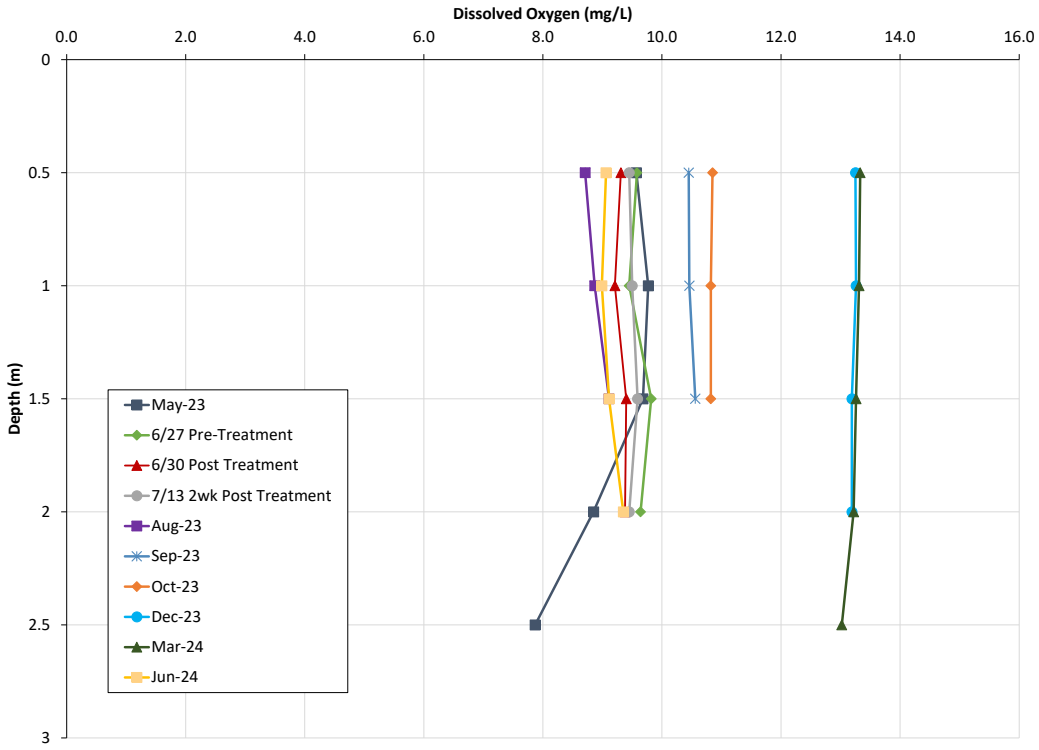

Figure 15. Dissolved oxygen profiles in Waughop Lake in 2023 and March/June 2024.

6.2.3 pH

In 2020, pH varied throughout the water column and was generally higher at the surface and lower at deeper locations. At the mid-lake station, pH ranged from 6.7 to 9.2 across all 2020 monitoring dates and January/March 2021 (Figure 16). The highest pH values were observed prior to the July alum treatment and near the surface in January 2021. There was a decrease in pH following both the March and July 2020 alum treatments, however pH values never fell below 7.0 following treatment. The higher pH values in July and January were most likely influenced by photosynthesis.

In 2023, pH also varied slightly throughout the water column and was generally higher at the surface and lower at deeper locations. At the mid-lake station, pH ranged from 7.2 to 8.8 across all 2023 and March/June 2024 monitoring dates (Figure 17). The highest pH values were observed in March 2024 and were similar to pH values measured in October 2023. The high pH values in March 2024 were likely influenced by photosynthesis as chlorophyll concentrations were at their highest measured concentration. A decrease in pH throughout the water column was observed following the June 2023 alum treatment.

pH in the lake was also monitored continuously during the June 2024 alum treatment and for 24 hours post treatment (Figure 18). pH prior to the start of the treatment was high, around 8.5. pH decreased initially after the alum treatment started the morning of June 28th, then stabilized overnight. There was another slight decrease in pH after the start of the treatment the second morning on June 29th, but then pH stabilized at around 7.1 and continued to remain stable for 24 hours following treatment (Figure 18).

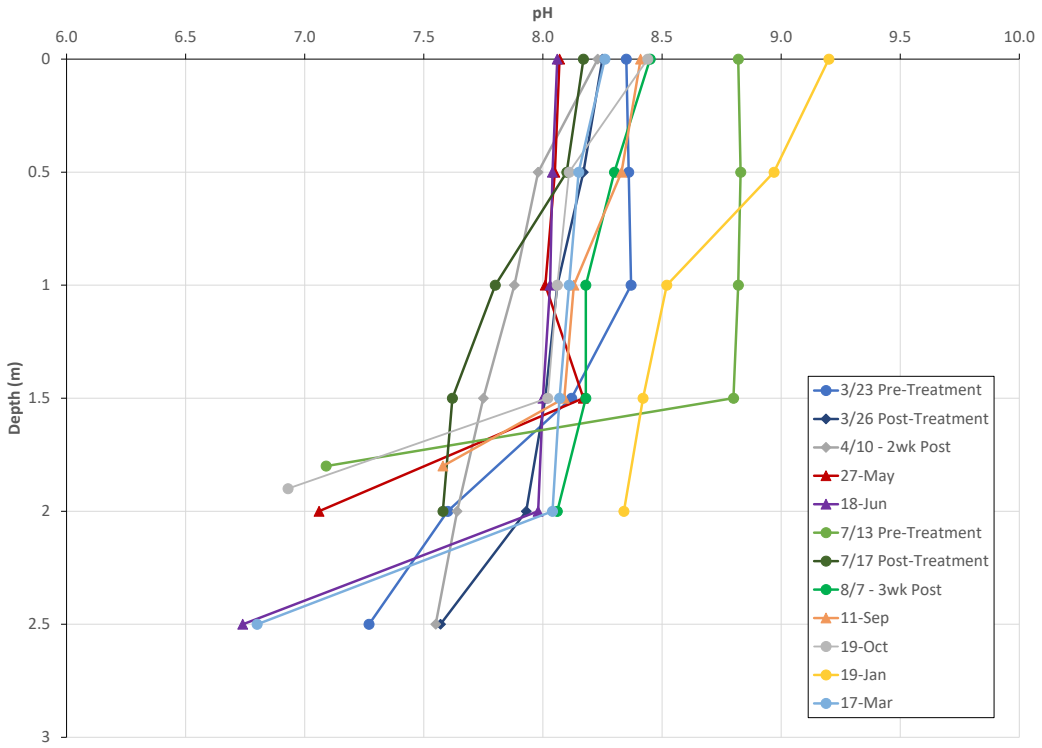

Figure 16. pH profiles in Waughop Lake in 2020 and January/March 2021.

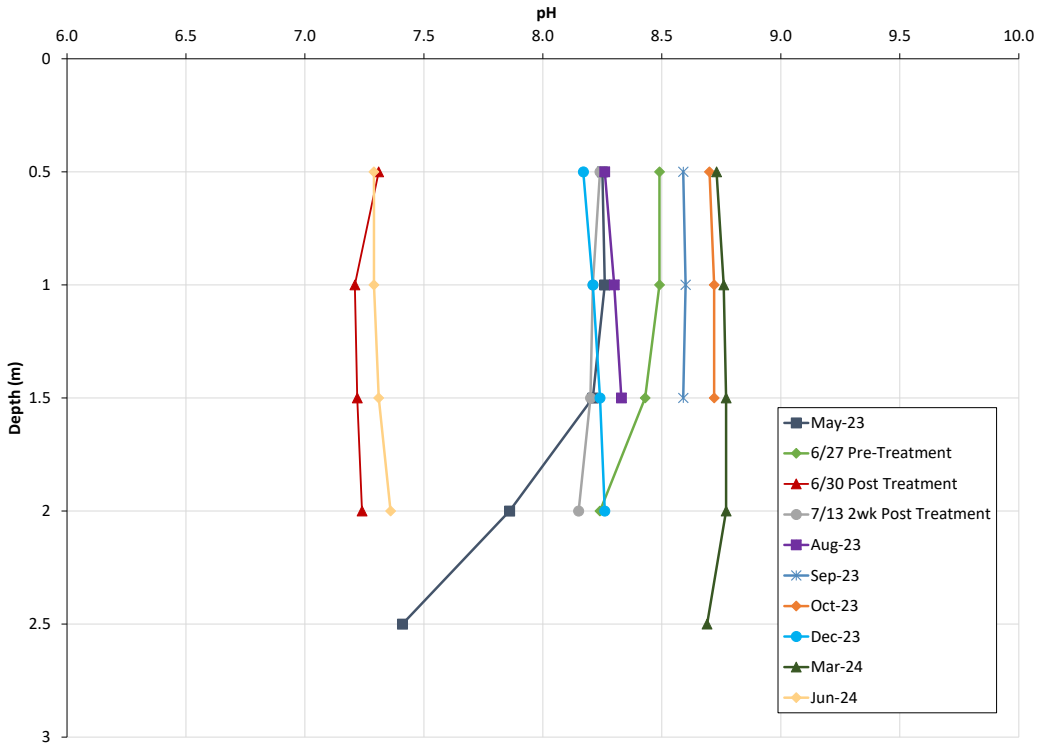

Figure 17. pH profiles in Waughop Lake in 2023 and March/June 2024.

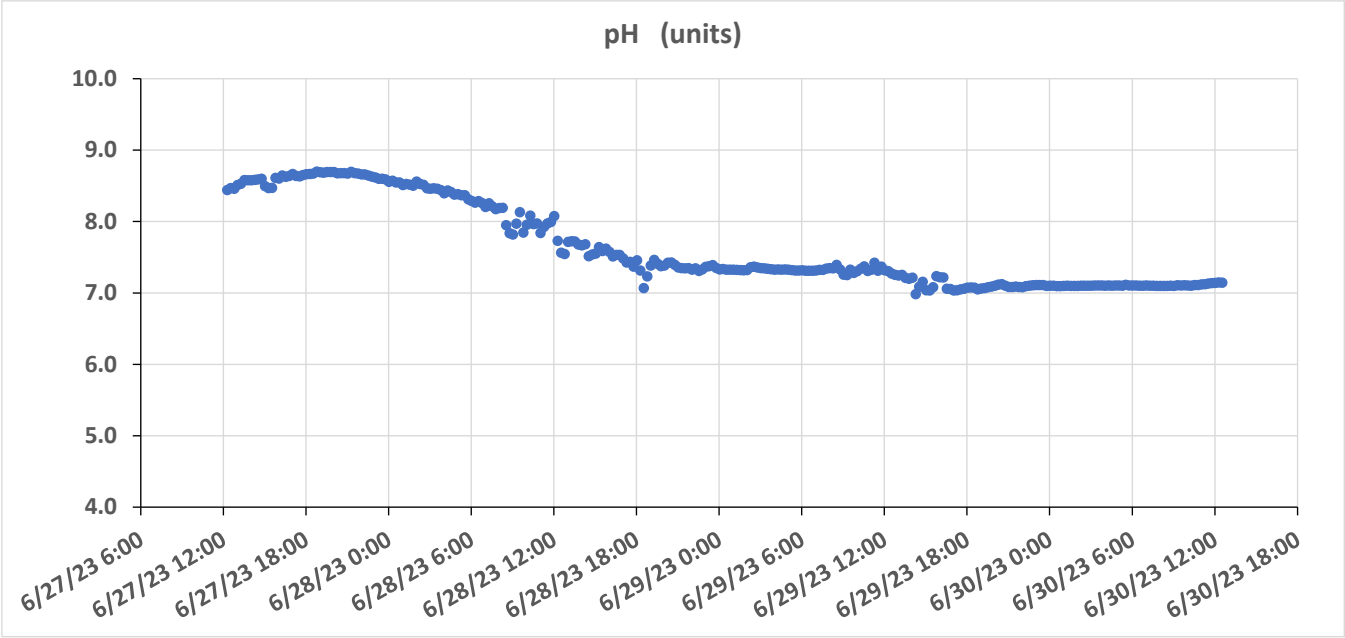

Figure 18. Continuous pH measurements in Waughop Lake during the June 2023 Alum Treatment.

6.2.4 Conductivity

In 2020 and early 2021, specific conductivity was generally uniform throughout the water column, varying only at the bottom of the profile, likely due to interaction with lake-bottom sediments. Specific conductivity varied over the course of the monitoring period and generally increased as a result of alum treatments (Figure 19).

Prior to the first 2020 alum treatment, conductivity in Waughop Lake had an average value of 46 µS/cm. One day after treatment, the average conductivity had increased to an average of 218 µS/cm and stayed in that range until the July alum treatment. After the July treatment, the average conductivity increased to an average of 494 µS/cm and reached a maximum average of 556 µS/cm in September before decreasing somewhat in October. Conductivity continued to decrease in January and March 2021 with water column averages of 317 and 307 µS/cm (Figure 19). Freshwater rivers and lakes generally have conductivity values between 50 and 1,500 µS/cm (Huron River Watershed Council, 2013).

In 2023 and 2024 specific conductivity profiles were uniform throughout the water column. Similar to conditions observed in 2020, specific conductivity varied over the course of the monitoring period and generally increased as a result of the 2023 alum treatment (Figure 20). Prior to the June 2023 alum treatment, conductivity in Waughop Lake had an average value of 153 µS/cm. This is a substantial decreased from average conductivities measured in January and March 2021. One day after the June 2023 treatment, the average conductivity had increased to an average of 286 µS/cm, similar to observed conductivities following that 2020 alum treatments. Conductivity remained higher than pre-treatment levels through June 2024, although conductivity measurements in March and June 2024 were lower than those measured in 2023. Maximum conductivity was measured in August 2023 (Figure 20).

An increase in specific conductivity was anticipated as a direct result of the alum treatments. However, the effect was prolonged due to the lack of flushing in Waughop Lake and the lowering of the water level during the summer months. The drastic water level decreases in Waughop Lake have a concentrating effect throughout the summer as lake volume decreases. Water level and lake volume decreases during the summer due to evaporation which leaves behind dissolved minerals, salts, nutrients, etc. in the water column. Therefore, the amount of minerals and salts in the lake become more concentrated within a smaller volume of water leading to higher measurements of specific conductivity. As groundwater flow increases over the winter, a reduction of specific conductivity is expected. This reduction has already been observed in the winters following the alum treatments.

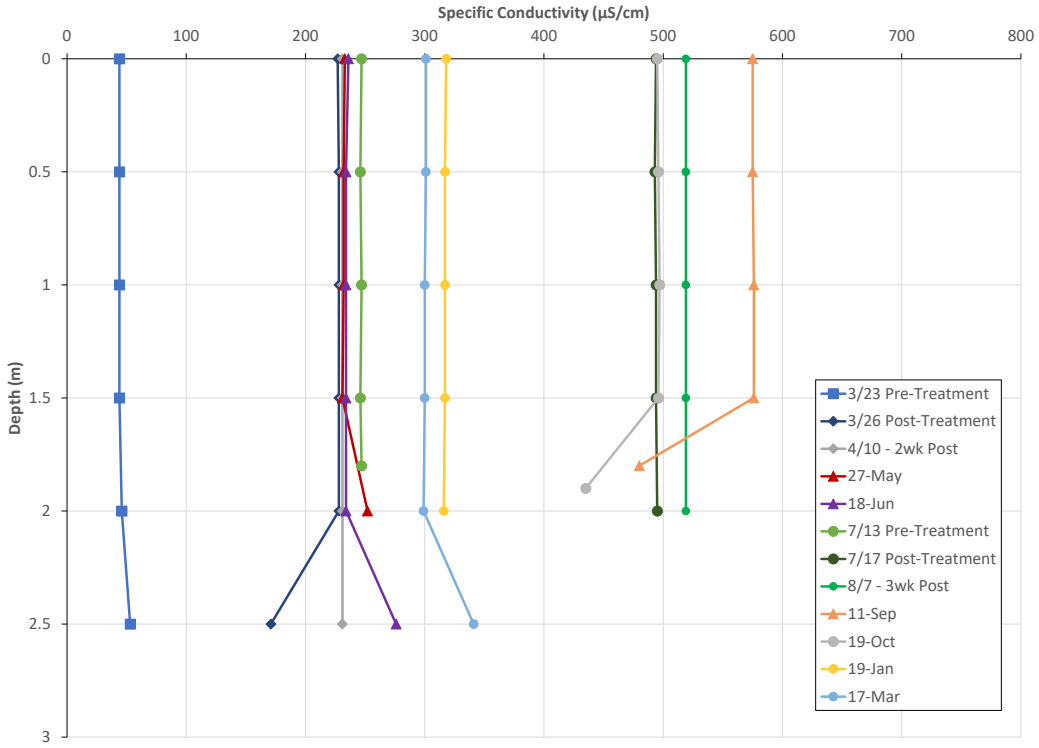

Figure 19. Conductivity profiles in Waughop Lake in 2020 and January/March 2021.

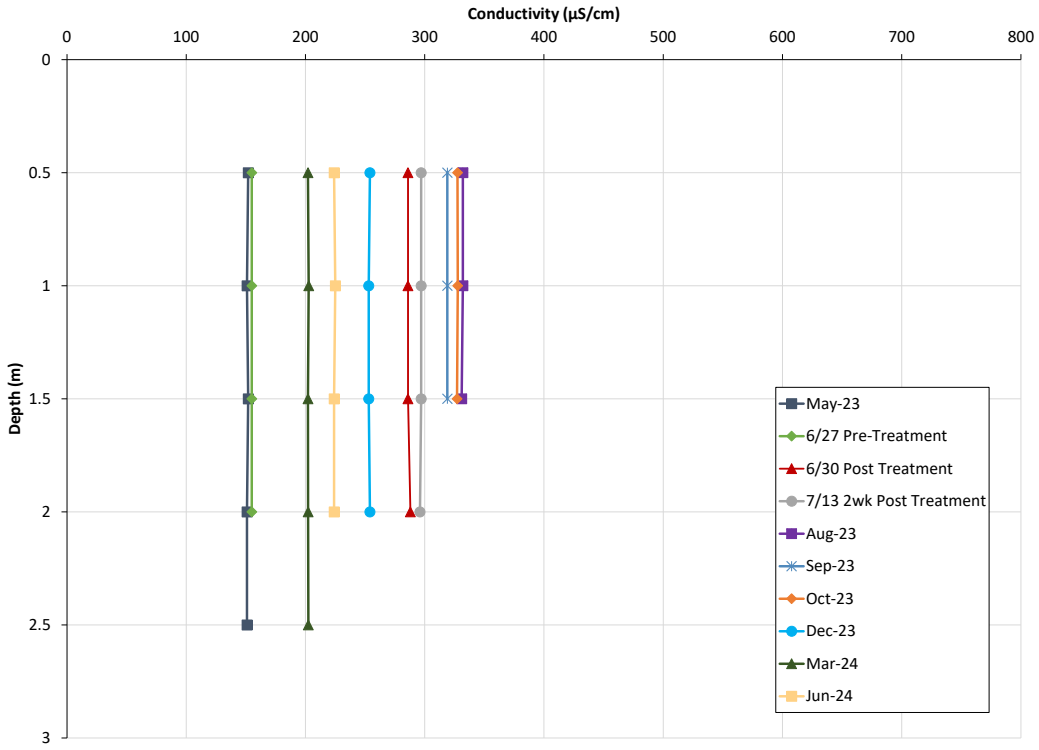

Figure 20. Conductivity profiles in Waughop Lake in 2023 and March/June 2024.

6.3 WATER CLARITY

Water clarity, or transparency, was measured with a Secchi disk during each monitoring event and numerous times during each alum treatment. Prior to the first alum treatment in March 2020, water clarity at Waughop Lake was less than 1 m at the mid-lake station. After the first day of treatment with alum, water clarity had increased to 1.7 m, and after completion of the March alum treatment, water clarity had increased such that the Secchi disk was visible at the bottom of the lake at 2.5 m depth. The high level of clarity was maintained throughout the summer of 2020 and the Secchi disk continued to be visible at the bottom of the lake. All measurements of water clarity from March 25 through October 19, 2020, were recorded at the bottom of the lake, varying between 1.45 to 2.5 m depending on location and date. Water clarity at Waughop Lake in 2020 is shown in Figure 21. The apparent decreasing trend from July to October 2020 is a representation of the decreasing lake level and does not represent a decline in water clarity. Higher levels of water clarity corresponded with lower observed chlorophyll concentrations and a reduction in algal production due to the alum treatments.

The increase in water clarity was persistent throughout 2020 and early 2021 (Figure 21). In March 2021, the Secchi disk was not visible all the way to the lake bottom for the first time since the March 2020 alum treatment. The slight decrease in water clarity observed in March 2021 is likely due to the seasonal winds and storm events resulting in some sediment mixing and resuspension, as well as spring algal activity. The lake bottom sediments are known to be very loose and observed to be easily resuspended in the water column.

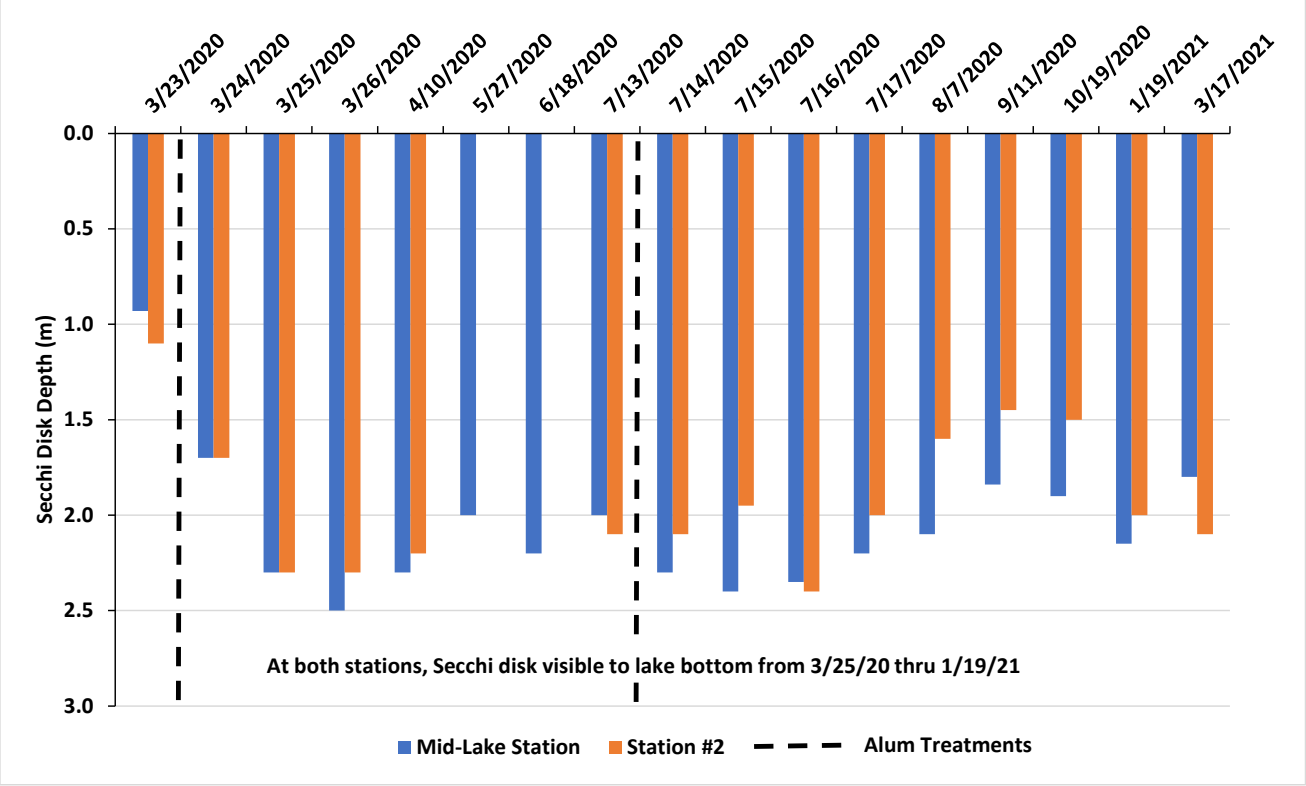

Figure 21. Secchi disk depth (water transparency) in Waughop Lake during 2020 and January/March 2021.

Water clarity in Waughop Lake during the summers of 2021 and 2022 was substantially less than in 2020 (Figure 22). May – October average Secchi disk depth was 1.2 m in 2021 and 0.92 m in 2022, compared to an average of

2.1 m in 2020. Chlorophyll concentrations were still significantly reduced from pre-treatment conditions in 2021 but increased during the summer of 2022 which most likely influenced water transparency.

Water clarity was less than 1 m deep at the mid-lake station prior to the June 2023 alum treatment (Figure 23). As was the case in 2020, after the first day of treatment with alum, water clarity had increased significantly to 2.2 m, and after completion of the treatment, water clarity had increased such that the Secchi disk was visible at the bottom of the lake (Figure 23). The high level of clarity was maintained throughout most of the summer of 2023 and the Secchi disk continued to be visible at the bottom or near the bottom of the lake through September. Average May to October Secchi disk depth for 2023 was 1.6 m. Water clarity decreased substantially in October and December 2023, with corresponding high concentrations of chlorophyll, back to less than 1 m. Water clarity remained low in March and May 2024 before increasing in early June (Figure 23). May to October average Secchi disk depth in 2024 was low compared to previously years at just 0.81 m.

There is a strong relationship between water clarity and chlorophyll concentrations and algal production in Waughop Lake. The photic zone in lakes, the zone where there is enough light for algal production, is typically around three times the Secchi disk depth. At times throughout the summer season, due to the shallowness of the lake, the majority of the water column in is in the photic zone. Higher levels of water clarity in Waughop Lake corresponded with lower observed chlorophyll concentration and a reduction in algal production following all three alum treatments. There is also a relationship between water clarity and lake water levels. In all years, there is a decrease in water clarity in the fall which is typically when the lake experiences its lowest water levels. Decreased water clarity in October 2023 corresponded with the lowest lake levels recorded and sediment resuspension, given the very shallow water depths, could have contributed to decreased clarity.

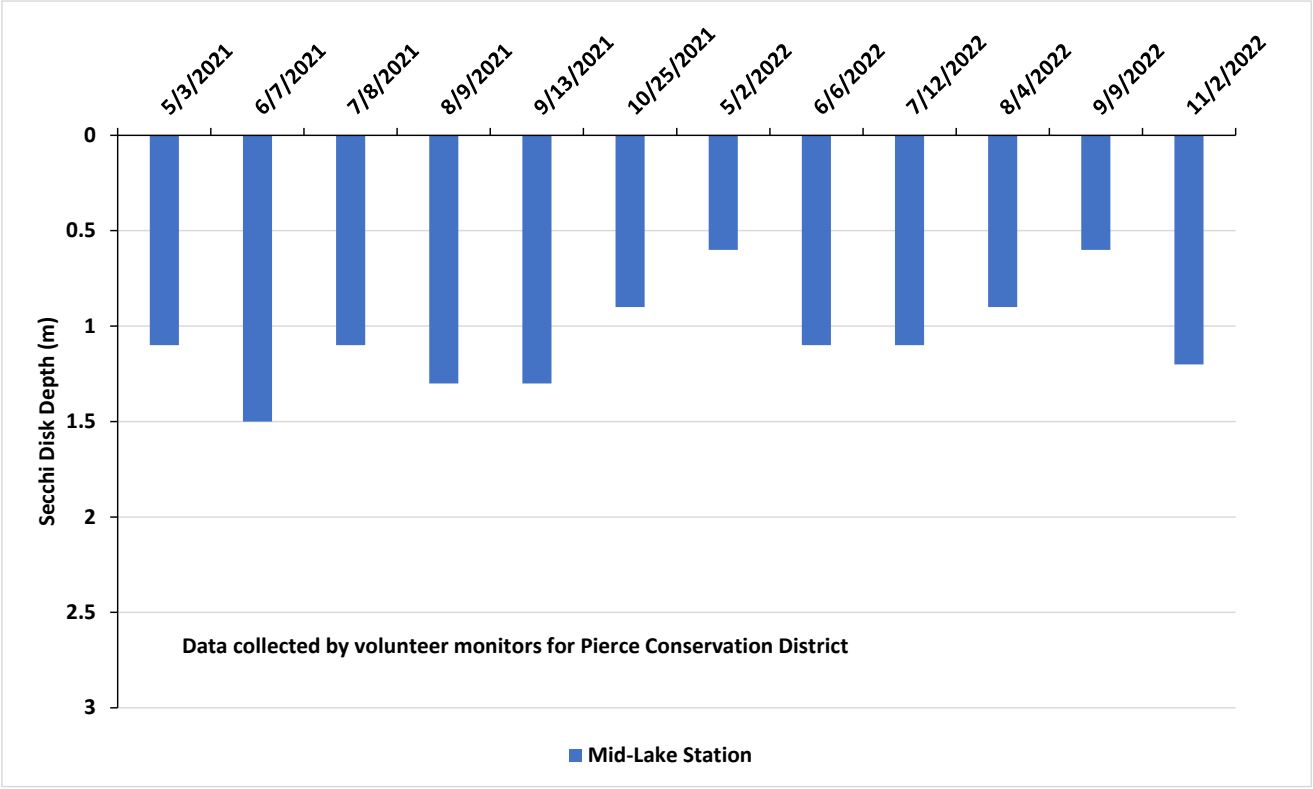

Figure 22. Secchi disk depth (water transparency) in Waughop Lake during 2021 and 2022.

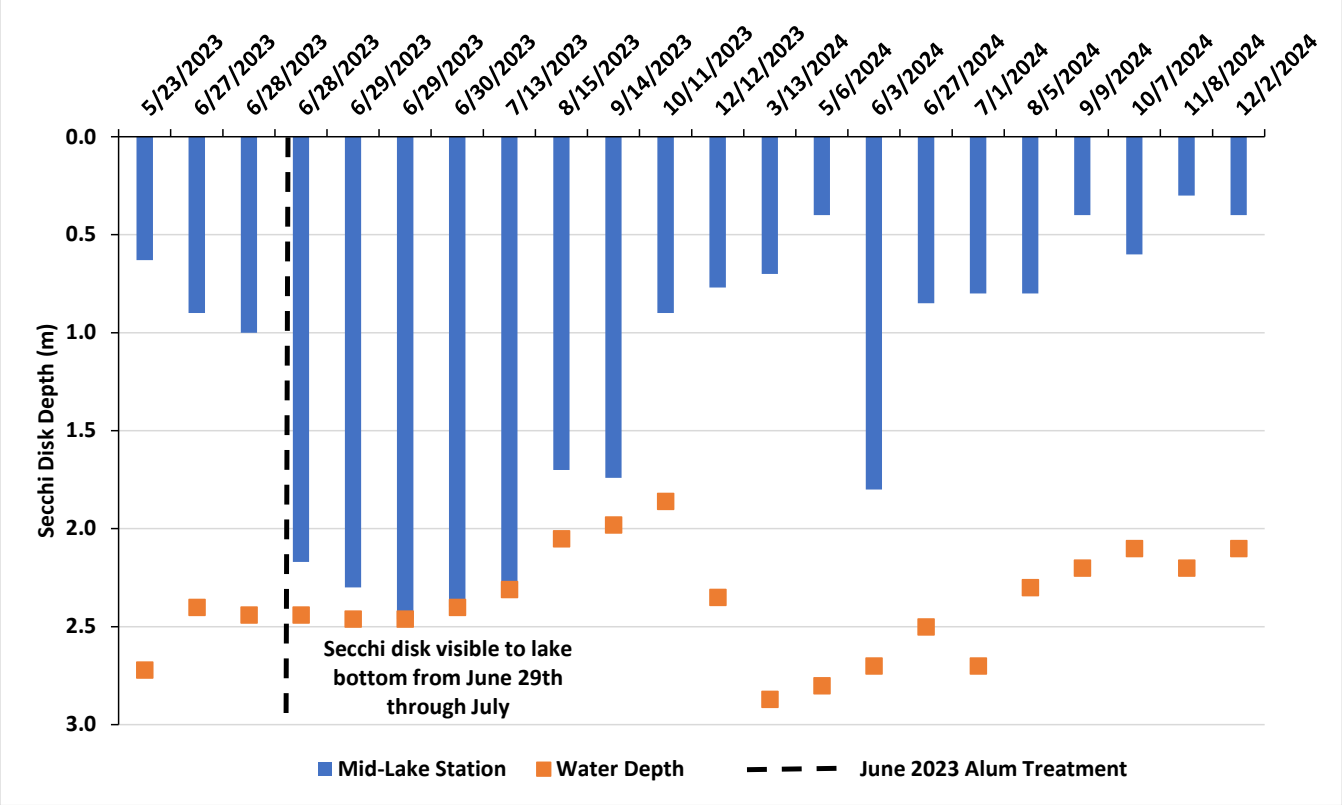

Figure 23. Secchi disk depth (water transparency) in Waughop Lake during 2023 and 2024.

6.4 TOTAL AND SOLUBLE PHOSPHORUS

6.4.1 Total Phosphorus

Prior to the March 2020 alum treatment, the average total phosphorus (TP) concentration in Waughop Lake was 89 µg/L. Total phosphorus concentrations at the mid-lake station prior to treatment were 85 and 96 µg/L at 1 m and 1.5 m depths, respectively (Figure 24). At Station #2, TP concentrations were 90 and 85 µg/L at 1 m and 1.5 m depths, respectively (Figure 24). Total phosphorus concentrations measured in Waughop Lake prior to the March 2020 alum treatment were similar to concentrations measured in previous year by various other entities. Total phosphorus concentrations in Waughop Lake during October 2014 through October 2015 ranged from 34 to 170 µg/L (Brown and Caldwell, 2017). According to the Waughop Lake Management Plan, TP concentrations during the 2014-2015 study were similar to concentrations measured by LaFontaine in 2007 which were as high as 85 µg/L (LaFontaine, 2012). Samples collected by PCD between 2011 and 2014 had an average TP of 61 µg/L with a maximum of 130 µg/L (Brown and Caldwell, 2017). Summer average TP concentrations above 30 µg/L are considered indicative of eutrophic, or overly productive, conditions (Welch and Jacoby, 2004; Nürnberg, 1996). To limit the risk of cyanobacteria dominance and potential presence of cyanotoxins in a waterbody, lake TP concentrations should remain below 30 µg/L (Downing et al., 2001).

Immediately after the March 2020 alum treatment, water column TP was reduced by 75 to 82% to an average of 13 µg/L (Figure 24). A gradual increase in TP was observed from April to July corresponding to warmer weather and increasing lake productivity. In July, one day before beginning the second alum treatment, the average lake TP was 29.4 µg/L, which was the highest average TP recorded in 2020, but still only one third of the pre-treatment

TP concentrations. Total phosphorus immediately decreased following the July alum treatment to 5 ug/L, and two weeks after treatment, TP was 11.4 ug/L. The general trend of increasing TP throughout the summer—decreasing only due to alum treatments—is consistent with seasonal productivity and the lowering of water level in the lake which had a concentrating effect due to lower lake volumes. However, despite these effects, water column TP concentrations remained in the target range of less than 35 µg/L for the duration of the post-treatment monitoring in 2020.

Total phosphorus concentrations in January and March 2021 were consistent with post-treatment levels observed in 2020. Starting in May 2021, TP concentrations increased and fluctuated between 26 and 44 µg/L throughout the summer of 2021 with an average TP over the summer of 35 µg/L (Figure 24). Total phosphorus concentrations in May – October 2022 were higher than those observed in 2021 and ranged from 30 µg/L to 290 µg/L (Figure 24). The very high TP concentration of 290 µg/L on July 12th, 2022, is suspected to be an outlier, however a similar spike in TP was also observed in June 2024 and was attributed to wind driven sediment resuspension during an incredibly windy day. So, the spike observed in July 2022 could have also been due to low water levels and subsequent wind sediment resuspension. Regardless, there was a general trend of increasing water column TP concentrations in the lake between 2021 and 2022, with the majority of samples having TP concentrations above the target range of less than 35 µg/L.

In May and June 2023, prior to the 2023 alum treatment, the average TP concentration in Waughop Lake was 42 µg/L (Figure 24). Similar to conditions in 2020, immediately after the June 2023 alum treatment, water column TP was reduced by 79% to 9 µg/L. A gradual increase in TP concentration was observed from July to October 2023 corresponding to warmer weather and the lowering of water level in the lake which had a concentrating effect on TP due to lower lake volumes. Despite the extreme low water levels and decreased lake volume, water column TP concentrations remained in the target range of less than 35 µg/L for most of the summer and early fall 2023. Although TP had increased to around 40 µg/L in October and December 2023, concentrations during the growing period in 2023 (July through September) were lower than in 2022 and much lower than TP observed in March 2020 prior to any alum treatments.

Total phosphorus concentrations increased in May 2024, up to around 50 µg/L, and remained elevated throughout the summer season and into the fall and early winter (Figure 24). Total phosphorus concentrations in November and December 2024 were similar to those measured in May, 52 and 51 µg/L, respectively. As mentioned earlier, there was a spike in TP concentration measured on June 27th, 2024 which was thought to be the result of low water levels and wind driven sediment resuspension, especially given that the TP concentrations measured on June 3rd and July 1st, just a few days after the 27th, were 37 and 41 µg/L, respectively. The source of phosphorus contributing to increasing TP concentrations in the lake is unknown. Most likely the major phosphorus loading source is from groundwater, but it could also be from localized runoff and stormwater inputs. During the summer months however groundwater inputs are assumed to be negligible and increases in TP concentration are due to either a concentrating effect of lower lake volume or internal loading from the sediments. If internal loading was occurring during the summer, there would be a corresponding increase in the total mass of phosphorus in the lake and not just an increase in concentration. An increase in TP concentration can be observed simply because the amount of water in the lake is less (concentration is mass divided by water volume - µg of phosphorus / volume of water).

To help further evaluate phosphorus in Waughop Lake, even with decreasing water levels during the summer, which had a concentrating effect on TP concentration, the mass of TP in the whole lake was calculated for each sampling event using estimated lake volumes and TP concentrations. To calculate TP mass, the concentration of TP on each sampling day was multiplied by the estimated lake volume for that day and then converted to kilograms (kg). Figure 25 shows the mass of TP in Waughop Lake for sampling events that had water level recorded to estimate lake volume. Total phosphorus mass was not calculated for the sampling event in July 2022 that had a very high TP concentration as it is believed to be an outlier. Total phosphorus mass in Waughop Lake

decreased dramatically, as expected, following the first alum treatment in March 2020 as well as the alum treatment in July 2020. The mass of TP in the lake remained low through most of 2021 then increased to above 10 kg during 2022 and 2023. Following the June 2023 alum treatment, TP mass in the lake was dramatically reduced and remained at 5 kg or below until October 2023. From October 2023 through May 2024 there was a small increasing trend in TP mass in the lake. This was most likely due to increasing inflows and external or groundwater loading of phosphorus into the lake.

During the summer of 2024, TP mass was stable and generally below 10 kg with the exception of the one high TP concentration measured in June on the windy day (Figure 25). The high TP concentrations in June was mostly likely due to sediment resuspension into the water column due to wind and the shallowness of the lake. The stability and slightly decreasing trend of the mass of TP in the lake over the summer of 2024 shows that lowering water levels and decreased lake volume did have a concentrating effect on TP concentration as TP concentrations increased over the summer period, but TP mass did not (Figures 24 and 25). In October 2024, there was a slight decrease in TP mass, possibly due to settling, before TP mass increased slightly in November and December 2024. Lake level also increased slightly in November and December 2024 so this increase in TP mass was mostly likely due to increasing inflows and external loading. In December 2024, the TP mass in the lake was around 8.4 kg which is much lower than the TP mass in the lake in March 2020 (23 kg) prior to any alum treatment (Figure 25).

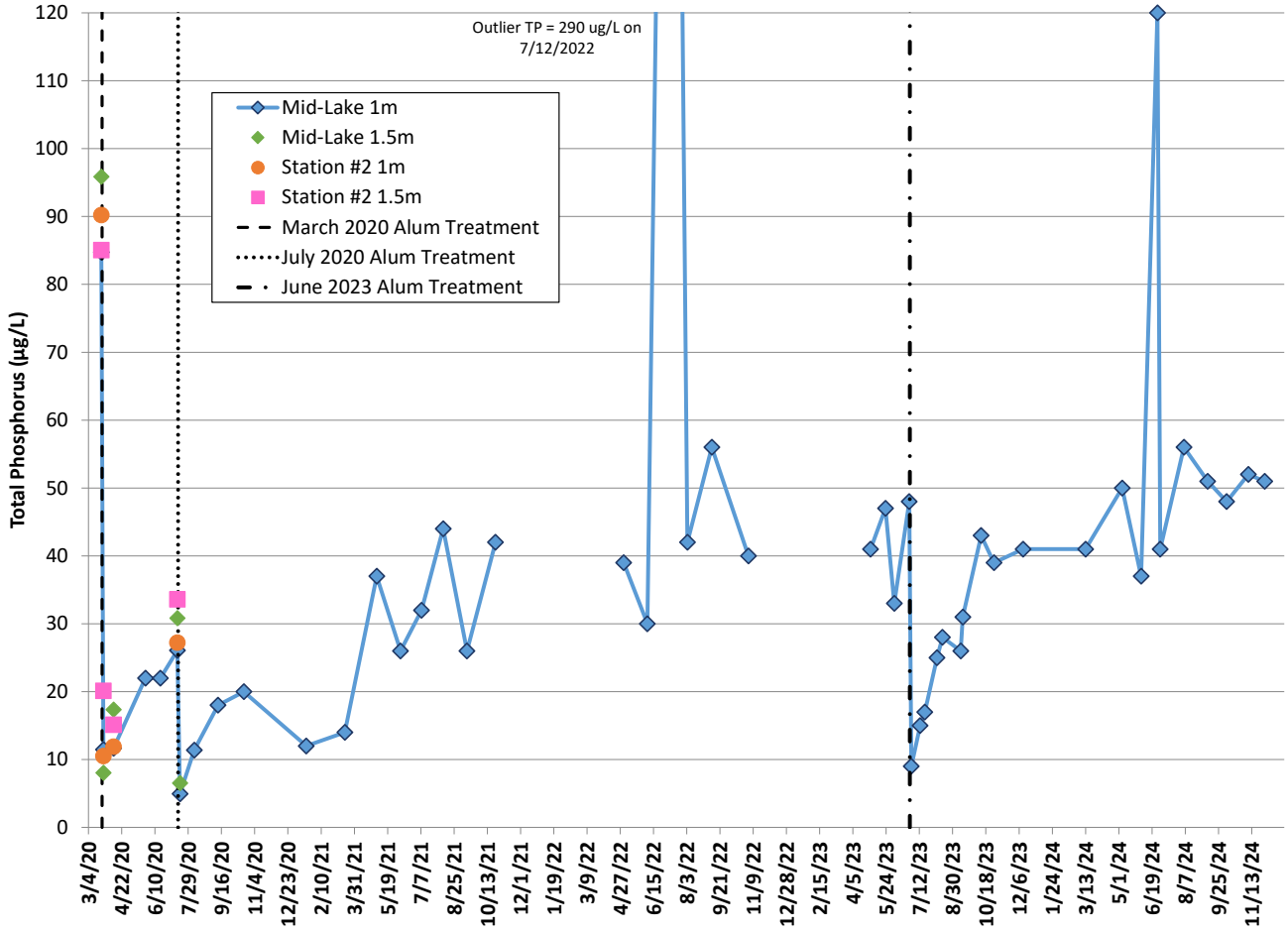

Figure 24. Total phosphorus concentrations in Waughop Lake in 2020 -2024.

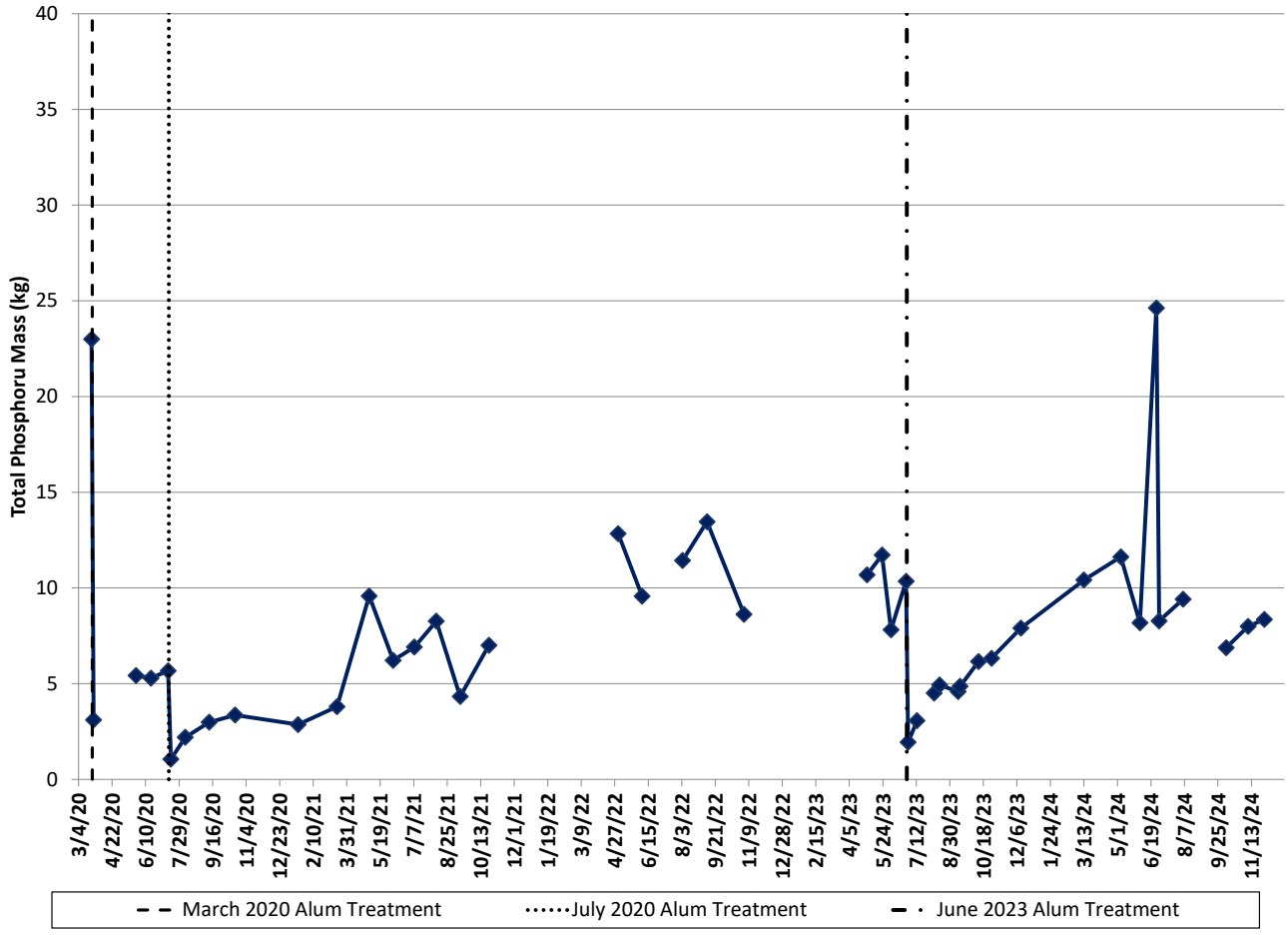

Figure 25. Total phosphorus mass in Waughop Lake 2020 – 2024.

6.4.2 Soluble Phosphorus

Soluble Reactive Phosphorus (SRP) was relatively low prior to the March 2020 alum treatment, ranging from 3 to 5 µg/L. Most likely SRP concentrations were low due to algal uptake and algal productivity as this is the fraction that is most available for algal uptake. Nevertheless, a significant reduction in SRP to below the detection limit of 1 µg/L was observed after the March 2020 treatment and SRP concentrations were consistently less than 1 µg/L throughout the summer and fall of 2020. Samples were not collected for SRP analysis in January and March 2021 however SRP concentrations measured in samples collected May – October 2021 and 2022, were consistently at or below the detection limit of 1 µg/L. On occasion during those two summers, SRP concentrations measured at just above the detection limit at 2 µg/L.

In 2023, prior to the June alum treatment, SRP concentrations in the lake were still low and ranged from below the detection limit to 2 µg/L. There was not a significant change in SRP concentrations following the treatment and concentrations during the rest of the summer in 2023 ranged from below the detection limit to 3 µg/L.

Soluble phosphorus concentrations in 2024 were slightly higher than those in 2023, ranging from below the detection limit to a maximum of 7 µg/L measured in May 2024. During the summer (June – September) of 2024,

SRP was below the detection limit or just slightly higher at 2 µg/L. In October 2024, SRP increased to 5 µg/L, before decreasing again to below or near the detection limit in November and December 2024.

6.5 CHLOROPHYLL-A

Prior to the March 2020 alum treatment, the average chlorophyll concentration in Waughop Lake was 52 µg/L (Figure 26). There was some slight variability in chlorophyll concentrations in the lake prior to treatment with concentrations ranging from 45 µg/L at 1 m depth at Station #2 to 81 µg/L at 1.5 m depth at the mid-lake station. Immediately after the March alum treatment, the chlorophyll concentration was dramatically reduced to an average of 1 µg/L. This reduction in chlorophyll in the water column reflects the physical removal of algae from the water column as a result of the alum treatment and represents a shift from a highly productive hypereutrophic state to a borderline oligotrophic-mesotrophic state (Welch & Jacoby, 2004). A slight increase in chlorophyll was observed from April to July corresponding to increasing lake productivity, but concentrations were still less than 10 percent of the concentrations in March prior to the first treatment and were mostly less than 5 µg/L. After the July 2020 alum treatment, chlorophyll concentrations were consistently low, ranging from 0.4 to 4.5 ug/L throughout October 2020 even with the concentrating effect of the lowering water level in the lake. These chlorophyll concentrations indicate the lake remained in a borderline oligotrophic-mesotrophic state in 2020.

There was a slight increase in chlorophyll observed from October 2020 to March 2021, from 2.5 to around 5.5 µg/L (Figure 26). Chlorophyll concentrations during the summer of 2021 remained below the eutrophic boundary of 9.0 µg/L and reflected more of a mesotrophic, or well-balanced system. However, there was a large increase in chlorophyll in October 2021 when concentrations peaked at 33 µg/L. Chlorophyll concentrations were also elevated in the lake at the start of the growing season in May 2022 and were generally higher in 2022 than in 2021. During June - October 2022, chlorophyll concentrations fluctuated over the season and ranged from 5.9 to 22 µg/L (Figure 26). On July 25th and August 15th, 2022, samples were collected from Waughop Lake and analyzed for cyanotoxins by King County Environmental Laboratory due to the presence of a noticeable bloom. The sample from July 25th had a detection for microcystin (0.225 µg/L) but well below the state recreational guideline of 8 µg/L. The sample collected on August 15th also had a small detection of microcystin (0.190 µg/L) which was well below the state guideline. Anatoxin-a was not detected in either sample collected in 2022.

Spring chlorophyll concentrations in 2023 were similar to those measured in 2022. The average chlorophyll concentration in Waughop Lake in May and June 2023, prior to the alum treatment, was 12.5 µg/L (Figure 26). Immediately after the June alum treatment, the chlorophyll concentration was dramatically reduced to 0.7 µg/L. As was the case in 2020, this reduction in chlorophyll in the water column reflected the physical removal of algae from the water column as a result of the alum treatment. Chlorophyll concentrations remained low, averaging 5.4 µg/L for the remainder of the summer, July through September 2023 (Figure 26). These chlorophyll concentrations indicate the lake remained in a mesotrophic state (moderately productive) through the summer. There was an increase in chlorophyll in October 2023, which may have been the result of the concentrating effect of lowering water level of the lake, but chlorophyll was also high in December, when water level had started to increase. Precipitation and groundwater recharge also increased in December which may have aided in phosphorus and nitrogen bioavailability. The chlorophyll concentration in December was 54 µg/L, which was very high compared to concentrations measured since the 2020 alum treatment. The lake was green in color in December 2023, but field crews did not observe a scum or any indication that the algae present was cyanobacteria. The algae observed in December 2023 appeared to be green algae.

Chlorophyll concentrations remained elevated in 2024 with a maximum concentration of 67 µg/L observed in March 2024 (Figure 26). This concentration is similar to concentrations observed prior to the 2020 alum treatments. Following the peak in March, chlorophyll concentrations during May through October 2024 averaged 20 µg/L. The chlorophyll concentration increased in November 2024 to just under 50 µg/L, which is consistent with the low water clarity (Secchi disk depth of only 0.3 m). In December 2024, the reported chlorophyll

concentration was 109 µg/L, which is considered to be an outlier and suspect data point. The very high chlorophyll concentration is inconsistent with the measured TP concentration in December of 51 µg/L and results in a chlorophyll to TP ratio of 2.1 to 1. Typical chlorophyll to TP ratios range from 0.3 to 0.6 and can reach as high as 1 to 1.5 in hypereutrophic waterbodies. The sample collected in December by PCD volunteer monitors may have accidentally contained a large portion of algal scum or algal mat that could have artificially inflated the chlorophyll concentration. The December chlorophyll concentration is included in Figure 26 below but not considered to be a valid data point.

In May 2024 there was concern that the lake had a large bloom of a small species of cyanobacteria, either *Synechocystis* or *Gloeothece.* A sample was collected and sent to the King County Environmental Laboratory for cyanotoxin analysis on May 8th, 2024. A sample was also collected in mid-May by City staff and shipped to Dr. Barry Rosen, a phycologist at Florida Gulf Coast University, for algal identification. Neither microcystin nor anatoxin-a was detected in the sample and microscopy conducted by Dr. Rosen revealed that there were no cyanobacteria species present in the lake. Dr. Rosen identified that the dinoflagellate *Parvodinium* was abundant in the lake as well as two species of green algae, *Chlamydomonas* and *Tetraedron*.

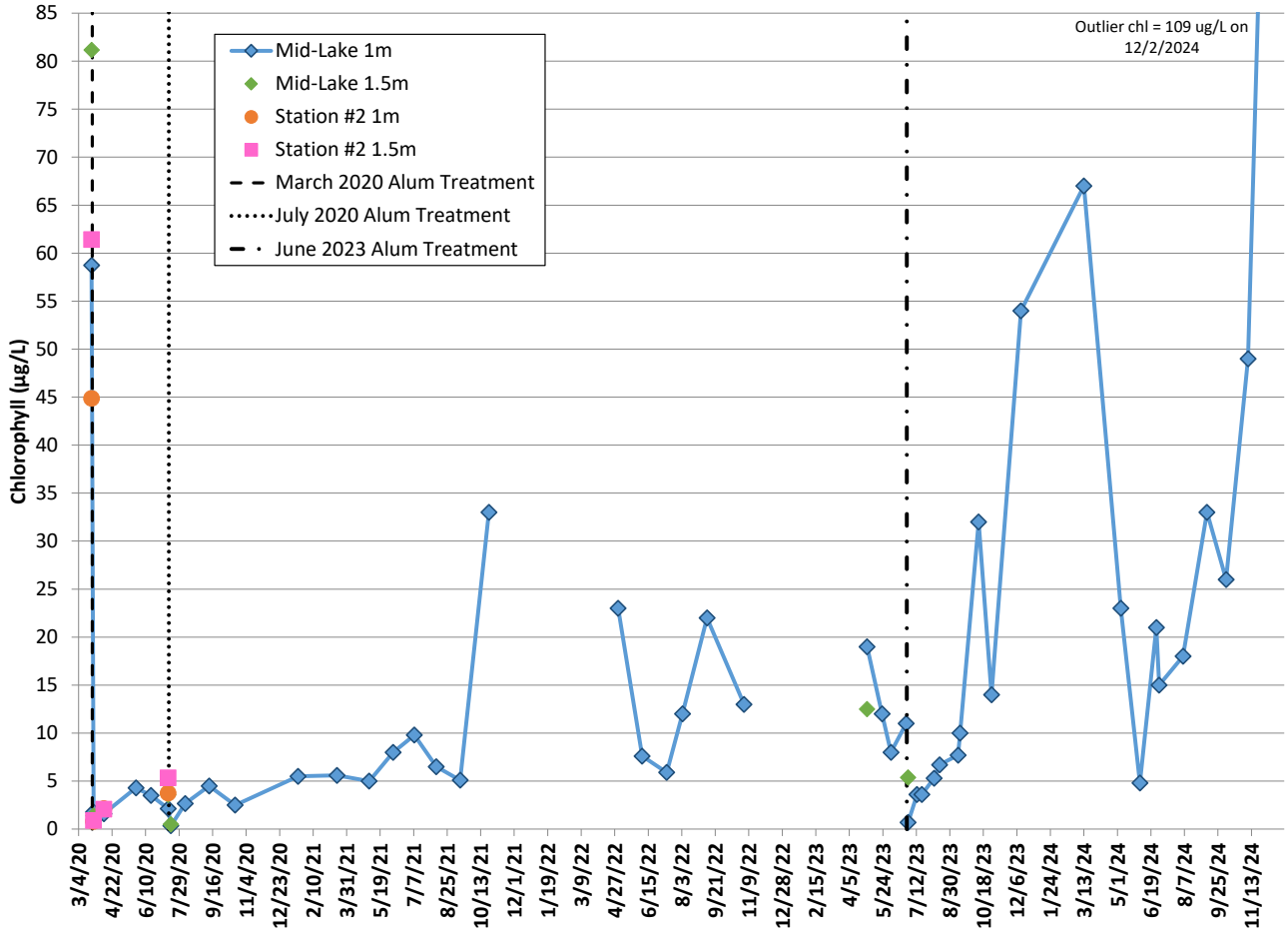

Figure 26. Chlorophyll concentrations in Waughop Lake in 2020 – 2024.

6.6 NITROGEN

The average total nitrogen (TN) concentration in Waughop Lake prior to the March 2020 alum treatment was 1,650 µg/L (Figure 27). Following the March treatment, TN was reduced by 70% from pre-treatment

concentrations due to its tie to organic compounds. There was an immediate, temporary decrease in TN observed following the July 2020 alum treatment but TN concentrations returned to near post March treatment concentrations by early August 2020 and remained relatively steady through the end of monitoring in October 2020 (Figure 27). Nitrate and nitrite concentrations were also reduced following the March treatment, by 25 to 50%. The average nitrate and nitrite concentration in the lake prior to treatment was 48 µg/L. The average nitrate and nitrite concentration in the lake following treatment, through October 2020, had decreased to 17 µg/L.

In January 2021, a temporary increase in TN concentration was observed from the relatively steady post-treatment levels in 2020. However, the January 2021 concentration (1,160 µg/L) was still lower than the March 2020 pre-treatment TN concentrations. After the temporary increase in TN in January, concentrations decreased to 527 µg/L, only slightly higher than the post-treatment 2020 concentrations, by March 2021 (Figure 27). The general trend of lower TN concentrations after the 2020 alum treatments is likely a response to the reduction in biogenic production due to phosphorus inactivation.

Total nitrogen concentrations fluctuated with a general increasing trend through the summers of 2021 and 2022. Concentrations ranged from 206 µg/L in September 2021 to 1,170 µg/L in June 2023, right before the 2023 alum treatment (Figure 27). Seasonal fluctuations of TN was anticipated based on plant and algal productivity, as well as external nitrogen loading from groundwater and direct precipitation.

After the 2023 alum treatment, TN was reduced by 46% from a pre-treatment average concentration of 1,060 µg/L to an immediate post-treatment average concentration of 545 µg/L (Figure 27). Total nitrogen concentrations remained reduced through July 2023 then started to increase to near pre-treatment concentrations in August. In December 2023, TN had returned to pre-treatment levels at 1,040 µg/L. Total nitrogen remained high and generally increased through 2024 (Figure 27). Nitrate and nitrite concentrations were at or near detection limits (10 µg/L) prior to the 2023 treatment and remained stable throughout the monitoring period with the exception of a slight increase to 17-19 µg/L, measured the day after treatment.

Alum does not specifically target nitrogen species in the water column or sediment. The reductions in nitrogen following each alum treatment was due to its tie with organic compounds in the water column which are physically removed with the alum floc. It is not uncommon to see a temporary reduction in nitrogen following an alum treatment followed by a rebound back to pre-treatment concentrations.

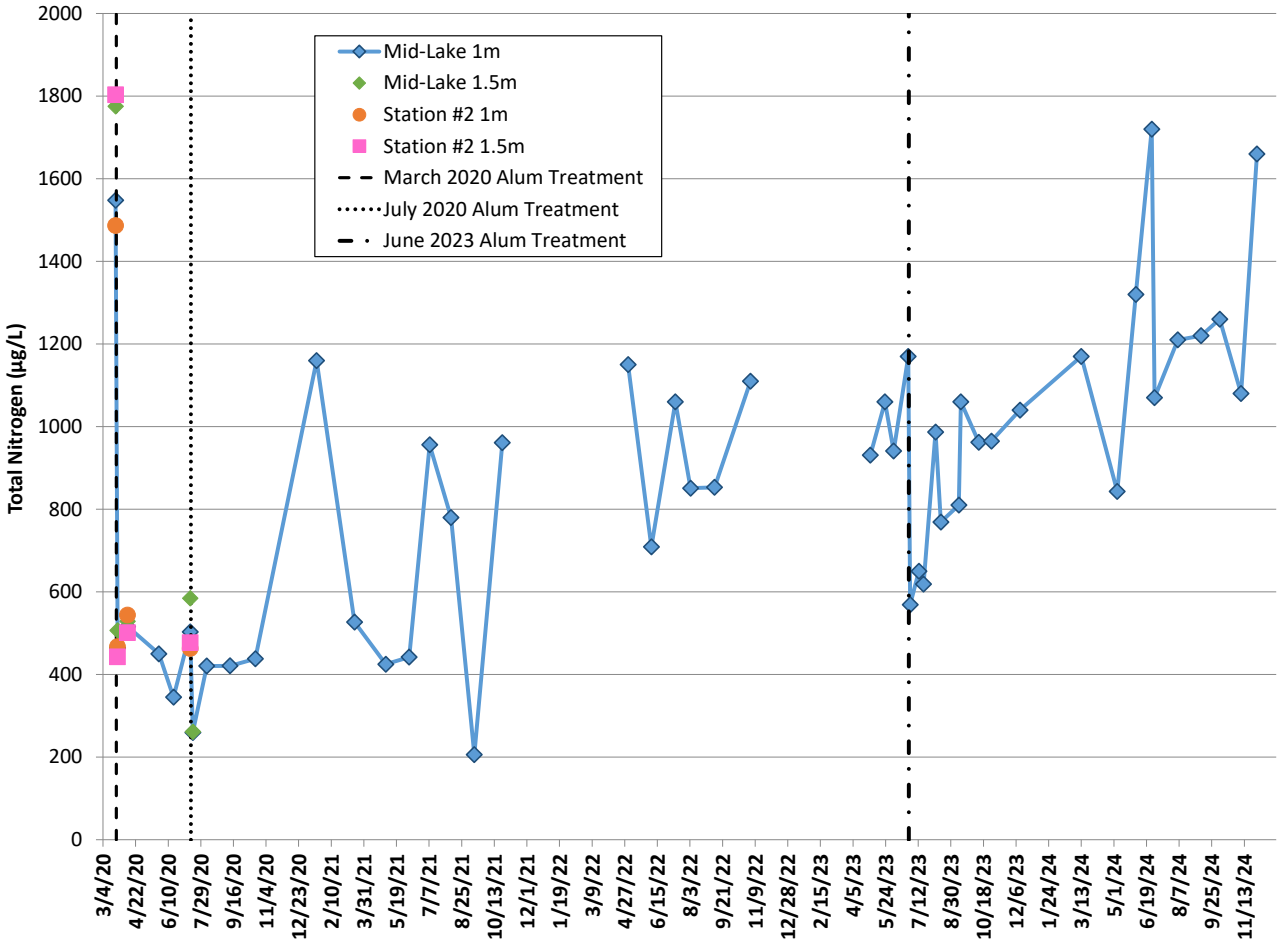

Figure 27. Total nitrogen concentrations in Waughop Lake in 2020 – 2024.

6.7 ALKALINITY

Lake alkalinity (as calcium carbonate) was significantly reduced following each alum treatment, which is expected following an alum treatment given that alum is an acidic compound. Alkalinity decreased by 50 percent to a low of 10 mg $CaCO_3$/L following the March 2020 alum treatment and then gradually increased to pre-treatment levels of 20 mg $CaCO_3$/L by July. A reduction in alkalinity was again observed following the alum treatment in July 2020, but a return to pre-treatment levels was achieved by October (Figure 28). The lowest alkalinity recorded in 2020 was 6.3 mg $CaCO_3$/L in September, reflecting the slower rebound following the July alum treatment. The observed reduction and slower rebound of alkalinity following each 2020 alum treatment is a direct result of the low build-up of alkalinity that normally occurs in lakes due to surface runoff and stream inflow. Given the lack of surface water input of calcium and carbonate, the only source to Waughop Lake is from atmospheric fallout which is very low in the Puget Sound region. Hence with the hydration of Al there is a reduction in reserve carbonate to help the alkalinity rebound like in other lakes.

January 2021 samples were not analyzed for alkalinity, but the March 2021 concentration of 15 mg $CaCO_3$/L indicated only a slight decrease in lake alkalinity when compared to the October 2020 concentration and pre-

treatment concentration in March 2020 (Figure 28). The slight decrease is likely tied to the dramatic increase of water level in the lake over the winter season which had a diluting effect due to higher lake volumes.

Over the course of 2021 and 2022, lake alkalinity steadily increased (Figure 28). Towards the end of 2021 and during 2022, alkalinity in the lake increased dramatically from pre-treatment concentrations in 2020 of around 20 mg $CaCO_3$/L. Maximum alkalinity in 2022 and 2023 prior to the June 2023 alum treatment was 58.2 mg $CaCO_3$/L. It is unknown what caused the increase in alkalinity at the end of 2021 and during 2022 but it could be the result of higher-than-normal inflows from groundwater and precipitation. Water levels during the end of 2021 and 2022 were also higher than typical indicating increased inflows.

As previously observed with the 2020 treatments, alkalinity was significantly reduced following the June 2023 alum treatment. Alkalinity decreased from a pre-treatment average of around 53 mg $CaCO_3$/L to an average of around 38 mg $CaCO_3$/L. Alkalinity in the lake remained stable, at around 30 mg $CaCO_3$/L for most of the summer and then gradually decreased over the fall and winter of 2023. A sharp increase in lake alkalinity was observed between the beginning of May 2024 to end of June 2024 with the last measured concentration reaching 47.2 mg $CaCO_3$/L in November 2024 (Figure 28).

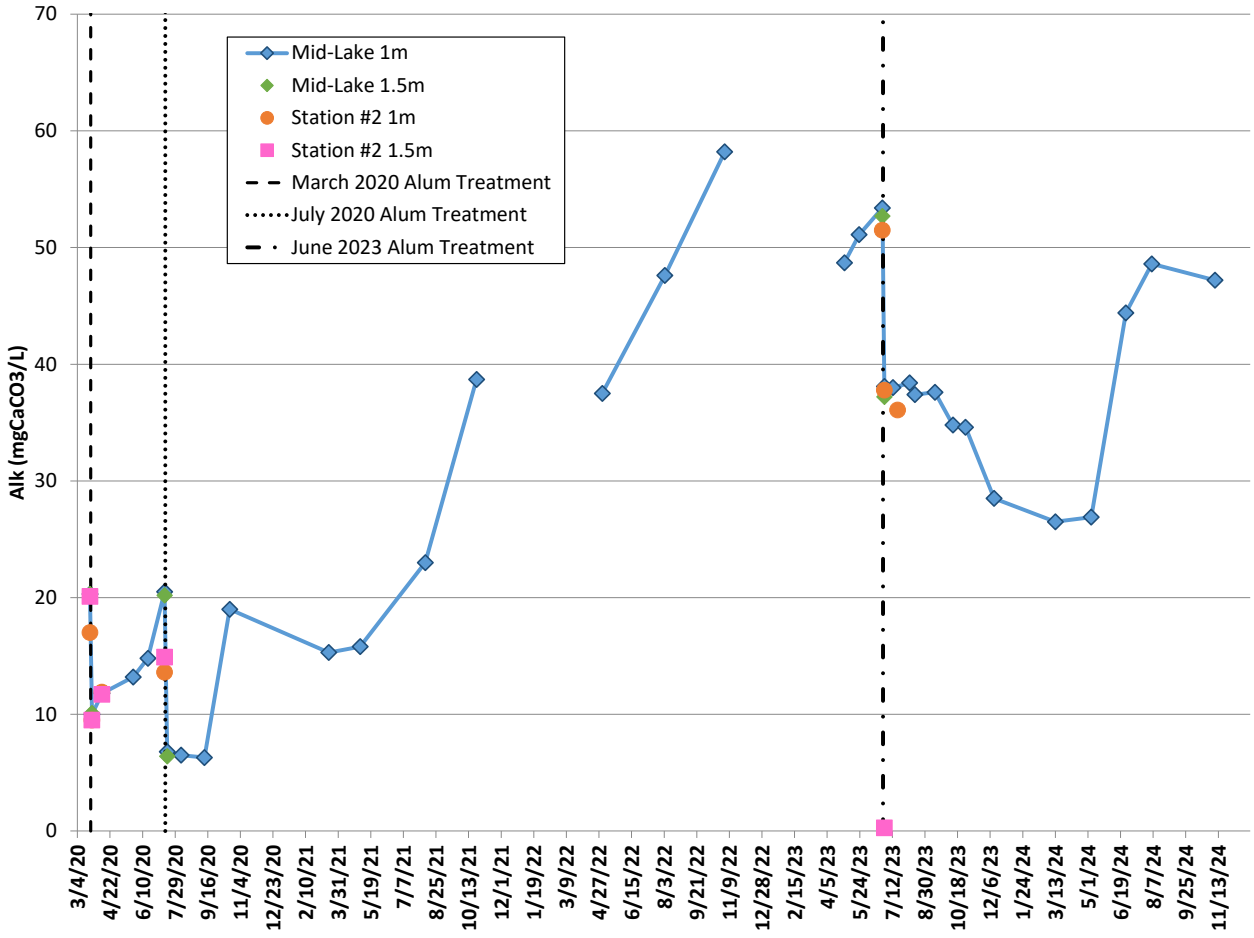

Figure 28. Alkalinity in Waughop Lake in 2020 – 2024.

6.8 SULFATE

Sulfate concentrations in Waughop Lake increased following the alum treatments. At a depth of 1 m at the mid-lake station, sulfate concentrations ranged from a low of 1.5 mg/L before the March treatment to a high of 245 mg/L in September after treatments (Figure 29). Due to the lack of inflow and outflow from the lake, a temporary increase in sulfate was expected. The normal settling of the sulfate following alum treatments was observed to be slower given that there is no outlet and no flushing. In addition, the high levels of sulfate in the sediment contributed to the observed increase as sulfate was likely entering the water column to replace the loss of negative carbonate ions with the reduction in alkalinity. As expected, sulfate again increased after the July 2020 treatment. A decrease in sulfate was observed from September to October 2020 with an increase in fall inflow to the lake.

Sulfate concentrations continued to decrease during the winter season of 2020 as expected with the seasonal increase in groundwater inflow to the lake. In May 2021 the concentration of sulfate in the lake at 1 m depth was 22.1 mg/L, still higher than the pre-treatment concentrations in March 2020, but significantly lower than the high concentration of 245 mg/L measured in September 2020 (Figure 29). Sulfate was only analyzed for a handful of samples collected over the summers of 2021 and 2022. There was an unexplained dramatic increase in sulfate concentration between May 2021 and August 2021 when the sulfate concentration in the lake at 1 m depth reached 133 mg/L. Following that increase sulfate concentrations in the lake declined steadily to a low of around 26 mg/L immediately prior to the June 2023 alum treatment (Figure 29). Following the 2023 alum treatment, sulfate increased, as expected, to around 92 mg/L. Sulfate remained elevated through December 2023 but as was observed in previous years, a reduction in sulfate was expected as groundwater flow increased over the winter. Sulfate concentrations did decrease from December 2023 to March 2024 and remained around 50 mg/L throughout 2024 (Figure 29). In December 2024 the concentration of sulfate had decreased to 38.2 mg/L (Figure 29).

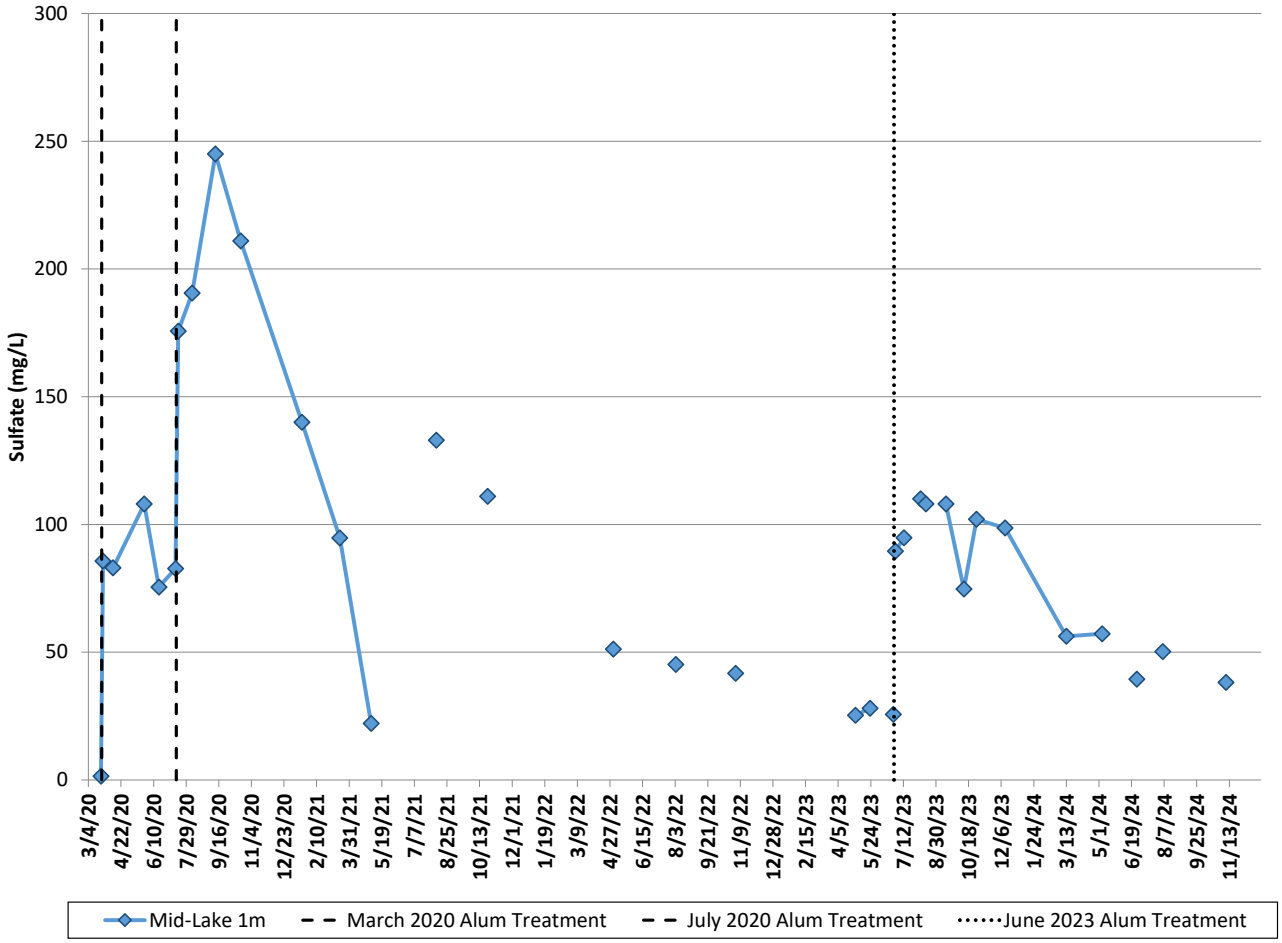

Figure 29. Sulfate concentrations in Waughop Lake at 1 m depth at the mid-lake station in 2020 – 2024.

6.9 TOTAL SULFIDES

Prior to the June 2023 alum treatment, Ecology required that the City collect samples as part of their permit monitoring in Waughop Lake for analysis of total sulfides. Samples were collected by Tetra Tech for total sulfides analysis beginning the day before treatment, on June 27th, 2023. Samples were collected at a depth of 1 m and at a depth of 0.5 m off the bottom, if water depths allowed. Samples were analyzed by Fremont Analytical using method SM 4500-S2-D which quantifies total sulfides in the water including dissolved hydrogen sulfide, hydrosulfide, and metallic sulfides (which are common in suspended particulates). Table 2 summarizes total sulfides results from samples collected at Waughop Lake before and after the June alum treatment.

Total sulfides concentrations were 1.6 and 2.8 mg/L in surface and bottom samples respectively, prior to the June 2023 alum treatment. Following the treatment, surface total sulfides concentrations increased but bottom concentrations decreased (Table 2). Two weeks post treatment, the surface total sulfides concentration had decreased substantially while the bottom concentration increased back to near pre-treatment levels. Starting in August, two months post-treatment, total sulfides in Waughop Lake decreased even further to concentrations near or at the detection limit or below the reporting limit. Concentrations in red italicized font in Table 2 indicate samples that were reported below the detection limit and the concentration in the table is the detection limit for that sample. Total sulfides concentrations in the lake remained low through November 2024 (the last date samples were collected and analyzed for total sulfides) and were just above the detection limit (Table 2).

Table 2. Waughop Lake Total Sulfides Concentrations, 2023 and 2024.

Date	Time Period	Total Sulfides (mg/L)	
		1 m	0.5 m off bottom
6/27/2023	Day before Treatment	1.6	2.8
6/30/2023	Day after Treatment	4	1.2
7/13/2023	2 Weeks Post Treatment	0.8	2.4
8/15/2023	Two Months After	0.6	*0.128 (ND)*
9/14/2023	Three Months After	*0.0138 (ND)*	0.0139 (J)
10/11/2023	Four Months After	*0.0138 (ND)*	--
12/12/2023	Six Months After	0.0336 (J)	0.0383 (J)
3/13/2024	Nine Months After	0.0232 (J)	0.107
5/6/2024	PCD May Event	*0.0500 (ND)*	*0.0500 (ND)*
6/27/2024	Twelve Months After	0.0508	0.117
8/5/2024	PCD August Event	*0.0500 (ND)*	*0.0500 (ND)*
11/8/2024	PCD November Event	0.052	0.052

6.10 ALUMINUM

Following the March 2020 alum treatment, both Total Aluminum (TA) and dissolved aluminum (DA) increased due to the aluminum addition but did not reach exceedingly high levels. Surprisingly, the highest levels of TA and DA were observed one day before the July alum treatment (Figure 30; Table 3). The high aluminum concentrations were not anticipated and did not correspond to dramatic changes in measurements of pH and DO, which were all considered normal. Therefore, the high aluminum concentrations in July were likely a result of interactions between aluminum and organic compounds in the lake. Under the somewhat alkaline conditions at Waughop Lake (average pH above 8.0), the solubility of aluminum is enhanced, and may form complexes with dissolved organic carbon (DOC). The complexing of aluminum and DOC has been observed in other lakes (Long Lake, Kitsap County; Cooke et al. 2005) because of humic substances in the water column and is a likely cause of high aluminum concentrations prior to the July treatment. Aluminum concentrations were also impacted by the lowering of water level in the lake which has a concentrating effect due to lower lake volumes.

A decrease in both TA and DA was observed following the July 2020 alum treatment. Despite the high levels in early July, DA quickly returned to similar levels observed in pre-treatment conditions. Total aluminum fluctuated through the late summer 2020 with a general decreasing trend. A similar effect was observed when DA decreased following an alum treatment in Long Lake, Kitsap County and the decrease was thought to have been the result of natural levels of aluminum complexed with humic materials by the alum floc in the relatively brow-water lake (Cooke et al. 2005).

Following the high concentration of both TA and DA in July 2020, Tetra Tech reached out to the contract laboratory, IEH Analytical, to see if samples could be analyzed for DOC and total organic carbon (TOC). Unfortunately, the July and August samples had already been disposed of, however, DOC and TOC were both analyzed in September and DOC in October. DOC and TOC concentrations in September were essentially the same, 4.18 and 4.22 mg/L, respectively, indicating that all of the organic carbon in the lake is in the dissolved fraction.

In early 2021, the decreasing trend in TA concentration observed in the fall of 2020 continued, and pre-treatment equilibrium concentrations were achieved (Figure 30; Table 3). In March 2020, prior to alum treatments, TA was 62 µg/L, while in January and March of 2021 measured TA concentrations were 54 µg/L and 69 ug/L, respectively. Samples collected by PCD were analyzed for TA three times per year in 2021 and 2022; May, August, and either October or November. Total aluminum concentrations in the lake increased from March 2021 to May 2021 and remained elevated through the end of the monitoring period in 2022 (Figure 30; Table 3). It is unknown what caused the sudden increase in TA concentrations. Unfortunately, there is limited to no corresponding data for DOC and hardness for TA samples in 2020 – 2022, so acute and chronic TA criteria could not be calculated using the EPA calculator.

Monitoring requirements for alum treatments changed prior to the 2023 June treatment and samples for analysis of TA, DOC and hardness were required to be collected by Ecology. Immediately following the June alum treatment (1 hour after treatment completion), TA increased due to the aluminum addition and temporarily exceeded the EPA aluminum acute and chronic criterion (Figure 30; Table 3). Total aluminum concentrations from samples collected the day after treatment were substantially lower and below both the acute and chronic EPA criterion concentrations (Table 3). The EPA aluminum criteria were calculated using an EPA published aluminum criteria spreadsheet and are based on concentrations of DOC, hardness, and pH. The EPA aluminum criteria are for total recoverable aluminum.

Total aluminum concentrations remained below the EPA acute and chronic criterion through the rest of 2023 and most of 2024. However, there was a slight increase in TA in July, two-weeks post treatment and again in September, before concentrations decreased to less than pre-treatment concentrations in December (Table 3). Total aluminum concentrations remained stable through May 2024. There was a spike in TA in June 2024 which was confirmed by the laboratory. Total phosphorus concentrations were also very high on the June sampling date and the spike in TP and TA is thought to be caused by wind driven sediment resuspension with the low water levels. The spike in TA in June 2024 was above the EPA chronic criterion but not the acute criterion (Table 3). Total aluminum concentrations were lower in August and November 2024 but still slightly higher than the concentrations measured prior to the spike in June (Figure 30). August and November 2024 TA concentrations were both below the EPA acute and chronic criterion (Table 3).

Dissolved aluminum (DA) was higher than expected in June 2023 prior to the alum treatment. There was an immediate decrease in DA following the treatment (Table 3). A similar effect was observed when DA decreased following the July 2020 alum treatment. Concentrations of DA increased two weeks post treatment and remained at concentrations higher than pre-treatment through August. Samples for DA were not collected after two months post treatment (Table 3). Following the high concentration of DA in July, Tetra Tech reached out to the contract laboratory, IEH Analytical, to see if samples could be re-analyzed for confirmation. IEH Analytical confirmed the DA concentrations from July. DOC concentrations increased steadily back to pre-treatment levels or higher throughout the summer. Samples for total organic carbon (TOC) analysis were not collected in 2023 but based on previous data, all of the organic carbon in Waughop Lake is typically in the dissolved fraction. The increased DA concentrations are most likely due to the complexing of aluminum and DOC in the water column.

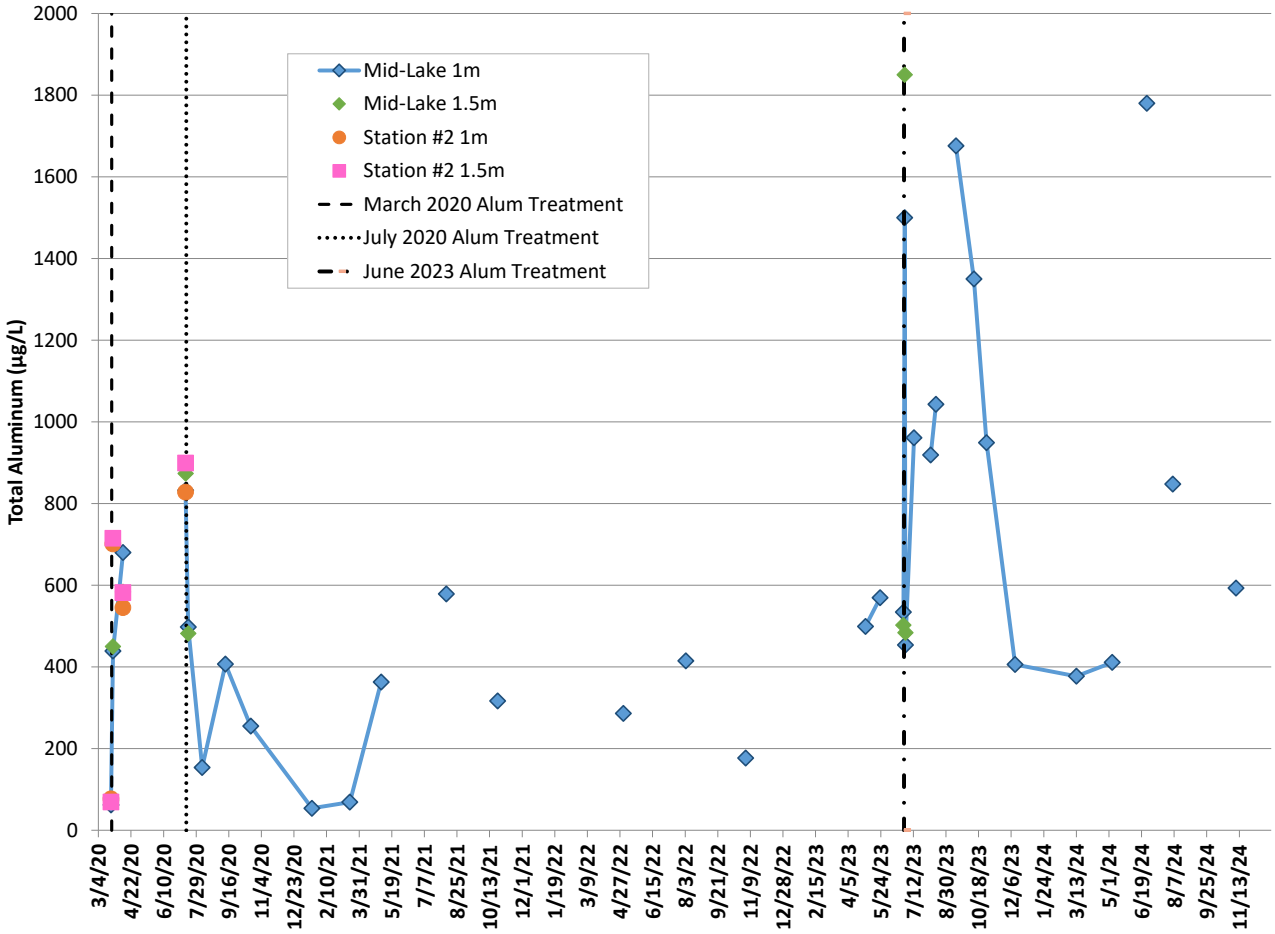

Figure 30. Total aluminum concentrations in Lake Waughop in 2020 – 2024.

Table 3. Waughop Lake Aluminum Concentrations, 2020 – 2024.

Date	Time Period	Depth (m)	Total Aluminum (ug/L)	Dissolved Aluminum (ug/L)	DOC (mg/L)	Hardness (mg CaCO3/L)	pH	EPA Aluminum Criteria Total Aluminum (ug/L)	
								Acute	Chronic
3/23/2020	Day Before	1	62	28	--	--	8.37	--	--
		1.5	72	17	--	--	8.12	--	--
3/26/2020	Day After	1	439	37	--	--	8.06	--	--
		1.5	450	38	--	--	8.01	--	--
4/10/2020	2-weeks Post	1	680	14	--	--	7.88	--	--
		1.5	584	17	--	--	7.75	--	--
7/13/2020	Day Before	1	833	763	--	--	8.82	--	--
		1.5	874	764	--	--	8.8	--	--
7/17/2020	Day After	1	498	21	--	--	7.8	--	--
		1.5	482	19	--	--	7.62	--	--
8/7/2020	3-weeks Post	1	154	66	--	--	8.18	--	--
9/11/2020	Monthly	1	407	27	4.18	--	8.13	--	--
10/19/2020	Monthly	1	255	24	4.05	--	8.06	--	--
1/19/2021	Monthly	1	54	8	4.98	--	8.52	--	--
3/17/2021	Monthly	1	69	14	3.59	--	8.11	--	--
5/3/2021	Monthly PCD	1	363	--	--	--	6.9	--	--
8/9/2021	Monthly PCD	1	579	--	--	--	7.9	--	--
10/25/2021	Monthly PCD	1	317	--	--	--	7.25	--	--
5/2/2022	Monthly PCD	1	286	--	--	--	7.5	--	--
8/4/2022	Monthly PCD	1	415	--	--	--	7.5	--	--
11/2/2022	Monthly PCD	1	177	--	--	--	7	--	--
5/1/2023	Monthly PCD	1	499	--	--	--	8.5	--	--
5/23/2023	Month Before	1	569	--	8.4	23.8	8.25	3900	1600
6/27/2023	Day Before	1	535	408.3	9.43	19.6	8.49	4400	2100

Date	Time Period	Depth (m)	Total Aluminum (ug/L)	Dissolved Aluminum (ug/L)	DOC (mg/L)	Hardness (mg CaCO3/L)	pH	EPA Aluminum Criteria Total Aluminum (ug/L)	
								Acute	Chronic
6/27/2023	Day Before	1.8	503	428.4	8.98	18.3	8.43	4200	2000
6/29/2023	1 hr Post	1	**1500**	41.4	--	--	6.99	1300*	500*
6/29/2023	1 hr Post	1.8	**1850**	39.2	--	--	6.95	1200*	480*
6/30/2023	Day After	1	454	61.4	5.94	17.9	7.21	1600	590
6/30/2023	Day After	1.8	484	50.7	6.01	17.9	7.22	1600	600
7/13/2023	2-weeks Post	1	961	845.8	6.21	19.5	8.21	3500	1600
7/13/2023	2-weeks Post	1.8	969	821.9	5.97	19.8	8.20	3400	1600
8/15/2023	Two Months After	1	1043	995.3	7.7	20.9	8.30	3900	1700
9/14/2023	Three Months After	1	1676	--	9.7	21.8	8.60	4500	2200
10/11/2023	Four Months After	1	1350	--	11.6	20.3	8.72	4900	2400
12/12/2023	Six Months After	1	406	--	10.7	18.2	8.21	4000	1500
3/13/2024	Nine Months After	1	377	--	13.4	18.5	8.76	4900	2600
5/6/2024	Monthly PCD	1	411	--	22.9	19	7.5	2700	840
6/27/2024	Twelve Months After	1	**1780**	--	12.7	22.5	7.29	2400	740
8/5/2024	Monthly PCD	1	848	--	11.4	25	8.0	3800	1200
11/8/2024	Monthly PCD	1	593	--	20.7	21.2	8.4	4500	1800

*Estimated based on DOC of 6 mg/L and a hardness of 18 mg $CaCO_3$/L

6.11 ADDITIONAL PARAMETERS REQUIRED BY ECOLOGY

Prior to the June 2023 alum treatment, Ecology required that the City collect additional samples for analysis of chloride, calcium, magnesium, potassium, sodium, carbonate (CO_3), and bicarbonate (HCO_3) as part of the APAM permit required monitoring. Tetra Tech collected samples for the above analyses starting the day before treatment. Samples were collected at a depth of 1 m and on occasion at 0.5 m off the bottom. Table 4 summarizes the data results for these additional requested parameters.

For most parameters, there was little difference between concentrations prior to the alum treatment and concentrations post treatment (Table 4). Sodium concentrations in the lake increased following the alum treatment, from an average of 28.3 mg/L to an average of 52.6 mg/L post treatment through December 2023. This increase was expected given that sodium is a main component of the buffer applied during treatment, sodium aluminate. The increase in sodium could have also been partially due to the concentrating effect of lowering lake water levels. Sodium levels in March and June 2024 were less than concentrations in December 2023. All parameters with the exception of chloride, decreased slightly from October 2023 to June 2024, which corresponded to an increase in lake water levels and volume.

Bicarbonate and alkalinity concentrations were very similar throughout the monitoring period and decreased following the treatment as expected. As stated previously, alum is an acidic compound and alkalinity/bicarbonate would be expected to decrease as alum is added. Prior to the alum treatment, bicarbonate averaged 51.1 mg $CaCO_3$/L and alkalinity averaged 53.1 mg $CaCO_3$/L. Post treatment bicarbonate concentrations averaged 33.8 mg $CaCO_3$/L and alkalinity averaged 36.4 mg $CaCO_3$/L through December 2023. This indicates that the majority of the alkalinity in Waughop Lake is due to the presence of bicarbonate in the water. Carbonate concentrations measured before and after the alum treatment were consistently below the detection limit of 1 mg $CaCO_3$/L. This was also expected given that carbonate becomes dominant in waters at pH values greater than 10.3. Bicarbonate is typically the dominant form of the carbonate cycle in surface waters with pH between 6.3 and 10.3.

Table 4. Summary of Additional Water Quality Parameters Requested by Ecology Before and After the June 2023 Alum Treatment.

Date	Time Period	Depth (m)	Chloride (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Potassium (mg/L)	Sodium (mg/L)	HCO3 (mg CaCO3/L)	CO3 (mg CaCO3/L)
6/27/2023	Day Before Treatment	1	4.62	5.99	1.12	3.37	28.5	51	<1.00
		1.8	4.94	5.81	0.913	2.92	28	51.1	<1.00
6/30/2023	Day After Treatment	1	4.73	5.84	0.804	2.73	48.8	32.3	<1.00
		1.8	4.41	5.82	0.816	2.71	48.5	30.6	<1.00
7/13/2023	2 Weeks Post Treatment	1	3.99	6.36	0.876	3.05	50.5	36.9	<1.00
		1.8	3.99	6.47	0.896	2.98	50.8	38	<1.00
8/15/2023	Two Months After	1	4.52	6.74	0.998	4.81	56.6	36.3	<1.00
9/14/2023	Three Months After	1	5.15	6.98	1.06	3.46	62.8	36.7	<1.00
10/11/2023	Four Months After	1	4.62	6.43	1.03	3.51	58.1	32.9	<1.00
12/12/2023	Six Months After	1	4.62	5.74	0.94	3.07	45	26.5	<1.00
3/13/2024	Nine Months After	1	5.36	5.92	0.902	2.77	34.7	25.6	<1.00
5/6/2024	PCD May Event	1	3.99	6.04	0.953	2.88	--	25.6	<1.00
6/27/2024	Twelve Months After	1	4.52	7.23	1.08	3.16	37.1	25	<1.00
8/5/2024	PCD August Event	1	5.47	8.06	1.18	3.59	--	44.7	<1.00
11/8/2024	PCD November Event	1	4.62	6.67	1.11	3.82	--	43.1	<1.00
Pre-Treatment Average			4.78	5.9	1.02	3.15	28.3	51.1	<1.00
Post-Treatment Average			4.61	6.5	0.97	3.27	49.3	33.4	<1.00

7.0 LAKE SEDIMENT MONITORING

Personnel from HAB Aquatics (currently known as SOLitude Lake Management), the contractor who conducted all three alum applications, collected sediment cores from Waughop Lake on the day prior to the March 2020 treatment (March 23, 2020), immediately following the March treatment on March 25, 2020, and immediately following the July 2020 treatment on July 16, 2020. The purpose of collecting the sediment core prior to the March 2020 treatment was to obtain baseline sediment characteristics and data prior to the application of alum. The purpose of collecting the sediment core immediately following the March treatment was mostly to visually see the alum floc layer, however, it was decided to also send the core to the laboratory for analysis. A comparison between the two cores collected in March and the visible alum floc layer is shown in Figure 31. During the July 2020 treatment, the City and Tetra Tech decided to have HAB Aquatics collect a third core upon completion of the application. Analysis of this third core would provide insights into the aluminum binding efficiency and conversion of mobile phosphorus to aluminum bound phosphorus following the March treatment.

Each of the three sediment cores were hand delivered to IEH Analytical Laboratory in Seattle, WA. Each of the cores were sectioned by the laboratory into the following sample increments: 0 to 10 cm, 11 to 20 cm, 21 to 30 cm, and 30 to 40 cm (or until the bottom of the core). The core collected on March 23, 2020 was 43 cm long, the core collected on March 25, 2020 was shorter and only 35 cm long, and the core collected on July 16, 2020 was 40 cm long. Due to budget constraints larger than normal increments, 10 cm vs. 2 or 5 cm, were analyzed for Waughop Lake. Each of the sediment increments were analyzed for the following parameters: TP, loosely-bound phosphorus, iron bound phosphorus, aluminum bound phosphorus, biogenic phosphorus, organic phosphorus, calcium bound phosphorus, total aluminum, total iron, total calcium, % solids, and % water. Unfortunately, due to issues in the laboratory, the core collected on July 16, 2020 was only analyzed for the phosphorus fractions and was not analyzed for total aluminum, total iron, or total calcium. To determine the different phosphorus fractions in each sediment increment, a series of sediment digestions were used by the laboratory as outlined in Rydin & Welch (1998). Laboratory data reports for the three sediment cores are included in Appendix A.

Figure 31. Sediment core collected prior to treatment on March 23, 2020 (left) and sediment core collected immediately following treatment on March 25, 2020 (right) with visible alum floc layer.

7.1 SEDIMENT CORE DATA

Data from the sediment cores collected post alum application on March 25 and July 16, 2020, show the expected increase in Al and aluminum bound phosphorus, and the subsequent decrease in iron bound phosphorus (mobile phosphorus) that is observed after nearly every alum treatment studied (Cooke et al., 2005; Rydin and Welch, 1999; Rydin et al., 2000; Reitzel et al., 2005). The conversion of iron bound phosphorus to stable aluminum bound phosphorus is the primary objective of an alum treatment. Figures 32 and 33 show the profiles of iron bound and aluminum bound phosphorus in the three sediment cores.

Iron bound phosphorus in the top 10 cm was 396 mg/kg prior to the March 2020 alum treatment and 462 mg/kg immediately following the March treatment. Iron bound phosphorus in the top 10 cm of the core collected in July 2020 had decreased to 294 mg/kg (Figure 32). For reference, iron bound phosphorus concentrations in sediments at Lake Ketchum prior to alum ranged from 140 to 215 mg/kg and in Wapato Lake iron bound phosphorus in the top 10 cm ranged from 199 to 368 mg/kg prior to alum. An immediately decrease in iron bound phosphorus was not expected following an application as it takes time for the alum floc to integrate into the lake sediments. So the decrease in iron bound phosphorus observed in the July core was most likely the result of the March treatment. There was a corresponding increase in aluminum bound phosphorus from 1403 mg/kg in the March 23 core to 2096 mg/kg in the July core (Figure 33). Total aluminum, while only available for the two cores collected in March, also increased in the top 10 cm following the treatment. The total aluminum concentration in the top 10 cm of the pre-treatment core was 11,845 mg/kg compared to 13,298 mg/kg in the core immediately collected post-treatment.

There was an overall increase in sediment TP between the core collected pre-treatment and the two cores collected following the March and July applications. This is not unusual as the alum application removes most all

of the particulates and TP from the water column as the floc settles to the lake bottom, which would result in the addition of phosphorus to the sediments.

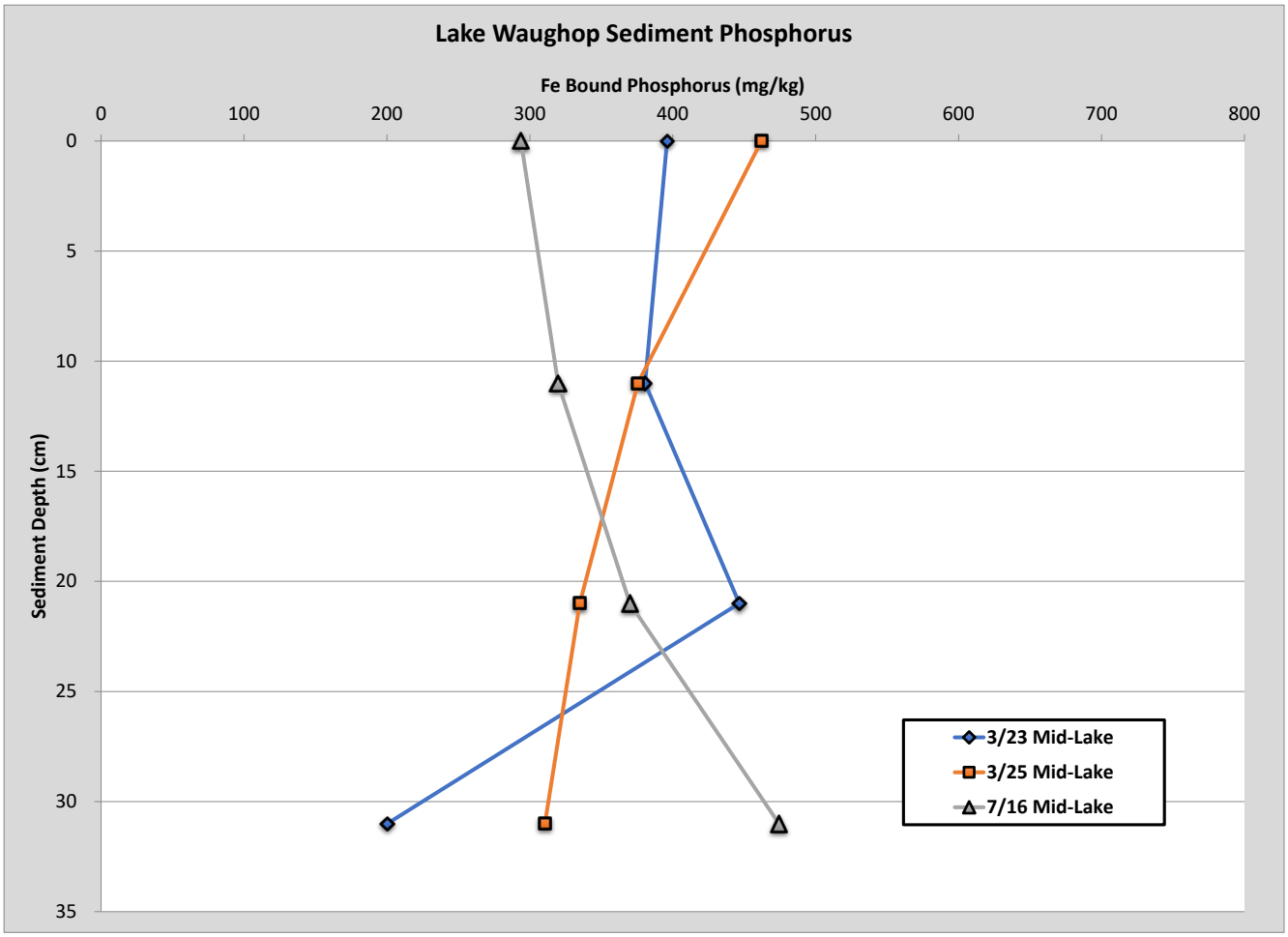

Figure 32. Iron bound phosphorus profiles in Waughop Lake sediments, 2020.

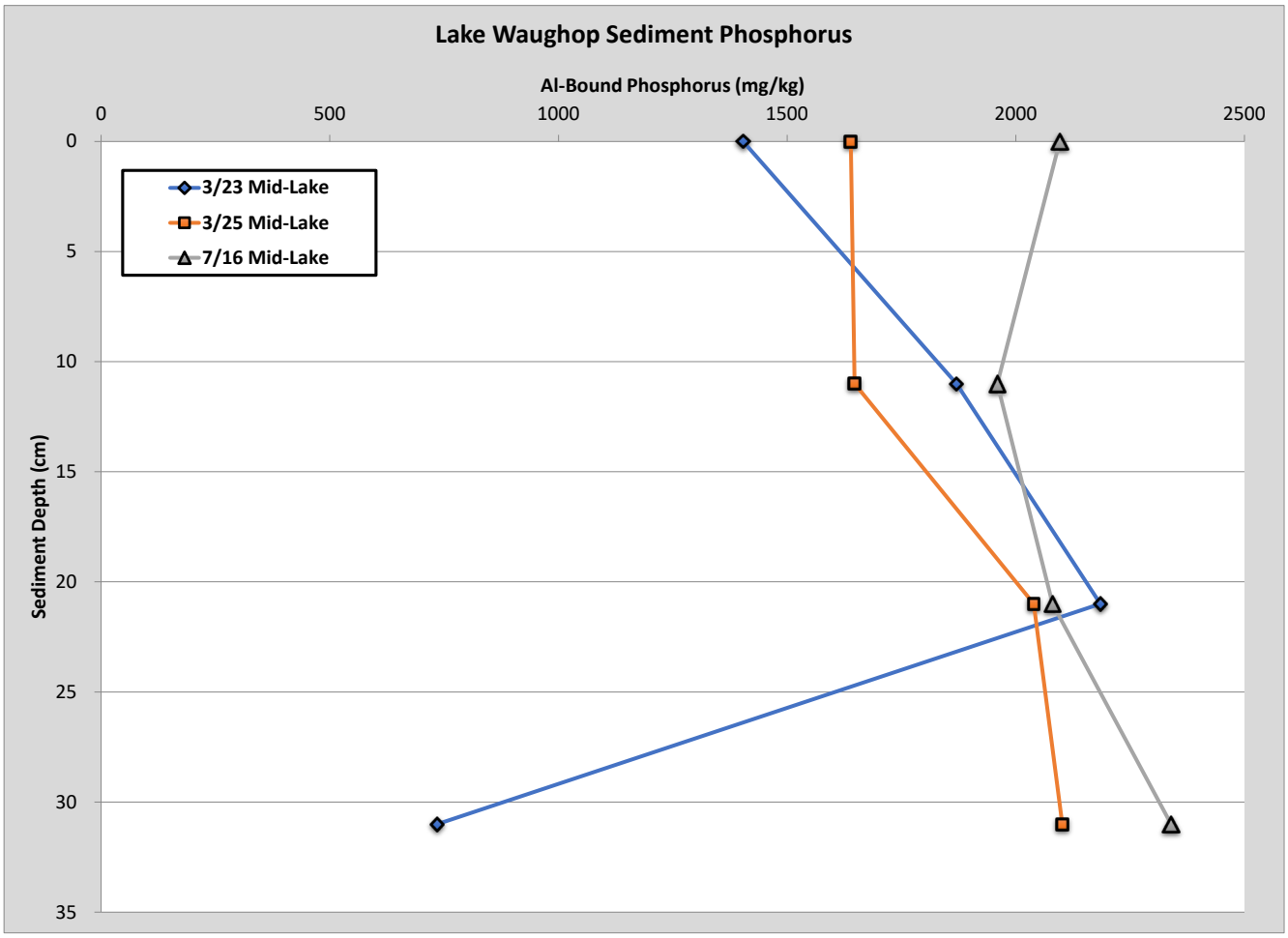

Figure 33. Aluminum bound phosphorus profiles in Waughop Lake sediments, 2020.

8.0 SUMMARY AND DISCUSSION

Following the 2020 treatments, Waughop Lake did not experience a toxic algae bloom for the first time in over a decade. Similar to conditions following the 2020 alum treatments, in 2023, Waughop Lake did not experience a toxic algae bloom. In 2022, the cyanotoxin microcystin was detected at concentrations just above the detection limit but well below the state recreational guideline. The growth of toxic algae was reduced by the two whole-lake buffered alum treatments conducted in March and July 2020 and the whole-lake buffered alum treatment conducted in June 2023. The alum treatments were designed to remove phosphorus from the water column and to inactivate the release of phosphorus from the lake sediments to reduce algal production.

In-situ water quality monitoring was conducted by Tetra Tech staff before, during, and after the alum treatments, with water samples collected for laboratory analysis before and after each treatment. Tetra Tech staff also conducted in-situ monitoring and collected water samples for analysis monthly from May through October 2023. Volunteer monitors associated with PCD conducted monthly monitoring at Waughop Lake May through October in 2021, 2022, 2023, and May through December 2024. Data collected by both Tetra Tech and volunteer monitors associated with PCD was presented in this report. Below is a summary of findings from the 2020 – 2024 monitoring conducted by both Tetra Tech and PCD at Waughop Lake.

- Waughop Lake experienced dramatic water level fluctuations with significant loss of water throughout each summer.
    - Water level decreased steadily over the summer months during all years due to limited recharge, even during 2022 when lake water levels were overall much higher than other years.
    - Water levels in the summer of 2023 and 2024 were much lower than recorded in previous years with minimum gage depths of 3.0 ft – 0.5 to 1.75 ft lower than minimums recorded in 2020 – 2022.
    - Water levels in 2022 were much higher than recorded in other years with a maximum gage measurement of 7.5 ft in May and a low of 4.75 ft in November.
    - Low water levels and lake volumes during the summer have a concentrating effect on nutrients, aluminum, and other parameters.
    - Water level in Waughop Lake is correlated with groundwater levels and reflects direct contact with the shallow groundwater-flow system.
    - The drastic water level decreases in Waughop Lake have a concentrating effect throughout the summer.
    - Lake volume decreased by 38% during the summers of 2020 and 2021, by 34% during the summer of 2022 and by 45% and 44% in 2023 and 2024, respectively.
- Temperature, pH, DO, and conductivity did not vary significantly throughout the water column.
    - Waughop Lake is a shallow lake that mixes frequently throughout the year with no evidence of stratification occurring in the summer.
    - Higher values of pH and DO were most likely due to higher photosynthetic activity in the water column.
    - Conductivity temporarily increased following the alum treatments.
    - There was a slight decrease in water column pH following each alum treatment, but water column average pH never fell below 7.0.
- Alum treatments reduced phosphorus concentrations and internal loading in Waughop Lake.

  - After the 2020 alum treatments, water column TP concentrations remained well below the target range of less than 35 µg/L through March 2021. Average water column TP during the growing season of 2021 was right at the target concentration of 35 µg/L.
  - Despite the concentrating effects of lowering water levels, water column TP after the June 2023 alum treatment remained well below the 35 µg/L target level for the duration of the summer.
  - The mass of phosphorus in Waughop Lake decreased dramatically following the alum treatments and remained low throughout the summer of 2023 and 2024 compared to pre-treatment levels.

- Alum treatments reduced algal production and the occurrence of cyanobacteria blooms in Waughop Lake.
  - Waughop Lake did not experience a toxic bloom in 2020 or 2021 that had been reoccurring every year on record from 2007-2018 (King County, 2018).
  - Chlorophyll concentrations in the lake were below the eutrophic boundary of 9.0 µg/L during 2020 and 2021 and reflected more of a mesotrophic, or well-balanced system.
  - In 2022 chlorophyll concentrations were higher and averaged about 14 µg/L during the growing season. Samples collected for cyanotoxin analysis had detections for microcystin at levels just above the detection limit but well below the state recreational guideline of 8 µg/L.
  - Waughop Lake did not experience a toxic bloom in 2023, even with more than favorable climatic and hydrologic conditions. Chlorophyll concentrations were reduced following the June 2023 treatment from an average of 12.5 µg/L to 5.4 µg/L prior to a large increase in October 2023.
  - Increased water clarity was observed throughout the summers of 2020 and 2023 and to some extent in 2021 due to the decrease in algae.
  - Waughop Lake also did not experience a toxic bloom in 2024 even though chlorophyll concentrations were elevated throughout the year. A sample was collected for cyanotoxin analyses in May 2024 and a second sample was collected in mid-May 2024 for algal identification. There were no cyanobacteria species present in the sample collected in mid-May 2024.

- The alum treatments did temporarily impact lake chemical composition.
  - Concentrations of aluminum and sulfate were temporarily increased in the lake. However, total aluminum concentrations only exceeded the calculated EPA aluminum criteria immediately following treatment, with concentrations decreasing dramatically the day after treatment.
  - Nitrogen and alkalinity were temporarily reduced in the lake as was expected.
  - Concentration of total sulfides varied after the 2023 alum treatment but eventually were well below pre-treatment concentrations and typically below the detection limit.
  - Concentrations of chloride, calcium, magnesium, potassium, and carbonate were unchanged following the 2023 alum treatment.
  - Sodium was temporarily increased but with concentrations trending downwards toward pre-treatment levels.

- Improved water quality in 2020, 2021, and 2023 compared to pre-treatment conditions.
  - After the first alum treatment in March 2020, average TP and chlorophyll were significantly reduced from March 2020 through March 2021. Although average TP and chlorophyll increased slightly during the summer of 2021, TP concentrations were near the target level of 35 µg/L and chlorophyll concentrations were below the eutrophic boundary.
  - Water clarity increased and the Secchi disk was visible to the lake bottom through January 2021. On average water clarity increased significantly from March 2020 through March 2021.

  - After the June 2023 alum treatment, average TP and chlorophyll were substantially reduced throughout the remainder of the 2023 summer.
  - Water clarity increased and the Secchi disk was visible to the lake bottom through September 2023.
  - Higher levels of water clarity in Waughop Lake corresponded with lower observed chlorophyll concentration and a reduction in algal production following all three alum treatments. In all years, there is a decrease in water clarity in the fall which is typically when the lake experiences its lowest water levels.
- Waughop Lake water column nutrient concentrations are influenced by external loading with water recharge in the winter and early spring months, as well as wind and subsequent sediment resuspension due to the shallowness of the lake.

9.0 RECOMMENDATIONS FOR FUTURE WORK

The 2020 and 2023 alum treatments dramatically reduced phosphorus availability in Waughop Lake and prevented the occurrence of a toxic algae bloom in 2020, 2021, 2023 and 2024, even with elevated chlorophyll concentrations in late 2023 and throughout 2024. Water quality improvements resulting from the 2020 treatments lasted through early 2022 but improvements from the 2023 treatments were shorter lived. This is most likely due to continued internal and external loading of phosphorus and adverse climatic and hydrologic conditions, as well as the reduced alum dosing in 2023. Dramatic decreases in water level during the summer growing season, exacerbates eutrophication, sediment resuspension, and increases nutrient concentrations, all potentially leading to higher algal production. Although water quality conditions in Waughop Lake during 2024 were reflective of a eutrophic system, with high chlorophyll concentrations, rather than a more mesotrophic system, there was no documented cyanobacteria bloom or cyanotoxins in the lake in 2024. In 2024 lake volume decreased by almost half during the summer exacerbating eutrophic conditions. A total phosphorus target range of around 35 µg/L is still a reasonable goal for Waughop Lake and will help control dominance by cyanobacteria and potentially toxic algal species. Additional water column phosphorus stripping or sediment inactivation treatments will most likely be needed in the future to continue to limit HAB events. Future treatments could explore modifications to the buffering and/or aluminum trichloride or other products, in addition to or versus alum to accelerate the general water chemistry recovery due to the limited surface water input of calcium, sodium, and flushing of sulfate.

Long-term monitoring in Waughop Lake is recommended to track water quality parameters, observe any changes in the lake, and to continue to monitor the effectiveness of the alum treatments. Long-term monitoring also will provide the necessary data for adaptive management. In addition to monthly sampling for TP, TN, SRP, and chlorophyll, periodic analysis (every other month) for alkalinity, sulfate, TA, DOC, and hardness are recommended. In-situ monitoring to collect profiles of water temperature, DO, pH, and conductivity should also occur monthly. Continued water quality monitoring will allow for adaptive management of the lake and help inform management decisions, such as aquatic plant management and the potential use of other phosphorus inactivation products instead of alum for possible future phosphorus inactivation treatments, if needed. A high degree of water clarity paired with abundant solar energy may allow for an increase in aquatic plant production, so continued monitoring of conditions at Waughop Lake should include observations of changes to aquatic plants such as mapping for density and community structure. Sediment core collection and analysis of phosphorus fractions, as well as TA, total iron, and total calcium, is also recommended to evaluate sediment chemistry pre- and post-treatment.

Since it has become apparent that there is some external loading of nutrients, especially phosphorus, from either groundwater inputs or stormwater runoff, it is recommended that monitoring of these two water sources to the lake also be conducted. Understanding the source and magnitude of nutrient loadings to the lake will help to guide future lake management decisions.

10.0 REFERENCES

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APPENDIX A: SEDIMENT DATA

IEH ANALYTICAL LABORATORIES

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CASE FILE NUMBER:	**1713770A**	**PAGE**	**1**
REPORT DATE:	**06/23/20**		
DATE SAMPLED:	**03/23,25/20**	**DATE RECEIVED:**	**03/25/20**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON SEDIMENT SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Two sediment cores were received by the laboratory in good condition and analyzed according to the chain of custody. Phosphorus fractions were determined according to the method of Rydin and Welch. Successive extractions with NH4Cl, Bicarbonate/Dithionate, NaOH, and HCL were performed and analyzed for phosphorus. One part of Organic P was determined by digesting the residue after the inorganic fractions were extracted. Organic P includes the P after the inorganic fractions plus Biogenic P. Total P is the sum of all fractions minus Biogenic P, which is part of the Organic P fraction. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows, while QA/QC data is contained on subsequent pages.

SAMPLE DATA - SEDIMENTS (DRY WT. BASIS)

SAMPLE ID	% SOLIDS	% WATER	TOTAL-P (mg/kg)	LOOSELY BOUND P (NH4CL) (mg/kg)	FE BOUND P (DITHIONATE) (mg/kg)	AL BOUND P (NAOH) (mg/kg)	BIOGENIC P (mg/kg)	CA BOUND P (HCL) (mg/kg)	ORGANIC P (mg/kg)	
Sediment Core 0-10cm	3.77%	96.2%	3809	<2.00	396	1403	1527	156	1853	collected 3/23/20
Sediment Core 11-20cm	4.90%	95.1%	3876	<2.00	381	1870	1101	213	1411	
Sediment Core 21-30cm	7.21%	92.8%	4714	<2.00	446	2185	1491	316	1767	
Sediment Core 31-43cm	6.27%	93.7%	2188	<2.00	200	735	934	118	1134	
Sediment Core 0-10cm	3.77%	96.2%	4077	<2.00	462	1639	1430	168	1807	
Sediment Core 11-20cm	5.03%	95.0%	3529	<2.00	376	1648	1020	184	1322	
Sediment Core 21-30cm	7.03%	93.0%	3881	<2.00	335	2039	941	283	1223	collected 3/25/20
Sediment Core 31-35cm	7.82%	92.2%	4261	<2.00	311	2101	1186	364	1485	

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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON SEDIMENT SAMPLES FROM TETRA TECH INC.

QA/QC DATA- SEDIMENTS

QC PARAMETER	% SOLIDS	TOTAL-P (mg/kg)	LOOSELY BOUND P (NH4CL) (mg/kg)	FE BOUND P (DITHIONATE) (mg/kg)	AL BOUND P (NAOH) (mg/kg)	BIOGENIC P (mg/kg)	CA BOUND P (HCL) (mg/kg)	ORGANIC P (mg/kg)
METHOD	SM18 2540B	CALCULATED	SM18 4500PF	SM18 4500PF	SM18 4500PF	EPA 365.1	SM18 4500PF	EPA 365.1
DATE PREPARED	05/28/20	06/01/20	05/29/20	05/29/20	05/29/20	06/01/20	05/29/20	06/01/20
DATE ANALYZED	1.00%	5.00	2.00	2.00	2.00	2.00	2.00	2.00
DETECTION LIMIT								
DUPLICATE								
	Sediment Core 31-35cm	Sediment Core 31-35cm	Sediment Core 31-35cm	Sediment Core 31-35cm	Sediment Core 31-35cm	Sediment Core 31-35cm	Sediment Core 31-35cm	Sediment Core 31-35cm
SAMPLE ID	7.82%	4261	<2.00	311	2101	1186	364	1485
ORIGINAL	7.86%	4323	<2.00	328	2137	1201	367	1491
DUPLICATE	0.56%	1.43%	NC	5.35%	1.66%	1.27%	0.74%	0.41%
RPD								
SPIKE SAMPLE								
SAMPLE ID								
ORIGINAL								
SPIKED SAMPLE								
SPIKE ADDED	NA	NA	NA	NA	NA	NA	NA	NA
% RECOVERY								
QC CHECK (mg/l)								
FOUND			0.042	0.042	0.042	0.097	0.042	0.097
TRUE			0.039	0.039	0.039	0.094	0.039	0.094
% RECOVERY	NA	NA	107.69%	107.69%	107.69%	103.19%	107.69%	103.19%
BLANK	NA	NA	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski
Project Manager

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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON SEDIMENT SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Two sediment cores were received by the laboratory and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows, while QA/QC data is contained on subsequent pages.

SAMPLE DATA - SEDIMENTS (DRY WT. BASIS)

SAMPLE ID	% SOLIDS	% WATER	ALUMINUM (mg/kg)	IRON (mg/kg)	CALCIUM (mg/kg)	MERCURY (mg/kg)	
Sediment Core 0-10cm	3.77%	96.2%	11845	7783	8055	<0.50	collected 3/23/20
Sediment Core 11-20cm	4.90%	95.1%	15674	9831	8674	<0.50	
Sediment Core 21-30cm	7.21%	92.8%	16485	13103	8392	<0.50	
Sediment Core 31-43cm	6.27%	93.7%	8118	5611	6419		
Sediment Core 0-10cm	3.77%	96.2%	13298	9729	8534	<0.50	
Sediment Core 11-20cm	5.03%	95.0%	13744	9416	9106	<0.50	
Sediment Core 21-30cm	7.03%	93.0%	16019	10875	9130	<0.50	collected 3/25/20
Sediment Core 31-35cm	7.82%	92.2%	16476	12508	9316		

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES
3927 AURORA AVENUE NORTH, SEATTLE, WA 98103
PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1713770B**	**PAGE**	**2**
REPORT DATE:	**06/23/20**		
DATE SAMPLED:	**03/23,25/20**	**DATE RECEIVED:**	**03/25/20**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON SEDIMENT SAMPLES FROM TETRA TECH INC.

QA/QC DATA- SEDIMENTS

QC PARAMETER	% SOLIDS	ALUMINUM (mg/kg)	IRON (mg/kg)	CALCIUM (mg/kg)	MERCURY (mg/kg)
METHOD	SM18 2540B	EPA 6010	EPA 6010	EPA 6010	EPA 6020
DATE ANALYZED	05/28/20	05/29/20	05/29/20	05/29/20	05/27/20
DETECTION LIMIT	1.00%	2.00	2.00	2.00	0.50
DUPLICATE					
SAMPLE ID	Sediment Core 31-35cm	BATCH	BATCH	BATCH	BATCH
ORIGINAL	7.82%	<2.00	<2.00	<2.00	<0.50
DUPLICATE	7.86%	<2.00	<2.00	<2.00	<0.50
RPD	0.56%	NC	NC	NC	NC
SPIKE SAMPLE					
SAMPLE ID					
ORIGINAL					
SPIKED SAMPLE					
SPIKE ADDED					
% RECOVERY	NA	NA	NA	NA	NA
QC CHECK **(mg/L)**					
FOUND		0.466	0.528	9.87	0.002
TRUE		0.500	0.500	10.0	0.002
% RECOVERY	NA	93.20%	105.60%	98.70%	105.00%
BLANK	NA	<2.00	<2.00	<2.00	<0.50

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski
Project Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1713770

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo, Harry Gibbons
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 206-838-6258 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Addres
Contac
Email:
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☐ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard

Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

SAMPLING			SAMPLE DESCRIPTION		Number of Containers	Analysis Requested															LAB USE ONLY		
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)			% water	solids	total organic	total organic P	Biogenic Phosphorus	Total Phosphorus	mobile P	Fe-P	Al-P	Ca-P	Total Aluminum	Total Fe	total Calcium	Total Hg	methyl Hg	Containers Received	Case File Number	
																						Temp	Lab ID
23-Mar		Sediment core		Sediment core	1																		
		0-10 cm		0-10 cm		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			41881
		11-20 cm		11-20 cm		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			41882
		21-30 cm		21-30 cm		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			41883
		~~31-50 cm~~	31-43 cm	~~31-50 cm~~ 31-43		x	x	x	x	x	x	x	x	x	x	x	x	x					41884
		~~51-70 cm~~		~~51-70 cm~~		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
		~~71-90 cm~~		~~71-90 cm~~		x	x	x	x	x	x	x	x	x	x	x	x	x					
3/25/2020		Sediment core			1																		
		0-10 cm				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			41885
		11-20 cm				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			41886
		21-30 cm				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			41887
		~~31-50 cm~~	31-35 cm			x	x	x	x	x	x	x	x	x	x	x	x	x					41888
		~~51-70 cm~~				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
		~~71-90 cm~~				x	x	x	x	x	x	x	x	x	x	x	x	x					

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:

Sampled By	Date	Time
Received By	Date	Time
Relinquished to IAL By (Signature)	Date	Time

Shipped By
Shipping Reference
Received at IAL By: Samuels
Date: 3/25/20
Time

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1715123A**	**PAGE**	**1**
REPORT DATE:	**08/15/20**		
DATE SAMPLED:	**07/16/20**	**DATE RECEIVED:**	**07/16/20**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON SEDIMENT SAMPLES FROM TETRA TECH

CASE NARRATIVE

Four sediment samples were received by the laboratory in good condition and analyzed according to the chain of custody. Phosphorus fractions were determined according to the method of Rydin and Welch. Successive extractions with NH4Cl, Bicarbonate/Dithionate, NaOH, and HCL were performed and analyzed for phosphorus. One part of Organic P was determined by digesting the residue after the inorganic fractions were extracted. Organic P includes the P after the inorganic fractions plus Biogenic P. Total P is the sum of all fractions minus Biogenic P, which is part of the Organic P fraction. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows, while QA/QC data is contained on subsequent pages.

SAMPLE DATA - SEDIMENTS (DRY WT. BASIS)

SAMPLE ID	% SOLIDS	% WATER	TOTAL-P (mg/kg)	LOOSELY BOUND P (NH4CL) (mg/kg)	FE BOUND P (DITHIONATE) (mg/kg)	AL BOUND P (NAOH) (mg/kg)	BIOGENIC P (mg/kg)	CA BOUND P (HCL) (mg/kg)	ORGANIC P (mg/kg)
Warghop 0-10cm	3.25%	96.8%	5204	<2.00	294	2096	2228	113	2702
Warghop 11-20cm	4.85%	95.1%	3862	<2.00	320	1959	1183	156	1427
Warghop 21-30cm	6.17%	93.8%	4024	<2.00	370	2080	995	145	1429
Warghop 31-40cm	7.34%	92.7%	4191	<2.00	474	2340	889	247	1130

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LABORATORY & CONSULTING SERVICES
3927 AURORA AVENUE NORTH, SEATTLE, WA 98103
PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1715123A**	**PAGE**	**2**
REPORT DATE:	**08/15/20**		
DATE SAMPLED:	**07/16/20**	**DATE RECEIVED:**	**07/16/20**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON SEDIMENT SAMPLES FROM TETRA TECH

QA/QC DATA- SEDIMENTS

QC PARAMETER	% SOLIDS	TOTAL-P (mg/kg)	LOOSELY BOUND P (NH4CL) (mg/kg)	FE BOUND P (DITHIONATE) (mg/kg)	AL BOUND P (NAOH) (mg/kg)	BIOGENIC P (mg/kg)	CA BOUND P (HCL) (mg/kg)	ORGANIC P (mg/kg)
METHOD	SM18 2540B	CALCULATED	SM18 4500PF	SM18 4500PF	SM18 4500PF	EPA 365.1	SM18 4500PF	EPA 365.1
DATE PREPARED	08/05/20	08/10/20	08/06/20	08/06/20	08/07/20	08/10/20	08/07/20	08/10/20
DATE ANALYZED	1.00%	5.00	2.00	2.00	2.00	2.00	2.00	2.00
DETECTION LIMIT								
DUPLICATE								
	Warghop 31-40cm	Warghop 31-40cm	Warghop 31-40cm	Warghop 31-40cm	Warghop 31-40cm	Warghop 31-40cm	Warghop 31-40cm	Warghop 31-40cm
SAMPLE ID	7.34%	4191	<2.00	474	2340	889	247	1130
ORIGINAL	7.42%	4201	<2.00	423	2436	867	248	1094
DUPLICATE	0.98%	0.23%	NC	11.30%	4.02%	2.46%	0.28%	3.26%
RPD								
SPIKE SAMPLE								
SAMPLE ID								
ORIGINAL								
SPIKED SAMPLE								
SPIKE ADDED	NA	NA	NA	NA	NA	NA	NA	NA
% RECOVERY								
QC CHECK (mg/l)								
FOUND			0.040	0.040	0.039	0.099	0.039	0.099
TRUE			0.039	0.039	0.039	0.094	0.039	0.094
% RECOVERY	NA	NA	102.56%	102.56%	100.00%	105.32%	100.00%	105.32%
BLANK	NA	NA	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski
Project Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form

Page ____ of ____

REPORT TO:
Client: Tetra Tech
Address:
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client:
Address:
Contact:
Email:
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project:

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Day ☒ Standard
Specific Date:
*Advanced notice required for Rush Analysis

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

LAB USE ONLY
Case File Number
Containers Received
Temp
Lab ID

SAMPLING		SAMPLE DESCRIPTION	Number of Containers	Analysis Requested																
Date (mm-dd-yy)	Matrix	(This Will Appear On The Report)		% water	% solids	Total Phosphorus	Loosely sorbed P	Fe-P	Al-P	Ca-P	Organic P	Biogenic P	Total Iron	Total Aluminum	Total Calcium	Total Mercury				
7/16/20	sediment	Wayshop 0-10 cm																		
		Wayshop 11-20 cm																		
		" 21-30 cm																		
		" 31-40 cm																		

Sample Retension Policy: Environmental - 90 days; Food & Perishables - 14 days

Comments:

	Date	Time
Sampled By: Iris Lippert		
Received By:		
Relinquished to IAL By (Signature):	7/16/20	4:42 PM

Shipped By:
Shipping Reference:
Received at IAL By:
Date: 7-16-20 Time: 4:40

APPENDIX B: FIELD DATA TABLES

Table B-1. Waughop Lake Field Monitoring Data Collected by Tetra Tech, 2020-2021.

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
3/23/2020	2020	12:00 PM	Mid-Lake Station	Pre-Treatment	0	10.22	0.044	13.85	8.35	0.93	
3/23/2020	2020	12:00 PM	Mid-Lake Station	Pre-Treatment	0.5	10.23	0.044	13.93	8.36		
3/23/2020	2020	12:00 PM	Mid-Lake Station	Pre-Treatment	1	10.19	0.044	13.99	8.37		
3/23/2020	2020	12:00 PM	Mid-Lake Station	Pre-Treatment	1.5	10.04	0.044	13.75	8.12		
3/23/2020	2020	12:00 PM	Mid-Lake Station	Pre-Treatment	2	9.32	0.046	12.02	7.60		
3/23/2020	2020	12:00 PM	Mid-Lake Station	Pre-Treatment	2.5	8.98	0.053	10.77	7.27		
3/23/2020	2020	12:30 PM	Station #2	Pre-Treatment	0	10.64	0.044	13.49	8.09	1.1	
3/23/2020	2020	12:30 PM	Station #2	Pre-Treatment	0.5	10.61	0.044	13.45	8.02		
3/23/2020	2020	12:30 PM	Station #2	Pre-Treatment	1	10.59	0.044	13.33	7.97		
3/23/2020	2020	12:30 PM	Station #2	Pre-Treatment	1.5	10.28	0.044	13.48	8.03		
3/23/2020	2020	12:30 PM	Station #2	Pre-Treatment	2	9.62	0.046	11.85	7.64		
3/23/2020	2020	12:30 PM	Station #2	Pre-Treatment	2.5	9.04	0.060	2.72	6.81		
3/24/2020	2020	10:00 AM	Mid-Lake Station	During treatment	0	10.19	0.045	13.02	8.25	0.95	
3/24/2020	2020	10:00 AM	Mid-Lake Station	During treatment	0.5	10.19	0.045	13.02	8.19		
3/24/2020	2020	10:00 AM	Mid-Lake Station	During treatment	1	10.17	0.045	12.98	8.13		
3/24/2020	2020	10:00 AM	Mid-Lake Station	During treatment	1.5	10.11	0.045	12.79	8.04		
3/24/2020	2020	10:00 AM	Mid-Lake Station	During treatment	2	10.07	0.045	12.90	7.59		
3/24/2020	2020	10:00 AM	Mid-Lake Station	During treatment	2.5	9.64	0.091	5.10	6.98		
3/24/2020	2020	10:15 AM	Station #2	During treatment	0	10.15	0.045	12.99	7.80	0.9	
3/24/2020	2020	10:15 AM	Station #2	During treatment	0.5	10.18	0.045	13.11	7.98		
3/24/2020	2020	10:15 AM	Station #2	During treatment	1	10.18	0.045	13.02	8.03		
3/24/2020	2020	10:15 AM	Station #2	During treatment	1.5	9.99	0.045	12.42	7.71		
3/24/2020	2020	10:15 AM	Station #2	During treatment	2	9.82	0.045	10.74	7.44		
3/24/2020	2020	10:15 AM	Station #2	During treatment	2.5	9.45	0.050	4.80	7.01		
3/24/2020	2020	10:30 AM	East bank 10 mins after passing	During treatment	0	10.22	0.058	13.16	7.12		
3/24/2020	2020	10:30 AM	East bank 10 mins after passing	During treatment	0.5	10.23	0.066	13.12	7.14		
3/24/2020	2020	10:30 AM	East bank 10 mins after passing	During treatment	1	10.23	0.080	13.09	7.14		
3/24/2020	2020	10:30 AM	East bank 10 mins after passing	During treatment	1.5	10.22	0.107	12.91	7.03		
3/24/2020	2020	10:30 AM	East bank 10 mins after passing	During treatment	1.8	10.23	0.140	12.84	6.70		
3/24/2020	2020	1:00 PM	East bank	During treatment	0	10.44	0.051	13.58	8.45	1	
3/24/2020	2020	1:00 PM	East bank	During treatment	0.5	10.45	0.052	13.86	8.45		
3/24/2020	2020	1:00 PM	East bank	During treatment	1	10.42	0.052	14.29	8.33		
3/24/2020	2020	1:00 PM	East bank	During treatment	1.5	10.41	0.052	14.05	8.21		
3/24/2020	2020	1:00 PM	East bank	During treatment	1.8	10.37	0.083	13.33	7.94		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
3/24/2020	2020	1:30 PM	North end 10 mins after passing	During treatment	0	10.36	0.084	13.41	7.94	1	
3/24/2020	2020	1:30 PM	North end 10 mins after passing	During treatment	0.5	10.38	0.069	13.61	7.99		
3/24/2020	2020	1:30 PM	North end 10 mins after passing	During treatment	1	10.37	0.086	13.37	8.02		
3/24/2020	2020	1:30 PM	North end 10 mins after passing	During treatment	1.5	10.19	0.127	13.03	7.91		
3/24/2020	2020	1:30 PM	North end 10 mins after passing	During treatment	2	10.27	0.149	13.29	7.80		
3/24/2020	2020	1:30 PM	North end 10 mins after passing	During treatment	2.5	10.27	0.156	12.74	7.74		
3/24/2020	2020	1:30 PM	North end 10 mins after passing	During treatment	3	10.17	0.101	12.48	7.83		
3/24/2020	2020	2:00 PM	Station #2	During treatment	0	10.31	0.083	12.60	7.73	1.1	floc visible
3/24/2020	2020	2:00 PM	Station #2	During treatment	0.5	10.32	0.084	12.51	7.69		
3/24/2020	2020	2:00 PM	Station #2	During treatment	1	10.05	0.097	12.40	7.65		
3/24/2020	2020	2:00 PM	Station #2	During treatment	1.5	10.07	0.140	12.32	7.58		
3/24/2020	2020	2:00 PM	Station #2	During treatment	2	10.16	0.161	12.46	7.54		
3/24/2020	2020	2:00 PM	Station #2	During treatment	2.5	9.78	0.090	8.63	7.30		
3/24/2020	2020	11:30 AM	Mid-Lake Station	During treatment	0	10.30	0.091	12.60	7.66	1.15	
3/24/2020	2020	11:30 AM	Mid-Lake Station	During treatment	0.5	10.28	0.096	12.39	7.64		
3/24/2020	2020	11:30 AM	Mid-Lake Station	During treatment	1	10.29	0.107	12.39	7.63		
3/24/2020	2020	11:30 AM	Mid-Lake Station	During treatment	1.5	10.24	0.143	12.29	7.61		
3/24/2020	2020	11:30 AM	Mid-Lake Station	During treatment	2	10.16	0.167	12.23	7.84		
3/24/2020	2020	11:30 AM	Mid-Lake Station	During treatment	2.5	9.75	0.146	11.45	7.89		
3/24/2020	2020	6:00 PM	East bank	During treatment	0	10.59	0.083	13.37	7.96	1.4	
3/24/2020	2020	6:00 PM	East bank	During treatment	0.5	10.55	0.087	13.80	7.92		
3/24/2020	2020	6:00 PM	East bank	During treatment	1	10.48	0.088	13.52	7.85		
3/24/2020	2020	6:00 PM	East bank	During treatment	1.5	10.46	0.090	13.55	7.78		
3/24/2020	2020	6:00 PM	North end	During treatment	0	10.44	0.110	12.93	7.80	1.8	
3/24/2020	2020	6:00 PM	North end	During treatment	0.5	10.46	0.110	13.15	7.82		
3/24/2020	2020	6:00 PM	North end	During treatment	1	10.47	0.110	13.60	7.80		
3/24/2020	2020	6:00 PM	North end	During treatment	1.5	10.40	0.133	13.13	7.74		
3/24/2020	2020	6:00 PM	North end	During treatment	2	10.29	0.145	12.80	7.65		
3/24/2020	2020	6:00 PM	North end	During treatment	2.5	10.26	0.173	12.80	7.57		
3/24/2020	2020	6:00 PM	North end	During treatment	3	10.21	0.180	12.73	7.28		
3/24/2020	2020	6:00 PM	Mid-Lake Station	During treatment	0	10.43	0.114	13.20	7.61	1.7	
3/24/2020	2020	6:00 PM	Mid-Lake Station	During treatment	0.5	10.53	0.121	13.20	7.73		
3/24/2020	2020	6:00 PM	Mid-Lake Station	During treatment	1	10.51	0.133	13.09	7.75		
3/24/2020	2020	6:00 PM	Mid-Lake Station	During treatment	1.5	10.45	0.196	13.12	7.71		
3/24/2020	2020	6:00 PM	Mid-Lake Station	During treatment	2	10.51	0.267	12.86	7.68		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
3/24/2020	2020	6:00 PM	Mid-Lake Station	During treatment	2.5	10.39	0.236	12.85	7.71		
3/24/2020	2020	6:00 PM	Station #2	During treatment	0	10.59	0.136	12.99	8.20	1.7	floc still faintly visible
3/24/2020	2020	6:00 PM	Station #2	During treatment	0.5	10.63	0.151	12.78	8.14		
3/24/2020	2020	6:00 PM	Station #2	During treatment	1	10.62	0.157	13.09	8.08		
3/24/2020	2020	6:00 PM	Station #2	During treatment	1.5	10.58	0.164	12.96	7.95		
3/24/2020	2020	6:00 PM	Station #2	During treatment	2	10.53	0.263	13.14	7.89		
3/24/2020	2020	6:00 PM	Station #2	During treatment	2.5	9.93	0.178	12.27	7.71		
3/25/2020	2020	10:00 AM	Mid-Lake Station	During treatment	0	9.87	0.164	12.81	8.22	2.50	
3/25/2020	2020	10:00 AM	Mid-Lake Station	During treatment	0.5	9.95	0.166	12.95	8.03		
3/25/2020	2020	10:00 AM	Mid-Lake Station	During treatment	1	9.93	0.167	13.10	7.98		
3/25/2020	2020	10:00 AM	Mid-Lake Station	During treatment	1.5	9.95	0.204	12.99	8.02		
3/25/2020	2020	10:00 AM	Mid-Lake Station	During treatment	2	9.97	0.246	12.68	8.33		
3/25/2020	2020	10:00 AM	Mid-Lake Station	During treatment	2.5	9.91	0.233	8.59	8.08		
3/25/2020	2020	10:00 AM	Station #2	During treatment	0	9.82	0.157	13.04	7.85	2.4	
3/25/2020	2020	10:00 AM	Station #2	During treatment	0.5	9.91	0.157	12.84	7.79		
3/25/2020	2020	10:00 AM	Station #2	During treatment	1	9.87	0.192	12.64	7.85		
3/25/2020	2020	10:00 AM	Station #2	During treatment	1.5	9.89	0.245	12.69	7.93		
3/25/2020	2020	10:00 AM	Station #2	During treatment	2	9.91	0.276	12.81	7.80		
3/25/2020	2020	10:00 AM	Station #2	During treatment	2.5	9.82	0.154	6.90	7.50		
3/25/2020	2020	10:30 AM	East bank	During treatment	0	9.92	0.152	12.94	7.51	1.9	
3/25/2020	2020	10:30 AM	East bank	During treatment	0.5	9.89	0.154	13.01	7.50		
3/25/2020	2020	10:30 AM	East bank	During treatment	1	9.91	0.156	13.12	7.50		
3/25/2020	2020	10:30 AM	East bank	During treatment	1.5	9.92	0.162	13.08	7.51		
3/25/2020	2020	10:30 AM	East bank	During treatment	1.7	9.93	0.162	12.17	7.48		
3/25/2020	2020	10:30 AM	North end	During treatment	0	10.03	0.164	12.81	7.44	2.9	
3/25/2020	2020	10:30 AM	North end	During treatment	0.5	10.04	0.167	12.95	7.44		
3/25/2020	2020	10:30 AM	North end	During treatment	1	10.09	0.202	12.94	7.46		
3/25/2020	2020	10:30 AM	North end	During treatment	1.5	10.19	0.236	12.90	7.49		
3/25/2020	2020	10:30 AM	North end	During treatment	2	10.18	0.252	12.64	7.49		
3/25/2020	2020	10:30 AM	North end	During treatment	2.5	10.13	0.250	12.43	7.48		
3/25/2020	2020	10:30 AM	North end	During treatment	3	9.60	0.238	11.64	7.33		
3/25/2020	2020	1:00 PM	Station #2	Post-treatment	0	10.16	0.176	12.98	7.49	2.3	
3/25/2020	2020	1:00 PM	Station #2	Post-treatment	0.5	10.17	0.173	13.17	7.55		
3/25/2020	2020	1:00 PM	Station #2	Post-treatment	1	10.11	0.209	13.02	7.58		
3/25/2020	2020	1:00 PM	Station #2	Post-treatment	1.5	10.11	0.300	13.15	6.83		
3/25/2020	2020	1:00 PM	Station #2	Post-treatment	2	10.13	0.339	13.18	5.81		
3/25/2020	2020	1:00 PM	Station #2	Post-treatment	2.5	10.15	0.241	12.98	5.39		
3/25/2020	2020	1:00 PM	Mid-Lake Station	Post-treatment	0	10.41	0.188	12.78	7.57	2.3	
3/25/2020	2020	1:00 PM	Mid-Lake Station	Post-treatment	0.5	10.41	0.188	12.89	7.92		
3/25/2020	2020	1:00 PM	Mid-Lake Station	Post-treatment	1	10.34	0.192	12.77	7.75		
3/25/2020	2020	1:00 PM	Mid-Lake Station	Post-treatment	1.5	10.15	0.231	13.02	7.70		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
3/25/2020	2020	1:00 PM	Mid-Lake Station	Post-treatment	2	10.20	0.312	13.13	8.33		
3/25/2020	2020	1:00 PM	Mid-Lake Station	Post-treatment	2.5	10.14	0.253	10.83	8.16		
3/25/2020	2020	2:00 PM	North end	Post-treatment	0	10.53	0.192	13.11	7.32	2.6	
3/25/2020	2020	2:00 PM	North end	Post-treatment	0.5	10.38	0.205	13.04	7.30		
3/25/2020	2020	2:00 PM	North end	Post-treatment	1	10.27	0.224	12.69	7.29		
3/25/2020	2020	2:00 PM	North end	Post-treatment	1.5	10.16	0.243	13.24	7.31		
3/25/2020	2020	2:00 PM	North end	Post-treatment	2	10.17	0.279	12.92	7.34		
3/25/2020	2020	2:00 PM	North end	Post-treatment	2.5	10.18	0.317	13.02	7.60		
3/25/2020	2020	2:00 PM	North end	Post-treatment	2.9	9.87	0.289	4.09	7.30		
3/26/2020	2020	11:00	Mid-Lake Station	Post-treatment	0	9.730	0.23	12.60	8.25	2.5	
3/26/2020	2020	11:00	Mid-Lake Station	Post-treatment	0.5	9.73	0.228	12.20	8.17		
3/26/2020	2020	11:00	Mid-Lake Station	Post-treatment	1	9.74	0.228	12.25	8.06		
3/26/2020	2020	11:00	Mid-Lake Station	Post-treatment	1.5	9.74	0.228	12.31	8.01		
3/26/2020	2020	11:00	Mid-Lake Station	Post-treatment	2	9.73	0.228	12.37	7.93		
3/26/2020	2020	11:00	Mid-Lake Station	Post-treatment	2.5	9.98	0.171	4.05	7.57		
3/26/2020	2020	11:00	Station #2	Post-treatment	0	9.99	0.246	12.13	7.44	2.3	
3/26/2020	2020	11:00	Station #2	Post-treatment	0.5	9.99	0.247	12.26	7.42		
3/26/2020	2020	11:00	Station #2	Post-treatment	1	10.00	0.248	12.26	7.41		
3/26/2020	2020	11:00	Station #2	Post-treatment	1.5	9.99	0.247	12.35	7.39		
3/26/2020	2020	11:00	Station #2	Post-treatment	2	9.96	0.243	12.42	7.39		
3/26/2020	2020	11:00	Station #2	Post-treatment	2.5	9.94	0.168	1.70	7.19		
4/10/2020	2020	11:00	Mid-Lake Station	Post-treatment	0	13.52	0.231	9.59	8.23	2.3	
4/10/2020	2020	11:00	Mid-Lake Station	Post-treatment	0.5	13.51	0.231	9.72	7.98		
4/10/2020	2020	11:00	Mid-Lake Station	Post-treatment	1	13.51	0.231	9.58	7.88		
4/10/2020	2020	11:00	Mid-Lake Station	Post-treatment	1.5	13.51	0.231	9.68	7.75		
4/10/2020	2020	11:00	Mid-Lake Station	Post-treatment	2	13.51	0.231	9.66	7.64		
4/10/2020	2020	11:00	Mid-Lake Station	Post-treatment	2.5	13.45	0.231	9.15	7.55		
4/10/2020	2020	11:00	Station #2	Post-treatment	0	13.65	0.231	9.66	7.40	2.2	
4/10/2020	2020	11:00	Station #2	Post-treatment	0.5	13.62	0.232	9.47	7.33		
4/10/2020	2020	11:00	Station #2	Post-treatment	1	13.66	0.231	9.52	7.27		
4/10/2020	2020	11:00	Station #2	Post-treatment	1.5	13.64	0.231	9.57	7.24		
4/10/2020	2020	11:00	Station #2	Post-treatment	2	13.61	0.231	9.59	7.20		
4/10/2020	2020	11:00	Station #2	Post-treatment	2.3	12.20	0.170	3.31	6.83		
5/27/2020	2020	14:30	Mid-Lake Station	Monthly Sampling	0	20.94	0.233	7.44	8.07	2.00	GAGE 5.5' note: DO probe calibration issues
5/27/2020	2020	14:30	Mid-Lake Station	Monthly Sampling	0.5	20.88	0.232	7.46	8.05		
5/27/2020	2020	14:30	Mid-Lake Station	Monthly Sampling	1	20.73	0.232	7.61	8.01		
5/27/2020	2020	14:30	Mid-Lake Station	Monthly Sampling	1.5	19.91	0.231	7.93	8.17		
5/27/2020	2020	14:30	Mid-Lake Station	Monthly Sampling	2	19.96	0.252	3.11	7.06		
6/18/2020	2020	11:00	Mid-Lake Station	Monthly Sampling	0	20.65	0.236	9.83	8.06	2.2	GAGE 5.35'
6/18/2020	2020	11:00	Mid-Lake Station	Monthly Sampling	0.5	20.75	0.234	9.85	8.04		
6/18/2020	2020	11:00	Mid-Lake Station	Monthly Sampling	1	20.67	0.234	10.08	8.03		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
6/18/2020	2020	11:00	Mid-Lake Station	Monthly Sampling	1.5	20.57	0.234	10.17	8.00		
6/18/2020	2020	11:00	Mid-Lake Station	Monthly Sampling	2	20.37	0.234	10.27	7.98		
6/18/2020	2020	11:00	Mid-Lake Station	Monthly Sampling	2.5	20.06	0.276	2.28	6.74		
7/13/2020	2020	12:00	Mid-Lake Station	Pre-Treatment	0	22.79	0.247	10.23	8.82	2	secchi at bottom
7/13/2020	2020	12:00	Mid-Lake Station	Pre-Treatment	0.5	22.78	0.246	10.19	8.83		
7/13/2020	2020	12:00	Mid-Lake Station	Pre-Treatment	1	22.78	0.247	10.41	8.82		
7/13/2020	2020	12:00	Mid-Lake Station	Pre-Treatment	1.5	22.78	0.246	10.65	8.80		
7/13/2020	2020	12:00	Mid-Lake Station	Pre-Treatment	1.8	22.78	0.247	9.51	7.09		
7/13/2020	2020	12:30	Station #2	Pre-Treatment	0	22.92	0.248	10.56	8.72	2.10	secchi bottom. Lake level 4.8'
7/13/2020	2020	12:30	Station #2	Pre-Treatment	0.5	22.92	0.248	10.55	8.73		
7/13/2020	2020	12:30	Station #2	Pre-Treatment	1	22.92	0.247	10.45	8.73		
7/13/2020	2020	12:30	Station #2	Pre-Treatment	1.5	22.92	0.248	10.76	8.72		
7/13/2020	2020	12:30	Station #2	Pre-Treatment	1.9	22.94	0.247	10.66	8.73		
7/14/2020	2020	9:00	Mid-Lake Station	During treatment	0	22.73	0.247	10.68	8.73	2.15	
7/14/2020	2020	9:00	Mid-Lake Station	During treatment	0.5	22.75	0.247	10.54	8.70		
7/14/2020	2020	9:00	Mid-Lake Station	During treatment	1	22.71	0.247	10.42	8.64		
7/14/2020	2020	9:00	Mid-Lake Station	During treatment	1.5	22.58	0.248	10.59	8.61		
7/14/2020	2020	9:00	Mid-Lake Station	During treatment	2	22.49	0.250	10.46	8.54		
7/14/2020	2020	9:00	Mid-Lake Station	During treatment	2.4	22.05	0.273	3.68	7.36		reading 2.4m in bottom muck
7/14/2020	2020	9:30	Station #2	During treatment	0	22.74	0.248	10.32	8.61	1.60	in floc ~10 mins after passing. Secchi in much
7/14/2020	2020	9:30	Station #2	During treatment	0.5	22.72	0.251	10.38	8.55		
7/14/2020	2020	9:30	Station #2	During treatment	1	22.69	0.289	10.31	8.29		
7/14/2020	2020	9:30	Station #2	During treatment	1.5	22.70	0.311	10.48	8.15		
7/14/2020	2020	9:30	Station #2	During treatment	2	22.47	0.311	10.30	7.82		
7/14/2020	2020	9:30	In floc just after pass	During treatment	0	22.57	0.333	10.16	8.15		
7/14/2020	2020	9:30	In floc just after pass	During treatment	0.5	22.67	0.341	10.35	8.19		
7/14/2020	2020	9:30	In floc just after pass	During treatment	1	22.65	0.337	10.53	8.10		
7/14/2020	2020	9:30	In floc just after pass	During treatment	1.5	22.44	0.346	10.24	8.16		
7/14/2020	2020	9:30	In floc just after pass	During treatment	1.8	22.19	0.340	2.60	7.20		reading in bottom much
7/14/2020	2020	11:30	Mid-Lake Station	During treatment	0	23.02	0.276	10.22	8.04	1.6	recently treated
7/14/2020	2020	11:30	Mid-Lake Station	During treatment	0.5	23.01	0.281	10.28	8.03		
7/14/2020	2020	11:30	Mid-Lake Station	During treatment	1	22.93	0.328	10.43	8.07		
7/14/2020	2020	11:30	Mid-Lake Station	During treatment	1.5	22.83	0.338	10.64	8.10		
7/14/2020	2020	11:30	Mid-Lake Station	During treatment	2	22.74	0.324	10.53	8.05		
7/14/2020	2020	11:30	Station #2	During treatment	0	23.21	0.268	10.33	8.14	2	
7/14/2020	2020	11:30	Station #2	During treatment	0.5	23.21	0.272	10.38	8.16		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
7/14/2020	2020	11:30	Station #2	During treatment	1	23.19	0.279	10.54	8.16		
7/14/2020	2020	11:30	Station #2	During treatment	1.5	23.19	0.285	10.57	8.17		
7/14/2020	2020	11:30	Station #2	During treatment	2	23.20	0.319	13.67	8.06		reading in bottom
7/14/2020	2020	12:00	West side in untreated area	During treatment	0	23.18	0.271	10.36	8.21	1.5	secchi at bottom
7/14/2020	2020	12:00	West side in untreated area	During treatment	0.5	23.20	0.275	1018.00	8.21		
7/14/2020	2020	12:00	West side in untreated area	During treatment	1	22.82	0.257	10.53	8.24		
7/14/2020	2020	12:00	West side in untreated area	During treatment	1.5	22.90	0.320	0.55	6.91		reading at bottom
7/14/2020	2020	12:00	North end	During treatment	0	23.53	0.276	10.16	8.01	2.2	secchi at bottom
7/14/2020	2020	12:00	North end	During treatment	0.5	23.14	0.279	10.30	8.04		
7/14/2020	2020	12:00	North end	During treatment	1	22.84	0.299	10.24	8.08		
7/14/2020	2020	12:00	North end	During treatment	1.5	22.55	0.258	10.34	8.03		
7/14/2020	2020	12:00	North end	During treatment	2	22.48	0.259	10.26	8.05		
7/14/2020	2020	12:30	East bank	During treatment	0	23.55	0.269	9.99	8.11	1.9	in muck
7/14/2020	2020	12:30	East bank	During treatment	0.5	23.40	0.275	9.97	8.11		
7/14/2020	2020	12:30	East bank	During treatment	1	23.08	0.278	10.20	8.08		
7/14/2020	2020	12:30	East bank	During treatment	1.5	23.07	0.279	10.27	8.06		
7/14/2020	2020	15:30	Mid-Lake Station	During treatment	0	24.21	0.321	10.33	8.04	2.00	secchi at bottom
7/14/2020	2020	15:30	Mid-Lake Station	During treatment	0.5	24.21	0.322	10.14	8.02		
7/14/2020	2020	15:30	Mid-Lake Station	During treatment	1	24.18	0.322	9.99	8.01		
7/14/2020	2020	15:30	Mid-Lake Station	During treatment	1.5	24.07	0.311	10.95	8.04		
7/14/2020	2020	15:30	Mid-Lake Station	During treatment	2	24.62	0.278	6.03	7.10		reading at bottom
7/14/2020	2020	15:45	North end	During treatment	0	24.49	0.306	10.05	7.91	2.2	
7/14/2020	2020	15:45	North end	During treatment	0.5	24.37	0.311	10.19	7.92		
7/14/2020	2020	15:45	North end	During treatment	1	24.03	0.316	10.48	7.90		
7/14/2020	2020	15:45	North end	During treatment	1.5	23.89	0.309	10.52	7.90		
7/14/2020	2020	15:45	North end	During treatment	2	23.86	0.329	10.12	7.60		
7/14/2020	2020	15:45	North end	During treatment	2.2	24.13	0.326	2.99	6.54		reading at bottom
7/14/2020	2020	15:45	East bank	During treatment	0	24.41	0.285	10.12	7.76	1.6	secchi at bottom
7/14/2020	2020	15:45	East bank	During treatment	0.5	24.27	0.295	10.43	7.82		
7/14/2020	2020	15:45	East bank	During treatment	1	24.01	0.287	10.82	7.93		
7/14/2020	2020	15:45	East bank	During treatment	1.5	23.61	0.300	11.36	7.91		
7/14/2020	2020	16:00	Station #2	During treatment	0	24.85	0.322	10.19	7.92	1.7	secchi at bottom
7/14/2020	2020	16:00	Station #2	During treatment	0.5	24.82	0.319	10.25	7.91		
7/14/2020	2020	16:00	Station #2	During treatment	1	23.85	0.361	10.49	7.88		
7/14/2020	2020	16:00	Station #2	During treatment	1.5	23.62	0.349	10.67	7.92		
7/14/2020	2020	17:00	Mid-Lake Station	During treatment	0	24.77	0.376	9.85	7.87	2.30	secchi at bottom
7/14/2020	2020	17:00	Mid-Lake Station	During treatment	0.5	24.78	0.384	10.11	7.86		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
7/14/2020	2020	17:00	Mid-Lake Station	During treatment	1	24.42	0.344	10.37	7.91		
7/14/2020	2020	17:00	Mid-Lake Station	During treatment	1.5	23.70	0.338	10.83	7.97		
7/14/2020	2020	17:00	Mid-Lake Station	During treatment	2	23.60	0.347	10.74	7.97		
7/14/2020	2020	17:00	North end	During treatment	0	24.51	0.311	10.19	7.97	2.1	secchi at bottom
7/14/2020	2020	17:00	North end	During treatment	0.5	24.53	0.321	10.22	7.93		
7/14/2020	2020	17:00	North end	During treatment	1	24.20	0.337	10.58	7.97		
7/14/2020	2020	17:00	North end	During treatment	1.5	23.97	0.327	10.54	7.98		
7/14/2020	2020	17:00	North end	During treatment	2	24.01	0.338	11.46	7.96		
7/14/2020	2020	17:00	Station #2	During treatment	0	24.81	0.315	10.46	7.95	2.1	secchi at bottom
7/14/2020	2020	17:00	Station #2	During treatment	0.5	24.82	0.313	10.07	7.94		
7/14/2020	2020	17:00	Station #2	During treatment	1	24.22	0.336	10.91	7.94		
7/14/2020	2020	17:00	Station #2	During treatment	1.5	23.80	0.343	11.09	7.96		
7/14/2020	2020	17:00	Station #2	During treatment	2	23.80	0.344	11.04	7.97		
7/15/2020	2020	10:00	Station #2	During treatment	0	23.50	0.346	10.12	8.38	1.95	secchi at bottom
7/15/2020	2020	10:00	Station #2	During treatment	0.5	23.49	0.343	10.25	8.26		
7/15/2020	2020	10:00	Station #2	During treatment	1	23.19	0.335	10.29	8.17		
7/15/2020	2020	10:00	Station #2	During treatment	1.5	23.17	0.335	10.19	8.08		
7/15/2020	2020	10:00	Station #2	During treatment	2	23.56	0.338	10.97	7.90		
7/15/2020	2020	10:00	Mid-Lake Station	During treatment	0	23.51	0.337	9.90	8.03		
7/15/2020	2020	10:00	Mid-Lake Station	During treatment	0.5	23.49	0.343	9.93	7.96		
7/15/2020	2020	10:00	Mid-Lake Station	During treatment	1	23.46	0.350	10.15	7.85		
7/15/2020	2020	10:00	Mid-Lake Station	During treatment	1.5	23.46	0.381	10.25	7.71		
7/15/2020	2020	10:00	Mid-Lake Station	During treatment	2	23.53	0.326	8.69	7.57		reading at bottom
7/15/2020	2020	10:30	North end	During treatment	0	23.51	0.330	10.09	7.94		
7/15/2020	2020	10:30	North end	During treatment	0.5	23.47	0.337	10.17	7.94		
7/15/2020	2020	10:30	North end	During treatment	1	23.37	0.347	10.18	8.12		
7/15/2020	2020	10:30	North end	During treatment	1.5	23.37	0.350	10.24	8.24		
7/15/2020	2020	10:30	North end	During treatment	2	23.43	0.355	11.49	8.21		
7/15/2020	2020	12:00	Station #2	During treatment	0	23.89	0.367	10.02	7.93	1.7	secchi at bottom
7/15/2020	2020	12:00	Station #2	During treatment	0.5	23.88	0.368	10.16	7.86		
7/15/2020	2020	12:00	Station #2	During treatment	1	23.85	0.364	10.29	7.83		
7/15/2020	2020	12:00	Station #2	During treatment	1.5	23.79	0.360	10.46	7.84		
7/15/2020	2020	12:00	Mid-Lake Station	During treatment	0	23.78	0.350	9.96	7.82	2.1	secchi at bottom
7/15/2020	2020	12:00	Mid-Lake Station	During treatment	0.5	23.77	0.350	10.05	7.81		
7/15/2020	2020	12:00	Mid-Lake Station	During treatment	1	23.75	0.349	10.32	7.78		
7/15/2020	2020	12:00	Mid-Lake Station	During treatment	1.5	23.67	0.349	10.34	7.79		
7/15/2020	2020	12:00	Mid-Lake Station	During treatment	2	23.51	0.347	10.31	7.82		
7/15/2020	2020	14:30	Station #2	During treatment	0	24.48	0.384	10.16	7.82	1.8	secchi at bottom
7/15/2020	2020	14:30	Station #2	During treatment	0.5	24.48	0.383	10.07	7.81		
7/15/2020	2020	14:30	Station #2	During treatment	1	24.37	0.378	10.25	7.82		
7/15/2020	2020	14:30	Station #2	During treatment	1.5	24.30	0.374	10.34	7.86		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
7/15/2020	2020	3:00 PM	Mid-Lake Station	During treatment	0	24.34	0.362	9.90	7.83	2.1	secchi at bottom
7/15/2020	2020	3:00 PM	Mid-Lake Station	During treatment	0.5	24.34	0.364	9.87	7.85		
7/15/2020	2020	3:00 PM	Mid-Lake Station	During treatment	1	24.34	0.362	9.98	7.86		
7/15/2020	2020	3:00 PM	Mid-Lake Station	During treatment	1.5	24.37	0.372	10.12	7.85		
7/15/2020	2020	3:00 PM	Mid-Lake Station	During treatment	2	24.39	0.378	10.31	7.85		
7/15/2020	2020	3:00 PM	In floc just after pass, W of lake gage	During treatment	0	24.36	0.373	9.78	7.57		
7/15/2020	2020	3:00 PM	In floc just after pass, W of lake gage	During treatment	0.5	24.38	0.375	9.74	7.71		
7/15/2020	2020	3:00 PM	In floc just after pass, W of lake gage	During treatment	1	24.33	0.366	9.96	7.69		
7/15/2020	2020	3:00 PM	In floc just after pass, W of lake gage	During treatment	1.5	24.38	0.371	10.08	7.71		
7/15/2020	2020	3:00 PM	In floc just after pass, W of lake gage	During treatment	2	24.32	0.383	10.10	7.69		
7/15/2020	2020	5:00 PM	Station #2	During treatment	0	25.45	0.424	9.26	7.94	1.90	secchi at bottom
7/15/2020	2020	5:00 PM	Station #2	During treatment	0.5	25.10	0.413	9.70	7.88		
7/15/2020	2020	5:00 PM	Station #2	During treatment	1	24.96	0.411	9.78	7.84		
7/15/2020	2020	5:00 PM	Station #2	During treatment	1.5	24.64	0.401	10.11	7.83		
7/15/2020	2020	5:00 PM	Station #2	During treatment	2	25.02	0.397	11.42	7.65		
7/15/2020	2020	5:00 PM	Mid-Lake Station	During treatment	0	25.01	0.402	9.78	7.68	2.4	secchi at bottom
7/15/2020	2020	5:00 PM	Mid-Lake Station	During treatment	0.5	25.00	0.400	9.77	7.69		
7/15/2020	2020	5:00 PM	Mid-Lake Station	During treatment	1	24.71	0.391	9.92	7.64		
7/15/2020	2020	5:00 PM	Mid-Lake Station	During treatment	1.5	24.69	0.398	9.98	7.52		
7/15/2020	2020	5:00 PM	Mid-Lake Station	During treatment	2	24.61	0.415	10.15	7.64		
7/15/2020	2020	5:00 PM	In floc just after pass, W of lake gage	During treatment	0.5	24.85	0.393	9.83	7.72		
7/15/2020	2020	5:00 PM	In floc just after pass, W of lake gage	During treatment	1	24.81	0.427	10.02	7.62		
7/15/2020	2020	8:00 PM	East bank	During treatment	0	25.24	0.395	9.15	7.93	1.6	secchi at bottom
7/15/2020	2020	8:00 PM	East bank	During treatment	0.5	25.17	0.397	9.92	7.86		
7/15/2020	2020	8:00 PM	East bank	During treatment	1	25.01	0.412	10.03	7.82		
7/15/2020	2020	8:00 PM	East bank	During treatment	1.5	24.88	0.421	10.28	7.82		
7/15/2020	2020	8:00 PM	North end	During treatment	0	25.24	0.447	9.46	7.78	2.1	secchi at bottom
7/15/2020	2020	8:00 PM	North end	During treatment	0.5	24.27	0.447	9.69	7.75		
7/15/2020	2020	8:00 PM	North end	During treatment	1	25.16	0.452	9.85	7.68		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
7/15/2020	2020	8:00 PM	North end	During treatment	1.5	25.08	0.445	9.98	7.70		
7/15/2020	2020	8:00 PM	North end	During treatment	2	24.84	0.411	10.37	7.76		
7/15/2020	2020	8:00 PM	Mid-Lake Station	During treatment	0	25.57	0.452	9.09	7.66	2.05	secchi at bottom
7/15/2020	2020	8:00 PM	Mid-Lake Station	During treatment	0.5	25.43	0.444	9.21	7.58		
7/15/2020	2020	8:00 PM	Mid-Lake Station	During treatment	1	24.97	0.441	9.80	7.50		
7/15/2020	2020	8:00 PM	Mid-Lake Station	During treatment	1.5	24.81	0.398	10.01	7.57		
7/15/2020	2020	8:00 PM	Mid-Lake Station	During treatment	2	24.8	0.395	4.41	7.47		reading at bottom
7/15/2020	2020	8:00 PM	Station #2	During treatment	0	25.15	0.473	9.04	7.51	1.7	secchi at bottom
7/15/2020	2020	8:00 PM	Station #2	During treatment	0.5	25.44	0.469	9.19	7.50		
7/15/2020	2020	8:00 PM	Station #2	During treatment	1	25.39	0.466	9.41	7.58		
7/15/2020	2020	8:00 PM	Station #2	During treatment	1.5	25.08	0.453	9.75	7.76		
7/16/2020	2020	10:00 AM	Mid-Lake Station	During treatment	0	23.73	0.453	9.38	8.54	2.35	secchi at bottom
7/16/2020	2020	10:00 AM	Mid-Lake Station	During treatment	0.5	23.78	0.448	9.41	8.38		
7/16/2020	2020	10:00 AM	Mid-Lake Station	During treatment	1	23.81	0.461	9.51	8.31		
7/16/2020	2020	10:00 AM	Mid-Lake Station	During treatment	1.5	23.79	0.485	9.33	8.24		
7/16/2020	2020	10:00 AM	Mid-Lake Station	During treatment	2	23.61	0.462	9.37	8.24		
7/16/2020	2020	10:00 AM	Station #2	During treatment	0	23.76	0.465	9.24	8.04	2.4	secchi at bottom
7/16/2020	2020	10:00 AM	Station #2	During treatment	0.5	23.8	0.464	9.31	8.01		
7/16/2020	2020	10:00 AM	Station #2	During treatment	1	23.78	0.466	9.45	7.96		
7/16/2020	2020	10:00 AM	Station #2	During treatment	1.5	23.77	0.466	9.30	7.88		
7/16/2020	2020	10:00 AM	Station #2	During treatment	2	23.73	0.479	9.12	7.82		
7/16/2020	2020	10:00 AM	Station #2	During treatment	2.3	23.74	0.507	7.25	7.33		reading at bottom
7/16/2020	2020	10:30 AM	North end	During treatment	0	23.94	0.445	9.50	7.83	2.1	secchi at bottom
7/16/2020	2020	10:30 AM	North end	During treatment	0.5	23.94	0.445	9.46	7.85		
7/16/2020	2020	10:30 AM	North end	During treatment	1	23.93	0.446	9.47	7.86		
7/16/2020	2020	10:30 AM	North end	During treatment	1.5	23.89	0.479	9.82	7.89		
7/16/2020	2020	10:30 AM	North end	During treatment	2	23.92	0.486	9.52	7.83		
7/16/2020	2020	10:30 AM	In floc 5 mins after passing	During treatment	0	23.79	0.513	9.61	7.81		
7/16/2020	2020	10:30 AM	In floc 5 mins after passing	During treatment	0.5	23.79	0.495	9.55	7.84		
7/16/2020	2020	10:30 AM	In floc 5 mins after passing	During treatment	1	23.79	0.506	9.47	7.88		
7/16/2020	2020	12:00 PM	Station #2	During treatment	0	24.03	0.499	9.29	7.58	1.7	secchi at bottom
7/16/2020	2020	12:00 PM	Station #2	During treatment	0.5	23.99	0.510	9.22	7.62		
7/16/2020	2020	12:00 PM	Station #2	During treatment	1	23.94	0.538	9.23	7.62		
7/16/2020	2020	12:00 PM	Station #2	During treatment	1.5	23.86	0.522	9.27	7.57		
7/16/2020	2020	12:00 PM	Mid-Lake Station	During treatment	0	24	0.473	9.13	7.69	2.3	secchi at bottom. Floc still visible in water column
7/16/2020	2020	12:00 PM	Mid-Lake Station	During treatment	0.5	24	0.475	9.19	7.66		
7/16/2020	2020	12:00 PM	Mid-Lake Station	During treatment	1	23.98	0.485	9.17	7.64		
7/16/2020	2020	12:00 PM	Mid-Lake Station	During treatment	1.5	23.99	0.498	9.36	7.69		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
7/16/2020	2020	12:00 PM	Mid-Lake Station	During treatment	2	24	0.508	9.32	7.86		
7/16/2020	2020	2:00 PM	Mid-Lake Station	Post-treatment	0	24.4	0.483	9.35	7.75	2.1	secchi at bottom
7/16/2020	2020	2:00 PM	Mid-Lake Station	Post-treatment	0.5	24.42	0.483	9.38	7.56		
7/16/2020	2020	2:00 PM	Mid-Lake Station	Post-treatment	1	24.37	0.484	9.43	7.33		
7/16/2020	2020	2:00 PM	Mid-Lake Station	Post-treatment	1.5	24.38	0.489	9.45	7.14		
7/16/2020	2020	2:00 PM	Mid-Lake Station	Post-treatment	2	24.43	0.505	12.76	7.12		reading at bottom
7/16/2020	2020	2:00 PM	Station #2	Post-treatment	0	24.51	0.484	9.06	7.13	1.95	secchi at bottom
7/16/2020	2020	2:00 PM	Station #2	Post-treatment	0.5	24.51	0.485	9.23	7.05		
7/16/2020	2020	2:00 PM	Station #2	Post-treatment	1	24.51	0.486	9.23	6.97		
7/16/2020	2020	2:00 PM	Station #2	Post-treatment	1.5	24.51	0.486	9.26	6.93		
7/16/2020	2020	2:00 PM	North end	Post-treatment	0	24.78	0.487	9.15	7.20	2.3	secchi at bottom
7/16/2020	2020	2:00 PM	North end	Post-treatment	0.5	24.59	0.494	9.24	7.17		
7/16/2020	2020	2:00 PM	North end	Post-treatment	1	24.23	0.505	9.29	7.00		
7/16/2020	2020	2:00 PM	North end	Post-treatment	1.5	24.23	0.506	9.47	6.86		
7/16/2020	2020	2:00 PM	North end	Post-treatment	2	24.23	0.506	9.59	6.76		
7/17/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	0	23.79	0.494	9.03	8.17	2.2	secchi at bottom
7/17/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	0.5	23.84	0.493	9.02	8.10		
7/17/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	1	23.86	0.494	9.01	7.80		
7/17/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	1.5	23.85	0.494	9.10	7.62		
7/17/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	2	23.85	0.495	8.70	7.58		
7/17/2020	2020	12:00 PM	Station #2	Post-treatment	0	23.81	0.497	8.84	7.32	2	secchi at bottom. GAGE 4.7'
7/17/2020	2020	12:00 PM	Station #2	Post-treatment	0.5	23.81	0.498	8.74	7.28		
7/17/2020	2020	12:00 PM	Station #2	Post-treatment	1	23.81	0.497	8.87	7.26		
7/17/2020	2020	12:00 PM	Station #2	Post-treatment	1.5	23.81	0.497	8.90	7.24		
7/17/2020	2020	12:00 PM	Station #2	Post-treatment	2	24.17	0.494	8.11	7.03		
8/7/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	0	23.2	0.519	8.94	8.45	2.1	secchi at bottom
8/7/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	0.5	23.2	0.519	8.88	8.30		
8/7/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	1	23.21	0.519	9.02	8.18		
8/7/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	1.5	23.21	0.519	9.13	8.18		
8/7/2020	2020	11:30 AM	Mid-Lake Station	Post-treatment	2	23.22	0.519	9.09	8.06		
8/7/2020	2020	12:00 PM	Station #2	Post-treatment	0	23.29	0.521	9.04	7.82	1.6	secchi at bottom. GAGE 4.2'
8/7/2020	2020	12:00 PM	Station #2	Post-treatment	0.5	23.28	0.519	8.95	7.82		
8/7/2020	2020	12:00 PM	Station #2	Post-treatment	1	23.29	0.519	8.93	7.81		
8/7/2020	2020	12:00 PM	Station #2	Post-treatment	1.5	23.3	0.519	4.19	7.30		at bottom
9/11/2020	2020	11:30 AM	Mid-Lake Station	Monthly Sampling	0	21.28	0.575	9.85	8.41	1.84	in muck. GAGE 3.55'
9/11/2020	2020	11:30 AM	Mid-Lake Station	Monthly Sampling	0.5	21.28	0.575	9.79	8.33		
9/11/2020	2020	11:30 AM	Mid-Lake Station	Monthly Sampling	1	21.29	0.576	9.84	8.13		
9/11/2020	2020	11:30 AM	Mid-Lake Station	Monthly Sampling	1.5	21.26	0.576	10.11	8.09		
9/11/2020	2020	11:30 AM	Mid-Lake Station	Monthly Sampling	1.8	21.26	0.480	2.58	7.58		at bottom
9/11/2020	2020	12:00 PM	Station #2	Monthly Sampling	0	21.39	0.578	9.82	7.65	1.45	secchi at bottom

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH	Secchi (m)	Notes
9/11/2020	2020	12:00 PM	Station #2	Monthly Sampling	0.5	21.38	0.576	9.79	7.66		
9/11/2020	2020	12:00 PM	Station #2	Monthly Sampling	1	21.37	0.576	9.81	7.66		
9/11/2020	2020	12:00 PM	Station #2	Monthly Sampling	1.5	21.4	0.506	6.83	6.97		at bottom
10/19/2020	2020		Mid-Lake Station	Monthly Sampling	0	14.49	0.495	10.57	8.44	1.9	secchi at bottom. GAGE 3.6' . After bringing up secchi, sulfur smell was observed, but 1m depth samples don't smell noticeably
10/19/2020	2020		Mid-Lake Station	Monthly Sampling	0.5	14.48	0.496	10.42	8.11		
10/19/2020	2020		Mid-Lake Station	Monthly Sampling	1	14.49	0.497	10.47	8.06		
10/19/2020	2020		Mid-Lake Station	Monthly Sampling	1.5	14.5	0.496	10.38	8.02		
10/19/2020	2020		Mid-Lake Station	Monthly Sampling	1.9	15.21	0.435	1.10	6.93		bottom
10/19/2020	2020		Station #2	Monthly Sampling	0	14.54	0.496	10.35	7.33	1.5	secchi at bottom
10/19/2020	2020		Station #2	Monthly Sampling	0.5	14.51	0.497	10.50	7.36		
10/19/2020	2020		Station #2	Monthly Sampling	1	14.52	0.497	10.48	7.39		
10/19/2020	2020		Station #2	Monthly Sampling	1.5	14.59	0.496	5.68	7.16		
1/19/2021	2021		Mid-Lake Station	Off-Season Sampling	0	7.04	0.318	11.79	9.20	2.15	secchi at bottom. GAGE 5.3'
1/19/2021	2021		Mid-Lake Station	Off-Season Sampling	0.5	7.01	0.317	11.88	8.97		
1/19/2021	2021		Mid-Lake Station	Off-Season Sampling	1	7.00	0.317	11.90	8.52		
1/19/2021	2021		Mid-Lake Station	Off-Season Sampling	1.5	6.93	0.317	11.78	8.42		
1/19/2021	2021		Mid-Lake Station	Off-Season Sampling	2	6.74	0.316	11.85	8.34		
1/19/2021	2021		Station #2	Off-Season Sampling	0	6.92	0.320	11.97	8.04	2.0	secchi at bottom
1/19/2021	2021		Station #2	Off-Season Sampling	0.5	6.89	0.317	12.17	8.13		
1/19/2021	2021		Station #2	Off-Season Sampling	1	6.94	0.319	12.01	8.04		
1/19/2021	2021		Station #2	Off-Season Sampling	1.5	6.87	0.318	12.01	8.00		
1/19/2021	2021		Station #2	Off-Season Sampling	2	6.89	0.317	12.03	7.97		
3/17/2021	2021		Mid-Lake Station	Off-Season Sampling	0	9.98	3.010	12.36	8.26	1.8	secchi NOT bottom. Gage 6.1 ft. several ducks observed
3/17/2021	2021		Mid-Lake Station	Off-Season Sampling	0.5	9.91	0.301	12.46	8.15		
3/17/2021	2021		Mid-Lake Station	Off-Season Sampling	1	9.64	0.300	12.29	8.11		
3/17/2021	2021		Mid-Lake Station	Off-Season Sampling	1.5	8.98	0.300	12.15	8.07		
3/17/2021	2021		Mid-Lake Station	Off-Season Sampling	2	8.90	0.299	12.75	8.04		
3/17/2021	2021		Mid-Lake Station	Off-Season Sampling	2.5	8.92	0.341	7.61	6.80		bottom
3/17/2021	2021		Station #2	Off-Season Sampling	0	10.09	0.301	11.82	7.44	2.1	just above/at bottom
3/17/2021	2021		Station #2	Off-Season Sampling	0.5	10.04	0.301	11.92	7.42		
3/17/2021	2021		Station #2	Off-Season Sampling	1	9.99	0.302	12.08	7.48		
3/17/2021	2021		Station #2	Off-Season Sampling	1.5	9.86	0.301	12.14	7.50		
3/17/2021	2021		Station #2	Off-Season Sampling	2	9.98	0.288	12.01	7.26		
3/17/2021	2021		Station #2	Off-Season Sampling	2.4	9.72	0.286	8.10	7.00		resting at bottom in muck

Table B-2. Waughop Lake Field Monitoring Data Collected by Tetra Tech, 2023-2024.

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Secchi (m)	Water Depth (m)	Notes
5/23/2023	2023	11:40 AM	Mid-Lake	Monthly	0.5	20.16	0.152	9.57	105.10	8.25	0.63	2.72	gage 5.54'
5/23/2023	2023	11:40 AM	Mid-Lake	Monthly	1	19.98	0.151	9.77	107.20	8.26			
5/23/2023	2023	11:40 AM	Mid-Lake	Monthly	1.5	19.87	0.152	9.68	105.80	8.21			
5/23/2023	2023	11:40 AM	Mid-Lake	Monthly	2	19.32	0.151	8.85	95.30	7.86			
5/23/2023	2023	11:40 AM	Mid-Lake	Monthly	2.5	18.98	0.151	7.87	83.90	7.41			
6/27/2023	2023	12:16 PM	Mid-Lake	Pre Treatment/Monthly	0.5	22.52	0.155	9.58	112.70	8.49	0.90	2.40	gage 4.75
6/27/2023	2023	12:16 PM	Mid-Lake	Pre Treatment/Monthly	1	22.39	0.155	9.45	113.90	8.49			
6/27/2023	2023	12:16 PM	Mid-Lake	Pre Treatment/Monthly	1.5	22.23	0.155	9.82	112.80	8.43			
6/27/2023	2023	12:16 PM	Mid-Lake	Pre Treatment/Monthly	2	22.16	0.155	9.64	107.30	8.24			
6/28/2023	2023	8:39 AM	Mid-Lake	Morning of Treatment	0.5	22.38	0.155	9.35	108.30	8.40	1.00	2.44	gage 4.75
6/28/2023	2023	8:39 AM	Mid-Lake	Morning of Treatment	1	22.37	0.155	9.35	109.10	8.41			
6/28/2023	2023	8:39 AM	Mid-Lake	Morning of Treatment	1.5	22.36	0.155	9.43	109.70	8.37			
6/28/2023	2023	8:39 AM	Mid-Lake	Morning of Treatment	2	22.31	0.155	8.75	101.20	8.16			
6/28/2023	2023	8:28 AM	Station #2	Morning of Treatment	0.5	22.25	0.155	9.09	105.50	8.16	0.93	1.85	
6/28/2023	2023	8:28 AM	Station #2	Morning of Treatment	1	22.30	0.155	9.25	107.00	8.23			
6/28/2023	2023	8:28 AM	Station #2	Morning of Treatment	1.5	22.26	0.155	9.16	106.10	8.17			
6/28/2023	2023	9:50 AM	Station #2	During	0.5	22.50	0.156	9.35	108.70	8.39	1.10		
6/28/2023	2023	9:50 AM	Station #2	During	1	22.40	0.156	9.21	106.90	8.33			
6/28/2023	2023	9:50 AM	Station #2	During	1.5	22.32	0.156	9.05	104.70	8.13			
6/28/2023	2023	10:02 AM	Mid-Lake	During	0.5	22.58	0.155	9.61	111.80	8.50			
6/28/2023	2023	10:02 AM	Mid-Lake	During	1	22.58	0.155	9.75	114.90	8.49			

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Secchi (m)	Water Depth (m)	Notes
6/28/2023	2023	10:02 AM	Mid-Lake	During	1.5	22.30	0.155	9.06	105.00	8.34			
6/28/2023	2023	10:02 AM	Mid-Lake	During	2	22.13	0.155	7.88	90.80	7.80			
6/28/2023	2023	11:14 AM	In Floc	During	0.5	22.69	0.179	9.50	111.00	7.80			
6/28/2023	2023	11:14 AM	In Floc	During	1.5	22.46	0.157	9.52	110.80	8.05			
6/28/2023	2023	11:24 AM	Mid-Lake	During	0.5	22.75	0.170	9.49	110.90	7.91	1.13		
6/28/2023	2023	11:24 AM	Mid-Lake	During	1	22.71	0.169	9.72	114.20	7.92			
6/28/2023	2023	11:24 AM	Mid-Lake	During	1.5	22.68	0.163	9.70	113.20	8.03			
6/28/2023	2023	11:24 AM	Mid-Lake	During	2	22.27	0.161	9.18	106.80	7.91			
6/28/2023	2023	11:40 AM	Station #2	During	0.5	22.82	0.166	9.42	110.10	7.91	0.97		
6/28/2023	2023	11:40 AM	Station #2	During	1	22.81	0.169	9.52	111.30	7.82			
6/28/2023	2023	11:40 AM	Station #2	During	1.5	22.79	0.167	9.19	107.40	7.69			
6/28/2023	2023	12:45 PM	Station #2	During	0.5	23.12	0.174	9.50	111.70	7.96	1.08		
6/28/2023	2023	12:45 PM	Station #2	During	1	7.63	0.174	9.47	111.40	7.93			
6/28/2023	2023	12:45 PM	Station #2	During	1.5	7.65	0.175	9.52	112.00	7.92			
6/28/2023	2023	12:56 PM	Mid-Lake	During	0.5	23.12	0.207	9.45	111.20	7.63	1.20		
6/28/2023	2023	12:56 PM	Mid-Lake	During	1	23.14	0.204	9.62	113.20	7.65			
6/28/2023	2023	12:56 PM	Mid-Lake	During	1.5	22.93	0.202	9.41	110.30	7.64			
6/28/2023	2023	12:56 PM	Mid-Lake	During	2	22.70	0.195	9.20	107.40	7.58			
6/28/2023	2023	2:39 PM	Station #2	During	0.5	23.75	0.209	9.36	111.50	7.59	1.29		
6/28/2023	2023	2:39 PM	Station #2	During	1	23.68	0.228	9.45	112.50	7.46			
6/28/2023	2023	2:39 PM	Station #2	During	1.5	23.68	0.234	4.94	58.80	7.33			

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Secchi (m)	Water Depth (m)	Notes
6/28/2023	2023	2:55 PM	Mid-Lake	During	0.5	23.73	0.202	9.65	115.20	7.67	1.33		
6/28/2023	2023	2:55 PM	Mid-Lake	During	1	23.34	0.208	9.72	115.00	7.55			
6/28/2023	2023	2:55 PM	Mid-Lake	During	1.5	23.14	0.213	9.87	116.40	7.55			
6/28/2023	2023	2:55 PM	Mid-Lake	During	2	22.87	0.202	10.18	118.60	7.55			
6/28/2023	2023	4:07 PM	Station #2	During	0.5	24.35	0.215	9.45	114.00	7.55	1.48		
6/28/2023	2023	4:07 PM	Station #2	During	1	24.23	0.228	9.40	113.30	7.44			
6/28/2023	2023	4:07 PM	Station #2	During	1.5	23.39	0.216	9.88	117.00	7.41			
6/28/2023	2023	4:20 PM	Mid-Lake	During	0.5	24.14	0.222	9.57	115.00	7.51	1.53		
6/28/2023	2023	4:20 PM	Mid-Lake	During	1	23.64	0.230	9.64	114.70	7.44			
6/28/2023	2023	4:20 PM	Mid-Lake	During	1.5	23.68	0.230	9.74	116.00	7.41			
6/28/2023	2023	4:20 PM	Mid-Lake	During	2	23.37	0.219	9.78	116.00	7.42			
6/28/2023	2023	6:30 PM	Station #2	After 1st day Application	0.5	24.30	0.239	9.61	115.80	7.53	1.73		
6/28/2023	2023	6:30 PM	Station #2	After 1st day Application	1	24.29	0.242	9.87	118.90	7.46			
6/28/2023	2023	6:30 PM	Station #2	After 1st day Application	1.5	24.25	0.251	9.80	118.00	7.41			
6/28/2023	2023	6:45 PM	Mid-Lake	After 1st day Application	0.5	24.26	0.267	9.36	112.60	7.32	2.17		
6/28/2023	2023	6:45 PM	Mid-Lake	After 1st day Application	1	24.25	0.262	9.81	118.10	7.27			
6/28/2023	2023	6:45 PM	Mid-Lake	After 1st day Application	1.5	24.08	0.250	9.79	117.50	7.36			
6/28/2023	2023	6:45 PM	Mid-Lake	After 1st day Application	2	23.85	0.241	10.27	122.60	7.35			
6/29/2023	2023	6:55 AM	Mid-Lake	Before 2nd day Application	0.5	23.08	0.232	--	--	7.61	2.3		gage 4.75; DO not recorded due to barge motor and interference
6/29/2023	2023	6:55 AM	Mid-Lake	Before 2nd day Application	1	23.19	0.232	--	--	7.60			
6/29/2023	2023	6:55 AM	Mid-Lake	Before 2nd day Application	1.5	23.19	0.231	--	--	7.59			

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Secchi (m)	Water Depth (m)	Notes
6/29/2023	2023	6:55 AM	Mid-Lake	Before 2nd day Application	2	23.17	0.230	--	--	7.59			
6/29/2023	2023	7:45 AM	Station #2	During	0.5	23.10	0.239	9.76	114.60	7.54	bottom	1.92	windy, lots of geese
6/29/2023	2023	7:45 AM	Station #2	During	1	23.15	0.238	9.79	115.10	7.47	bottom		
6/29/2023	2023	7:45 AM	Station #2	During	1.5	23.12	0.239	9.71	114.10	7.48	bottom		
6/29/2023	2023	7:30 AM	Mid-Lake	During	0.5	23.17	0.232	10.05	118.50	7.65	2.20	2.46	windy; barge drove by right when collecting 2 m measurements
6/29/2023	2023	7:30 AM	Mid-Lake	During	1	23.14	0.235	9.93	117.30	7.57			
6/29/2023	2023	7:30 AM	Mid-Lake	During	1.5	23.10	0.236	9.62	113.20	7.53			
6/29/2023	2023	7:30 AM	Mid-Lake	During	2	23.11	0.234	9.77	114.70	7.49			
6/29/2023	2023	9:25 AM	Station #2	During	0.5	23.09	0.284	9.59	112.50	7.27	bottom	1.92	
6/29/2023	2023	9:25 AM	Station #2	During	1	23.08	0.286	9.77	114.70	7.15	bottom		
6/29/2023	2023	9:25 AM	Station #2	During	1.5	23.07	0.286	9.71	115.10	7.14	bottom		
6/29/2023	2023	9:40 AM	Mid-Lake	During	0.5	23.12	0.273	9.65	113.30	7.26	bottom	2.46	
6/29/2023	2023	9:40 AM	Mid-Lake	During	1	23.13	0.272	9.80	115.10	7.19	bottom		
6/29/2023	2023	9:40 AM	Mid-Lake	During	1.5	23.15	0.283	9.65	113.40	7.13	bottom		
6/29/2023	2023	9:40 AM	Mid-Lake	During	2	23.16	0.299	9.64	113.30	7.06	bottom		
6/29/2023	2023	10:55 AM	Station #2	During	0.5	23.42	0.302	9.20	108.70	7.03	bottom		
6/29/2023	2023	10:55 AM	Station #2	During	1	23.42	0.302	9.28	109.80	6.99	bottom		
6/29/2023	2023	10:55 AM	Station #2	During	1.5	23.38	0.302	9.26	109.40	6.98	bottom		
6/29/2023	2023	11:15 AM	Mid-Lake	During	0.5	23.40	0.276	9.59	112.90	7.25	bottom		
6/29/2023	2023	11:15 AM	Mid-Lake	During	1	23.35	0.278	9.65	113.90	7.21	bottom		
6/29/2023	2023	11:15 AM	Mid-Lake	During	1.5	23.33	0.281	9.83	116.10	7.12	bottom		

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Secchi (m)	Water Depth (m)	Notes
6/29/2023	2023	11:15 AM	Mid-Lake	During	2	23.33	0.289	9.70	114.30	7.14	bottom		
6/29/2023	2023	12:53 PM	Station #2	After 2nd Day Application	0.5	23.90	0.293	9.67	115.30	7.08	bottom		very windy; waves and white caps
6/29/2023	2023	12:53 PM	Station #2	After 2nd Day Application	1	23.84	0.293	9.62	114.60	6.98	bottom		
6/29/2023	2023	12:53 PM	Station #2	After 2nd Day Application	1.5	23.83	0.294	9.59	114.20	6.94	bottom		
6/29/2023	2023	1:10 PM	Mid-Lake	After 2nd Day Application	0.5	23.76	0.276	9.65	114.80	7.11	bottom		
6/29/2023	2023	1:10 PM	Mid-Lake	After 2nd Day Application	1	23.71	0.276	9.80	116.40	6.99	bottom		
6/29/2023	2023	1:10 PM	Mid-Lake	After 2nd Day Application	1.5	23.71	0.276	9.85	116.90	6.95	bottom		
6/29/2023	2023	1:10 PM	Mid-Lake	After 2nd Day Application	2	23.70	0.276	9.91	117.70	6.98	bottom		
6/30/2023	2023	12:10 PM	Mid-Lake	Post Treatment - Day After	0.5	23.91	0.286	9.31	110.80	7.31	bottom	2.40	gage 4.75
6/30/2023	2023	12:10 PM	Mid-Lake	Post Treatment - Day After	1	23.85	0.286	9.21	110.80	7.21	bottom		
6/30/2023	2023	12:10 PM	Mid-Lake	Post Treatment - Day After	1.5	23.84	0.286	9.40	111.50	7.22	bottom		
6/30/2023	2023	12:10 PM	Mid-Lake	Post Treatment - Day After	2	23.84	0.288	9.38	111.20	7.24	bottom		
6/30/2023	2023	11:54 AM	Station #2	Post Treatment - Day After	0.5	23.91	0.286	9.23	110.50	7.30	bottom	1.88	
6/30/2023	2023	11:54 AM	Station #2	Post Treatment - Day After	1	23.90	0.286	9.37	110.80	7.29	bottom		
6/30/2023	2023	11:54 AM	Station #2	Post Treatment - Day After	1.5	23.91	0.286	9.33	110.60	7.26	bottom		
7/13/2023	2023	11:00 AM	Mid-Lake	2 wk Post Treatment - July Monthly	0.5	23.15	0.297	9.45	111.00	8.24	bottom	2.31	gage 4.48
7/13/2023	2023	11:00 AM	Mid-Lake	2 wk Post Treatment - July Monthly	1	23.14	0.297	9.50	111.50	8.21	bottom		
7/13/2023	2023	11:00 AM	Mid-Lake	2 wk Post Treatment - July Monthly	1.5	23.13	0.297	9.59	112.80	8.20	bottom		
7/13/2023	2023	11:00 AM	Mid-Lake	2 wk Post Treatment - July Monthly	2	22.89	0.296	9.45	110.30	8.15	bottom		
8/15/2023	2023	9:30 AM	Mid-Lake	Monthly Post Treatment	0.5	25.67	0.332	8.71	107.80	8.26	1.70	2.05	gage 3.8 ft; lost about 0.7 m of water depth since July; many fish jumping, no odor, slight green color

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Secchi (m)	Water Depth (m)	Notes
8/15/2023	2023	9:30 AM	Mid-Lake	Monthly Post Treatment	1	25.60	0.332	8.87	109.40	8.30			
8/15/2023	2023	9:30 AM	Mid-Lake	Monthly Post Treatment	1.5	25.46	0.331	9.11	112.10	8.33			
9/14/2023	2023	10:20 AM	Mid-Lake	Monthly Post Treatment (HL4)	0.5	20.55	0.346	10.44	116.50	8.72	1.74	1.98	gage 3.33 bottom of lake depth gage; very windy
9/14/2023	2023	10:20 AM	Mid-Lake	Monthly Post Treatment (HL4)	1	20.46	0.345	10.76	120.10	8.71			
9/14/2023	2023	10:20 AM	Mid-Lake	Monthly Post Treatment (HL4)	1.5	20.28	0.345	10.65	118.80	8.71			
9/14/2023	2023	10:20 AM	Mid-Lake	Monthly Post Treatment (MS5)	0.5	20.55	0.319	10.45	115.50	8.59	1.74	1.98	gage 3.33 bottom of lake depth gage; very windy
9/14/2023	2023	10:20 AM	Mid-Lake	Monthly Post Treatment (MS5)	1	20.45	0.319	10.46	115.40	8.60			
9/14/2023	2023	10:20 AM	Mid-Lake	Monthly Post Treatment (MS5)	1.5	20.31	0.319	10.56	116.30	8.59			
10/11/2023	2023	10:30 AM	Mid-Lake	Monthly Post Treatment (MS5)	0.5	15.80	0.328	10.85	111.10	8.70	0.90	1.86	gage 3.0; raining hard, made secchi disk reading difficult
10/11/2023	2023	10:30 AM	Mid-Lake	Monthly Post Treatment (MS5)	1	15.80	0.328	10.82	110.70	8.72			
10/11/2023	2023	10:30 AM	Mid-Lake	Monthly Post Treatment (MS5)	1.5	15.75	0.327	10.82	110.50	8.72			
12/12/2023	2023	10:18 AM	Mid-Lake	Quarterly Post Treatment (MS5)	0.5	7.17	0.254	13.25	108.50	8.17	0.77	2.35	gage 4.2; water is green, fish jumping, geese on the lake, no smell when picking up anchor; water level much higher, 40 and overcast
12/12/2023	2023	10:18 AM	Mid-Lake	Quarterly Post Treatment (MS5)	1	7.13	0.253	13.26	108.50	8.21			
12/12/2023	2023	10:18 AM	Mid-Lake	Quarterly Post Treatment (MS5)	1.5	7.13	0.253	13.19	108.00	8.24			
12/12/2023	2023	10:18 AM	Mid-Lake	Quarterly Post Treatment (MS5)	2	7.14	0.254	13.19	108.00	8.26			
3/13/2024	2024	9:30	Mid-Lake	Quarterly Post Treatment (MS5)	0.5	7.67	0.202	13.33	109.40	8.73	0.7	2.9	gage 5.68 ft; sunny 40, water is green and cloudy, waterfowl and fish observed, rotten egg smell when pulling up seechi disk and anchor; water leaves hands feeling slimy and sticky
3/13/2024	2024	9:30	Mid-Lake	Quarterly Post Treatment (MS5)	1	7.62	0.203	13.31	109.80	8.76			
3/13/2024	2024	9:30	Mid-Lake	Quarterly Post Treatment (MS5)	1.5	7.59	0.202	13.26	109.20	8.77			
3/13/2024	2024	9:30	Mid-Lake	Quarterly Post Treatment (MS5)	2	7.58	0.202	13.22	108.80	8.77			
3/13/2024	2024	9:30	Mid-Lake	Quarterly Post Treatment (MS5)	2.5	7.48	0.202	13.02	107.20	8.69			
6/27/2024	2024	10:30	Mid-Lake	Quarterly Post Treatment (MS5)	0.5	21.48	0.224	9.06	102.40	7.29	0.85	2.50	gage (big) 4.5 ft; cloudy, very windy, 50-60 deg C, secchi probably affected by choppy water, geese and ducks, kingfisher, sparrows, bald

Date	Year	Time	Location	Pre-, During, or Post-Treatment	Depth (m)	Temperature (°C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (%)	pH	Secchi (m)	Water Depth (m)	Notes
													eagle and osprey observed flying around lake; osprey nest in same location as last year, brownish/green tint to water, feels slimy to touch, slight hydrogen sulfide smell near lily pads on north shore, no odor at middle of lake, buoy is not located at GPS coordinates, samples were collected at GPS coordinates
6/27/2024	2024	10:30	Mid-Lake	Quarterly Post Treatment (MS5)	1	21.49	0.225	8.99	101.70	7.29			
6/27/2024	2024	10:30	Mid-Lake	Quarterly Post Treatment (MS5)	1.5	21.43	0.224	9.11	103.10	7.31			
6/27/2024	2024	10:30	Mid-Lake	Quarterly Post Treatment (MS5)	2	21.24	0.224	9.35	105.40	7.36			

APPENDIX C: LABORATORY DATA REPORTS

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1712538 **PAGE 1**

REPORT DATE: 04/28/20

DATE SAMPLED: 03/23/20 **DATE RECEIVED:** 03/23/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Four water samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 1m	0.085	0.005	0.046	0.040	1.55	20.3
Mid-Lake Bottom	0.096	0.004	0.055	0.049	1.78	20.3
Lake #2 1 m	0.090	0.003	0.037	0.052	1.49	17.0
Lake #2 Bottom	0.085	0.003	0.044	0.050	1.80	20.1

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	1.45	0.062	0.028	59	12
Mid-Lake Bottom	<1.00	0.072	0.017	81	16
Lake #2 1 m	<1.00	0.077	0.022	45	12
Lake #2 Bottom	<1.00	0.069	0.021	61	15

IEH ANALYTICAL LABORATORIES

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CASE FILE NUMBER: 1712538 **PAGE 2**

REPORT DATE: 04/28/20

DATE SAMPLED: 03/23/20 **DATE RECEIVED:** 03/23/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM18 4500PF	SM184500NH3H	SM184500N03F	SM204500NC	SM18 2320B
DATE ANALYZED	03/30/20	03/25/20	03/25/20	03/25/20	03/31/20	04/28/20
DETECTION LIMIT	0.002	0.001	0.010	0.010	0.050	1.00
DUPLICATE						
SAMPLE ID	BATCH	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	BATCH	Lake #2 Bottom
ORIGINAL	<0.002	0.003	0.044	0.050	0.443	20.1
DUPLICATE	<0.002	0.003	0.040	0.045	0.429	20.5
RPD	NC	0.00%	9.52%	10.53%	3.15%	1.97%
SPIKE SAMPLE						
SAMPLE ID	BATCH	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	BATCH	
ORIGINAL	<0.002	0.003	0.044	0.050	0.443	
SPIKED SAMPLE	0.050	0.023	0.248	0.256	1.60	
SPIKE ADDED	0.050	0.020	0.200	0.200	1.00	
% RECOVERY	100.00%	100.00%	102.00%	103.00%	115.63%	NA
QC CHECK						
FOUND	0.095	0.042	0.328	0.416	0.500	101
TRUE	0.094	0.039	0.324	0.408	0.490	100
% RECOVERY	101.06%	107.69%	101.23%	101.96%	102.04%	101.00%
BLANK	<0.002	<0.001	<0.010	<0.010	<0.050	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1712538 **PAGE 3**

REPORT DATE: 04/28/20

DATE SAMPLED: 03/23/20 **DATE RECEIVED:** 03/23/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.7	EPA 200.7	SM1810200H	SM1810200H
DATE ANALYZED	03/31/20	03/30/20	03/30/20	03/27/20	03/27/20
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	Lake #2 Bottom	BATCH	Lake #2 Bottom	BATCH	BATCH
ORIGINAL	<1.00	<0.003	0.021	7.7	1.0
DUPLICATE	<1.00	<0.003	0.023	7.1	0.9
RPD	NC	NC	9.09%	8.00%	10.53%
SPIKE SAMPLE					
SAMPLE ID	Lake #2 Bottom	BATCH	Lake #2 Bottom		
ORIGINAL	<1.00	<0.003	0.021		
SPIKED SAMPLE	10.3	0.477	0.485		
SPIKE ADDED	10.0	0.500	0.500		
% RECOVERY	103.00%	95.40%	92.80%	NA	NA
QC CHECK					
FOUND	10.5	0.482	0.482		
TRUE	10.0	0.500	0.500		
% RECOVERY	105.00%	96.40%	96.40%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

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Chain of Custody Form 712538

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 206-838-6258 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address:
Contact:
Email:
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☐ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard

Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

SAMPLING

Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Alkalinity	Total Aluminum	Dissolved Aluminum	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Ammonia Nitrogen	Chlorophyll a	Metals Field Filtered (Y/N)	Containers Received	Case File Number: Temp	Case File Number: Lab ID
3/23/20		SW	Mid-Lake 1m	3		X	X	X	X	X	X	X	X	X	N			A1 37791
↓		SW	Mid-Lake Bottom	3		↓	↓	↓	↓	↓	↓	↓	↓	↓	N			A2 37792
		SW	Lake #2 1 m	3											N			A3 37793
		SW	Lake #2 Bottom	3											N			AA 37794

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
Dissolved aluminum and SRP samples not filtered, will need filtration

	Date	Time
Sampled By: Iris Lippert	3/23/2020	~~3PM~~
Received By:		
Relinquished to IAL By (Signature):	3/23/2020	3PM

Shipped By:
Shipping Reference:
Received at IAL By: Rachel Mat 4/SAMPLES
Date: 3/23/20 Time: 3pm

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1712546 **PAGE 1**

REPORT DATE: 04/28/20

DATE SAMPLED: 03/26/20 **DATE RECEIVED:** 03/26/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Four water samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 1m	0.011	0.003	0.031	0.025	0.465	10.0
Mid-Lake Bottom	0.008	<0.001	0.031	0.025	0.507	10.1
Lake #2 1 m	0.010	0.003	0.035	0.024	0.468	9.50
Lake #2 Bottom	0.020	<0.001	0.032	0.024	0.443	9.50

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	85.6	0.439	0.037	1.8	<0.1
Mid-Lake Bottom	85.1	0.450	0.038	1.4	<0.1
Lake #2 1 m	81.8	0.701	0.068	0.8	<0.1
Lake #2 Bottom	94.9	0.715	0.044	0.9	<0.1

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1712546 **PAGE 2**

REPORT DATE: 04/28/20

DATE SAMPLED: 03/26/20 **DATE RECEIVED:** 03/26/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM18 4500PF	SM184500NH3H	SM184500N03F	SM204500NC	SM18 2320B
DATE ANALYZED	03/30/20	03/27/20	03/27/20	03/27/20	03/31/20	04/08/20
DETECTION LIMIT	0.002	0.001	0.010	0.010	0.050	1.00
DUPLICATE						
SAMPLE ID	BATCH	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom
ORIGINAL	<0.002	<0.001	0.032	0.024	0.443	9.50
DUPLICATE	<0.002	<0.001	0.033	0.025	0.429	9.90
RPD	NC	NC	3.08%	4.08%	3.15%	4.12%
SPIKE SAMPLE						
SAMPLE ID	BATCH	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	
ORIGINAL	<0.002	<0.001	0.032	0.024	0.443	
SPIKED SAMPLE	0.050	0.022	0.234	0.228	1.60	
SPIKE ADDED	0.050	0.020	0.200	0.200	1.00	
% RECOVERY	100.00%	110.00%	101.00%	102.00%	115.63%	NA
QC CHECK						
FOUND	0.095	0.042	0.325	0.406	0.500	100
TRUE	0.094	0.039	0.324	0.408	0.490	100
% RECOVERY	101.06%	107.69%	100.31%	99.51%	102.04%	100.00%
BLANK	<0.002	<0.001	<0.010	<0.010	<0.050	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1712546 **PAGE 3**

REPORT DATE: 04/28/20

DATE SAMPLED: 03/26/20 **DATE RECEIVED:** 03/26/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.7	EPA 200.7	SM1810200H	SM1810200H
DATE ANALYZED	04/01/20	03/30/20	03/30/20	03/27/20	03/27/20
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	Lake #2 Bottom	BATCH	BATCH	BATCH	BATCH
ORIGINAL	94.9	<0.003	0.021	7.7	1.0
DUPLICATE	95.0	<0.003	0.023	7.1	0.9
RPD	0.13%	NC	9.09%	8.00%	10.53%
SPIKE SAMPLE					
SAMPLE ID	Lake #2 Bottom	BATCH	BATCH		
ORIGINAL	94.9	<0.003	0.021		
SPIKED SAMPLE	105	0.477	0.485		
SPIKE ADDED	10.0	0.500	0.500		
% RECOVERY	105.81%	95.40%	92.80%	NA	NA
QC CHECK					
FOUND	10.6	0.482	0.482		
TRUE	10.0	0.500	0.500		
% RECOVERY	106.00%	96.40%	96.40%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1712546

Page ___ of ___

REPORT TO:

Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 206-838-6258 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)

Client: Same
Address:
Contact:
Email:
Phone: Fax:

PROJECT INFORMATION

Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format

☐ Fax ☐ Email ☐ Mail

QC Data Reported

☐ Yes ☐ No

Sample Disposal

☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*

☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard

Specific Date: 4 weeks

*Advanced notice required for Rush Analysis

LAB USE ONLY

Case File Number

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Total Alkalinity	Total Aluminum	Dissolved Aluminum	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Ammonia Nitrogen	Chlorophyll a					Metals Field Filtered (Y/N)	Containers Received	Temp	Lab ID
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)	Analysis Requested																	
03-26-2020		SW	Mid-Lake 1m	3	X	X	X	X	X	X	X	X	X	X					N			37824
↓		SW	Mid-Lake Bottom	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					N			37825
		SW	Lake #2 1 m	3															N			37826
		SW	Lake #2 Bottom	3															N			37827

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:

Dissolved aluminum and SRP samples not filtered, will need filtration

Sampled By: Iris Lippert	Date: 3/26/20	Time: 12PM
Received By:	Date:	Time:
Relinquished to IAL By (Signature):	Date: 3/26/20	Time: 2PM

Shipped By:	Shipping Reference:	
Received at IAL By: US SAMPLES AS1594	Date: 3-26-20	Time: 2:00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1712845 **PAGE 1**

REPORT DATE: 04/28/20

DATE SAMPLED: 04/10/20 **DATE RECEIVED:** 04/10/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Four water samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 1m	0.012	<0.001	0.094	0.021	0.516	11.8
Mid-Lake Bottom	0.017	<0.001	0.097	0.021	0.529	11.9
Lake #2 1 m	0.012	<0.001	0.091	0.020	0.544	11.9
Lake #2 Bottom	0.015	<0.001	0.095	0.020	0.501	11.7

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	83.0	0.680	0.014	1.6	1.1
Mid-Lake Bottom	83.5	0.584	0.017	2.1	1.4
Lake #2 1 m	81.4	0.545	0.014	2.1	1.0
Lake #2 Bottom	83.0	0.582	0.019	2.1	1.2

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1712845 **PAGE 2**

REPORT DATE: 04/28/20

DATE SAMPLED: 04/10/20 **DATE RECEIVED:** 04/10/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM18 4500PF	SM184500NH3H	SM184500N03F	SM204500NC	SM18 2320B
DATE ANALYZED	04/13/20	04/11/20	04/15/20	04/15/20	04/14/20	04/15/20
DETECTION LIMIT	0.002	0.001	0.010	0.010	0.050	1.00
DUPLICATE						
SAMPLE ID	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom
ORIGINAL	0.015	<0.001	0.095	0.020	0.501	11.7
DUPLICATE	0.015	<0.001	0.092	0.019	0.492	11.8
RPD	0.26%	NC	2.34%	2.44%	1.88%	0.85%
SPIKE SAMPLE						
SAMPLE ID	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom	
ORIGINAL	0.015	<0.001	0.095	0.020	0.501	
SPIKED SAMPLE	0.069	0.020	0.293	0.226	1.48	
SPIKE ADDED	0.050	0.020	0.200	0.200	1.00	
% RECOVERY	108.73%	100.00%	99.02%	103.21%	97.48%	NA
QC CHECK						
FOUND	0.092	0.042	0.331	0.407	0.508	99.8
TRUE	0.094	0.039	0.324	0.408	0.490	100
% RECOVERY	97.87%	107.69%	102.10%	99.83%	103.67%	99.80%
BLANK	<0.002	<0.001	<0.010	<0.010	<0.050	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1712845 **PAGE 3**

REPORT DATE: 04/28/20

DATE SAMPLED: 04/10/20 **DATE RECEIVED:** 04/10/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.7	EPA 200.7	SM1810200H	SM1810200H
DATE ANALYZED	04/16/20	04/13/20	04/13/20	04/13/20	04/13/20
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	Lake #2 Bottom	BATCH	Lake #2 Bottom	Lake #2 Bottom	Lake #2 Bottom
ORIGINAL	83.0	<0.003	0.019	2.1	1.2
DUPLICATE	83.5	<0.003	0.017	2.4	1.4
RPD	0.60%	NC	11.11%	13.33%	9.09%
SPIKE SAMPLE					
SAMPLE ID	Lake #2 Bottom	BATCH	Lake #2 Bottom		
ORIGINAL	83.0	<0.003	0.019		
SPIKED SAMPLE	93.9	0.497	0.517		
SPIKE ADDED	10.0	0.500	0.500		
% RECOVERY	109.00%	99.40%	99.60%	NA	NA
QC CHECK					
FOUND	10.5	0.488	0.488		
TRUE	10.0	0.500	0.500		
% RECOVERY	105.00%	97.60%	97.60%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 712845

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 206-838-6258 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address:
Contact:
Email:
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☐ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard

Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Analysis Requested													Metals Field Filtered (Y/N)	LAB USE ONLY	
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)		Total Alkalinity	Total Aluminum	Dissolved Aluminum	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Ammonia Nitrogen	Chlorophyll a						Containers Received	Case File Number: Temp	Case File Number: Lab ID
4/10/20		SW	Mid-Lake 1m	3	X	X	X	X	X	X	X	X	X	X					N			38614
↓		SW	Mid-Lake Bottom	3	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓					N			38615
		SW	Lake #2 1 m	3															N			38616
		SW	Lake #2 Bottom	3															N			38617

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
Dissolved aluminum and SRP samples not filtered, will need filtration

Sampled By: Iris Lippert	Date: 4/10/20	Time:
Received By:	Date:	Time:
Relinquished to IAL By (Signature):	Date: 4/10/20	Time: 2:15PM

Shipped By:	Shipping Reference:	
Received at IAL By: HSAMPLES AS 154.7°C	Date: 4-10-20	Time: 2:20

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1713845**	**PAGE 1**	
REPORT DATE:	**06/15/20**		
DATE SAMPLED:	**05/27/20**	**DATE RECEIVED:**	**05/28/20**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	ALKALINITY (mgCaCO3/L)	SULFATE (mg/L)
Mid-Lake 1m	0.022	0.450	4.3	2.1	13.2	108

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1713845 **PAGE 2**

REPORT DATE: 06/15/20

DATE SAMPLED: 05/27/20 **DATE RECEIVED:** 05/28/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	ALKALINITY (mgCaCO3/L)	SULFATE (mg/L)
METHOD	SM18 4500PF	SM204500NC	SM1810200H	SM1810200H	SM18 2320B	EPA 375.4
DATE ANALYZED	06/01/20	05/29/20	06/01/20	06/01/20	05/30/20	06/01/20
DETECTION LIMIT	0.002	0.050	0.1	0.1	1.00	1.00
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	Mid-Lake 1m
ORIGINAL	0.007	0.163	3.7	2.1	23.2	108
DUPLICATE	0.007	0.167	3.2	2.0	23.5	107
RPD	1.27%	2.00%	15.38%	3.43%	1.28%	0.93%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH				Mid-Lake 1m
ORIGINAL	0.007	0.163				108
SPIKED SAMPLE	0.056	1.15				120
SPIKE ADDED	0.050	1.00				10.0
% RECOVERY	97.93%	98.32%	NA	NA	NA	120.00%
QC CHECK						
FOUND	0.097	0.500			105	10.6
TRUE	0.094	0.499			100	10.0
% RECOVERY	103.19%	100.20%	NA	NA	105.00%	106.00%
BLANK	<0.002	<0.050	NA	NA	NA	<1.00

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1713845

Page ___ of ___

REPORT TO:

Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 509-232-4312 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)

Client: Same
Address
Contact: Shannon Brattebo, Harry Gibbons
Email: shannon.brattebo@tetratech.com, Harry.Gibbons@tetratech.com
Phone: Fax:

PROJECT INFORMATION

Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format

☐ Fax ☒ Email ☐ Mail

QC Data Reported

☐ Yes ☐ No

Sample Disposal

☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*

☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard

Specific Date: 4 weeks

*Advanced notice required for Rush Analysis

SAMPLING

Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Phosphorus	Total Nitrogen	Chlorophyll a	Sulfate	Alkalinity	Metals Field Filtered (Y/N)	Containers Received	Temp	Lab ID
5/27/20	2:30 PM	SW	Mid-Lake 1m	2	x	x	x	x	X				42065

Analysis Requested

LAB USE ONLY

Case File Number

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:

Sampled By	Date	Time
Iris Lippert	5/27/20	2:30 PM
Received By	Date	Time
Relinquished to IAL By (Signature)	5/28/20	2:50 PM

Shipped By

Shipping Reference

Received at IAL By

Date 5.28.20 Time 2:50

SAMPLE TEMP IS 23.9°C T-074

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1714341**	**PAGE 1**	
REPORT DATE:	**07/01/20**		
DATE SAMPLED:	**06/18/20**	**DATE RECEIVED:**	**06/18/20**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	SULFATE (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 1m	0.022	0.345	3.5	1.0	75.5	14.8

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1714341 **PAGE 2**

REPORT DATE: 07/01/20

DATE SAMPLED: 06/18/20 **DATE RECEIVED:** 06/18/20

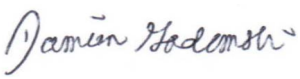
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	SULFATE (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM204500NC	SM1810200H	SM1810200H	EPA 375.4	SM18 2320B
DATE ANALYZED	06/29/20	06/23/20	06/23/20	06/23/20	06/19/20	06/26/20
DETECTION LIMIT	0.002	0.050	0.1	0.1	1.00	1.00
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	<0.002	0.239	2.9	0.2	6.56	57.0
DUPLICATE	<0.002	0.234	2.9	0.2	6.64	57.2
RPD	NC	2.03%	0.00%	0.00%	1.27%	0.35%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH			BATCH	
ORIGINAL	<0.002	0.239			6.56	
SPIKED SAMPLE	0.052	1.27			17.6	
SPIKE ADDED	0.050	1.00			10.0	
% RECOVERY	104.00%	102.78%	NA	NA	110.58%	NA
QC CHECK						
FOUND	0.091	0.478			10.6	102
TRUE	0.094	0.499			10.0	100
% RECOVERY	96.81%	95.79%	NA	NA	106.00%	102.00%
BLANK	<0.002	<0.050	NA	NA	<1.00	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1714341

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 509-232-4312 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address
Contact: Shannon Brattebo, Harry Gibbons
Email: shannon.brattebo@tetratech.com, Harry.Gibbons@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☒ 3 Business Da ☐ Standard

Specific Date: ~~4 weeks~~

*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

SAMPLING Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Phosphorus	Total Nitrogen	Chlorophyll a	Sulfate		Metals Field Filtered (Y/N)	Containers Received	Temp	Lab ID
6/18/20	11:00	SW	Mid-Lake 1m	2	x	x	x	x	✓				U3598

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:

Sampled By	Date	Time
Received By	Date	Time
Relinquished to IAL By (Signature) [signature]	Date 6/18/20	Time 2:40 PM

Shipped By	Shipping Reference	
Received at IAL By [signature] SAMPLE AS IS	Date 6-18-20	Time 2:45

22.8°c T-074

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1714921 **PAGE 1**

REPORT DATE: 08/26/20

DATE SAMPLED: 07/13/20 **DATE RECEIVED:** 12/13/01

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Four water samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 1m	0.026	<0.001	0.012	<0.010	0.503	20.5
Mid-Lake Bottom	0.031	<0.001	<0.010	<0.010	0.585	20.2
Station #2 1m	0.027	<0.001	<0.010	<0.010	0.463	13.6
Station #2 Bottom	0.034	<0.001	<0.010	<0.010	0.477	14.9

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	82.7	0.833	0.763	2.1	0.1
Mid-Lake Bottom	71.5	0.874	0.764	3.6	1.0
Station #2 1m	69.0	0.828	0.801	3.7	0.6
Station #2 Bottom	95.7	0.899	0.780	5.3	0.9

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1714921 **PAGE 2**

REPORT DATE: 08/26/20

DATE SAMPLED: 07/13/20 **DATE RECEIVED:** 12/13/01

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM18 4500PF	SM184500NH3H	SM184500N03F	SM204500NC	SM18 2320B
DATE ANALYZED	07/20/20	07/14/20	07/15/20	07/15/20	07/16/20	07/15/20
DETECTION LIMIT	0.002	0.001	0.010	0.010	0.050	1.00
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.008	0.005	0.018	0.054	0.228	70.4
DUPLICATE	0.008	0.005	0.017	0.056	0.213	70.8
RPD	2.55%	1.95%	7.04%	3.42%	6.90%	0.57%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.008	0.005	0.018	0.054	0.228	
SPIKED SAMPLE	0.060	0.023	0.222	0.257	1.24	
SPIKE ADDED	0.050	0.020	0.200	0.200	1.00	
% RECOVERY	104.63%	91.99%	101.68%	101.80%	100.88%	NA
QC CHECK						
FOUND	0.097	0.039	0.341	0.428	0.508	95.3
TRUE	0.094	0.039	0.324	0.408	0.490	100
% RECOVERY	103.19%	100.00%	105.22%	104.96%	103.67%	95.30%
BLANK	<0.002	<0.001	<0.010	<0.010	<0.050	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1714921 **PAGE 3**

REPORT DATE: 08/26/20

DATE SAMPLED: 07/13/20 **DATE RECEIVED:** 12/13/01

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.8	EPA 200.8	SM1810200H	SM1810200H
DATE ANALYZED	07/17/20	07/21/20	07/21/20	07/17/20	07/17/20
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	Station #2 Bottom	BATCH	Station #2 Bottom	BATCH	BATCH
ORIGINAL	95.7	0.019	0.780	5.6	<0.1
DUPLICATE	96.7	0.019	0.777	5.2	<0.1
RPD	1.05%	0.00%	0.39%	7.41%	NC
SPIKE SAMPLE					
SAMPLE ID	Station #2 Bottom	BATCH	Station #2 Bottom		
ORIGINAL	95.7	0.018	0.780		
SPIKED SAMPLE	106	0.547	1.27		
SPIKE ADDED	10.0	0.500	0.500		
% RECOVERY	102.82%	105.80%	97.20%	NA	NA
QC CHECK					
FOUND	10.7	0.492	0.492		
TRUE	10.0	0.500	0.500		
% RECOVERY	107.00%	98.40%	98.40%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1714921

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 206-838-6258 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address:
Contact:
Email:
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard

Specific Date: 4 weeks

*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Alkalinity	Total Aluminum	Dissolved Aluminum	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Ammonia Nitrogen	Chlorophyll a					Metals Field Filtered (Y/N)	Containers Received	Temp	Lab ID
7/13/20	12PM	SW	Mid-Lake 1m	3	x	x	x	x	x	x	x	x	x	x					N			45284
|	|	SW	Mid-Lake Bottom	3	x	x	x	x	x	x	x	x	x	x					N			45285
|	|	SW	Station #2 1m	3	x	x	x	x	x	x	x	x	x	x					N			45286
|	|	SW	Station #2 Bottom	3	x	x	x	x	x	x	x	x	x	x					N			45287

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
Dissolved aluminum and SRP samples not filtered, will need filtration

Sampled By: Iris Lippert	Date: 7/13/20	Time
Received By	Date	Time
Relinquished to IAL By (Signature) [signature]	Date: 7/13/20	Time

Shipped By	Shipping Reference	
Received at IAL By [signature] IAL	Date: 3:40	Time: 3:40 PM

4 SAMPLES rec'd @ 4°C 7/13/20

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1715086 **PAGE 1**

REPORT DATE: 08/26/20

DATE SAMPLED: 07/17/20 **DATE RECEIVED:** 07/17/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Two water samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 1m	0.005	<0.001	0.036	<0.010	0.260	6.80
Mid-Lake Bottom	0.007	<0.001	0.036	<0.010	0.261	6.40

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	176	0.498	0.021	0.4	<0.1
Mid-Lake Bottom	198	0.482	0.019	0.5	<0.1

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1715086 **PAGE 2**

REPORT DATE: 08/26/20

DATE SAMPLED: 07/17/20 **DATE RECEIVED:** 07/17/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM18 4500PF	SM184500NH3H	SM184500N03F	SM204500NC	SM18 2320B
DATE ANALYZED	07/27/20	07/17/20	07/18/20	07/18/20	07/27/20	07/21/20
DETECTION LIMIT	0.002	0.001	0.010	0.010	0.050	1.00
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.092	<0.001	<0.010	0.161	0.284	16.3
DUPLICATE	0.093	<0.001	<0.010	0.163	0.282	16.1
RPD	1.43%	NC	NC	1.29%	0.74%	1.23%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.092	<0.001	<0.010	0.161	0.284	
SPIKED SAMPLE	0.144	0.019	0.232	0.360	1.30	
SPIKE ADDED	0.050	0.020	0.200	0.200	1.00	
% RECOVERY	103.82%	95.00%	115.86%	99.52%	101.28%	NA
QC CHECK						
FOUND	0.097	0.040	0.344	0.404	0.503	98.3
TRUE	0.094	0.039	0.324	0.408	0.490	100
% RECOVERY	103.19%	102.56%	106.17%	99.10%	102.65%	98.30%
BLANK	<0.002	<0.001	<0.010	<0.010	<0.050	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1715086 **PAGE 3**

REPORT DATE: 08/26/20

DATE SAMPLED: 07/17/20 **DATE RECEIVED:** 07/17/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.8	EPA 200.8	SM1810200H	SM1810200H
DATE ANALYZED	07/22/20	07/21/20	07/21/20	07/23/20	07/23/20
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	Mid-Lake Bottom	BATCH	BATCH	BATCH	BATCH
ORIGINAL	198	0.023	<0.003	11	2.3
DUPLICATE	200	0.025	<0.003	11	2.4
RPD	0.74%	8.33%	NC	0.00%	4.38%
SPIKE SAMPLE					
SAMPLE ID	Mid-Lake Bottom	BATCH	BATCH		
ORIGINAL	198	0.023	<0.003		
SPIKED SAMPLE	209	0.567	0.521		
SPIKE ADDED	10.0	0.500	0.500		
% RECOVERY	107.52%	108.80%	104.20%	NA	NA
QC CHECK					
FOUND	10.2	0.492	0.492		
TRUE	10.0	0.500	0.500		
% RECOVERY	102.00%	98.40%	98.40%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1715080

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 206-838-6258 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address:
Contact:
Email:
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Analysis Requested														Metals Field Filtered (Y/N)	LAB USE ONLY		
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)		Total Alkalinity	Total Aluminum	Dissolved Aluminum	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Ammonia Nitrogen	Chlorophyll a						Containers Received	Case File Number: Temp	Case File Number: Lab ID
7/17/20	11 AM	SW	Mid-Lake 1m	3	x	x	x	x	x	x	x	x	x	x					N			45772
7/17/20	11AM	SW	Mid-Lake Bottom	3	x	x	x	x	x	x	x	x	x	x					N			45773
			[redacted]																N			
		SW																	N			

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
Dissolved aluminum and SRP samples not filtered, will need filtration

Sampled By: Iris Lippert	Date: 7/17/20	Time: 11AM
Received By:	Date:	Time:
Relinquished to IAL By (Signature):	Date: 7/17/20	Time: 2:45 PM

Shipped By:	Shipping Reference:	
Received at IAL By:	Date: 7/17/20	Time: 2:45 PM

(2) Samples

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1715655 **PAGE 1**

REPORT DATE: 08/26/20

DATE SAMPLED: 08/07/20 **DATE RECEIVED:** 08/07/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 1m	0.011	<0.001	<0.010	<0.010	0.421	6.50

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	191	0.154	0.066	2.7	1.1

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1715655 **PAGE 2**

REPORT DATE: 08/26/20

DATE SAMPLED: 08/07/20 **DATE RECEIVED:** 08/07/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	AMMONIA (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM18 4500PF	SM184500NH3H	SM184500N03F	SM204500NC	SM18 2320B
DATE ANALYZED	08/17/20	08/07/20	08/08/20	08/08/20	08/18/20	08/13/20
DETECTION LIMIT	0.002	0.001	0.010	0.010	0.050	1.00
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.005	<0.001	<0.010	0.211	0.372	21.6
DUPLICATE	0.005	<0.001	<0.010	0.212	0.341	21.5
RPD	5.77%	NC	NC	0.31%	8.58%	0.46%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.005	<0.001	<0.010	0.211	0.372	
SPIKED SAMPLE	0.055	0.020	0.185	0.407	1.47	
SPIKE ADDED	0.050	0.020	0.200	0.200	1.00	
% RECOVERY	99.42%	100.00%	92.32%	97.91%	109.40%	NA
QC CHECK						
FOUND	0.094	0.039	0.329	0.409	0.524	96.5
TRUE	0.094	0.039	0.324	0.408	0.490	100
% RECOVERY	100.00%	100.00%	101.69%	100.33%	106.94%	96.50%
BLANK	<0.002	<0.001	<0.010	<0.010	<0.050	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1715655 **PAGE 3**

REPORT DATE: 08/26/20

DATE SAMPLED: 08/07/20 **DATE RECEIVED:** 08/07/20

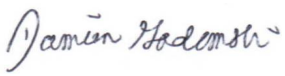
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.8	EPA 200.8	SM1810200H	SM1810200H
DATE ANALYZED	08/11/20		08/12/20	08/12/20	08/12/20
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	Mid-Lake 1m	BATCH	Mid-Lake 1m	Mid-Lake 1m	Mid-Lake 1m
ORIGINAL	191	<0.003	0.066	2.7	1.1
DUPLICATE	190	<0.003	0.066	2.3	1.2
RPD	0.30%	NC	0.00%	13.33%	8.96%
SPIKE SAMPLE					
SAMPLE ID	Mid-Lake 1m	BATCH	Mid-Lake 1m		
ORIGINAL	191	<0.003	0.066		
SPIKED SAMPLE	202	0.521	0.528		
SPIKE ADDED	10.0	0.500	0.500		
% RECOVERY	114.38%	104.20%	92.40%	NA	NA
QC CHECK					
FOUND	10.7	0.472	0.472		
TRUE	10.0	0.500	0.500		
% RECOVERY	107.00%	94.40%	94.40%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form

Page ___ of ___ 17156555

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 509-232-4312 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address
Contact: Shannon Brattebo, Harry Gibbons
Email: shannon.brattebo@tetratech.com, Harry.Gibbons@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Analysis Requested													Metals Field Filtered (Y/N)	Containers Received	LAB USE ONLY	
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)		Total Phosphorus	Total Nitrogen	Chlorophyll a	Sulfate	Alkalinity	Total Aluminum	Dissolved Aluminum	SRP	NO3+NO2-Nitrogen	Ammonia Nitrogen						Case File Number: Temp	Lab ID
8/7/20	1130 AM	SW	Mid-Lake 1m	3	x	x	x	x	x	x	x	x	x	x					N		47427
		SW		3	x	x	x	x	x	x	x	x	x	x					N		

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:

Sampled By: Iris Lippert	Date	Time
Received By	Date	Time
Relinquished to IAL By (Signature)	Date: 8/7/20	Time: 2:40 PM

Shipped By	Shipping Reference	
Received at IAL By	Date: 8.7.20	Time: 2:40

ISAMPLE AS IS 23.8°C T-074

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1716594**	**PAGE 1**	
REPORT DATE:	**09/27/20**		
DATE SAMPLED:	**09/11/20**	**DATE RECEIVED:**	**09/11/20**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 1m	0.018	0.421	6.30

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	245	0.407	0.027	4.5	1.9

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1716594

REPORT DATE: 09/27/20

DATE SAMPLED: 09/11/20 **DATE RECEIVED:** 09/11/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM204500NC	SM18 2320B
DATE ANALYZED	09/22/20	09/23/20	09/15/20
DETECTION LIMIT	0.002	0.050	1.00
DUPLICATE			
SAMPLE ID	BATCH	BATCH	BATCH
ORIGINAL	0.036	0.777	140
DUPLICATE	0.035	0.773	140
RPD	2.12%	0.53%	0.14%
SPIKE SAMPLE			
SAMPLE ID	BATCH	BATCH	
ORIGINAL	0.036	0.777	
SPIKED SAMPLE	0.090	1.70	
SPIKE ADDED	0.050	1.00	
% RECOVERY	108.38%	92.61%	NA
QC CHECK			
FOUND	0.097	0.495	103
TRUE	0.094	0.490	100
% RECOVERY	103.19%	101.02%	103.00%
BLANK	<0.002	<0.050	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1716594 **PAGE 3**

REPORT DATE: 09/27/20

DATE SAMPLED: 09/11/20 **DATE RECEIVED:** 09/11/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.8	EPA 200.8	SM1810200H	SM1810200H
DATE ANALYZED	09/23/20	09/22/20	09/22/20	09/16/20	09/16/20
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	Mid-Lake 1m	BATCH	Mid-Lake 1m	Mid-Lake 1m	Mid-Lake 1m
ORIGINAL	245	<0.003	0.027	7.5	11
DUPLICATE	245	<0.003	0.027	6.9	12
RPD	0.27%	NC	2.24%	7.41%	4.65%
SPIKE SAMPLE					
SAMPLE ID	Mid-Lake 1m	BATCH	Mid-Lake 1m		
ORIGINAL	245	<0.003	0.027		
SPIKED SAMPLE	254	0.525	0.548		
SPIKE ADDED	10.0	0.500	0.500		
% RECOVERY	92.59%	105.00%	104.18%	NA	NA
QC CHECK					
FOUND	10.6	0.495	0.495		
TRUE	10.0	0.500	0.500		
% RECOVERY	106.00%	99.00%	99.00%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form

Page ___ of ___ 1716594

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 509-232-4312 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address
Contact: Shannon Brattebo, Harry Gibbons
Email: shannon.brattebo@tetratech.com, Harry.Gibbons@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

SAMPLING

Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Phosphorus	Total Nitrogen	Chlorophyll a	Sulfate	Alkalinity	Total Aluminum	Dissolved Aluminum	Metals Field Filtered (Y/N)	Containers Received	Temp	Lab ID
9/11/20	11:30 PM	SW	Mid-Lake 1m	3	x	x	x	x	X	X	X	N			90064

Analysis Requested

LAB USE ONLY
Case File Number

Comments:

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

	Date	Time			
Sampled By: Iris Lippert	9/11/20		Shipped By	Shipping Reference	
Received By				Date	Time
Relinquished to IAL By (Signature)	9/11/20	2:30 PM	Received at IAL By: SAMPLE TS IS 21.9°C T-074	9-11-20	2:30

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: **1718103** **PAGE 1**

REPORT DATE: **12/02/20**

DATE SAMPLED: **10/19/20** **DATE RECEIVED:** **10/19/20**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	DOC (mg/L)
Mid-Lake 1m	0.020	0.438	19.0	4.05

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	211	0.255	0.024	2.5	1.1

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1718103 **PAGE 2**

REPORT DATE: 12/02/20

DATE SAMPLED: 10/19/20 **DATE RECEIVED:** 10/19/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	DOC (mg/L)
METHOD	SM18 4500PF	SM204500NC	SM18 2320B	EPA 415.1
DATE ANALYZED	10/26/20	10/27/20	10/24/20	10/30/20
DETECTION LIMIT	0.002	0.050	1.00	0.250
DUPLICATE				
SAMPLE ID	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.011	0.524	22.3	<0.250
DUPLICATE	0.010	0.529	22.7	<0.250
RPD	7.67%	1.05%	1.78%	NC
SPIKE SAMPLE				
SAMPLE ID	BATCH	BATCH		BATCH
ORIGINAL	0.011	0.524		<0.250
SPIKED SAMPLE	0.067	1.68		4.34
SPIKE ADDED	0.050	1.00		4.50
% RECOVERY	111.35%	115.50%	NA	96.44%
QC CHECK				
FOUND	0.097	0.500	103	4.10
TRUE	0.094	0.490	100	4.00
% RECOVERY	103.19%	102.04%	103.00%	102.50%
BLANK	<0.002	<0.050	NA	<0.250

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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1718103 **PAGE 3**

REPORT DATE: 12/02/20

DATE SAMPLED: 10/19/20 **DATE RECEIVED:** 10/19/20

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.8	EPA 200.8	SM1810200H	SM1810200H
DATE ANALYZED	10/22/20	10/22/20	10/22/20	10/23/20	10/23/20
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	Mid-Lake 1m	BATCH	BATCH	BATCH	BATCH
ORIGINAL	211	0.023	<0.003	4.7	3.4
DUPLICATE	212	0.024	<0.003	4.5	3.4
RPD	0.45%	3.39%	NC	6.45%	2.62%
SPIKE SAMPLE					
SAMPLE ID	Mid-Lake 1m	BATCH	BATCH		
ORIGINAL	211	0.023	<0.003		
SPIKED SAMPLE	222	0.522	0.485		
SPIKE ADDED	10.0	0.500	0.500		
% RECOVERY	104.94%	99.80%	97.00%	NA	NA
QC CHECK					
FOUND	10.8	0.485	0.485		
TRUE	10.0	0.500	0.500		
% RECOVERY	108.00%	97.00%	97.00%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
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NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form

Page ___ of ___

1718103

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 509-232-4312 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address
Contact: Shannon Brattebo, Harry Gibbons
Email: shannon.brattebo@tetratech.com, Harry.Gibbons@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Analysis Requested													Metals Field Filtered (Y/N)	LAB USE ONLY	
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)		Total Phosphorus	Total Nitrogen	Chlorophyll a	Sulfate	Alkalinity	Total Aluminum	Dissolved Aluminum	DOC							Containers Received	Case File Number: Temp / Lab ID
10/19/20	11:30 AM	SW	Mid-Lake 1m	3	x	x	x	x	X	X	x	x								54847

Received @ 15.6°C

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:

Sampled By	Date	Time
Iris Lippert	10/19/20	11:30 AM

Received By	Date	Time	Shipped By	Shipping Reference

Relinquished to IAL By (Signature)	Date	Time	Received at IAL By	Date	Time
	10/19/20	3:20 PM	Kevin Wahlberg	10/19/20	3:19 pm

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1720485**	**PAGE 1**	
REPORT DATE:	**02/23/21**		
DATE SAMPLED:	**01/19/21**	**DATE RECEIVED:**	**01/19/21**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	TOTAL-N (mg/L)	DOC (mg/L)
Mid-Lake 1m	0.012	1.16	4.98

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	140	0.054	0.008	5.5	1.7

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1720485

REPORT DATE: 02/23/21

DATE SAMPLED: 01/19/21 **DATE RECEIVED:** 01/19/21

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	TOTAL-N (mg/L)	DOC (mg/L)
METHOD	SM18 4500PF	SM204500NC	EPA 415.1
DATE ANALYZED	01/25/21	01/26/21	02/10/21
DETECTION LIMIT	0.002	0.050	0.250
DUPLICATE			
SAMPLE ID	BATCH	BATCH	BATCH
ORIGINAL	0.005	0.339	2.49
DUPLICATE	0.005	0.315	2.40
RPD	2.62%	7.30%	3.52%
SPIKE SAMPLE			
SAMPLE ID	BATCH	BATCH	BATCH
ORIGINAL	0.005	0.339	2.49
SPIKED SAMPLE	0.057	1.47	6.83
SPIKE ADDED	0.050	1.00	4.50
% RECOVERY	104.07%	113.11%	96.64%
QC CHECK			
FOUND	0.097	0.494	3.92
TRUE	0.094	0.490	4.00
% RECOVERY	103.19%	100.82%	98.00%
BLANK	<0.002	<0.050	<0.250

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1720485

REPORT DATE: 02/23/21

DATE SAMPLED: 01/19/21 **DATE RECEIVED:** 01/19/21

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.8	EPA 200.8	SM1810200H	SM1810200H
DATE ANALYZED	01/27/21	01/21/21	01/21/21	01/21/21	01/21/21
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	13800	<0.003	<0.003	3.2	14
DUPLICATE	13700	<0.003	<0.003	3.7	17
RPD	0.73%	NC	NC	15.38%	15.75%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	BATCH		
ORIGINAL		<0.003	<0.003		
SPIKED SAMPLE		0.437	0.492		
SPIKE ADDED		0.500	0.500		
% RECOVERY	OR	87.40%	98.40%	NA	NA
QC CHECK					
FOUND	10.4	0.478	0.478		
TRUE	10.0	0.500	0.500		
% RECOVERY	104.00%	95.60%	95.60%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 509-232-4312 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address: 1720 485
Contact: Shannon Brattebo, Harry Gibbons
Email: shannon.brattebo@tetratech.com, Harry.Gibbons@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.: ___
Client PO: ___
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☒ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☒ Standard

Specific Date: ~~4 weeks~~
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

SAMPLING

Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Phosphorus	Total Nitrogen	Chlorophyll a	Sulfate	Total Aluminum	Dissolved Aluminum	Dissolved Organic Carbon	Metals Field Filtered (Y/N)	Containers Received	Temp	Lab ID
1/19/21	11:30	SW	Mid-Lake 1m	4	x	x	x	x	x	x					61904

Analysis Requested

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
DOC analysis may be requested, pending TA/DA results.
Please provide Aluminum results and hold samples

Sampled By: Iris Lippert	Date: 1/19/21	Time:
Received By:	Date:	Time:
Relinquished to IAL By (Signature):	Date: 1/19/21	Time: 4:15 PM

Shipped By: 1 sample, 4 bottles @ 11.5°C as is T-074
Shipping Reference:
Received at IAL By:
Date: 1/19/21 Time: 4:15

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1722021**	**PAGE 1**	
REPORT DATE:	**03/26/21**		
DATE SAMPLED:	**03/17/21**	**DATE RECEIVED:**	**03/17/21**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	TOTAL-N (mg/L)	DOC (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 1m	0.014	0.527	3.59	15.3

SAMPLE ID	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	94.7	0.069	0.014	5.6	1.4

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1722021

REPORT DATE: 03/26/21

DATE SAMPLED: 03/17/21 **DATE RECEIVED:** 03/17/21

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	TOTAL-N (mg/L)	DOC (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM204500NC	EPA 415.1	SM18 2320B
DATE ANALYZED	03/22/21	03/22/21	03/23/21	03/25/21
DETECTION LIMIT	0.002	0.050	0.250	1.00
DUPLICATE				
SAMPLE ID	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.004	0.180	2.03	66.8
DUPLICATE	0.004	0.178	1.97	67.8
RPD	0.82%	1.06%	2.95%	1.49%
SPIKE SAMPLE				
SAMPLE ID	BATCH	BATCH	BATCH	
ORIGINAL	0.004	0.180	2.03	
SPIKED SAMPLE	0.055	1.17	6.21	
SPIKE ADDED	0.050	1.00	4.50	
% RECOVERY	102.46%	98.57%	92.80%	NA
QC CHECK				
FOUND	0.094	0.507	3.62	104
TRUE	0.094	0.490	4.00	100
% RECOVERY	100.00%	103.47%	90.50%	104.00%
BLANK	<0.002	<0.050	<0.250	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1722021 **PAGE 3**

REPORT DATE: 03/26/21

DATE SAMPLED: 03/17/21 **DATE RECEIVED:** 03/17/21

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	SULFATE (mg/L)	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 375.4	EPA 200.8	EPA 200.8	SM1810200H	SM1810200H
DATE ANALYZED	03/25/21	03/20/21	03/20/21	03/23/21	03/23/21
DETECTION LIMIT	1.00	0.003	0.003	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	Mid-Lake 1m	BATCH	BATCH
ORIGINAL	143	<0.003	0.014	2.1	0.2
DUPLICATE	142	<0.003	0.013	2.3	0.2
RPD	1.07%	NC	7.41%	8.00%	0.00%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	Mid-Lake 1m		
ORIGINAL	143	<0.003	0.014		
SPIKED SAMPLE	152	0.528	0.546		
SPIKE ADDED	10.0	0.500	0.500		
% RECOVERY	84.66%	105.60%	106.40%	NA	NA
QC CHECK					
FOUND	10.1	0.507	0.507		
TRUE	10.0	0.500	0.500		
% RECOVERY	101.00%	101.40%	101.40%	NA	NA
BLANK	<1.00	<0.003	<0.003	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1712021

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 1420 5th Ave, Suite 650
Seattle, WA 98101
Contact: Iris Lippert, Shannon Brattebo
Email: iris.lippert@tetratech.com; shannon.brattebo@tetratech.com
Phone: 509-232-4312 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address
Contact: Shannon Brattebo, Harry Gibbons
Email: shannon.brattebo@tetratech.com, Harry.Gibbons@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 1 week
*Advanced notice required for Rush Analysis

SAMPLING

Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Phosphorus	Total Nitrogen	Chlorophyll a	Sulfate	Alkalinity	Total Aluminum	Dissolved Aluminum	DOC	Metals Field Filtered (Y/N)	Containers Received	Temp	Lab ID
3/17/21	2PM	SW	Mid-Lake 1m	3	x	x	x	x	X	X	X	X				65829

Analysis Requested; LAB USE ONLY; Case File Number

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:

	Date	Time
Sampled By: Iris Lippert	3/17/21	2PM
Received By		
Relinquished to IAL By (Signature): [signature]	3/17/21	

Shipped By
Shipping Reference

Received at IAL By	Date	Time
[signature]	3-17-21	5:45

SAMPLE AS IS 14.3°C T-044

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: **1740273** **PAGE 1**

REPORT DATE: **06/11/23**

DATE SAMPLED: **05/23/23** **DATE RECEIVED:** **05/23/23**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	DOC (mg/L)	ALKALINITY (mgCaCO3/L)
Mid-Lake 0.5m1	0.047	<0.001	0.011	1.06	8.40	51.1

SAMPLE ID	TOTAL ALUMINUM (mg/L)	HARDNESS (mg/CaCO3/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 0.5m1	0.5693	23.8	28.0	12	6.2

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1740273 **PAGE 2**

REPORT DATE: 06/11/23

DATE SAMPLED: 05/23/23 **DATE RECEIVED:** 05/23/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	TOTAL-N (mg/L)	DOC (mg/L)	ALKALINITY (mgCaCO3/L)
METHOD	SM18 4500PF	SM18 4500PF	SM184500N03F	SM204500NC	EPA 415.1	SM18 2320B
DATE ANALYZED	05/27/23	05/25/23	05/24/23	05/31/23	06/09/23	05/25/23
DETECTION LIMIT	0.002	0.001	0.010	0.050	0.250	1.00
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.023	<0.001	<0.010	0.682	1.18	41.0
DUPLICATE	0.024	<0.001	<0.010	0.716	1.24	41.6
RPD	4.01%	NC	NC	4.86%	4.98%	1.45%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.023	<0.001	<0.010	0.682	1.18	
SPIKED SAMPLE	0.076	0.020	0.194	1.74	5.52	
SPIKE ADDED	0.050	0.020	0.200	1.00	4.50	
% RECOVERY	106.14%	100.00%	96.78%	106.23%	96.49%	NA
QC CHECK						
FOUND	0.094	0.041	0.404	0.499	3.98	100
TRUE	0.094	0.039	0.408	0.499	4.00	100
% RECOVERY	100.00%	105.13%	99.02%	100.00%	99.50%	100.00%
BLANK	<0.002	<0.001	<0.010	<0.050	<0.250	NA

RPD = RELATIVE PERCENT DIFFERENCE.
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NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1740273 **PAGE 3**

REPORT DATE: 06/11/23

DATE SAMPLED: 05/23/23 **DATE RECEIVED:** 05/23/23

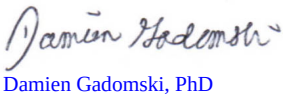
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	HARDNESS (mgCaCO3/l)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	SM18 2340C	EPA 375.4	SM1810200H	SM1810200H
DATE ANALYZED	06/01/23	05/30/23	05/26/23	05/31/23	05/31/23
DETECTION LIMIT	0.0030	2.00	1.00	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	Mid-Lake 0.5m1	BATCH	BATCH
ORIGINAL	0.0051	17.8	28.0	2.3	3.8
DUPLICATE	0.0050	16.6	27.7	2.1	3.7
RPD	0.40%	6.82%	0.89%	8.00%	1.90%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	Mid-Lake 0.5m1		
ORIGINAL	0.0051	17.8	28.0		
SPIKED SAMPLE	0.4983	35.6	37.7		
SPIKE ADDED	0.5000	20.0	10.0		
% RECOVERY	98.65%	88.93%	97.21%	NA	NA
QC CHECK					
FOUND	0.5034	36.9	10.2		
TRUE	0.5000	40.0	10.0		
% RECOVERY	100.68%	92.25%	102.00%	NA	NA
BLANK	<0.0030	<2.00	<1.00	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1740273

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☐ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
IN 2 WKS
Specific Date:
*Advanced notice required for Rush Analysis

SAMPLING

Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Alkalinity	Total Hardness	Dissolved Organic Carbon	Total Aluminum	Total Phosphorus	SRP	Total Nitrogen	Nitrate+Nitrite	Chlorophyll a	Sulfate	Field Filtered (Y/N)	Containers Received	Temp	Lab ID
5-23-23	1140	SW	Mid-Lake ~~0.5m~~ SB		x	x	x	x	x	x	x	x	x	x	N			176580

AB 5/23/23

Analysis Requested

LAB USE ONLY
Case File Number

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
SRP and Chlorophyll a samples need lab filtration

Sampled By	Date	Time			
[signature]	5/23/2023	11:40			
Received By	Date	Time	Shipped By	Shipping Reference	
[signature]	5/23/2023	2:45	[signature]		
Relinquished to IAL By (Signature)	Date	Time	Received at IAL By	Date	Time
[signature]	5/23/23		1 SAMPLE AS 13 16.4°C	5-23-23	2:45

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741068 **PAGE 1**

REPORT DATE: 08/08/23

DATE SAMPLED: 06/27/23 **DATE RECEIVED:** 06/27/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Two water samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Mid-Lake 1m	0.048	0.002	<0.010	9.43	1.17	53.4	7.70
Mid-Lake Bottom	0.047	0.002	<0.010	8.98	1.20	52.7	7.91

SAMPLE ID	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	0.5345	0.4083	4.62	25.7	11	4.9
Mid-Lake Bottom	0.5026	0.4284	4.94	25.2		

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Mid-Lake 1m	5.99	1.12	3.37	28.5	19.6	51.0	<1.00
Mid-Lake Bottom	5.81	0.913	2.92	28.0	18.3	51.1	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741068 **PAGE 2**

REPORT DATE: 08/08/23

DATE SAMPLED: 06/27/23 **DATE RECEIVED:** 06/27/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	SM204500N03F	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	07/01/23	06/28/23	06/28/23	07/11/23	07/03/23	06/29/23	06/27/23
DETECTION LIMIT	0.002	0.001	0.010	0.250	0.050	1.00	0.10
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.009	0.002	0.114	<0.250	0.284	74.8	
DUPLICATE	0.008	0.002	0.121	<0.250	0.295	73.8	
RPD	0.47%	5.48%	5.77%	NC	3.80%	1.35%	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.009	0.002	0.114	<0.250	0.284		
SPIKED SAMPLE	0.060	0.026	0.326	4.24	1.24		
SPIKE ADDED	0.050	0.020	0.200	4.50	1.00		
% RECOVERY	102.65%	119.05%	106.22%	94.18%	95.30%	NA	NA
QC CHECK							
FOUND	0.095	0.040	0.421	4.25	0.526	96.8	
TRUE	0.094	0.039	0.408	4.00	0.490	100	
% RECOVERY	101.06%	101.52%	103.09%	106.25%	107.35%	96.80%	NA
BLANK	<0.002	<0.001	<0.010	<0.250	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741068

REPORT DATE: 08/08/23

DATE SAMPLED: 06/27/23 **DATE RECEIVED:** 06/27/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H
DATE ANALYZED	07/06/23	07/10/23	06/29/23	07/07/23	07/06/23	07/06/23
DETECTION LIMIT	0.0030	0.0030	0.50	1.00	0.1	0.1
DUPLICATE						
SAMPLE ID	BATCH	BATCH	Mid-Lake Bottom	BATCH	BATCH	BATCH
ORIGINAL	0.0272	0.0507	4.94	17.7	36	9.7
DUPLICATE	0.0255	0.0524	4.94	17.9	37	8.5
RPD	6.62%	3.26%	0.00%	1.17%	3.64%	13.65%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	Mid-Lake Bottom	BATCH		
ORIGINAL	0.0272	0.0507	4.94	17.7		
SPIKED SAMPLE	0.5633	0.5018	14.6	39.4		
SPIKE ADDED	0.5000	0.5000	20.0	20.0		
% RECOVERY	107.20%	90.22%	48.35%	108.34%	NA	NA
QC CHECK						
FOUND	0.5481	0.5220	30.4	9.57		
TRUE	0.5000	0.5000	30.0	10.0		
% RECOVERY	109.62%	104.39%	101.33%	95.70%	NA	NA
BLANK	<0.0030	<0.0030	<0.50	<1.00	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741068 **PAGE 4**

REPORT DATE: 08/08/23

DATE SAMPLED: 06/27/23 **DATE RECEIVED:** 06/27/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	06/30/23	06/30/23	06/30/23	06/30/23	06/30/23	06/29/23	06/29/23
DETECTION LIMIT	0.100	0.100	0.500	0.500	0.700	1.00	1.00
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	35.8	9.25	2.78	26.4	127		
DUPLICATE	35.8	9.24	2.75	26.5	127		
RPD	0.09%	0.09%	0.81%	0.23%	0.09%	NA	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH			
ORIGINAL	35.8	9.25	2.78	26.4			
SPIKED SAMPLE	46.4	19.6	13.5	37.5			
SPIKE ADDED	10.0	10.0	10.0	10.0			
% RECOVERY	105.80%	103.42%	107.48%	110.76%	NA	NA	NA
QC CHECK							
FOUND	9.79	9.82	10.1	10.2	64.9		
TRUE	10.0	10.0	10.0	10.0	66.2		
% RECOVERY	97.92%	98.16%	101.36%	102.47%	98.07%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.500	<0.700	NA	NA

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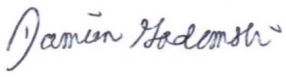
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1741068

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Addres
Contac Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard

Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Alkalinity	Total Aluminum	Dissolved Aluminum	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Dissolved Organic Carbon	Chlorophyll a	Total Hardness	Chloride	Bicarbonate	Carbonate	Total Calcium	Total Magnesium	Sodium	Potassium	pH	Field Filtered (Y/N)	Containers Received	Temp	Lab ID
06-27-23	1230	SW	Mid-Lake 1m		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	N			129282
06-27-23	1240	SW	Mid-Lake Bottom		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	N			129283

OK

ATB 06/27/23

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
Dissolved aluminum, SRP, DOC, and chlorophyll samples not filtered, will need filtration

Sampled By: Adam Bryant	Date: 6/27/23	Time: 12:40
Received By	Date	Time
Relinquished to IAL By (Signature): Adam B[signature]	Date: 6/27/23	Time: 3:35

Shipped By: 2 SAMPLES AS CS 5.8°C T044
Shipping Reference
Received at IAL By: [signature] Date: 06/27/23 Time: 15:34

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1741118**	**PAGE 1**	
REPORT DATE:	**08/08/23**		
DATE SAMPLED:	**06/29/23**	**DATE RECEIVED:**	**06/29/23**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Three water samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)
Mid-Lake 1m	1.50	0.0414
Mid-Lake 0.5m from bottom	1.85	0.0392
West Shore	1.51	0.0306

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1741118**	**PAGE 2**	
REPORT DATE:	**08/08/23**		
DATE SAMPLED:	**06/29/23**	**DATE RECEIVED:**	**06/29/23**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)
METHOD	EPA 200.8	EPA 200.8
DATE ANALYZED	07/06/23	07/10/23
DETECTION LIMIT	0.0030	0.0030
DUPLICATE		
SAMPLE ID	BATCH	BATCH
ORIGINAL	0.0272	0.0507
DUPLICATE	0.0255	0.0524
RPD	6.62%	3.26%
SPIKE SAMPLE		
SAMPLE ID	BATCH	BATCH
ORIGINAL	0.0272	0.0507
SPIKED SAMPLE	0.5633	0.5018
SPIKE ADDED	0.5000	0.5000
% RECOVERY	107.20%	90.22%
QC CHECK		
FOUND	0.5481	0.5220
TRUE	0.5000	0.5000
% RECOVERY	109.62%	104.39%
BLANK	<0.0030	<0.0030

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1741118

Page 1 of 1

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address:
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number
Containers Received

SAMPLING Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Analysis Requested: Total Aluminum	Analysis Requested: Dissolved Aluminum	Field Filtered (Y/N)	Temp	Lab ID
06/29/23	13:20	SW	Mid-Lake 1m		x	x	N		129595
06/29/23	13:25	SW	Mid-lake 0.5m from bottom		x	x	N		129596
06/29/23	13:05	SW	West shore		x	x	N		129597

06/29/23
ATB

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments: Dissolved aluminum not filtered, will need filtration

Sampled By: Adam Bryant	Date: 06/29/23	Time: 3:45 PM	
Received By:	Date:	Time:	Shipped By:
Relinquished to IAL By (Signature): Adam Bryant	Date: 06/29/23	Time: 1616	Received at IAL By: 3 Samples

Shipping Reference
Date: 6-29-23 Time: 4:19

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741155 **PAGE 1**

REPORT DATE: 08/08/23

DATE SAMPLED: 06/30/23 **DATE RECEIVED:** 06/30/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Two water samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Mid-Lake 1m	0.009	0.003	0.019	5.94	0.569	38.1	7.10
Mid-Lake Bottom	0.009	0.002	0.017	6.01	0.580	37.2	7.02

SAMPLE ID	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	0.4539	0.0614	4.73	89.5	0.7	1.2
Mid-Lake Bottom	0.4839	0.0507	4.41	91.9		

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Mid-Lake 1m	5.84	0.804	2.73	48.8	17.9	32.3	<1.00
Mid-Lake Bottom	5.82	0.816	2.71	48.5	17.9	30.6	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741155 **PAGE 2**

REPORT DATE: 08/08/23

DATE SAMPLED: 06/30/23 **DATE RECEIVED:** 06/30/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	SM204500N03F	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	07/10/23	07/01/23	07/01/23	07/11/23	07/08/23	07/10/23	07/01/23
DETECTION LIMIT	0.002	0.001	0.010	0.250	0.050	1.00	0.10
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.090	0.017	0.446	<0.250	0.397	166	
DUPLICATE	0.092	0.017	0.449	<0.250	0.444	164	
RPD	2.75%	1.20%	0.56%	NC	11.18%	1.01%	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.090	0.017	0.446	<0.250	0.397		
SPIKED SAMPLE	0.135	0.037	0.657	4.24	1.49		
SPIKE ADDED	0.050	0.020	0.200	4.50	1.00		
% RECOVERY	90.60%	100.50%	105.29%	94.18%	109.10%	NA	NA
QC CHECK							
FOUND	0.094	0.039	0.417	4.25	0.499	96.8	
TRUE	0.094	0.039	0.408	4.00	0.490	100	
% RECOVERY	100.00%	98.98%	102.28%	106.25%	101.84%	96.80%	NA
BLANK	<0.002	<0.001	<0.010	<0.250	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
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NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741155 **PAGE 3**

REPORT DATE: 08/08/23

DATE SAMPLED: 06/30/23 **DATE RECEIVED:** 06/30/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H
DATE ANALYZED	07/06/23	07/10/23	07/05/23	07/11/23	07/06/23	07/06/23
DETECTION LIMIT	0.0030	0.0030	0.50	1.00	0.1	0.1
DUPLICATE						
SAMPLE ID	BATCH	Mid-Lake Bottom	BATCH	Mid-Lake Bottom	BATCH	BATCH
ORIGINAL	0.0272	0.0507	20.0	91.9	8.5	2.7
DUPLICATE	0.0255	0.0524	19.3	95.0	8.5	2.7
RPD	6.62%	3.26%	3.21%	3.24%	0.00%	0.00%
SPIKE SAMPLE						
SAMPLE ID	BATCH	Mid-Lake Bottom	BATCH	Mid-Lake Bottom		
ORIGINAL	0.0272	0.0507	20.0	91.9		
SPIKED SAMPLE	0.5633	0.5018	38.9	103		
SPIKE ADDED	0.5000	0.5000	20.0	10.0		
% RECOVERY	107.20%	90.22%	94.60%	109.51%	NA	NA
QC CHECK						
FOUND	0.5481	0.5220	30.2	9.98		
TRUE	0.5000	0.5000	30.0	10.0		
% RECOVERY	109.62%	104.39%	100.67%	99.80%	NA	NA
BLANK	<0.0030	<0.0030	<0.50	<1.00	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
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IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741155 **PAGE 4**

REPORT DATE: 08/08/23

DATE SAMPLED: 06/30/23 **DATE RECEIVED:** 06/30/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	07/06/23	07/06/23	07/06/23	07/06/23	07/06/23	07/10/23	07/10/23
DETECTION LIMIT	0.100	0.100	0.500	0.500	0.700	1.00	1.00
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	35.3	8.92	2.52	25.2	125		
DUPLICATE	35.3	8.92	2.56	25.1	125		
RPD	0.23%	0.02%	1.54%	0.13%	0.16%	NA	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH			
ORIGINAL	35.3	8.92	2.52	25.2			
SPIKED SAMPLE	45.5	19.1	12.7	35.8			
SPIKE ADDED	10.0	10.0	10.0	10.0			
% RECOVERY	102.06%	101.47%	102.13%	106.36%	NA	NA	NA
QC CHECK							
FOUND	9.93	9.68	9.88	10.2	64.7		
TRUE	10.0	10.0	10.0	10.0	66.2		
% RECOVERY	99.33%	96.85%	98.80%	101.53%	97.78%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.500	<0.700	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
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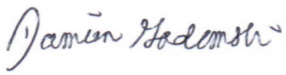
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1741155

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Addres
Contac Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Analysis Requested																		Containers Received	LAB USE ONLY	
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)		Total Alkalinity	Total Aluminum	Dissolved Aluminum	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Dissolved Organic Carbon	Chlorophyll a	Total Hardness	Chloride	Bicarbonate	Carbonate	Total Calcium	Total Magnesium	Sodium	Potassium	pH	Field Filtered (Y/N)		Temp	Lab ID
06/30/23	12:20	SW	Mid-Lake 1m		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	N			129701
06/30/23	12:35	SW	Mid-Lake Bottom		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	N			129702

06/30/23
ATB

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
Dissolved aluminum, SRP, DOC, and chlorophyll samples not filtered, will need filtration

Sampled By	Date	Time
Adam Bryant	06/30/23	12:20

Received By	Date	Time

Relinquished to IAL By (Signature)	Date	Time
Adam Bryant	06/30/23	4:05

Shipped By: 2 SAMPLE SAS <5 8.9°C T-079
Shipping Reference:

Received at IAL By: JDH
Date: 6/30
Time: 16:00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741377 **PAGE 1**

REPORT DATE: 09/14/23

DATE SAMPLED: 07/13/23 **DATE RECEIVED:** 07/13/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

Two water samples were received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Mid-Lake 1m	0.015	<0.001	<0.010	6.21	0.650	38.0	7.94
Mid-Lake Bottom	0.016	<0.001	<0.010	5.97	0.620	39.2	7.93

SAMPLE ID	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	0.9611	0.8458	3.99	94.8	3.6	1.5
Mid-Lake Bottom	0.9689	0.8219	3.99	97.6		

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Mid-Lake 1m	6.36	0.876	3.05	50.5	19.5	36.9	<1.00
Mid-Lake Bottom	6.47	0.896	2.98	50.8	19.8	38.0	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741377 **PAGE 2**

REPORT DATE: 09/14/23

DATE SAMPLED: 07/13/23 **DATE RECEIVED:** 07/13/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	SM204500N03F	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	07/17/23	07/14/23	07/13/23	07/24/23	07/17/23	07/25/23	07/14/23
DETECTION LIMIT	0.002	0.001	0.010	0.250	0.050	1.00	0.10
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.151	<0.001	<0.010	<0.250	0.545	158	
DUPLICATE	0.151	<0.001	<0.010	<0.250	0.539	158	
RPD	0.04%	NC	NC	NC	1.11%	0.00%	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.151	<0.001	<0.010	<0.250	0.545		
SPIKED SAMPLE	0.201	0.020	0.208	4.22	1.54		
SPIKE ADDED	0.050	0.020	0.200	4.50	1.00		
% RECOVERY	99.31%	100.00%	104.24%	93.84%	99.20%	NA	NA
QC CHECK							
FOUND	0.094	0.039	0.418	4.14	0.528	102	
TRUE	0.094	0.039	0.408	4.00	0.490	100	
% RECOVERY	100.00%	98.98%	102.45%	103.43%	107.76%	102.00%	NA
BLANK	<0.002	<0.001	<0.010	<0.250	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741377 **PAGE 3**

REPORT DATE: 09/14/23

DATE SAMPLED: 07/13/23 **DATE RECEIVED:** 07/13/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H
DATE ANALYZED	08/09/23	08/09/23	07/19/23	07/14/23	07/19/23	07/19/23
DETECTION LIMIT	0.0030	0.0030	0.50	1.00	0.1	0.1
DUPLICATE						
SAMPLE ID	BATCH	Mid-Lake 1m	Mid-Lake Bottom	Mid-Lake Bottom	BATCH	BATCH
ORIGINAL	<0.0030	0.8458	3.99	97.6	4.0	0.9
DUPLICATE	<0.0030	0.8164	4.52	94.8	4.0	0.9
RPD	NC	3.54%	12.35%	2.94%	0.00%	0.00%
SPIKE SAMPLE						
SAMPLE ID	BATCH	Mid-Lake 1m	Mid-Lake Bottom	Mid-Lake Bottom		
ORIGINAL	<0.0030	0.8458	3.99	97.6		
SPIKED SAMPLE	0.4590	1.300	14.8	109		
SPIKE ADDED	0.5000	0.5000	10.0	10.0		
% RECOVERY	91.80%	90.84%	108.26%	115.34%	NA	NA
QC CHECK						
FOUND	0.4760	0.5220	30.5	9.84		
TRUE	0.5000	0.5000	30.0	10.0		
% RECOVERY	95.21%	104.39%	101.67%	98.40%	NA	NA
BLANK	<0.0030	<0.0030	<0.50	<1.00	NA	NA

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IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1741377 **PAGE 4**

REPORT DATE: 09/14/23

DATE SAMPLED: 07/13/23 **DATE RECEIVED:** 07/13/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	07/18/23	07/18/23	07/18/23	07/18/23	07/18/23	07/25/23	07/25/23
DETECTION LIMIT	0.100	0.100	0.500	0.500	0.700	1.00	1.00
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	34.6	8.67	2.73	24.8	122		
DUPLICATE	34.5	8.65	2.68	25.0	122		
RPD	0.18%	0.29%	1.90%	0.42%	0.21%	NA	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH			
ORIGINAL	34.6	8.67	2.73	24.8			
SPIKED SAMPLE	44.9	18.5	12.7	35.9			
SPIKE ADDED	10.0	10.0	10.0	10.0			
% RECOVERY	103.17%	97.80%	99.85%	110.89%	NA	NA	NA
QC CHECK							
FOUND	9.73	9.49	9.98	10.1	63.4		
TRUE	10.0	10.0	10.0	10.0	66.2		
% RECOVERY	97.26%	94.89%	99.75%	100.86%	95.78%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.500	<0.700	NA	NA

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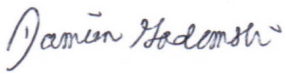
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1741377

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Addres
Contac Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Analysis Requested																		Field Filtered (Y/N)	Containers Received	Temp	Lab ID
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)		Total Alkalinity	Total Aluminum	Dissolved Aluminum	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Dissolved Organic Carbon	Chlorophyll a	Total Hardness	Chloride	Bicarbonate	Carbonate	Total Calcium	Total Magnesium	Sodium	Potassium	pH				
7-13-23	1100	SW	Mid-Lake 1m		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	N			130336
7-13-23	1115	SW	Mid-Lake Bottom		x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	N			130337

7/13/23

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
Dissolved aluminum, SRP, DOC, and chlorophyll samples not filtered, will need filtration

Sampled By: Adam Bryant	Date: 7/13/23	Time: ~~1400~~ 1100	Shipped By:		Shipping Reference
Received By:	Date: 7/13/23	Time: 11:00 2100			
Relinquished to IAL By (Signature): Adam Bryant	Date: 7/13/23	Time: 1400	Received at IAL By: 2 SAMPLES NS IS 18.2C TOTH	7-13-23	Time: 2:00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1742078 **PAGE 1**

REPORT DATE: 10/16/23

DATE SAMPLED: 08/15/23 **DATE RECEIVED:** 08/15/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Mid-Lake 1m	0.028	0.001	<0.010	7.70	0.769	37.4	7.94

SAMPLE ID	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	1.043	0.9953	4.52	108	6.7	3.4

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Mid-Lake 1m	6.74	0.998	4.81	56.6	20.9	36.3	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1742078 **PAGE 2**

REPORT DATE: 10/16/23

DATE SAMPLED: 08/15/23 **DATE RECEIVED:** 08/15/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	SM204500N03F	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	08/25/23	08/16/23	08/17/23	08/17/23	08/22/23	08/21/23	08/15/23
DETECTION LIMIT	0.002	0.001	0.010	0.250	0.050	1.00	0.10
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.005	<0.001	0.091	<0.250	0.179	79.5	
DUPLICATE	0.005	<0.001	0.091	<0.250	0.191	78.5	
RPD	5.60%	NC	0.60%	NC	6.49%	1.27%	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.005	<0.001	0.091	<0.250	0.179		
SPIKED SAMPLE	0.053	0.022	0.298	4.07	1.36		
SPIKE ADDED	0.050	0.020	0.200	4.50	1.00		
% RECOVERY	96.66%	110.00%	103.44%	90.38%	117.60%	NA	NA
QC CHECK							
FOUND	0.093	0.040	0.414	4.02	0.510	101	
TRUE	0.094	0.039	0.408	4.00	0.490	100	
% RECOVERY	98.94%	101.52%	101.47%	100.50%	104.08%	101.00%	NA
BLANK	<0.002	<0.001	<0.010	<0.250	<0.050	NA	NA

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IEH ANALYTICAL LABORATORIES

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

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CASE FILE NUMBER: 1742078 **PAGE 3**

REPORT DATE: 10/16/23

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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	DISSOLVED ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H
DATE ANALYZED	08/17/23	08/17/23	08/23/23	08/18/23	08/22/23	08/22/23
DETECTION LIMIT	0.0030	0.0030	0.50	1.00	0.1	0.1
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.1001	0.0148	2.31	23.5	6.4	2.4
DUPLICATE	0.1001	0.0141	2.52	23.3	6.4	2.0
RPD	0.00%	4.70%	8.70%	0.76%	0.00%	17.07%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.1001	0.0148	2.31	23.5		
SPIKED SAMPLE	0.6313	0.5418	12.6	33.2		
SPIKE ADDED	0.5000	0.5000	10.0	10.0		
% RECOVERY	106.24%	105.41%	103.01%	97.11%	NA	NA
QC CHECK						
FOUND	0.5373	0.5369	30.9	9.86		
TRUE	0.5000	0.5000	30.0	10.0		
% RECOVERY	107.46%	107.38%	103.00%	98.60%	NA	NA
BLANK	<0.0030	<0.0030	<0.50	<1.00	NA	NA

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IEH ANALYTICAL LABORATORIES

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1742078 **PAGE 4**

REPORT DATE: 10/16/23

DATE SAMPLED: 08/15/23 **DATE RECEIVED:** 08/15/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	08/21/23	08/21/23	08/21/23	08/21/23	08/21/23	08/21/23	08/21/23
DETECTION LIMIT	0.100	0.100	0.500	0.500	0.700	1.00	1.00
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	8.47	1.06	0.565	2.39	26		
DUPLICATE	8.54	1.05	0.575	2.40	26		
RPD	0.82%	0.83%	1.76%	0.57%	0.54%	NA	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH			
ORIGINAL	8.47	1.06	0.565	2.39			
SPIKED SAMPLE	19.0	11.6	11.1	13.4			
SPIKE ADDED	10.0	10.0	10.0	10.0			
% RECOVERY	105.37%	105.45%	105.38%	110.56%	NA	NA	NA
QC CHECK							
FOUND	10.3	10.4	10.4	10.9	68.6		
TRUE	10.0	10.0	10.0	10.0	66.2		
% RECOVERY	102.88%	104.21%	104.21%	109.40%	103.71%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.500	<0.700	NA	NA

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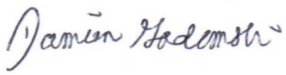
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1742078

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Addres
Contac Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Analysis Requested																				Field Filtered (Y/N)	Containers Received	Temp	Lab ID
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)		Total Alkalinity	Total Aluminum	Dissolved Aluminum	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Dissolved Organic Carbon	Chlorophyll a	Total Hardness	Chloride	Bicarbonate	Carbonate	Total Calcium	Total Magnesium	Sodium	Potassium	pH					
08-15-23	0945	SW	Mid-Lake 1m		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	N			132972
~~[illegible]~~	~~[illegible]~~	~~SW~~	~~Mid-Lake Bottom~~		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	N			

8/15/23

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
Dissolved aluminum, SRP, DOC, and chlorophyll samples not filtered, will need filtration

Sampled By: Adam Bryant	Date: 0945	Time: 8/15/23	Shipped By:		Shipping Reference:
Received By:	Date:	Time:	Received at IAL By: 1 SAMPLE AS IS 22.32 TOT4	Date: 8-15-23	Time: 1:30
Relinquished to IAL By (Signature):	Date: 1330	Time: 8/15/23			

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: **1742786** **PAGE 1**

REPORT DATE: **10/16/23**

DATE SAMPLED: **09/14/23** **DATE RECEIVED:** **09/14/23**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Mid-Lake 1m	0.031	<0.001	<0.010	9.70	1.06	37.6	8.09

SAMPLE ID	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	1.676	5.15	108	10	4.5

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Mid-Lake 1m	6.98	1.06	3.46	62.8	21.8	36.7	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1742786 **PAGE 2**

REPORT DATE: 10/16/23

DATE SAMPLED: 09/14/23 **DATE RECEIVED:** 09/14/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	SM204500N03F	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	09/25/23	09/15/23	09/15/23	10/10/23	09/19/23	09/21/23	09/15/23
DETECTION LIMIT	0.002	0.001	0.010	0.250	0.050	1.00	0.10
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.062	0.002	0.019	1.11	0.565	86.4	
DUPLICATE	0.062	0.002	0.016	1.17	0.540	87.2	
RPD	0.32%	2.40%	12.10%	5.62%	4.52%	0.92%	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.062	0.002	0.019	1.11	0.565		
SPIKED SAMPLE	0.110	0.022	0.191	5.40	1.56		
SPIKE ADDED	0.050	0.020	0.200	4.50	1.00		
% RECOVERY	95.79%	103.46%	86.33%	95.51%	99.70%	NA	NA
QC CHECK							
FOUND	0.095	0.041	0.402	4.26	0.461	98.8	
TRUE	0.094	0.039	0.408	4.00	0.490	100	
% RECOVERY	101.06%	104.06%	98.53%	106.50%	94.08%	98.80%	NA
BLANK	<0.002	<0.001	<0.010	<0.250	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
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NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1742786 **PAGE 3**

REPORT DATE: 10/16/23

DATE SAMPLED: 09/14/23 **DATE RECEIVED:** 09/14/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H
DATE ANALYZED	09/25/23	09/21/23	09/22/23	09/29/23	09/29/23
DETECTION LIMIT	0.0030	0.50	1.00	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.0241	1.37	21.1	8.0	3.7
DUPLICATE	0.0239	1.37	21.5	7.7	3.5
RPD	0.61%	0.00%	1.59%	4.26%	3.70%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	BATCH		
ORIGINAL	0.0241	1.37	21.1		
SPIKED SAMPLE	0.5328	11.9	31.5		
SPIKE ADDED	0.5000	10.0	10.0		
% RECOVERY	101.74%	105.11%	104.05%	NA	NA
QC CHECK					
FOUND	0.5276	31.3	9.93		
TRUE	0.5000	30.0	10.0		
% RECOVERY	105.52%	104.33%	99.35%	NA	NA
BLANK	<0.0030	<0.50	<1.00	NA	NA

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IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1742786 **PAGE 4**

REPORT DATE: 10/16/23

DATE SAMPLED: 09/14/23 **DATE RECEIVED:** 09/14/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	09/30/23	09/30/23	09/30/23	09/30/23	09/30/23	09/30/23	09/30/23
DETECTION LIMIT	0.100	0.100	0.500	0.500	0.700	1.00	1.00
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	35.6	9.60	2.49	27.4	128		
DUPLICATE	35.7	9.62	2.52	27.5	129		
RPD	0.29%	0.15%	1.25%	0.21%	0.25%	NA	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH			
ORIGINAL	35.6	9.60	2.49	27.4			
SPIKED SAMPLE	45.6	19.9	12.8	37.1			
SPIKE ADDED	10.0	10.0	10.0	10.0			
% RECOVERY	99.77%	102.89%	103.58%	96.48%	NA	NA	NA
QC CHECK							
FOUND	9.85	10.1	10.3	10.3	66.3		
TRUE	10.0	10.0	10.0	10.0	66.2		
% RECOVERY	98.50%	101.23%	102.54%	102.58%	100.20%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.500	<0.700	NA	NA

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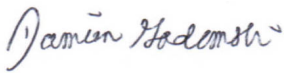
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1792786

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700, Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address:
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

SAMPLING

Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Alkalinity	Total Aluminum	pH	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Dissolved Organic Carbon	Chlorophyll a	Total Hardness	Chloride	Bicarbonate	Carbonate	Total Calcium	Total Magnesium	Sodium	Potassium	~~Dissolved Aluminum~~	Field Filtered (Y/N)	Containers Received	Temp	Lab ID
09/14/23	10:27	SW	Mid-Lake 1m	6	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	~~x~~	N		135337	

ATB 9/14/23

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
SRP, DOC, and chlorophyll samples not filtered, will need filtration

Sampled By	Date	Time
Adam Bryant	09/14/23	1545
Received By	Date	Time
Relinquished to IAL By (Signature): Adam Bryant	09/14/23	1545

Shipped By	Shipping Reference

Received at IAL By	Date	Time
Alex Hanner / Sample 16.3°C As Is T-074	9/14/23	3:45

LAB USE ONLY
Case File Number

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1743346 **PAGE 1**

REPORT DATE: 11/09/23

DATE SAMPLED: 10/11/23 **DATE RECEIVED:** 10/11/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Mid-Lake 1m	0.043	0.001	0.014	11.6	0.962	34.8	7.60

SAMPLE ID	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	1.35	4.62	74.7	32	11

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Mid-Lake 1m	6.43	1.03	3.51	58.1	20.3	32.9	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1743346 **PAGE 2**

REPORT DATE: 11/09/23

DATE SAMPLED: 10/11/23 **DATE RECEIVED:** 10/11/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	SM204500N03F	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	10/16/23	10/12/23	10/13/23	10/12/23	10/17/23	10/18/23	10/11/23
DETECTION LIMIT	0.002	0.001	0.010	0.250	0.050	1.00	0.10
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.080	0.018	0.012	<0.250	0.391	58.4	
DUPLICATE	0.081	0.017	0.012	<0.250	0.387	58.8	
RPD	0.98%	0.58%	1.70%	NC	1.03%	0.68%	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.080	0.018	0.012	<0.250	0.391		
SPIKED SAMPLE	0.130	0.038	0.201	3.89	1.35		
SPIKE ADDED	0.050	0.020	0.200	4.50	1.00		
% RECOVERY	100.25%	101.06%	94.47%	86.44%	96.30%	NA	NA
QC CHECK							
FOUND	0.094	0.040	0.408	3.91	0.441	102	
TRUE	0.094	0.039	0.408	4.00	0.469	100	
% RECOVERY	100.00%	101.52%	99.88%	97.63%	94.03%	102.00%	NA
BLANK	<0.002	<0.001	<0.010	<0.250	<0.050	NA	NA

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FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H
DATE ANALYZED	10/18/23	10/20/23	10/18/23	10/17/23	10/17/23
DETECTION LIMIT	0.0030	0.50	1.00	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.0155	31.4	6.29	0.5	1.6
DUPLICATE	0.0160	31.7	6.46	0.5	1.6
RPD	3.60%	1.00%	2.71%	0.00%	0.00%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	BATCH		
ORIGINAL	0.0155	31.4	6.29		
SPIKED SAMPLE	0.4859	53.6	16.6		
SPIKE ADDED	0.5000	20.0	10.0		
% RECOVERY	94.09%	110.89%	103.18%	NA	NA
QC CHECK					
FOUND	0.4542	31.3	9.86		
TRUE	0.5000	30.0	10.0		
% RECOVERY	90.83%	104.33%	98.62%	NA	NA
BLANK	<0.0030	<0.50	<1.00	NA	NA

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IEH ANALYTICAL LABORATORIES

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PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1743346 **PAGE 4**

REPORT DATE: 11/09/23

DATE SAMPLED: 10/11/23 **DATE RECEIVED:** 10/11/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	10/26/23	10/26/23	10/26/23	10/26/23	10/26/23	10/26/23	10/26/23
DETECTION LIMIT	0.100	0.100	0.500	0.500	0.700	1.00	1.00
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	36.1	9.50	2.72	26.9	129		
DUPLICATE	37.9	9.98	2.85	28.2	136		
RPD	4.82%	4.94%	4.70%	4.66%	4.85%	NA	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH			
ORIGINAL	36.1	9.50	2.72	26.9			
SPIKED SAMPLE	46.5	19.8	13.4	38.2			
SPIKE ADDED	10.0	10.0	10.0	10.0			
% RECOVERY	103.75%	103.46%	106.61%	112.72%	NA	NA	NA
QC CHECK							
FOUND	10.1	9.97	10.3	10.2	66.3		
TRUE	10.0	10.0	10.0	10.0	66.2		
% RECOVERY	101.01%	99.69%	102.54%	102.43%	100.19%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.500	<0.700	NA	NA

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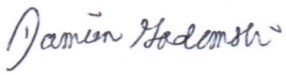
SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1743346

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Addres
Contac Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard

Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

Date (mm-dd-yy)	Time	Matrix**	Sample Description (This Will Appear On The Report)	Number of Containers	Total Alkalinity	Total Aluminum	~~Dissolved Aluminum~~ MA 10/11/23	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Dissolved Organic Carbon	Chlorophyll a	Total Hardness	Chloride	Bicarbonate	Carbonate	Total Calcium	Total Magnesium	Sodium	Potassium	pH	Field Filtered (Y/N)	Containers Received	Temp	Lab ID
10/11/23	10:30	SW	Mid-Lake 1m		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	N			137068
~~3A 10/11/23~~		~~SW~~	~~Mid-Lake Bottom~~		~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~		~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~x~~	~~N~~			

3A 10/11/23

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
Dissolved aluminum, SRP, DOC, and chlorophyll samples not filtered, will need filtration

Sampled By: Adam Bryant	Date: 10/11/23	Time: 1332
Received By	Date	Time
Relinquished to IAL By (Signature)	Date	Time

Shipped By: [signature]		Shipping Reference	
Received at IAL By: [signature] 18.2 °C 12.6 °C T-074		Date: 10-11-23	Time: 1:30

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1744586 **PAGE 1**

REPORT DATE: 12/26/23

DATE SAMPLED: 12/12/23 **DATE RECEIVED:** 12/12/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Mid-Lake 1m	0.041	0.002	0.034	10.7	1.04	28.5	7.47

SAMPLE ID	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	0.406	4.62	98.6	54	7.4

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Mid-Lake 1m	5.74	0.940	3.07	45.0	18.2	26.5	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1744586 **PAGE 2**

REPORT DATE: 12/26/23

DATE SAMPLED: 12/12/23 **DATE RECEIVED:** 12/12/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	SM204500N03F	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	12/16/23	12/12/23	12/13/23	12/22/23	12/19/23	12/15/23	12/12/23
DETECTION LIMIT	0.002	0.001	0.010	0.250	0.050	1.00	0.10
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.038	0.002	0.504	<0.250	0.851	33.2	
DUPLICATE	0.041	0.002	0.488	<0.250	0.827	32.7	
RPD	8.20%	0.42%	3.12%	NC	2.86%	1.52%	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.038	0.002	0.504	<0.250	0.851		
SPIKED SAMPLE	0.084	0.021	0.717	3.99	1.81		
SPIKE ADDED	0.050	0.020	0.200	4.50	1.00		
% RECOVERY	93.01%	97.74%	106.54%	88.67%	95.50%	NA	NA
QC CHECK							
FOUND	0.095	0.040	0.432	3.92	0.441	99.3	
TRUE	0.094	0.039	0.408	4.00	0.469	100	
% RECOVERY	101.06%	101.52%	105.88%	98.08%	94.03%	99.30%	NA
BLANK	<0.002	<0.001	<0.010	<0.250	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1744586 **PAGE 3**

REPORT DATE: 12/26/23

DATE SAMPLED: 12/12/23 **DATE RECEIVED:** 12/12/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H
DATE ANALYZED	12/14/23	12/13/23	12/13/23	12/19/23	12/19/23
DETECTION LIMIT	0.0030	0.50	1.00	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	Mid-Lake 1m	BATCH	BATCH	BATCH
ORIGINAL	0.0166	4.62	30.5	17	3.3
DUPLICATE	0.0184	4.52	31.3	19	3.5
RPD	10.19%	2.30%	2.58%	9.35%	5.88%
SPIKE SAMPLE					
SAMPLE ID	BATCH	Mid-Lake 1m	BATCH		
ORIGINAL	0.0166	4.62	30.5		
SPIKED SAMPLE	0.5563	14.7	41.5		
SPIKE ADDED	0.5000	20.0	10.0		
% RECOVERY	107.94%	50.45%	109.67%	NA	NA
QC CHECK					
FOUND	0.4954	30.9	9.70		
TRUE	0.5000	30.0	10.0		
% RECOVERY	99.08%	103.00%	97.00%	NA	NA
BLANK	<0.0030	<0.50	<1.00	NA	NA

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IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1744586 **PAGE 4**

REPORT DATE: 12/26/23

DATE SAMPLED: 12/12/23 **DATE RECEIVED:** 12/12/23

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	12/14/23	12/14/23	12/14/23	12/14/23	12/14/23	12/15/23	12/15/23
DETECTION LIMIT	0.100	0.100	0.500	0.500	0.700	1.00	1.00
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	42.1	13.4	1.86	141	160		
DUPLICATE	44.8	12.2	1.93	136	162		
RPD	6.21%	9.21%	3.57%	3.31%	1.17%	NA	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH			
ORIGINAL	42.1	13.4	1.86	141			
SPIKED SAMPLE	50.8	25.0	12.4	151			
SPIKE ADDED	10.0	10.0	10.0	10.0			
% RECOVERY	87.00%	116.20%	105.09%	104.15%	NA	NA	NA
QC CHECK							
FOUND	10.4	10.2	10.3	10.6	68.2		
TRUE	10.0	10.0	10.0	10.0	66.2		
% RECOVERY	103.93%	102.50%	102.68%	105.71%	103.04%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.500	<0.700	NA	NA

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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories

3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 1744586

Page ___ of ___

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address:
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard

Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number
Containers Received
Temp
Lab ID

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Analysis Requested																									
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)		Total Alkalinity	Total Aluminum	pH	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Dissolved Organic Carbon	Chlorophyll a	Total Hardness	Chloride	Bicarbonate	Carbonate	Total Calcium	Total Magnesium	Sodium	Potassium	Field Filtered (Y/N)								
12-12-23	1018	SW	Mid-Lake 1m	4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	N			141092					

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
SRP, DOC, and chlorophyll samples not filtered, will need filtration

Sampled By: Adam Bryant	Date: 12/12/23	Time: 1347
Received By:	Date:	Time:
Relinquished to IAL By (Signature): Adam Bryant	Date: 12/12/23	Time: 1347

Shipped By:
Shipping Reference:
Received at IAL By: Date: 12-12-23 Time: 1:50

12/12/2023

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1746394 **PAGE 1**

REPORT DATE: 03/27/24

DATE SAMPLED: 03/13/24 **DATE RECEIVED:** 03/13/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Mid-Lake 1m	0.041	<0.001	<0.010	13.4	1.17	26.5	7.84

SAMPLE ID	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	0.3773	5.36	56.2	67	9.9

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Mid-Lake 1m	5.92	0.902	2.77	34.7	18.5	25.6	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1746394 **PAGE 2**

REPORT DATE: 03/27/24

DATE SAMPLED: 03/13/24 **DATE RECEIVED:** 03/13/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	SM204500N03F	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	03/18/24	03/13/24	03/15/24	03/19/24	03/18/24	03/14/24	03/13/24
DETECTION LIMIT	0.002	0.001	0.010	0.250	0.050	1.00	0.10
DUPLICATE							
SAMPLE ID	BATCH	BATCH	Mid-Lake 1m	BATCH	BATCH	Mid-Lake 1M	
ORIGINAL	0.013	0.074	<0.010	<0.250	0.689	26.5	
DUPLICATE	0.013	0.072	<0.010	<0.250	0.698	26.7	
RPD	3.21%	1.97%	NC	NC	1.30%	0.75%	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	Mid-Lake 1m	BATCH	BATCH		
ORIGINAL	0.013	0.074	<0.010	<0.250	0.689		
SPIKED SAMPLE	0.062	0.093	0.240	4.67	1.64		
SPIKE ADDED	0.050	0.020	0.200	4.50	1.00		
% RECOVERY	98.18%	95.65%	119.88%	103.78%	95.20%	NA	NA
QC CHECK							
FOUND	0.093	0.040	0.423	3.83	0.445	102	
TRUE	0.094	0.039	0.408	4.00	0.469	100	
% RECOVERY	98.94%	101.52%	103.60%	95.78%	94.88%	102.00%	NA
BLANK	<0.002	<0.001	<0.010	<0.250	<0.050	NA	NA

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IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

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CASE FILE NUMBER: 1746394 **PAGE 3**

REPORT DATE: 03/27/24

DATE SAMPLED: 03/13/24 **DATE RECEIVED:** 03/13/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H
DATE ANALYZED	03/25/24	03/20/24	03/18/24	03/15/24	03/15/24
DETECTION LIMIT	0.0030	0.50	1.00	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	Mid-Lake 1m	Mid-Lake 1m	BATCH	BATCH
ORIGINAL	0.0647	5.36	56.2	4.0	1.4
DUPLICATE	0.0666	5.15	56.9	3.7	1.6
RPD	2.93%	4.00%	1.32%	8.70%	15.61%
SPIKE SAMPLE					
SAMPLE ID	BATCH		Mid-Lake 1m		
ORIGINAL	0.0647		56.2		
SPIKED SAMPLE	0.6518		155		
SPIKE ADDED	0.5000		100		
% RECOVERY	117.42%	NA	99.13%	NA	NA
QC CHECK					
FOUND	0.5379	31.7	9.69		
TRUE	0.5000	30.0	10.0		
% RECOVERY	107.59%	105.81%	96.90%	NA	NA
BLANK	<0.0030	<0.50	<1.00	NA	NA

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IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1746394 **PAGE 4**

REPORT DATE: 03/27/24

DATE SAMPLED: 03/13/24 **DATE RECEIVED:** 03/13/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	03/23/24	03/23/24	03/23/24	03/23/24	03/23/24	03/14/24	03/14/24
DETECTION LIMIT	0.100	0.100	0.500	0.500	0.700	1.00	1.00
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	29.7	6.38	2.32	16.2	100		
DUPLICATE	29.5	6.32	2.31	16.0	100		
RPD	0.72%	0.92%	0.70%	0.95%	0.77%	NA	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH			
ORIGINAL	29.7	6.38	2.32	16			
SPIKED SAMPLE	39.9	16.4	13.1	27			
SPIKE ADDED	10.0	10.0	10.0	10.0			
% RECOVERY	102.05%	100.70%	107.73%	106.46%	NA	NA	NA
QC CHECK							
FOUND	10.3	10.2	10.8	10.8	67.9		
TRUE	10.0	10.0	10.0	10.0	66.2		
% RECOVERY	103.04%	102.50%	108.00%	108.00%	102.70%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.500	<0.700	NA	NA

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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form

17446394

Page 1 of 1

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address:
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
~~3A~~ ~~☒ Next Day~~ ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
~~Specific Date:~~ 2 weeks 3A ~~4 weeks~~
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

SAMPLING			SAMPLE DESCRIPTION	Number of Containers	Analysis Requested																		Containers Received	Temp	Lab ID
Date (mm-dd-yy)	Time	Matrix**	(This Will Appear On The Report)		Total Alkalinity	Total Aluminum	pH	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Dissolved Organic Carbon	Chlorophyll a	Total Hardness	Chloride	Bicarbonate	Carbonate	Total Calcium	Total Magnesium	Sodium	Potassium	Field Filtered (Y/N)			
3/13/24	1000	SW	Mid-Lake 1m	4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	N			146538

3/13/24 3A

*Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments:
SRP, DOC, and chlorophyll samples not filtered, will need filtration

Sampled By: Adam Brymt	Date: ~~3/13~~ 03/13/24	Time: 1335
Received By:	Date:	Time:
Relinquished to IAL By (Signature): Adam Brymt	Date: 03/13/24	Time: 1335

Shipped By:
Shipping Reference:
Received at IAL By: ISMEEK AS IS 13.4° Date: 3-13-24 Time: 1:35

T-074

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1748847 **PAGE 1**

REPORT DATE: 08/02/24

DATE SAMPLED: 06/27/24 **DATE RECEIVED:** 06/27/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Mid-Lake 1m	0.120	0.001	<0.010	12.7	1.72	44.4	6.46

SAMPLE ID	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Mid-Lake 1m	1.78	4.52	39.4	21	12

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Mid-Lake 1m	7.23	1.08	3.16	37.1	22.5	25.0	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1748847 **PAGE 2**

REPORT DATE: 08/02/24

DATE SAMPLED: 06/27/24 **DATE RECEIVED:** 06/27/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	N03+N02 (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	SM204500N03F	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	07/06/24	06/28/24	06/28/24	07/08/24	07/02/24	07/02/24	06/27/24
DETECTION LIMIT	0.002	0.001	0.010	0.250	0.050	1.00	0.10
DUPLICATE							
SAMPLE ID	Mid-Lake 1m	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.120	<0.001	0.233	<0.250	0.302	60.2	
DUPLICATE	0.121	<0.001	0.231	<0.250	0.304	60.0	
RPD	1.24%	NC	0.91%	NC	0.66%	0.33%	NA
SPIKE SAMPLE							
SAMPLE ID	Mid-Lake 1m	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.120	<0.001	0.233	<0.250	0.302		
SPIKED SAMPLE	0.170	0.019	0.446	4.03	0.768		
SPIKE ADDED	0.050	0.020	0.200	4.50	0.500		
% RECOVERY	100.80%	93.00%	106.29%	89.64%	93.20%	NA	NA
QC CHECK							
FOUND	0.095	0.037	0.370	3.76	0.442	96.3	
TRUE	0.094	0.039	0.408	4.00	0.469	100	
% RECOVERY	101.06%	93.91%	90.67%	94.00%	94.24%	96.30%	NA
BLANK	<0.002	<0.001	<0.010	<0.250	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1748847 **PAGE 3**

REPORT DATE: 08/02/24

DATE SAMPLED: 06/27/24 **DATE RECEIVED:** 06/27/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H
DATE ANALYZED	07/02/24	07/15/24	07/16/24	07/12/24	07/12/24
DETECTION LIMIT	0.0030	0.50	1.00	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	Mid-Lake 1m	Mid-Lake 1m	BATCH	BATCH
ORIGINAL	0.0646	4.52	27.0	15	6.7
DUPLICATE	0.0729	4.83	27.6	16	8.0
RPD	12.09%	6.74%	2.17%	6.90%	17.27%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	Mid-Lake 1m		
ORIGINAL	0.0646	4.52	27.0		
SPIKED SAMPLE	0.5909	15.1	37.5		
SPIKE ADDED	0.5000	10.0	10.0		
% RECOVERY	105.26%	106.16%	104.56%	NA	NA
QC CHECK					
FOUND	0.5490	30.4	9.66		
TRUE	0.5000	30.0	10.0		
% RECOVERY	109.80%	101.33%	96.60%	NA	NA
BLANK	<0.0030	<0.50	<1.00	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1748847 **PAGE 4**

REPORT DATE: 08/02/24

DATE SAMPLED: 06/27/24 **DATE RECEIVED:** 06/27/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM TETRA TECH INC.

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	SODIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	07/02/24	07/02/24	07/02/24	07/02/24	07/02/24	07/02/24	07/02/24
DETECTION LIMIT	0.100	0.100	0.500	0.500	0.700	1.00	1.00
DUPLICATE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	29.2	6.56	2.24	15.9	100		
DUPLICATE	28.3	6.30	2.21	16.0	96.7		
RPD	3.24%	4.00%	0.97%	0.61%	3.44%	NA	NA
SPIKE SAMPLE							
SAMPLE ID	BATCH	BATCH	BATCH	BATCH			
ORIGINAL	29.2	6.56	2.24	15.9			
SPIKED SAMPLE	38.4	16.4	12.8	26.8			
SPIKE ADDED	10.0	10.0	10.0	10.0			
% RECOVERY	91.57%	98.70%	105.88%	109.10%	NA	NA	NA
QC CHECK							
FOUND	10.3	10.5	10.6	10.6	69.1		
TRUE	10.0	10.0	10.0	10.0	66.2		
% RECOVERY	102.98%	105.39%	105.76%	105.59%	104.48%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.500	<0.700	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
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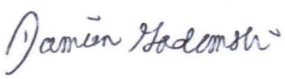
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

IEH Analytical Laboratories
3927 Aurora Ave N • Seattle • WA • 98103
P: 206-632-2715 F: 206-632-2417

Chain of Custody Form 17458847

Page ____ of ____

REPORT TO:
Client: Tetra Tech Inc.
Address: 2003 Western Avenue, Suite 700
Seattle, WA 98121
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: 509-979-9672 Fax

INVOICE TO: (IF DIFFERENT FROM REPORT)
Client: Same
Address:
Contact: Shannon Brattebo
Email: shannon.brattebo@tetratech.com
Phone: Fax:

PROJECT INFORMATION
Quote No.:
Client PO:
Client Project: Waughop Lake

Reporting/Invoicing Format
☐ Fax ☒ Email ☐ Mail

QC Data Reported
☒ Yes ☐ No

Sample Disposal
☐ Hold ☐ Dispose ☐ Return

Turn Around Time (TAT)*
☐ Next Day ☐ 2 Business Day
☐ 3 Business Da ☐ Standard
Specific Date: 4 weeks
*Advanced notice required for Rush Analysis

LAB USE ONLY
Case File Number

SAMPLING Date (mm-dd-yy)	Time	Matrix**	SAMPLE DESCRIPTION (This Will Appear On The Report)	Number of Containers	Total Alkalinity	Total Aluminum	pH	Sulfate	Total Phosphorus	SRP	Total Nitrogen	NO3+NO2-Nitrogen	Dissolved Organic Carbon	Chlorophyll a	Total Hardness	Chloride	Bicarbonate	Carbonate	Total Calcium	Total Magnesium	Sodium	Potassium	Field Filtered (Y/N)	Containers Received	Temp	Lab ID
06/27/24	10:45	SW	Mid-Lake 1m	4	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	N			159062

Analysis Requested

Containers Received | **Temp** | **Lab ID**

**Matrix: B=Biota, DW=Drinking Water, GW=Ground Water, P=Paint, S=Soil, SD=Sediment, SL=Sludge, SW=Surface Water, WW=Wastewater

Comments: **SRP, DOC, and chlorophyll samples not filtered, will need filtration**

	Date	Time
Sampled By: Adam Bryant	06/27/24	1415
Received By:		
Relinquished to IAL By (Signature): Adam Bryant	06/27/24	1415

Shipped By:
Received at IAL By: SAMPLE AS IS 12.8°C
Shipping Reference
Date: 6-28-24 Time: 2:15

T-074 27

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Tetra Tech, Inc.
Shannon Brattebo
2003 Western Ave Suite 700
Seattle, WA 98121

RE: Waughop Lake Alum
Work Order Number: 2306470

July 05, 2023

Attention Shannon Brattebo:

Fremont Analytical, Inc. received 2 sample(s) on 6/27/2023 for the analyses presented in the following report.

Sulfide by SM 4500-S2-F

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

Date: *07/05/2023*

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum
Work Order: 2306470

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2306470-001	Mid-Lake 1 m	06/27/2023 12:30 PM	06/27/2023 3:45 PM
2306470-002	Mid-Lake Bottom	06/27/2023 12:40 PM	06/27/2023 3:45 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2306470**

Date: **7/5/2023**

CLIENT: Tetra Tech, Inc.

Project: Waughop Lake Alum

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2306470**
Date Reported: **7/5/2023**

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

Lab ID: 2306470-001 **Collection Date:** 6/27/2023 12:30:00 PM
Client Sample ID: **Mid-Lake 1 m** **Matrix:** Water

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Sulfide by SM 4500-S2-F				Batch ID: R85056		Analyst: SS
Sulfide	1.60	0.500		mg/L	1	7/3/2023 11:22:17 AM

Lab ID: 2306470-002 **Collection Date:** 6/27/2023 12:40:00 PM
Client Sample ID: **Mid-Lake Bottom** **Matrix:** Water

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Sulfide by SM 4500-S2-F				Batch ID: R85056		Analyst: SS
Sulfide	2.80	0.500		mg/L	1	7/3/2023 11:22:17 AM

Work Order: 2306470
CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

QC SUMMARY REPORT

Sulfide by SM 4500-S2-F

Sample ID: **MB-R85056**	SampType: **MBLK**	Units: **mg/L**	Prep Date: **7/3/2023**	RunNo: **85056**
Client ID: **MBLKW**	Batch ID: **R85056**		Analysis Date: **7/3/2023**	SeqNo: **1775518**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.500									

Sample ID: **LCS-R85056**	SampType: **LCS**	Units: **mg/L**	Prep Date: **7/3/2023**	RunNo: **85056**
Client ID: **LCSW**	Batch ID: **R85056**		Analysis Date: **7/3/2023**	SeqNo: **1775519**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	2.40	0.500	2.000	0	120	45.6	120				

Sample ID: **2306470-001ADUP**	SampType: **DUP**	Units: **mg/L**	Prep Date: **7/3/2023**	RunNo: **85056**
Client ID: **Mid-Lake 1 m**	Batch ID: **R85056**		Analysis Date: **7/3/2023**	SeqNo: **1775521**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	2.40	0.500						1.600	40.0	30	R

NOTES:
R - High RPD observed.

Sample ID: **2306536-002AMS**	SampType: **MS**	Units: **mg/L**	Prep Date: **7/3/2023**	RunNo: **85056**
Client ID: **BATCH**	Batch ID: **R85056**		Analysis Date: **7/3/2023**	SeqNo: **1776234**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	4.00	0.500	2.000	1.200	140	21.5	190				

Fremont Analytical
An Alliance Technical Group Company

Sample Log-In Check List

Client Name:	TETRAS	Work Order Number:	2306470
Logged by:	Clare Griggs	Date Received:	6/27/2023 3:45:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
		Unknown prior to receipt.		
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16.	Was client notified of all discrepancies with this order?	Yes ☐	No ☐	NA ☑

Person Notified: _____ Date: _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	17.3

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Chain of Custody Record & Laboratory Services Agreement

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Date: 6/27/2023 Page: 1 of: 1

Laboratory Project No (internal): 2306470

Project Name: Waughop Lake Alum

Project No: 100-RCE-T39045

Collected by: Adam Bryant

Location: Waughop Lake, Lakewood, WA

Report To (PM): Shannon Brattebo, Tetra Tech

Special Remarks:
Bill to City of Lakewood
Attn: Weston Ott
wott@cityoflakewood.us
253-983-7725
6000 Main St. SW
Lakewood, WA 98499-5027

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Client: Tetra Tech, Inc.

Address: 2003 Western Ave. Suite 700

City, State, Zip: Seattle, WA 98121

Telephone: 206-728-9655

Email(s): shannon.brattebo@tetratech.com

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	SULFIDES			Comments
1	Mid-Lake 1 m	6/27/23	1230	W													X			
2	Mid-Lake Bottom	6/27/23	1240	W													X			
3																				
4																				
5																				
6																				
7																				
8																				
9														ATB 06/27/23						
10																				

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Tl Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ☐ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x Adam Bryant	Adam Bryant	6/27/23 3:40	x	Ashley Salvemini	6/27/23 1545
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Tetra Tech, Inc.
Shannon Brattebo
2003 Western Ave Suite 700
Seattle, WA 98121

RE: Waughop Lake Alum
Work Order Number: 2306536

July 07, 2023

Attention Shannon Brattebo:

Fremont Analytical, Inc. received 2 sample(s) on 6/30/2023 for the analyses presented in the following report.

Sulfide by SM 4500-S2-F

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

Date: *07/07/2023*

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum
Work Order: 2306536

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2306536-001	Mid-Lake 1 M	06/30/2023 12:20 PM	06/30/2023 4:12 PM
2306536-002	Mid-Lake Bottom	06/30/2023 12:35 PM	06/30/2023 4:12 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2306536**
Date: **7/7/2023**

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

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B - Analyte detected in the associated Method Blank
D - Dilution was required
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H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2306536**
Date Reported: **7/7/2023**

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

Lab ID: 2306536-001 **Collection Date:** 6/30/2023 12:20:00 PM
Client Sample ID: **Mid-Lake 1 M** **Matrix:** Water

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
Sulfide by SM 4500-S2-F				Batch ID: R85056		Analyst: SS
Sulfide	4.00	0.500		mg/L	1	7/3/2023 11:22:17 AM

Lab ID: 2306536-002 **Collection Date:** 6/30/2023 12:35:00 PM
Client Sample ID: **Mid-Lake Bottom** **Matrix:** Water

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
Sulfide by SM 4500-S2-F				Batch ID: R85056		Analyst: SS
Sulfide	1.20	0.500		mg/L	1	7/3/2023 11:22:17 AM

Work Order: 2306536
CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

QC SUMMARY REPORT

Sulfide by SM 4500-S2-F

Sample ID: **MB-R85056**	SampType: **MBLK**	Units: **mg/L**	Prep Date: **7/3/2023**	RunNo: **85056**
Client ID: **MBLKW**	Batch ID: **R85056**		Analysis Date: **7/3/2023**	SeqNo: **1775518**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.500									

Sample ID: **LCS-R85056**	SampType: **LCS**	Units: **mg/L**	Prep Date: **7/3/2023**	RunNo: **85056**
Client ID: **LCSW**	Batch ID: **R85056**		Analysis Date: **7/3/2023**	SeqNo: **1775519**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	2.40	0.500	2.000	0	120	45.6	120				

Sample ID: **2306470-001ADUP**	SampType: **DUP**	Units: **mg/L**	Prep Date: **7/3/2023**	RunNo: **85056**
Client ID: **BATCH**	Batch ID: **R85056**		Analysis Date: **7/3/2023**	SeqNo: **1775521**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	2.40	0.500						1.600	40.0	30	R

NOTES:
R - High RPD observed.

Sample ID: **2306536-002AMS**	SampType: **MS**	Units: **mg/L**	Prep Date: **7/3/2023**	RunNo: **85056**
Client ID: **Mid-Lake Bottom**	Batch ID: **R85056**		Analysis Date: **7/3/2023**	SeqNo: **1776234**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	4.00	0.500	2.000	1.200	140	21.5	190				

Fremont Analytical
An Alliance Technical Group Company

Sample Log-In Check List

Client Name:	TETRAS	Work Order Number:	2306536
Logged by:	Morgan Wilson	Date Received:	6/30/2023 4:20:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
		Unknown prior to receipt.		
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16.	Was client notified of all discrepancies with this order?	Yes ☐	No ☐	NA ☑

Person Notified: _____ Date: _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	19.8

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: 06/30/23 Page: 1 of: 1

Laboratory Project No (internal): 2306536

Project Name: Waughop Lake Alum

Project No: 100-RCE-T39045

Collected by:

Location: Waughop Lake, Lakewood, WA

Report To (PM): Shannon Brattebo, Tetra Tech

Special Remarks:
Bill to City of Lakewood
Attn: Weston Ott
wott@cityoflakewood.us
253-983-7725
6000 Main St. SW
Lakewood, WA 98499-5027

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Client: Tetra Tech, Inc.

Address: 2003 Western Ave. Suite 700

City, State, Zip: Seattle, WA 98121

Telephone: 206-728-9655

Email(s): shannon.brattebo@tetratech.com

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T)	Dissolved (D)	Anions (IC)***	EDB (8011)	SULFIDES	Comments
1	Mid-Lake 1 m	06/30/23	12:20	W														X	
2	Mid-Lake Bottom	06/30/23	12:35	W														X	
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			

06/30/23 ATB

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ☐ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x Adam Brymt	Adam Brymt	06/30/23 16:14	x	Nathan Keller	6/30/23 1614
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Tetra Tech, Inc.
Shannon Brattebo
2003 Western Ave Suite 700
Seattle, WA 98121

RE: Waughop Lake Alum
Work Order Number: 2307159

July 20, 2023

Attention Shannon Brattebo:

Fremont Analytical, Inc. received 2 sample(s) on 7/13/2023 for the analyses presented in the following report.

Sulfide by SM 4500-S2-F

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

Date: *07/20/2023*

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum
Work Order: 2307159

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2307159-001	Mid-Lake 1 M	07/13/2023 11:00 AM	07/13/2023 2:09 PM
2307159-002	Mid-Lake Bottom	07/13/2023 11:15 AM	07/13/2023 2:09 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Original

Case Narrative

WO#: **2307159**
Date: **7/20/2023**

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Associated LCS is outside of control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Method Detection Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2307159**
Date Reported: **7/20/2023**

Client: Tetra Tech, Inc. **Collection Date:** 7/13/2023 11:00:00 AM
Project: Waughop Lake Alum
Lab ID: 2307159-001 **Matrix:** Water
Client Sample ID: Mid-Lake 1 M

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sulfide by SM 4500-S2-F				Batch ID: R85352			Analyst: AM
Sulfide	0.800	0.500	0.128		mg/L	1	07/17/23 16:30:46

Client: Tetra Tech, Inc. **Collection Date:** 7/13/2023 11:15:00 AM
Project: Waughop Lake Alum
Lab ID: 2307159-002 **Matrix:** Water
Client Sample ID: Mid-Lake Bottom

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sulfide by SM 4500-S2-F				Batch ID: R85352			Analyst: AM
Sulfide	2.40	0.500	0.128		mg/L	1	07/17/23 16:30:46

Work Order: 2307159
CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

QC SUMMARY REPORT

Sulfide by SM 4500-S2-F

Sample ID: **MB-R85352**	SampType: **MBLK**			Units: **mg/L**		Prep Date: **7/17/2023**			RunNo: **85352**	
Client ID: **MBLKW**	Batch ID: **R85352**					Analysis Date: **7/17/2023**			SeqNo: **1780883**	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.500									

Sample ID: **LCS-R85352**	SampType: **LCS**			Units: **mg/L**		Prep Date: **7/17/2023**			RunNo: **85352**	
Client ID: **LCSW**	Batch ID: **R85352**					Analysis Date: **7/17/2023**			SeqNo: **1780884**	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	2.00	0.500	2.000	0	100	45.6	120				

Sample ID: **2307159-001ADUP**	SampType: **DUP**			Units: **mg/L**		Prep Date: **7/17/2023**			RunNo: **85352**	
Client ID: **Mid-Lake 1 M**	Batch ID: **R85352**					Analysis Date: **7/17/2023**			SeqNo: **1780887**	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.800	0.500						0.8000	0	30	

Sample ID: **2307159-002AMS**	SampType: **MS**			Units: **mg/L**		Prep Date: **7/17/2023**			RunNo: **85352**	
Client ID: **Mid-Lake Bottom**	Batch ID: **R85352**					Analysis Date: **7/17/2023**			SeqNo: **1780889**	
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	4.80	0.500	2.000	2.400	120	21.5	190				

Fremont Analytical
An Alliance Technical Group Company

Sample Log-In Check List

Client Name:	TETRAS	Work Order Number:	2307159
Logged by:	Morgan Wilson	Date Received:	7/13/2023 2:09:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
		Unknown prior to receipt.		
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	21.4

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Chain of Custody Record & Laboratory Services Agreement

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Date: 7/13/23 Page: 1 of: 1

Laboratory Project No (internal): 2307159

Project Name: Waughop Lake Alum

Project No: 100-RCE-T39045

Collected by: Zach Skelton (TT)

Location: Waughop Lake, Lakewood, WA

Report To (PM): Shannon Brattebo, Tetra Tech

Special Remarks:
Bill to City of Lakewood
Attn: Weston Ott
wott@cityoflakewood.us
253-983-7725
6000 Main St. SW
Lakewood, WA 98499-5027

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Client: Tetra Tech, Inc.

Address: 2003 Western Ave. Suite 700

City, State, Zip: Seattle, WA 98121

Telephone: 206-728-9655

Email(s): shannon.brattebo@tetratech.com

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	SULFIDES			Comments
1	Mid-Lake 1 m	7/13/23	1100	W	1												X			
2	Mid-Lake Bottom	7/13/23	1115	W	1												X			
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10				7/13/23																

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Tl Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x Adam Bryant	Adam Bryant	7/13/23 1410	x	7/13/23	1409
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Tetra Tech, Inc.
Shannon Brattebo
2003 Western Ave Suite 700
Seattle, WA 98121

RE: Waughop Lake Alum
Work Order Number: 2308209

August 22, 2023

Attention Shannon Brattebo:

Fremont Analytical, Inc. received 2 sample(s) on 8/15/2023 for the analyses presented in the following report.

Sulfide by SM 4500-S2-F

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

Date: *08/22/2023*

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum
Work Order: 2308209

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2308209-001	Mid-Lake 1 m	08/15/2023 9:45 AM	08/15/2023 1:35 PM
2308209-002	Mid-Lake Bottom	08/15/2023 10:00 AM	08/15/2023 1:35 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2308209**
Date: **8/22/2023**

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Associated LCS is outside of control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Method Detection Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2308209**
Date Reported: **8/22/2023**

Client: Tetra Tech, Inc. **Collection Date:** 8/15/2023 9:45:00 AM
Project: Waughop Lake Alum
Lab ID: 2308209-001 **Matrix:** Water
Client Sample ID: Mid-Lake 1 m

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sulfide by SM 4500-S2-F				Batch ID: R86063			Analyst: SS
Sulfide	0.600	0.500	0.128		mg/L	1	08/22/23 14:17:17

Client: Tetra Tech, Inc. **Collection Date:** 8/15/2023 10:00:00 AM
Project: Waughop Lake Alum
Lab ID: 2308209-002 **Matrix:** Water
Client Sample ID: Mid-Lake Bottom

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Sulfide by SM 4500-S2-F				Batch ID: R86063			Analyst: SS
Sulfide	ND	0.500	0.128		mg/L	1	08/22/23 14:17:17

Work Order: 2308209
CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

QC SUMMARY REPORT

Sulfide by SM 4500-S2-F

Sample ID: **MB-R86063**	SampType: **MBLK**	Units: **mg/L**	Prep Date: **8/22/2023**	RunNo: **86063**
Client ID: **MBLKW**	Batch ID: **R86063**		Analysis Date: **8/22/2023**	SeqNo: **1795802**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.500									

Sample ID: **LCS-R86063**	SampType: **LCS**	Units: **mg/L**	Prep Date: **8/22/2023**	RunNo: **86063**
Client ID: **LCSW**	Batch ID: **R86063**		Analysis Date: **8/22/2023**	SeqNo: **1795803**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	1.40	0.500	2.000	0	70.0	45.6	120				

Sample ID: **LCSD-R86063**	SampType: **LCSD**	Units: **mg/L**	Prep Date: **8/22/2023**	RunNo: **86063**
Client ID: **LCSW02**	Batch ID: **R86063**		Analysis Date: **8/22/2023**	SeqNo: **1795804**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	1.40	0.500	2.000	0	70.0	45.6	120	1.400	0	20	

Sample ID: **2308209-001ADUP**	SampType: **DUP**	Units: **mg/L**	Prep Date: **8/22/2023**	RunNo: **86063**
Client ID: **Mid-Lake 1 m**	Batch ID: **R86063**		Analysis Date: **8/22/2023**	SeqNo: **1795806**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.500						0.6000	200	30	R

NOTES:
R - High RPD observed.

Sample ID: **2308209-002AMS**	SampType: **MS**	Units: **mg/L**	Prep Date: **8/22/2023**	RunNo: **86063**
Client ID: **Mid-Lake Bottom**	Batch ID: **R86063**		Analysis Date: **8/22/2023**	SeqNo: **1795808**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	5.60	0.500	2.000	0	280	21.5	190				S

NOTES:
S - Outlying spike recoveries were associated with this sample.

Fremont Analytical
An Alliance Technical Group Company

Sample Log-In Check List

Client Name:	TETRAS	Work Order Number:	2308209
Logged by:	Clare Griggs	Date Received:	8/15/2023 1:35:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	19.4

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Chain of Custody Record & Laboratory Services Agreement

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Date: | Page: 1 of: 1 | Laboratory Project No (internal): 23082Q9

Client: Tetra Tech, Inc.
Address: 2003 Western Ave. Suite 700
City, State, Zip: Seattle, WA 98121
Telephone: 206-728-9655
Email(s): shannon.brattebo@tetratech.com

Project Name: Waughop Lake Alum
Project No: 100-RCE-T39045
Collected by:
Location: Waughop Lake, Lakewood, WA
Report To (PM): Shannon Brattebo, Tetra Tech

Special Remarks:
Bill to City of Lakewood
Attn: Weston Ott
wott@cityoflakewood.us
253-983-7725
6000 Main St. SW
Lakewood, WA 98499-5027

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	SULFIDES			Comments
1	Mid-Lake 1 m	8/15/23	0945	W	1													X			
2	Mid-Lake Bottom	8/15/23	1000	W	1													X			
3																					
4																					
5																					
6																					
7																					
8																					
9		BA																			
10		8/15/23																			

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x Adam Bryant	Adam Bryant	08/15/23 1335	x ET	Emma Twelt	8/15/23 13:35
Relinquished (Signature) x	Print Name	Date/Time	Received (Signature) x	Print Name	Date/Time

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Tetra Tech, Inc.
Shannon Brattebo
2003 Western Ave Suite 700
Seattle, WA 98121

RE: Waughop Lake Alum
Work Order Number: 2309168

September 21, 2023

Attention Shannon Brattebo:

Fremont Analytical, Inc. received 2 sample(s) on 9/14/2023 for the analyses presented in the following report.

Toal Sulfide by SM 4500-S2-D

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

Date: *09/21/2023*

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum
Work Order: 2309168

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2309168-001	Mid-Lake 1 m	09/14/2023 10:27 AM	09/14/2023 3:52 PM
2309168-002	Mid-Lake Bottom	09/14/2023 10:37 AM	09/14/2023 3:52 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2309168**
Date: **9/21/2023**

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Associated LCS is outside of control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Method Detection Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2309168**
Date Reported: **9/21/2023**

Client: Tetra Tech, Inc. **Collection Date:** 9/14/2023 10:27:00 AM
Project: Waughop Lake Alum
Lab ID: 2309168-001 **Matrix:** Water
Client Sample ID: **Mid-Lake 1 m**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Toal Sulfide by SM 4500-S2-D				Batch ID: R86639		Analyst: FG	
Sulfide	ND	0.0500	0.0138		mg/L	1	09/21/23 9:39:01

Client: Tetra Tech, Inc. **Collection Date:** 9/14/2023 10:37:00 AM
Project: Waughop Lake Alum
Lab ID: 2309168-002 **Matrix:** Water
Client Sample ID: **Mid-Lake Bottom**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Toal Sulfide by SM 4500-S2-D				Batch ID: R86639		Analyst: FG	
Sulfide	0.0139	0.0500	0.0138	J	mg/L	1	09/21/23 9:39:01

Work Order: 2309168
CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

QC SUMMARY REPORT

Toal Sulfide by SM 4500-S2-D

Sample ID: **LCS-R86639**	SampType: **LCS**			Units: **mg/L**		Prep Date: **9/21/2023**		RunNo: **86639**		
Client ID: **LCSW**	Batch ID: **R86639**					Analysis Date: **9/21/2023**		SeqNo: **1807644**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.0997	0.0500	0.1000	0	99.7	80	120				

Sample ID: **MB-R86639**	SampType: **MBLK**			Units: **mg/L**		Prep Date: **9/21/2023**		RunNo: **86639**		
Client ID: **MBLKW**	Batch ID: **R86639**					Analysis Date: **9/21/2023**		SeqNo: **1807645**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500									

Sample ID: **2309168-001ADUP**	SampType: **DUP**			Units: **mg/L**		Prep Date: **9/21/2023**		RunNo: **86639**		
Client ID: **Mid-Lake 1 m**	Batch ID: **R86639**					Analysis Date: **9/21/2023**		SeqNo: **1807704**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500						0	0	20	

Sample ID: **2309168-001AMS**	SampType: **MS**			Units: **mg/L**		Prep Date: **9/21/2023**		RunNo: **86639**		
Client ID: **Mid-Lake 1 m**	Batch ID: **R86639**					Analysis Date: **9/21/2023**		SeqNo: **1807705**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.103	0.0500	0.1000	0	103	80	120				

Sample ID: **2309168-001AMSD**	SampType: **MSD**			Units: **mg/L**		Prep Date: **9/21/2023**		RunNo: **86639**		
Client ID: **Mid-Lake 1 m**	Batch ID: **R86639**					Analysis Date: **9/21/2023**		SeqNo: **1807706**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.114	0.0500	0.1000	0	114	80	120	0.1030	10.1	20	

Sample Log-In Check List

Client Name:	**TETRAS**	Work Order Number:	**2309168**
Logged by:	**Lyann Rivera**	Date Received:	**9/14/2023 3:52:00 PM**

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
		Unknown prior to receipt		
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16.	Was client notified of all discrepancies with this order?	Yes ☐	No ☐	NA ☑

Person Notified: _____ Date: _____

By Whom: _____ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: _____

Client Instructions: _____

17. Additional remarks:

Item Information

Item #	Temp °C
Sample	14.7

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: | Page: 1 of: 1 | Laboratory Project No (internal): 2309168

Client: Tetra Tech, Inc.
Address: 2003 Western Ave. Suite 700
City, State, Zip: Seattle, WA 98121
Telephone: 206-728-9655
Email(s): shannon.brattebo@tetratech.com

Project Name: Waughop Lake Alum
Project No: 100-RCE-T39045
Collected by: Adam Bryant
Location: Waughop Lake, Lakewood, WA
Report To (PM): Shannon Brattebo, Tetra Tech

Special Remarks:
Bill to City of Lakewood
Attn: Weston Ott
wott@cityoflakewood.us
253-983-7725
6000 Main St. SW
Lakewood, WA 98499-5027

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	SULFIDES				Comments
1	Mid-Lake 1 m	09/14/23	10:27	W	1												X				
2	Mid-Lake Bottom	09/14/23	10:37	W	1												X				
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ☐ _____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x Adam Bryant	Adam Bryant	1550	x	Britton Stone	9/14/23 15:52
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Tetra Tech, Inc.
Shannon Brattebo
2003 Western Ave Suite 700
Seattle, WA 98121

RE: Waughop Lake Alum
Work Order Number: 2310163

October 18, 2023

Attention Shannon Brattebo:

Fremont Analytical, Inc. received 1 sample(s) on 10/11/2023 for the analyses presented in the following report.

Total Sulfide by SM 4500-S2-D

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

Date: *10/18/2023*

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum
Work Order: 2310163

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2310163-001	Mid-Lake 1 m	10/11/2023 12:00 AM	10/11/2023 1:39 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2310163**
Date: **10/18/2023**

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Associated LCS is outside of control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Method Detection Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2310163**
Date Reported: **10/18/2023**

Client: Tetra Tech, Inc.
Collection Date: 10/11/2023
Project: Waughop Lake Alum
Lab ID: 2310163-001
Matrix: Water
Client Sample ID: **Mid-Lake 1 m**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R87181			Analyst: FG
Sulfide	ND	0.0500	0.0138		mg/L	1	10/17/23 11:00:00

Work Order: 2310163
CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

QC SUMMARY REPORT

Total Sulfide by SM 4500-S2-D

Sample ID: **MB-R87181**	SampType: **MBLK**	Units: **mg/L**	Prep Date: **10/17/2023**	RunNo: **87181**
Client ID: **MBLKW**	Batch ID: **R87181**		Analysis Date: **10/17/2023**	SeqNo: **1819888**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500									

Sample ID: **LCS-R87181**	SampType: **LCS**	Units: **mg/L**	Prep Date: **10/17/2023**	RunNo: **87181**
Client ID: **LCSW**	Batch ID: **R87181**		Analysis Date: **10/17/2023**	SeqNo: **1819889**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.188	0.0500	0.2000	0	93.9	80	120				

Sample ID: **2310163-001ADUP**	SampType: **DUP**	Units: **mg/L**	Prep Date: **10/17/2023**	RunNo: **87181**
Client ID: **Mid-Lake 1 m**	Batch ID: **R87181**		Analysis Date: **10/17/2023**	SeqNo: **1819891**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500						0	0	20	

Sample ID: **2310163-001AMS**	SampType: **MS**	Units: **mg/L**	Prep Date: **10/17/2023**	RunNo: **87181**
Client ID: **Mid-Lake 1 m**	Batch ID: **R87181**		Analysis Date: **10/17/2023**	SeqNo: **1819892**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.192	0.0500	0.2000	0	96.2	80	120				

Sample ID: **2310163-001AMSD**	SampType: **MSD**	Units: **mg/L**	Prep Date: **10/17/2023**	RunNo: **87181**
Client ID: **Mid-Lake 1 m**	Batch ID: **R87181**		Analysis Date: **10/17/2023**	SeqNo: **1819893**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.198	0.0500	0.2000	0	99.1	80	120	0.1924	2.97	20	

Fremont Analytical
An Alliance Technical Group Company

Sample Log-In Check List

Client Name:	TETRAS	Work Order Number:	2310163
Logged by:	Morgan Wilson	Date Received:	10/11/2023 1:39:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
		Unknown prior to receipt.		
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all hold times (except field parameters, pH e.g.) able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	14.5

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: | Page: 1 of: 1 | Laboratory Project No (internal): 2310163

Project Name: Waughop Lake Alum

Special Remarks:
Bill to City of Lakewood
Attn: Weston Ott
wott@cityoflakewood.us
253-983-7725
6000 Main St. SW
Lakewood, WA 98499-5027

Client: Tetra Tech, Inc.

Project No: 100-RCE-T39045

Address: 2003 Western Ave. Suite 700

Collected by:

City, State, Zip: Seattle, WA 98121

Location: Waughop Lake, Lakewood, WA

Telephone: 206-728-9655

Report To (PM): Shannon Brattebo, Tetra Tech

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Email(s): shannon.brattebo@tetratech.com

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	SULFIDES	Comments
1	Mid-Lake 1 m			W													X	
2	~~Mid-Lake Bottom~~ BA	10/11/23		W													X	
3																		
4																		
5																		
6																		
7																		
8																		
9	BA 10/11/23																	
10																		

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ☐ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x Adam Bryant	Adam Bryant	10/11/2023 1339	x	Winthrop Koffler	10/11/23 1339
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Tetra Tech, Inc.
Shannon Brattebo
2003 Western Ave Suite 700
Seattle, WA 98121

RE: Waughop Lake Alum
Work Order Number: 2312294

December 19, 2023

Attention Shannon Brattebo:

Fremont Analytical, Inc. received 2 sample(s) on 12/12/2023 for the analyses presented in the following report.

Total Sulfide by SM 4500-S2-D

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

Date: *12/19/2023*

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum
Work Order: 2312294

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2312294-001	Mid-Lake 1 m	12/12/2023 10:18 AM	12/12/2023 1:56 PM
2312294-002	Mid-Lake Bottom	12/12/2023 10:25 AM	12/12/2023 1:56 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2312294**
Date: **12/19/2023**

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Associated LCS is outside of control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Method Detection Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2312294**
Date Reported: **12/19/2023**

Client: Tetra Tech, Inc. **Collection Date:** 12/12/2023 10:18:00 AM
Project: Waughop Lake Alum
Lab ID: 2312294-001 **Matrix:** Water
Client Sample ID: **Mid-Lake 1 m**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R88428			Analyst: AM
Sulfide	0.0336	0.0500	0.0138	J	mg/L	1	12/19/23 10:01:31

Client: Tetra Tech, Inc. **Collection Date:** 12/12/2023 10:25:00 AM
Project: Waughop Lake Alum
Lab ID: 2312294-002 **Matrix:** Water
Client Sample ID: **Mid-Lake Bottom**

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R88428			Analyst: AM
Sulfide	0.0383	0.0500	0.0138	J	mg/L	1	12/19/23 10:01:31

Work Order: 2312294
CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

QC SUMMARY REPORT

Total Sulfide by SM 4500-S2-D

Sample ID: **CCB-R88428**	SampType: **CCB**			Units: **mg/L**		Prep Date: **12/19/2023**		RunNo: **88428**			
Client ID: **CCB**	Batch ID: **R88428**					Analysis Date: **12/19/2023**		SeqNo: **1846585**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500									

Sample ID: **LCS-R88428**	SampType: **LCS**			Units: **mg/L**		Prep Date: **12/19/2023**		RunNo: **88428**			
Client ID: **LCSW**	Batch ID: **R88428**					Analysis Date: **12/19/2023**		SeqNo: **1846586**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.163	0.0500	0.2000	0	81.7	80	120				

Sample ID: **2312338-001FDUP**	SampType: **DUP**			Units: **mg/L**		Prep Date: **12/19/2023**		RunNo: **88428**			
Client ID: **BATCH**	Batch ID: **R88428**					Analysis Date: **12/19/2023**		SeqNo: **1847024**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.0359	0.0500						0.02900	21.4	20	J

Sample ID: **2312338-001FMS**	SampType: **MS**			Units: **mg/L**		Prep Date: **12/19/2023**		RunNo: **88428**			
Client ID: **BATCH**	Batch ID: **R88428**					Analysis Date: **12/19/2023**		SeqNo: **1847025**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.210	0.0500	0.2000	0.02900	90.4	80	120				

Sample ID: **2312338-001FMSD**	SampType: **MSD**			Units: **mg/L**		Prep Date: **12/19/2023**		RunNo: **88428**			
Client ID: **BATCH**	Batch ID: **R88428**					Analysis Date: **12/19/2023**		SeqNo: **1847026**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.205	0.0500	0.2000	0.02900	88.1	80	120	0.2098	2.23	20	

Fremont Analytical
An Alliance Technical Group Company

Sample Log-In Check List

Client Name:	TETRAS	Work Order Number:	2312294
Logged by:	Lyann Rivera	Date Received:	12/12/2023 1:56:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
		Unknown Prior to Receipt		
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all hold times (except field parameters, pH e.g.) able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	10.5

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: | Page: 1 of: 1 | Laboratory Project No (internal): 2312294

Client: Tetra Tech, Inc.
Address: 2003 Western Ave. Suite 700
City, State, Zip: Seattle, WA 98121
Telephone: 206-728-9655
Email(s): shannon.brattebo@tetratech.com

Project Name: Waughop Lake Alum
Project No: 100-RCE-T39045
Collected by:
Location: Waughop Lake, Lakewood, WA
Report To (PM): Shannon Brattebo, Tetra Tech

Special Remarks:
Bill to City of Lakewood
Attn: Weston Ott
wott@cityoflakewood.us
253-983-7725
6000 Main St. SW
Lakewood, WA 98499-5027

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	SULFIDES	Comments
1	Mid-Lake 1 m	12/12/23	1018	W	1												X	
2	Mid-Lake Bottom	12/12/23	1025	W	1												X	
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10	3A	12/12/23																

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day _____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	Adam Bryant	12/12/23 1355	x [signature]		12/12/23 1356
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Tetra Tech, Inc.
Shannon Brattebo
2003 Western Ave Suite 700
Seattle, WA 98121

RE: Waughop Lake Alum
Work Order Number: 2403233

March 18, 2024

Attention Shannon Brattebo:

Fremont Analytical, Inc. received 2 sample(s) on 3/13/2024 for the analyses presented in the following report.

Total Sulfide by SM 4500-S2-D

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

Date: *03/18/2024*

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum
Work Order: 2403233

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2403233-001	Mid-Lake 1 m	03/13/2024 10:00 AM	03/13/2024 1:43 PM
2403233-002	Mid-Lake Bottom	03/13/2024 10:10 AM	03/13/2024 1:43 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2403233**
Date: **3/18/2024**

CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Associated LCS is outside of control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Method Detection Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2403233**
Date Reported: **3/18/2024**

Client: Tetra Tech, Inc. **Collection Date:** 3/13/2024 10:00:00 AM
Project: Waughop Lake Alum
Lab ID: 2403233-001 **Matrix:** Water
Client Sample ID: Mid-Lake 1 m

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R90250			Analyst: SLL
Sulfide	0.0232	0.0500	0.0138	J	mg/L	1	03/15/24 11:41:09

Client: Tetra Tech, Inc. **Collection Date:** 3/13/2024 10:10:00 AM
Project: Waughop Lake Alum
Lab ID: 2403233-002 **Matrix:** Water
Client Sample ID: Mid-Lake Bottom

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R90250			Analyst: SLL
Sulfide	0.107	0.0500	0.0138		mg/L	1	03/15/24 11:41:09

Work Order: 2403233
CLIENT: Tetra Tech, Inc.
Project: Waughop Lake Alum

QC SUMMARY REPORT

Total Sulfide by SM 4500-S2-D

Sample ID: **MB-R90250**	SampType: **MBLK**			Units: **mg/L**		Prep Date: **3/15/2024**		RunNo: **90250**			
Client ID: **MBLKW**	Batch ID: **R90250**					Analysis Date: **3/15/2024**		SeqNo: **1882557**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500									

Sample ID: **LCS-R90250**	SampType: **LCS**			Units: **mg/L**		Prep Date: **3/15/2024**		RunNo: **90250**			
Client ID: **LCSW**	Batch ID: **R90250**					Analysis Date: **3/15/2024**		SeqNo: **1882558**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.181	0.0500	0.2000	0	90.4	80	120				

Sample ID: **2403151-004HDUP**	SampType: **DUP**			Units: **mg/L**		Prep Date: **3/15/2024**		RunNo: **90250**			
Client ID: **BATCH**	Batch ID: **R90250**					Analysis Date: **3/15/2024**		SeqNo: **1882560**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.0151	0.0500						0	200	20	J

Sample ID: **2403151-004HMS**	SampType: **MS**			Units: **mg/L**		Prep Date: **3/15/2024**		RunNo: **90250**			
Client ID: **BATCH**	Batch ID: **R90250**					Analysis Date: **3/15/2024**		SeqNo: **1882561**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.206	0.0500	0.2000	0	103	80	120				

Sample ID: **2403151-004HMSD**	SampType: **MSD**			Units: **mg/L**		Prep Date: **3/15/2024**		RunNo: **90250**			
Client ID: **BATCH**	Batch ID: **R90250**					Analysis Date: **3/15/2024**		SeqNo: **1882562**			
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.213	0.0500	0.2000	0	107	80	120	0.2063	3.31	20	

Fremont Analytical
An Alliance Technical Group Company

Sample Log-In Check List

Client Name:	TETRAS	Work Order Number:	2403233
Logged by:	Morgan Wilson	Date Received:	3/13/2024 1:43:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
		Unknown prior to receipt.		
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all hold times (except field parameters, pH e.g.) able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	11.9

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Chain of Custody Record & Laboratory Services Agreement

Fremont Analytical
An Alliance Technical Group Company

3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Date: 3/13/24 | Page: 1 of: 1 | Laboratory Project No (internal): 2403233

Project Name: Waughop Lake Alum

Project No: 100-RCE-T39045

Collected by:

Location: Waughop Lake, Lakewood, WA

Report To (PM): Shannon Brattebo, Tetra Tech

Special Remarks:
Bill to City of Lakewood
Attn: Weston Ott
wott@cityoflakewood.us
253-983-7725
6000 Main St. SW
Lakewood, WA 98499-5027

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Client: Tetra Tech, Inc.

Address: 2003 Western Ave. Suite 700

City, State, Zip: Seattle, WA 98121

Telephone: 206-728-9655

Email(s): shannon.brattebo@tetratech.com

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	SULFIDES	Comments
1	Mid-Lake 1 m	3/13/24	1000	W	1													X	
2	Mid-Lake Bottom	3/13/24	1010	W	1													X	
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10		3/13/24																	

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
~~Standard~~ ~~Next Day~~
☐ 3 Day ☐ Same Day
☐ 2 Day 2 weeks (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x Adam Bryant	Adam Bryant	1342	x	Briana Ballard	3/13 1:43PM
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

3600 Fremont Ave N
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Tetra Tech, Inc.
Shannon Brattebo
2003 Western Ave Suite 700
Seattle, WA 98121

RE: Waughlop Lake Alum, 100-RCE-T39045
Work Order Number: 2406500

July 02, 2024

Attention Shannon Brattebo:

Fremont Analytical, Inc, an Alliance Technical Group company, received 2 sample(s) on 6/27/2024 for the analyses presented in the following report.

Total Sulfide by SM 4500-S2-D

All analyses were performed according to our accredited Quality Assurance program. Please contact the laboratory if you should have any questions about the results.

Please note, while the appearance of our logo and branding will update, our commitment to accuracy, speed, and customer service remain values celebrated and shared by Alliance Technical Group. Thank you for the opportunity to serve you.

Sincerely,

Brianna Barnes
Project Manager

DoD-ELAP Accreditation #79636 by PJLA, ISO/IEC 17025:2017 and QSM 5.4 for Environmental Testing
ORELAP Certification: WA 100009 (NELAP Recognized) for Environmental Testing
Washington State Department of Ecology Accredited for Environmental Testing, Lab ID C910

Original

Date: *07/02/2024*

CLIENT: Tetra Tech, Inc.
Project: Waughlop Lake Alum
Work Order: 2406500

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2406500-001	Mid-Lake 1 m	06/27/2024 10:45 AM	06/27/2024 2:25 PM
2406500-002	Mid-Lake Bottom	06/27/2024 11:00 AM	06/27/2024 2:25 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2406500**

Date: **7/2/2024**

CLIENT: Tetra Tech, Inc.

Project: Waughlop Lake Alum

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Associated LCS is outside of control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Method Detection Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2406500**
Date Reported: **7/2/2024**

Client: Tetra Tech, Inc. **Collection Date:** 6/27/2024 10:45:00 AM
Project: Waughlop Lake Alum
Lab ID: 2406500-001 **Matrix:** Water
Client Sample ID: Mid-Lake 1 m

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R92755		Analyst: JH	
Sulfide	0.0508	0.0500	0.0138		mg/L	1	07/01/24 10:10:59

Client: Tetra Tech, Inc. **Collection Date:** 6/27/2024 11:00:00 AM
Project: Waughlop Lake Alum
Lab ID: 2406500-002 **Matrix:** Water
Client Sample ID: Mid-Lake Bottom

Analyses	Result	RL	MDL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R92755		Analyst: JH	
Sulfide	0.117	0.0500	0.0138		mg/L	1	07/01/24 10:10:59

Work Order: 2406500
CLIENT: Tetra Tech, Inc.
Project: Waughlop Lake Alum

QC SUMMARY REPORT

Total Sulfide by SM 4500-S2-D

Sample ID: **MB-R92755**	SampType: **MBLK**	Units: **mg/L**	Prep Date: **7/1/2024**	RunNo: **92755**
Client ID: **MBLKW**	Batch ID: **R92755**		Analysis Date: **7/1/2024**	SeqNo: **1935777**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500									

Sample ID: **LCS-R92755**	SampType: **LCS**	Units: **mg/L**	Prep Date: **7/1/2024**	RunNo: **92755**
Client ID: **LCSW**	Batch ID: **R92755**		Analysis Date: **7/1/2024**	SeqNo: **1935778**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.185	0.0500	0.2000	0	92.4	80	120				

Sample ID: **2406500-001AMS**	SampType: **MS**	Units: **mg/L**	Prep Date: **7/1/2024**	RunNo: **92755**
Client ID: **Mid-Lake 1 m**	Batch ID: **R92755**		Analysis Date: **7/1/2024**	SeqNo: **1935780**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.256	0.0500	0.2000	0.05076	102	80	120				

Sample ID: **2406500-001AMSD**	SampType: **MSD**	Units: **mg/L**	Prep Date: **7/1/2024**	RunNo: **92755**
Client ID: **Mid-Lake 1 m**	Batch ID: **R92755**		Analysis Date: **7/1/2024**	SeqNo: **1935781**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.282	0.0500	0.2000	0.05076	116	80	120	0.2557	9.71	20	

Sample ID: **2406500-001ADUP**	SampType: **DUP**	Units: **mg/L**	Prep Date: **7/1/2024**	RunNo: **92755**
Client ID: **Mid-Lake 1 m**	Batch ID: **R92755**		Analysis Date: **7/1/2024**	SeqNo: **1935782**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.0595	0.0500						0.05076	15.8	20	

Alliance TECHNICAL GROUP

Sample Log-In Check List

Client Name:	TETRAS	Work Order Number:	2406500
Logged by:	Morgan Wilson	Date Received:	6/27/2024 2:25:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☐	No ☑	NA ☐
		Unknown prior to receipt.		
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all hold times (except field parameters, pH e.g.) able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	17.4

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: | Page: 1 of: 1 | Laboratory Project No (internal): 2406500

Client: Tetra Tech, Inc.
Address: 2003 Western Ave. Suite 700
City, State, Zip: Seattle, WA 98121
Telephone: 206-728-9655
Email(s): shannon.brattebo@tetratech.com

Project Name: Waughop Lake Alum
Project No: 100-RCE-T39045
Collected by:
Location: Waughop Lake, Lakewood, WA
Report To (PM): Shannon Brattebo, Tetra Tech

Special Remarks:
Bill to City of Lakewood
Attn: Weston Ott
wott@cityoflakewood.us
253-983-7725
6000 Main St. SW
Lakewood, WA 98499-5027

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	SULFIDES			Comments
1	Mid-Lake 1 m	06/27/24	10:45	W	1												X			
2	Mid-Lake Bottom	06/27/24	11:00	W	1												X			
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ☐ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x Adam Bryant	Adam Bryant	06/27/24 1425	x	Nathan Volker	6/27/24 1425
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

APPENDIX D: PCD ANNUAL DATA REPORTS & 2024 LABORATORY DATA REPORTS

City of Lakewood
Volunteer Lake Monitoring Program
2021 Season Report

Introduction

The City of Lakewood initiated a volunteer lake monitoring program in 2000 with the goals of promoting lake stewardship through citizen participation in the monitoring program, and to provide water quality data to assist in tracking and better understanding of conditions of American, Gravelly, Louise, Carp, Steilacoom (added in 2004), and Waughop (added in 2011) lakes and make appropriate management decisions. Carp Lake and Steilacoom Lake no longer participate in the volunteer lake program.

While conditions may vary from year to year, long-term data collection is the key to tracking trends in water quality over time. This report summarizes the data collected during the 2021 lake monitoring season on American, Gravelly, Louise and Waughop lakes.

Lake Descriptions

The monitored lakes vary in size and depth – American Lake is the largest at 1,100 acres and 90 feet at maximum depth, Gravelly Lake is 160 acres and 55 feet maximum depth, Lake Louise is 39 acres and 35 feet at maximum depth, and Waughop Lake at 33 acres and 14 feet at maximum depth. These lakes are in the Chambers-Clover Watershed within the city limits of Lakewood.

Eleven volunteers participated in the 2021 monitoring program and contributed a total of 111 hours of volunteer time.

Sampling Program

Water chemistry and physical characteristics of lakes vary both seasonally and with depth. Lake volunteers record observations and collect physical data (secchi depth, lake stage, weather conditions); record temperature and dissolved oxygen profile measurements; and measure pH on a monthly basis beginning in May and ending in late October with an additional late fall/early winter session conducted on American and Gravelly Lakes. This year the final October session on Louise and the additional late fall/early winter session on Gravelly were not completed due to rough weather conditions.

Samples for pH measurement were collected from one meter (shallow sample) below the surface of the lakes at each monitoring session. Three times during the monitoring season (May, August, October) an additional sample for pH measurement was collected at one meter above the lake bottom (deep sample) from American, Gravelly, and Louise lakes; Waughop is a shallow, well-mixed lake and no additional deep sample was collected. Monitoring data for 2021 can be found in Table 1 at the end of the report.

In Spring 2021, American Lake volunteers received training and a loan of equipment from Washington Fish and Wildlife Department to conduct additional monitoring for invasive mussel presence in American Lake. They deployed an artificial substrate at American Lake Park boat launch. Each month they completed a plankton tow to collect a sample and photographed the substrate to submit to WDFW for determination of presence or absence of invasive mussels.

Additional monitoring was conducted on Waughop to track post alum treatment conditions. This added sampling included monthly sample collection for lab analysis for total phosphorus, soluble reactive phosphorus, total nitrogen, chlorophyll *a*, and phaeophytin *a.* Three times during the season (May, Aug, Oct) additional samples were collected for analysis for sulfate, alkalinity, and total aluminum. Observations of algal scum and aquatic plant coverage were also recorded at 6 locations around the lake. The results of this additional monitoring can be found in Table 2 at the end of the report.

Dissolved Oxygen and Water Temperature Profiles

Dissolved oxygen and temperature are important attributes of a lake ecosystem and both are critically important to determining the types of aquatic life found in lakes. The amount of oxygen dissolved in water is affected by the water temperature – all other factors being equal, cold water holds more oxygen than warm water. The amount of dissolved oxygen present in water will determine where in the lake plants and animals can live.

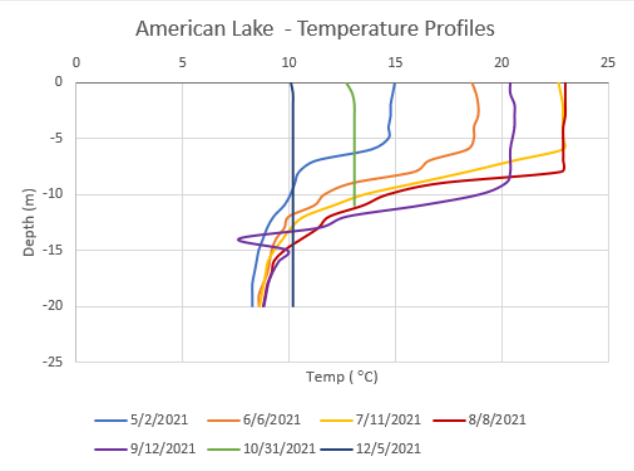
With the onset of warmer weather in spring and early summer, deep lakes will begin to separate into a warmer, low-density layer at the surface, known as the epilimnion, and a cooler, high-density layer at the bottom, known as the hypolimnion. Between the epilimnion and the hypolimnion is a layer of rapidly changing temperature called the thermocline. This process is called thermal stratification. Once this condition is fully developed in deeper lakes, usually in summer, there is no vertical mixing of the upper and lower layers because of their density differences. Shallower lakes may also separate into these layers although the layers may not remain separate throughout the entire summer. These shallower lakes will mix on windy or stormy days.

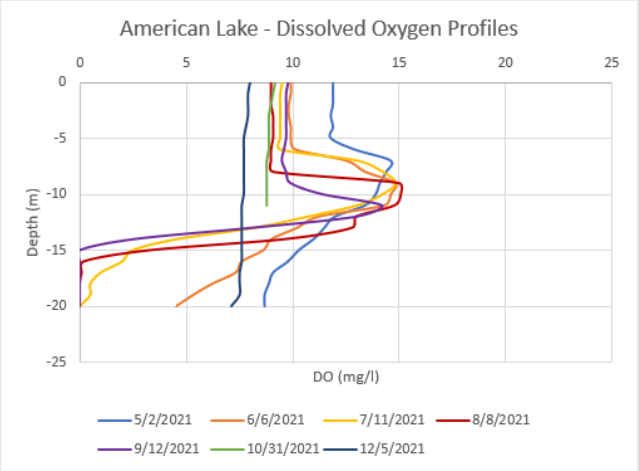
With the arrival of cooler weather in the fall, the thermal stratification begins to break down and the shallow and deep layers of water begin to mix vertically once again. This phenomenon is usually called turnover.

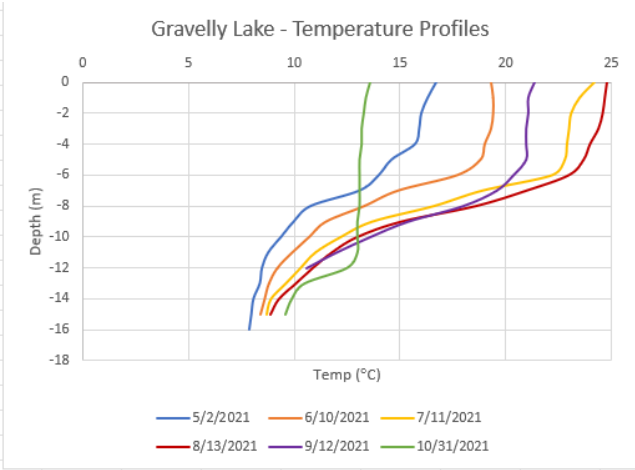
The 2021 temperature profiles for American and Gravelly Lakes indicate that stratification was well underway in May and remained strongly stratified until turnover in the fall. Lake Louise shows very little thermal stratification in May, June and July, and no stratification August and September. Waughop Lake did not show any stratification in 2021.

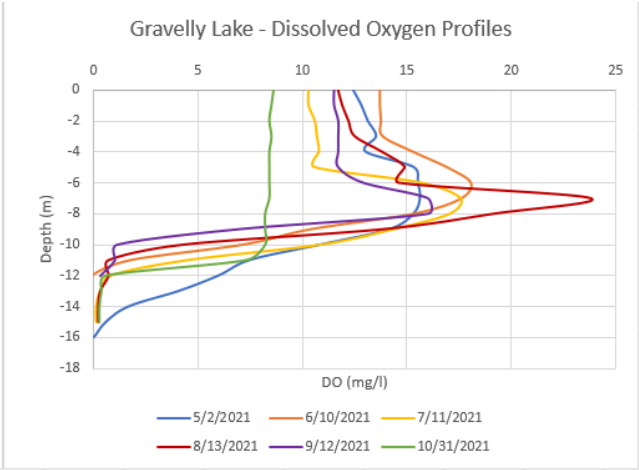
Like temperature profiles, dissolved oxygen levels vary with depth and over time. The upper layer of water (epilimnion) has abundant oxygen as a result of the diffusion of oxygen from the atmosphere and the presence of algae that produce oxygen as a byproduct of photosynthesis. Meanwhile, as spring and summer progresses oxygen levels decline in the lower layer (hypolimnion). This is the result of decomposition of organic matter that settles into that layer, no diffusion of oxygen from the atmosphere, and not enough sunlight to support oxygen-producing plant life. These low oxygen conditions will remain until the lake mixes again at the time of fall turnover. These conditions occur even though the general rule is cold water can hold more dissolved oxygen than warm water.

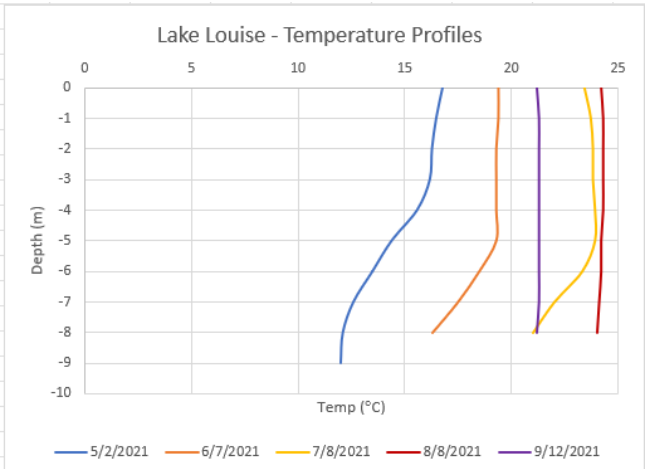
The 2021 dissolved oxygen profiles for American and Gravelly Lakes are similar to their temperature profiles showing stratification in May and remaining stratified until after the fall turn-over. Both lakes also showed a mid-depth increase in oxygen due to the presence of algae undergoing photosynthesis at that depth. Dissolved oxygen profiles for Louise displayed a decline in oxygen near the lake bottom May through September. The dissolved oxygen profiles for Waughop while like its temperature profiles, did show a decrease in oxygen levels every month except in August. Individual lake temperature and dissolved oxygen profiles are displayed below in Figure 1.

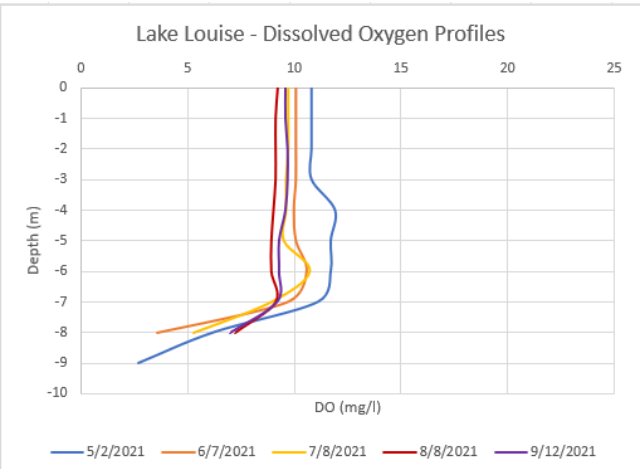

American Lake - Temperature Profiles
Depth (m)
Temp (°C)
5/2/2021
6/6/2021
7/11/2021
8/8/2021
9/12/2021
10/31/2021
12/5/2021


American Lake - Dissolved Oxygen Profiles
Depth (m)
DO (mg/l)
5/2/2021
6/6/2021
7/11/2021
8/8/2021
9/12/2021
10/31/2021
12/5/2021


Gravelly Lake - Temperature Profiles
Depth (m)
Temp (°C)
5/2/2021
6/10/2021
7/11/2021
8/13/2021
9/12/2021
10/31/2021


Gravelly Lake - Dissolved Oxygen Profiles
Depth (m)
DO (mg/l)
5/2/2021
6/10/2021
7/11/2021
8/13/2021
9/12/2021
10/31/2021


Lake Louise - Temperature Profiles
Depth (m)
Temp (°C)
5/2/2021
6/7/2021
7/8/2021
8/8/2021
9/12/2021


Lake Louise - Dissolved Oxygen Profiles
Depth (m)
DO (mg/l)
5/2/2021
6/7/2021
7/8/2021
8/8/2021
9/12/2021

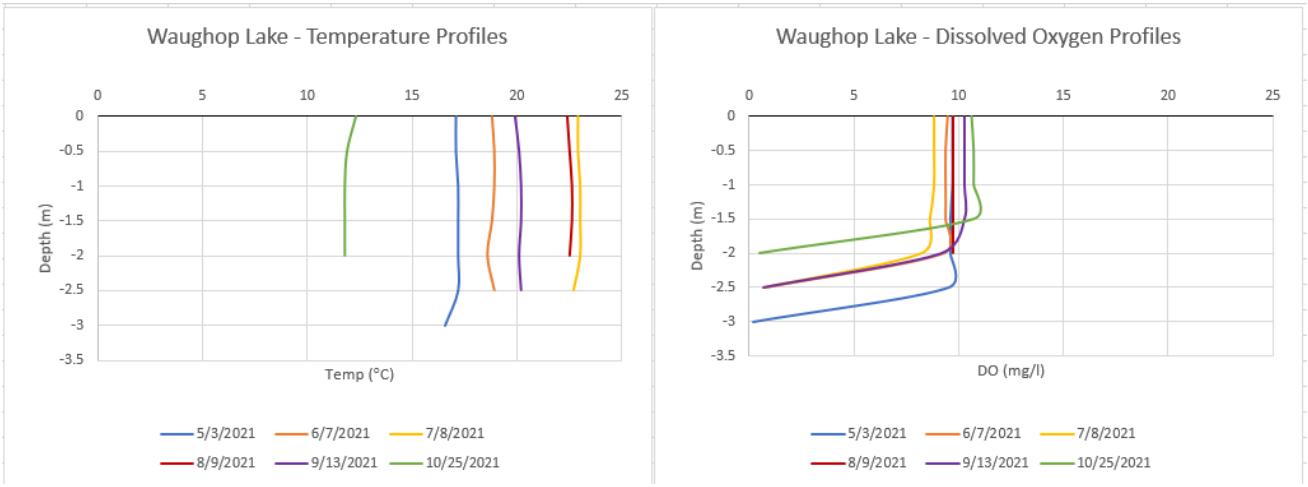


Figure 1.

Lake Stage

Lake stage, water surface level in the lake, varies seasonally and year to year. While precipitation and evaporation are the main causes of fluctuating lake levels, water levels are also affected by watershed area, land uses in the watershed, vegetation types and cover, presence of wetlands, geology, surface and subterranean hydrology, and type of outflow structure (if present). The source, amount, and composition of the water flowing into a lake also impact the water quality of that lake.

Lake monitors recorded lake stage from staff gauges (calibrated in feet) located on American, Gravelly, Louise, and Waughop each sampling session. The staff gauges on American, Gravelly, and Louise have been surveyed so that elevation above sea level is known. While there is a gauge on Waughop, its actual elevation with respect to sea level is unknown; therefore, the data presented for that lake reflects relative changes only.

The lakes showed a typical lake stage fluctuation pattern of declining through the summer to a seasonal low in fall. Precipitation data is collected for the Lakewood area at Joint Base Lewis-McChord, and total recorded precipitation for water year (Oct-Sept) 2021 was 30.06 inches. Annual precipitation since 2000 is displayed in Figure 2 below for comparison. Lake stage data was collected May through October for Waughop, American, and Gravelly lakes with an additional reading in December for American Lake. Lake stage data for Lake Louise were collected May through September for Louise. Recorded lake stage this year fluctuated 2.6 feet in American Lake, 3.48 feet in Gravelly Lake, 1.50 feet in Louise Lake, and 2.24 feet in Waughop. The individual lake level graphs can be found in Appendix 1 at the end of the report.

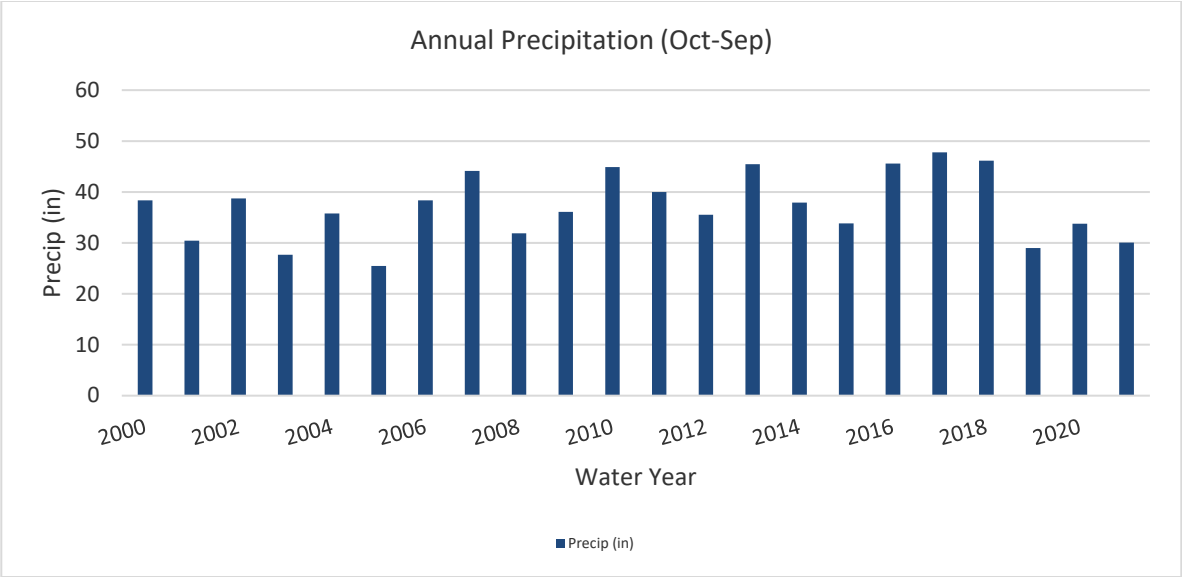


Figure 2.

Water Transparency

Water transparency is measured with an eight-inch diameter, black and white secchi disk and is traditionally reported as secchi depth, in meters (1 meter = 3.3 feet). Transparency is influenced by several factors such as dissolved substances, algae, and sediment particles. Transparency readings can also be affected by waves, wind, and glare at the water surface. Deeper secchi depth readings indicate clearer water (more transparent) while shallower secchi depth readings indicate more turbid water. Clear water allows more light to penetrate deeper into the lake, allowing photosynthesis in aquatic plants and algae to occur; this leads to higher levels of dissolved oxygen during the day. A decrease in transparency is often seen with an increase in algal density, or an influx of sediment and detritus due to a major storm event in the watershed. Secchi depth is used primarily as an approximate indicator of algal abundance.

Secchi depth measurements in 2021 for American Lake ranged from 6.25 meters to 8.9 meters with greater transparency occurring mid-summer. The summer averages for secchi depths in American Lake over all the years of data collection are shown below in Figure 3.

Note: The 2020 secchi depth average was calculated with only 4 monthly readings for American, Louise, and Waughop lakes while in previous years 7-8 monthly readings were used to calculate the averages. Lake monitoring was not conducted in Gravelly Lake in 2020 due to COVID restrictions.

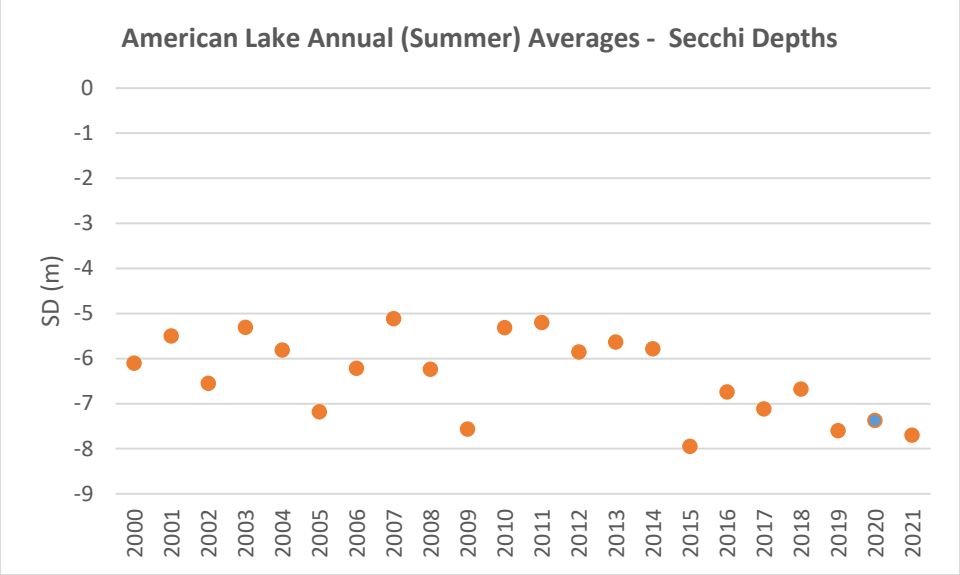


Figure 3.

Secchi depth measurements in Gravelly Lake varied from 3.0 meters to 8.0 meters with greater transparency occurring in the fall. Summer averages for secchi depths in Gravelly Lake are displayed below in Figure 4.

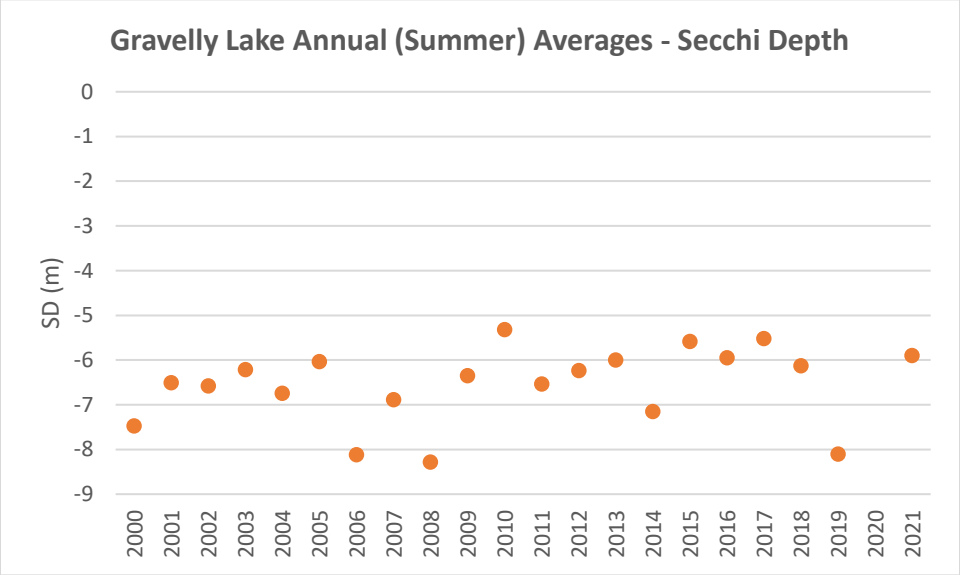


Figure 4.

Secchi depth measurements in Lake Louise ranged from 4.5 meters to 9.5 meters with greater transparency occurring earlier in the season. Summer averages for secchi depths in Lake Louise are displayed below in Figure 5.

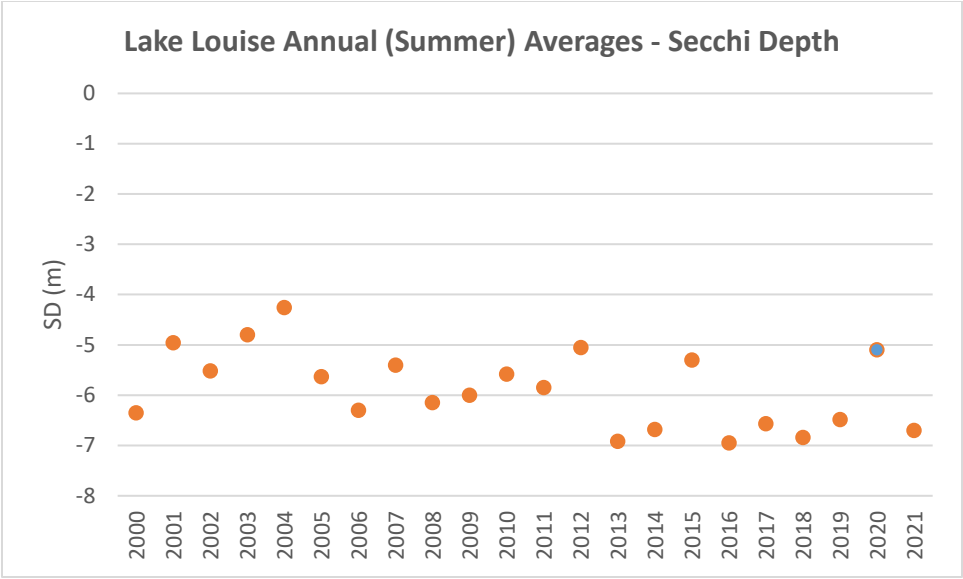


Figure 5.

Waughop Lake, the shallowest lake, had secchi depths that varied from 0.9 meters to 1.5 meters. Transparency was greatest in June, and lowest in October. Summer averages for secchi depth in Waughop Lake are found below in Figure. 6.

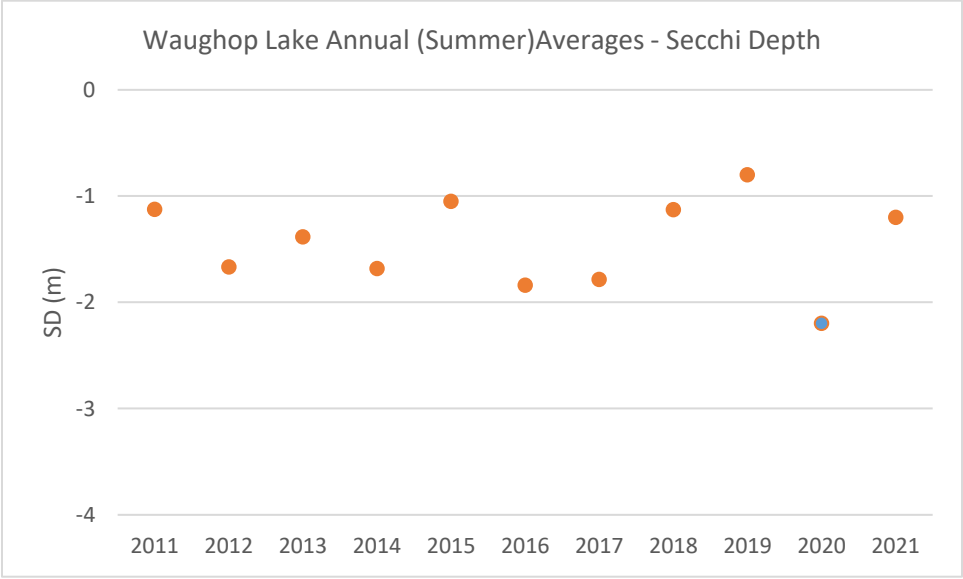


Figure 5.

Graphs of secchi depths for all years in the lakes are displayed in Appendix 1 at the end of the report.

pH

pH is a measure of the hydrogen ion concentrations in water and indicates whether water is acidic, basic, or neutral. The pH scale goes from 0 to 14 with 7 being neutral. pH above 7 is considered basic and pH below 7 is considered neutral. The pH scale is logarithmic, meaning that a change of one whole number on the scale is a tenfold change in acidity. pH determines the solubility and biological availability of chemical constituents such as nutrients and heavy metals in the water.

Volunteers measured pH levels at one-meter below the surface each month and at depth (one-meter above the bottom) in May, August, and October. An additional pH measurement (shallow and deep) was collected in American and Gravelly Lakes after the fall turnover. Results of the shallow pH measurement for the lakes varied from near neutral to basic (in Gravelly lake) (pH range = 6.6 to 9.0), see Figure 6 below. The pH levels for Waughop were not as high (basic) as seen in previous years. The deeper pH results ranged from near neutral to more acidic (pH range = 7.5 to 6.2). At the time of the fall turnover in American Lake there was no difference between shallow and deep pH results. pH results for the lakes are in Table 1.

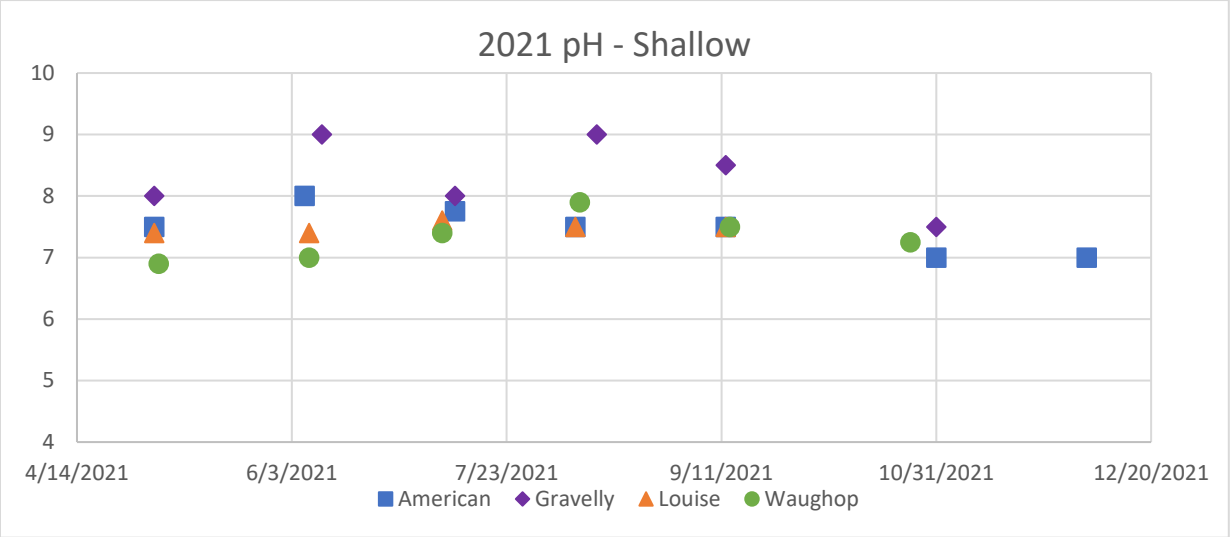


Figure 6.

Graphs of pH results for all the years of collection can be found in Appendix 1.

Algae

For the last several years the Tacoma Pierce County Health Department has not routinely monitored algae in Lakewood. However, they do encourage lake homeowners to report suspected toxic algae blooms to Washington State Department of Ecology. While there were no reported algal toxin levels exceeding state guidelines for these lakes in 2021, cyanobacteria bloom presence was noted in American and Waughop Lakes in fall.

Summary

Lake monitor volunteers collected data monthly May through October for Waughop, American, and Gravelly lakes; with one final monitoring session in December for American Lake. Data was collected monthly for Lake Louise May through September. The data are summarized as follows:

- Temperature and dissolved oxygen stratification were already established in American and Gravelly lakes in May at the time of the first monitoring session. Lake Louise showed very little

thermal stratification in May, June, and July and none in August and September. Waughop did not thermally stratify; however, the dissolved oxygen profiles showed low oxygen levels at depth during all months except August.

- Precipitation in 2021 was lower than 2020; and lake levels were similar to 2019 and 2020 levels.

- Secchi depths were generally shallower (cloudier water) as the season progressed into fall, except for Gravelly Lake which had its deepest secchi depths occurring in October.

- Shallow pH in the lakes ranged from 6.9 to 9.0 pH units. Deep pH results for American, Gravelly, and Louise lakes ranged from 6.0 to 7.4 pH units. pH in Waughop was similar to 2020 pH results.

Lake conditions vary from year to year with the change in seasons, weather patterns, and climate conditions. Long-term lake monitoring helps us to understand how our lakes are doing and if they are degrading over time. Additional graphs displaying the data collected for the lakes for all monitored years are in Appendix 1.

Recommendations

Lakes reflect their watershed. They receive water, dissolved substances carried in water, and sediment from its watershed. Lakes also receive particulates and gases from the atmosphere, and energy from the sun and wind. The condition of a lake at any one time is determined by what is already in the lake, and by what is coming into the lake – attesting to the fact that lakes are complex ecosystems.

Lake management is a complicated job that takes the combined efforts of local government, community groups, individuals, and landowners. To be effective lake management is a long-term commitment and investment.

Many lakes suffer from too many nutrients (phosphorus and nitrogen), entering a lake with stormwater, soil erosion, or groundwater from the surrounding watershed. When it rains nutrients wash into ditches and down storm drains eventually ending up in the lake. This can lead to problems such as excessive aquatic plant growth, nuisance and/or toxic algae blooms, lower water clarity, stressed fish and wildlife, and lower property values.

Here are some voluntary actions that can be taken to protect the health of the lake:

- Avoid fertilizer. If you do fertilize choose phosphorus-free products.
- Scoop pet waste, bag it and toss it in the trash.
- Divert runoff from roofs and driveways into stable vegetated areas.
- If you have a septic system, schedule routine inspections.
- Cover bare soil area with mulch or plants.
- Fix eroding areas in the yard, driveway, and parking areas.
- Maintain existing natural shorelines – these areas provide additional wildlife benefits for birds, turtles, frogs and other aquatic life.

- If you are a boater or angler prevent the spread of aquatic invasive species in your lake using the Clean/Drain/Dry method recommended by Washington State Department of Fish & Wildlife. Check here for more information: https://wdfw.wa.gov/ais/youcanhelp.html.

Table 1. Lakewood Lake Data 2021

Lake	Date	Time	Site Depth (m)	Secchi Depth (m)	Air Temp (C)	Water Temp (°C) Top	Dissolved Oxygen (mg/l) Top	Water Temp (°C) Bottom	Dissolved Oxygen (mg/l) Bottom	Lake Level (ft.)	Suspended Algae	pH (1 m)	pH (deep)	Comments/Observations
American	5/2/2021	10:45 AM	26.5	-7.25	20.6	15	11.9	8.3	8.7	232	light, small cellular in the water column	7.5	7	Wind cond: light; weather: partly cloudy; water surface: ripples; light cond: strong sunlight. No water odor. 7 boats, 10 people fishing, 1 swimmer/wader.
	6/6/2021	10:30am	25.8	-6.25	12.6	18.6	9.9	8.6	4.5	231.6	none	8		Wind cond: light, SSW; weather: rain; water surface: ripples; Light cond: overcast. No water odor. 2 swimmers. Eagles, swallows
	7/11/2021	10:00 AM	24	-8.2	24.6	22.7	9.5	8.6	0	231	Light, very clear	7.75		Wind cond: light; weather: overcast; water surface cond: ripples; light cond: overcast. No water odor. 10boats, 14 people fishing, 2 swimmers/waders. Osprey.
	8/8/2021	10:00 AM	22	-8.9	27.6	23	9	8.8	0	230.2	Light, water column	7.5	6.5	Wind cond: Light, SSW; weather: partly cloudy; water surface cond: ripples; light cond: hazy sunlight. No water odor; 2 boats, 1 swimmer/wader.
	9/12/2021	10:30 AM	26	-8.5	18.6	20.4	9.8	8.8	0	229.4	Light, tiny scattered balls in water column	7.5		Wind cond: calm; weaterh: overcast; water surface cond: ripples; light cond: overcast. Water odor not noted; geese; recreational lake use not noted. Air temp correction factor is 0.6 not 6. Lake level was below bottom of gauge (230') and was estimated.
	10/31/2021	11:00am	27	-7.7	11.6	12.7	9.2	13.1*	8.8*	230	light, clumpy, in water column	7	6	Wind cond: calm; weather: clear; water surface cond: calm; light cond: strong sunlight. Rotten egg odor noticed for first time this season. 70+ gulls, eagles, mud hens. 5 boats, 4 fishing, 0 swimmers/waders. *Meter battery died at 11 meters.
	12/5/2021	10:15am	26.5	-7	3.9	10.1	8	10.2	7.1	230.3	chunky HAB blobs over surface, heavy in water column & surface	7	7	Wind cond: light, N; weather: overcast; water surface cond: calm; light cond: bright cloud conditions. No water odor. Waterfowl: coots, eagle. 3 boats; 3 people fishing. Air thermometer had a broken column, air temperature from cell phone. Lots of floating cyanobacteria.

Lake	Date	Time	Site Depth (m)	Secchi Depth (m)	Air Temp (C)	Water Temp (°C) Top	Dissolved Oxygen (mg/l) Top	Water Temp (°C) Bottom	Dissolved Oxygen (mg/l) Bottom	Lake Level (ft.)	Suspended Algae	pH (1 m)	pH (deep)	Comments/Observations
Gravelly	5/2/2021	4:26PM	16.6	-6.1	18.0	16.7	12.4	7.9	0.2	5.48	None	8		Wind cond: light, WNW; weather: clear; water surface cond: ripples; light cond: strong sunlight. 3 ducks; 3 boats (2 kayaks, 1 paddle board). No water odor
	6/10/2021	2:34pm	16.0	-3.0	19.0	19.3	13.7	8.4	-2.4	4.80	None	9		Wind cond: light/strong, SW; weather: partly cloudy, rain, storm; water surface cond: ripples, small waves: light: strong sunlight, overcast. No water odor. 1 boat. 3 geese.
	7/11/2021	3:28PM	16.2	-7.8	25.0	24.2	10.3	8.7	0.1	4.22	Light, small dots in water column	8		Wind cond: calm; weather: clear; water surface cond: calm; Light cond:strong sunlight. No water odor. Eagle. 4 boats, 0 fishing, 1 swimmer/wader
	8/13/2021	10:15 AM	16.0	-5.0	29.0	24.8	11.7	8.9	0.2	3.40	light, spots	9		Wind cond: calm; weather: clear, haze (smoke); water surface cond: calm; light cond: hazy sunlight. No water odor. 0 waterfowl; 0 boats, 0 fishing, 0 swimmers/waders. Clover Creek is dry.
	9/12/2021	3:55 PM	14.3	-5.6	21.0	21.4	11.5	10.6	0.3	2.25	Light, small spots in water column	8.5		Wind cond: light; weather: partly cloudy; water surface cond: ripples; light cond: strong sunlight. No water odor. Waterfowl - 1, geese. No boats, fishing or waders/swimmers.
	10/31/2021	3:30pm	15.8	-8.0	18.0	13.6	8.6	9.6	0.3	2.00	none	7.5	6.5	Wind cond: breezy; weather: clear; water surface cond: ripples; light cond: strong sunlight. No water odor; 8 ducks; 3 boats, 0 fishing, 0 swimming/wading.

Lake	Date	Time	Site Depth (m)	Secchi Depth (m)	Air Temp (C)	Water Temp (°C) Top	Dissolved Oxygen (mg/l) Top	Water Temp (°C) Bottom	Dissolved Oxygen (mg/l) Bottom	Lake Level (ft.)	Suspended Algae	pH (1 m)	pH (deep)	Comments/Observations
Louise	5/2/2021	1:00PM	9.5	-9.5	23.1	16.8	10.8	12	2.7	-0.92	None	7.4	6.5	Wind cond: light, NW; weather: partly cloudy; water surface cond: ripples; light cond: strong sunlight. No water odor. Waterfowl - mallard with clutch of 7; 3 boats, 5 people fishing. Monitor noted that he had never seen the water so clear - secchi disk was on the bottom.
	6/7/2021	11:15 AM	9.4	-6.7	16.6	19.4	10.1	16.3	3.6	-1.12	Light, small specks	7.4		Wind cond: light, S; weather: partly cloudy; water surface: ripples; light cond: bright cloud conditions. No water odor. No boats, fishing, swimming/wading.
	7/8/2021	11:20am	9.2	-7.8	18.6	23.4	9.7	21	5.3	-1.38	None	7.6		Wind cond: light, NW; weather: overcast; water surface cond: ripples; light cond: overcast. No water odor. 4 geese, bald eagle. 2 boats, 2 people fishing, 1 swimmer/wader.
	8/8/2021	1:30 PM	9.1	-5.2	23.6	24.2	9.2	24	7.2	-1.92	Moderate, big flakes in the water column	7.5	7.4	Wind cond: breezy, SE; weather: partly cloudy; water surf cond: ripples; light cond: bright cloud conditions. No water odor. No boats, fishing, or waders/swimmers.
	9/12/2021	12:55Pm	8.7	-4.5	19.4	21.2	9.6	21.2	7	-2.42	Light, very light algae in spite of low SD	7.5		Wind cond: light, NE; weather: partly cloudy; water surface cond: ripples; Light cond: bright cloud conditions. No water odor. 0 waterfowl; No boats, fishing, or waders/swimmers. .

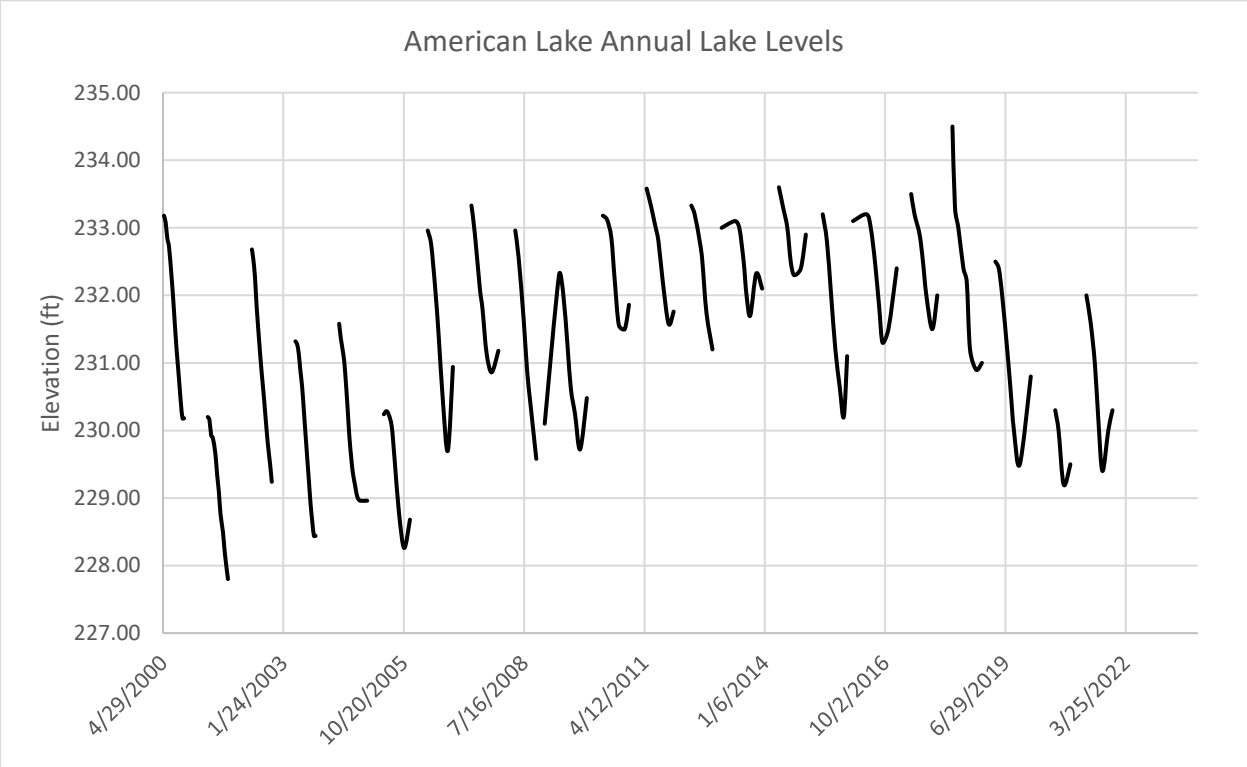
Lake	Date	Time	Site Depth (m)	Secchi Depth (m)	Air Temp (C)	Water Temp (°C) Top	Dissolved Oxygen (mg/l) Top	Water Temp (°C) Bottom	Dissolved Oxygen (mg/l) Bottom	Lake Level (ft.)	Suspended Algae	pH (1 m)	pH (surface)	Comments/Observations
Waughop	5/3/2021	9:15am	3.2	-1.1	13.5	17.1	9.7	16.6	2.7	5.8	small dots, moderate, brown in color	6.9	7	Wind cond: light, SW; Weather: overcast; water surface cond: ripples; light conditions: overcast. No odor. 5 mallards, 3 families of geese with young, 0 boats, 0 fishing, 0 swimming/wading.
	6/7/2021	9:08am	2.9	-1.5	16.1	18.8	9.5	18.9	0.8	5.32	heavy, cloud-like	7	7	Wind conditons - light, SW; weather - partly cloudy; water surface - ripples; light conditions - strong sunlight. No water odor; waterfowl - 2 mallards, geese - 3 pairs with ~ 20 goslings. 0 boats; 8 people fishing; no swimmers/waders.
	7/8/2021	8:56 AM	3	-1.1	17.6	22.9	8.8	22.7	0.7	4.76	substantial cloudiness	7.4	7.5	Wind cond: calm; weather: overcast; water surface cond: ripples; light conditions: overcast. Water odor - slight rotten egg odor. ~40 geese, mallard. 0 boats; 1 person fishing; no swimmers/waders.
	8/9/2021	9:06 AM	2.5	-1.3	21.6	22.4	9.7	22.5	9.7	4.08	heavy, cloudy, murky	7.9	8	Wind cond: calm; weather: partly cloudy; water surface cond: calm; light cond: bright cloud conditions. No water odor. Waterfowl - 5, geese, mallard and youg; no boats, 2 fishing, no swimmers/waders.
	9/13/2021	9:07am	2.3	-1.3	16.2	19.9	10.3	20.2	0.7	3.56	little dots plus pea-sized globules (new)	7.5		Wind cond: calm; weather: overcast; water surface cond: calm; light cond: overcast. No water odor. Waterfowl - 2 mallards, kingfisher, heron, 4 sandpiper or plover. No boats, fishing, or swimmers/waders. The turbidity of the algae was worse on the north and east sides, more than just from wind blowing effect. I noticed it when checking the staff gauge, that the water just looked a lot thicker than in the shallower areas over on the west side by the college.
	10/25/2021	10:10 AM	2.4	-0.9	13.1	12.3	10.6	11.8	0.5	3.57	Heavy amount of small dots	7.25	7.25	Wind cond: breezy, S; weather: overcast; water surface cond: ripples; light cond: bright cloud cond. No water odor. 6 ducks. 0 boats, 0 fishing; 0 swimmers/waders.

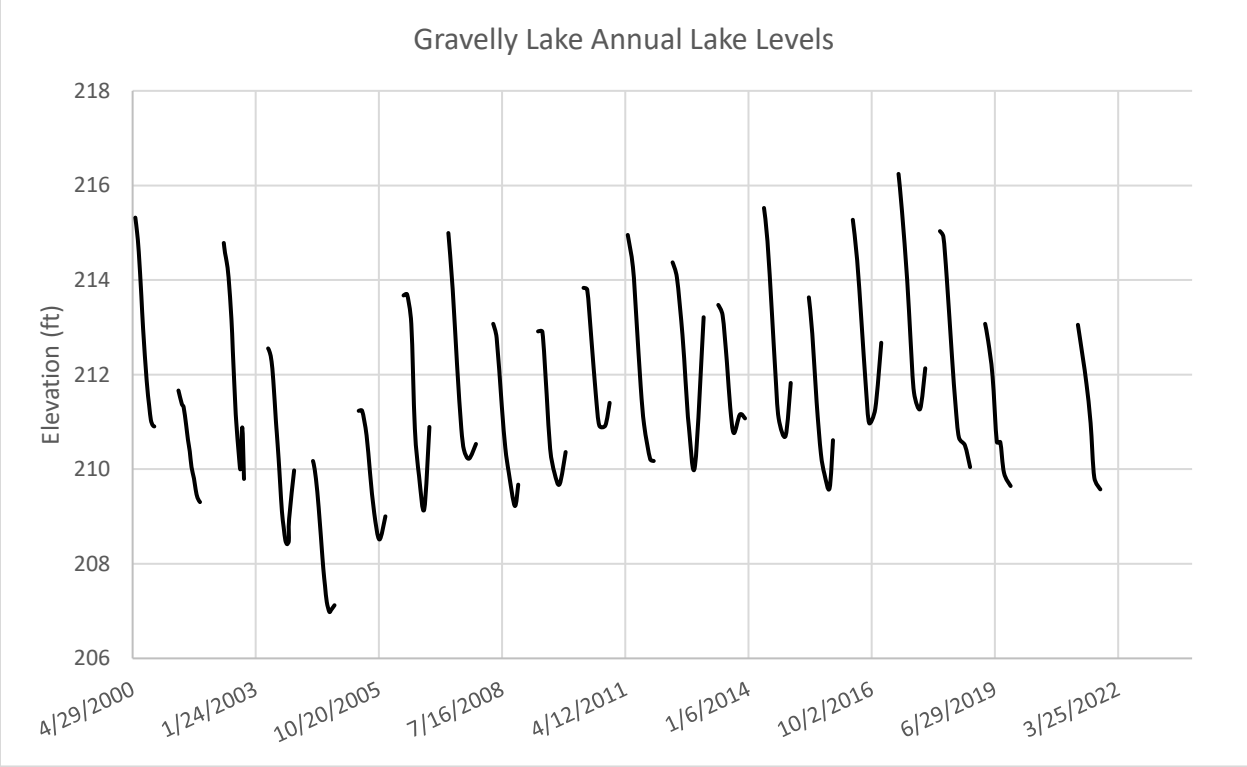
Table 2. Waughop Lake Additional Monitoring Results

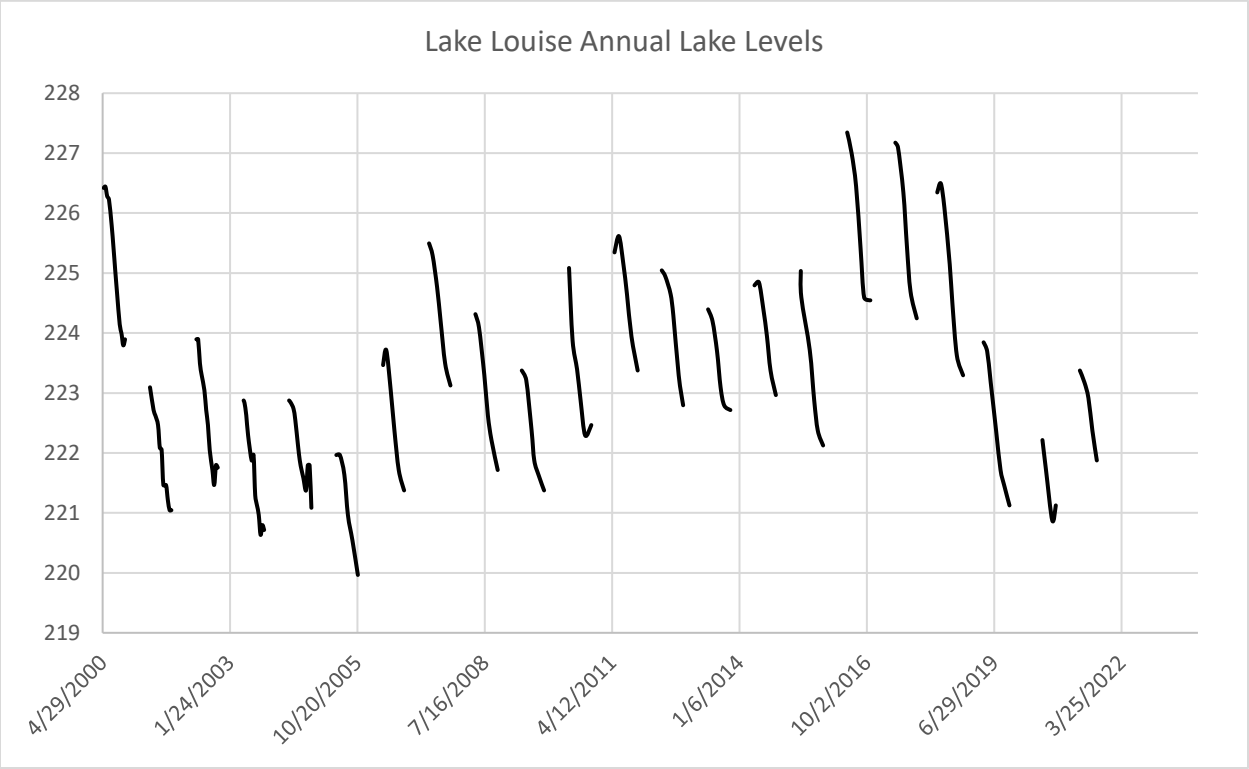
Date	Time	Site Depth (m)	Secchi Depth (m)	Air Temp (C)	Water Temp (°C) Top	Dissolved Oxygen (mg/l) Top	Water Temp (°C) Bottom	Dissolved Oxygen (mg/l) Bottom	Lake Level (ft.)	Suspended Algae	pH (1 m)	pH (surface)	TP (mg/l)	SRP (mg/l)	TN (mg/l)	Chla (ug/l)	Phaeo a(ug/l)	Sulfate (mg/l)	Alkalinity (mg CaCO3/l)	Total Aluminum (mg/l)
5/3/2021	9:15am	3.2	-1.1	13.5	17.1	9.7	16.6	2.7	5.8	small dots, moderate, brown in color	6.9	7	0.037	0.001	0.425	5	1.7	22.1	15.8	0.363
6/7/2021	9:08am	2.9	-1.5	16.1	18.8	9.5	18.9	0.8	5.32	heavy, cloud-like	7	7	0.026	0.002	0.442	8	1.7			
7/8/2021	8:56 AM	3	-1.1	17.6	22.9	8.8	22.7	0.7	4.76	substantial cloudiness	7.4	7.5	0.032	0.002	0.956	9.8	0.8			
8/9/2021	9:06 AM	2.5	-1.3	21.6	22.4	9.7	22.5	9.7	4.08	heavy, cloudy, murky	7.9	8	0.044	<0.001	0.78	6.5	0.9	133	23	0.579
9/13/2021	9:07am	2.3	-1.3	16.2	19.9	10.3	20.2	0.7	3.56	little dots plus pea-sized globules (new)	7.5		0.026	<0.001	0.206	5.1	2.8			
10/25/2021	10:10 AM	2.4	-0.9	13.1	12.3	10.6	11.8	0.5	3.57	Heavy amount of small dots	7.25	7.25	0.042	0.001	0.961	33	9.1	111	38.7	0.317

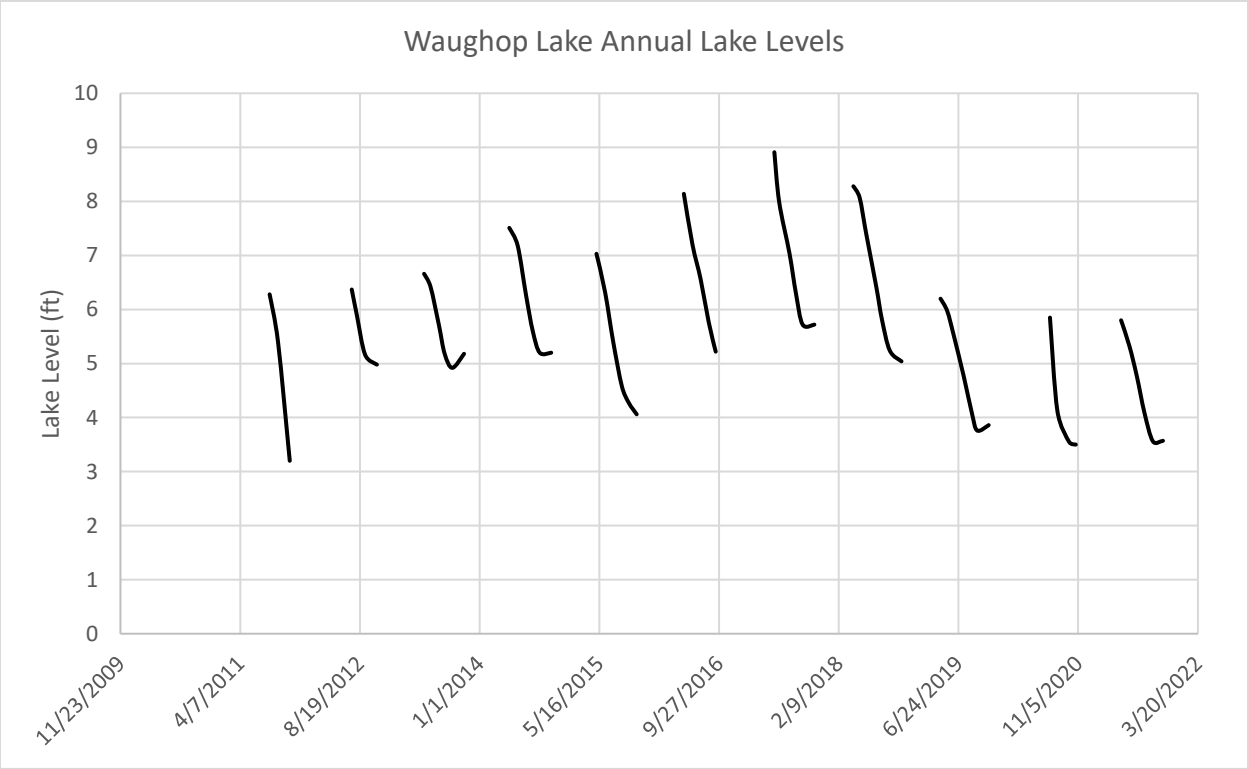
Shoreline Observations						
	5/3/2021	6/7/2021	7/8/2021	8/9/2021	9/13/2021	10/25/2021
Site 1 (beach for boats)	No scum; 0% bottom coverage by plants	No scum, white foam; 0% bottom coverage by plants	No algae scum; 0% bottom coverage by plants	No algae scum, some bits of foam. 0% bottom coverage by aquatic plants	No surface algal scum; brown algae coating the lake bottom. 0% plant coverage on bottom	No algal scum; 0% plant coverage on bottom
Site 2: SE corner	No scum; 0% bottom coverage by plants	No scum. 0% bottom coverage by plants	No algae scum; 0% bottom coverage by plants	Some algae scum; 0% bottom coverage by aquatic plants	No surface algal scum; brown algae coating the lake bottom. 0% plant coverage on bottom	No algal scum; algae on lake bottom. 0% plant coverage of bottom
Site 3: South by trash can	No scum; 10% pads coverage - spatterdock, cattail	No scum. Brown sediment. 50% bottom coverage with spatterdock	No algae scum; 60% bottom coverage with spatterdock on west side of area; cattails present too	Some algae scum present, brown algae on lake bottom; 70 % bottom coverage on west side of area with spatterdock	No surface algal scum; brown algae coating the lake bottom. 70% plant coverage on bottom - spatterdock now out of water due to lake receding.	No algal scum; algae on lake bottom. 0% plant coverage on bottom.
Site 4: Dock	No scum; too cloudy to see any plants in water	No scum, brown and green algae growing on bottom close to shore. Probable Ludwigia palustris (water purslane) close to shore; 80% spatterdock coverage out from dock	No algae scum; 85% bottom coverage-spatterdock out from dock	Water has receded about 40' from the dock; 85% coverage where water is present with spatterdock.	Water has receded to far from dock.	Water receded from dock. No algal scum present. 80% spatterdock where water receded.
Site 5: By college outfall	No scum; 5% plant coverage; spatterdock	No scum, algae on bottom. 2% probable Ludwigia palustris (water purslane), 40% spatterdock	No algae scum; couldn't clearly see bottom; 50 % bottom coverage - spatterdock out from shore edge	Water has receded here too. Brown algae on lake bottom; 50% bottom coverage with spatterdock	No surface algal scum; brown algae coating the lake bottom. 60% bottom coverage - spatterdock.	No algal scum; other scum present - vegetative debris. Water partially receded. 60% spatterdock coverage.
Site 6: N. fishing spot	White bubbles present; 0% bottom coverage	No scum; foam present. 0% bottom plant coverage	No algae scum, looked like pollen on water; 0% plant coverage	No algae scum, 0% plant coverage	No surface algal scum; brown algae coating the lake bottom. 0% coverage	No algal scum; 0% plant coverage on bottom.

Appendix 1. Lake Data

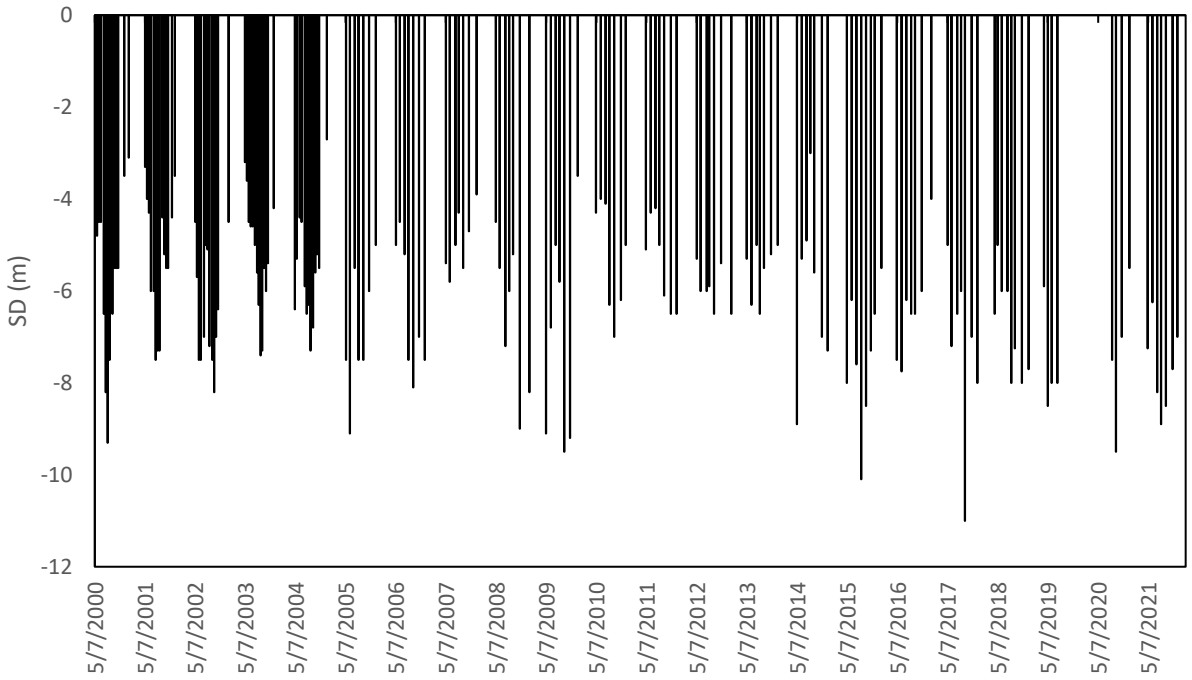




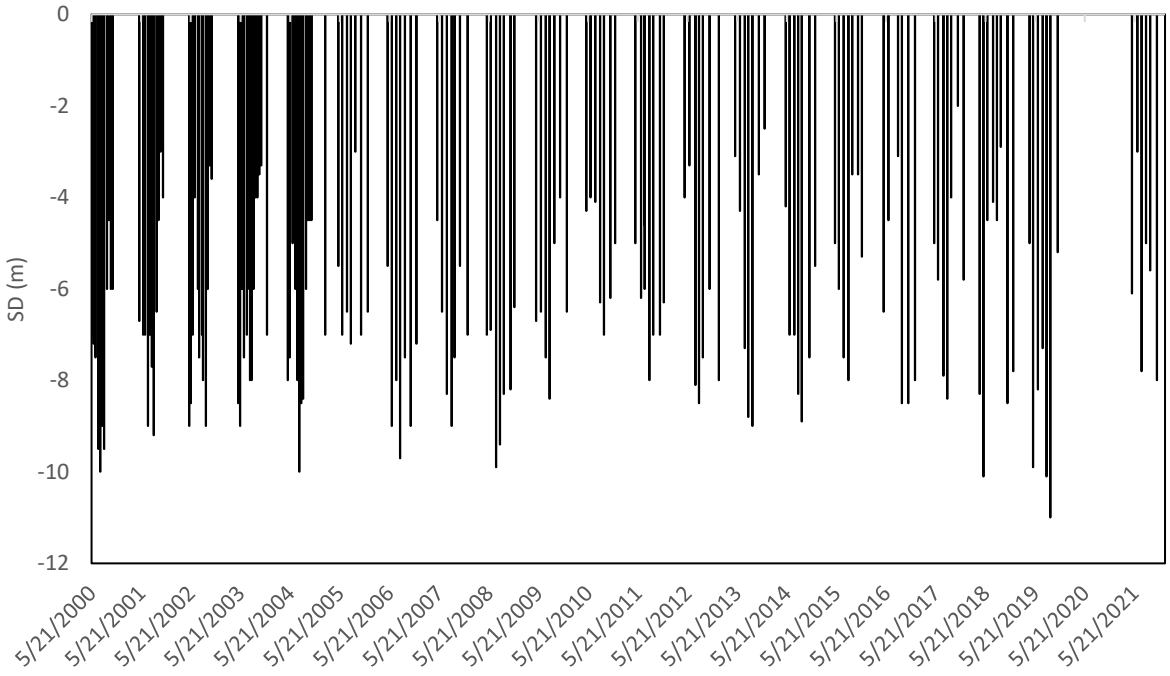

Lake Louise Annual Lake Levels
228
227
226
225
224
223
222
221
220
219
4/29/2000
1/24/2003
10/20/2005
7/16/2008
4/12/2011
1/6/2014
10/2/2016
6/29/2019
3/25/2022


Waughop Lake Annual Lake Levels
Lake Level (ft)
10
9
8
7
6
5
4
3
2
1
0
11/23/2009
4/7/2011
8/19/2012
1/1/2014
5/16/2015
9/27/2016
2/9/2018
6/24/2019
11/5/2020
3/20/2022

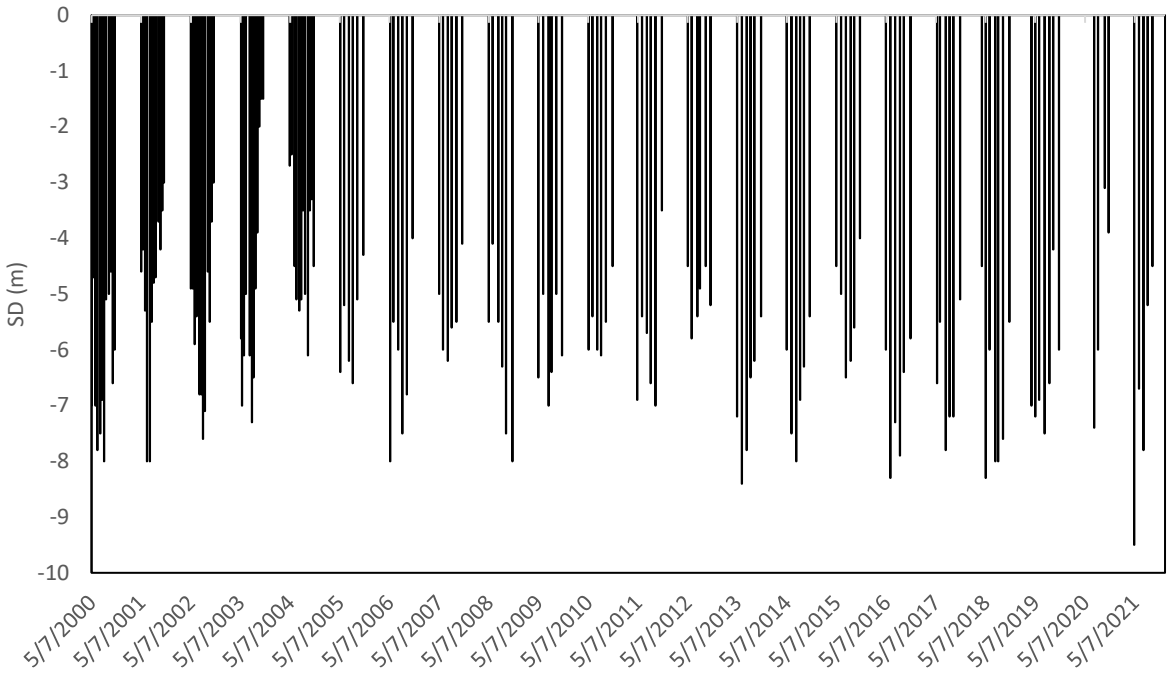
American Lake Annual Secchi Depths



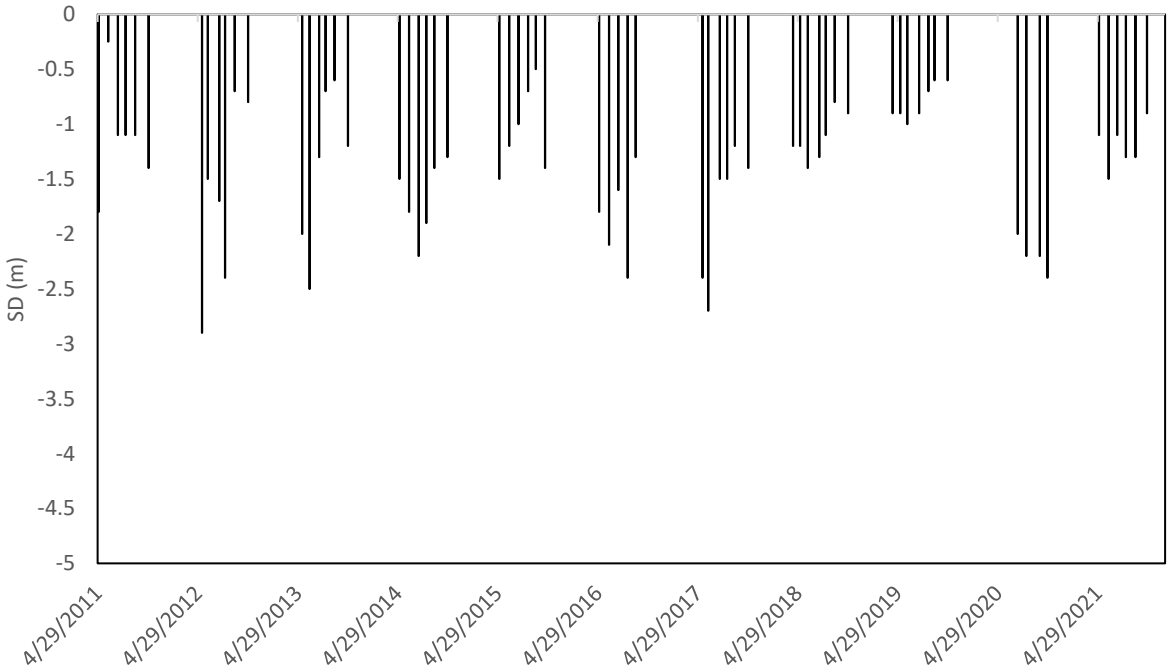
Gravelly Lake Annual Secchi Depths

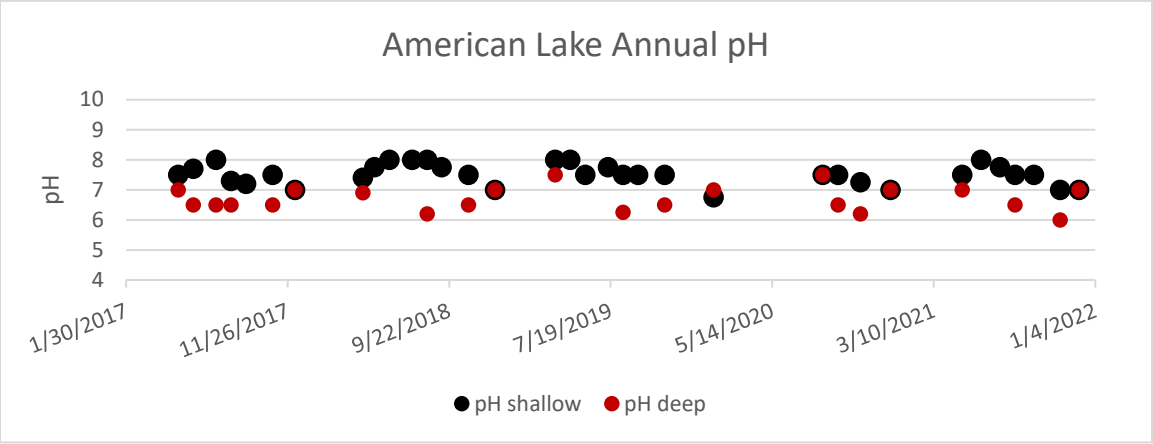


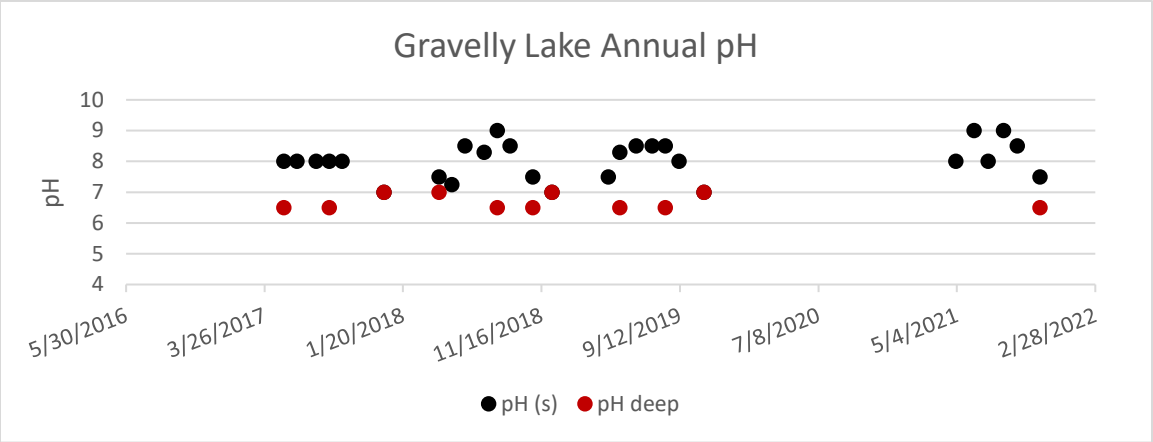
Lake Louise Annual Secchi Depths

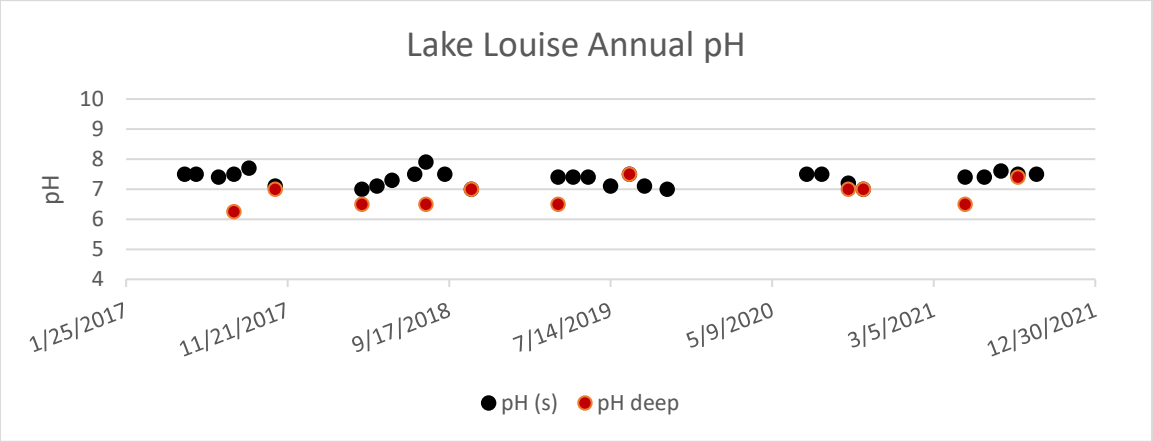


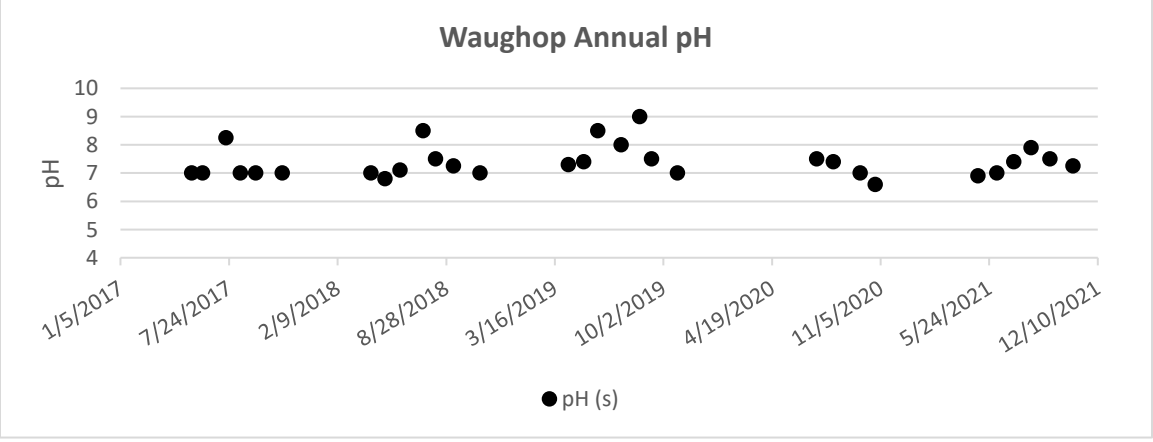
Waughop Lake Secchi Depths




American Lake Annual pH
pH
10
9
8
7
6
5
4
1/30/2017
11/26/2017
9/22/2018
7/19/2019
5/14/2020
3/10/2021
1/4/2022
pH shallow
pH deep


Gravelly Lake Annual pH
pH
10
9
8
7
6
5
4
5/30/2016
3/26/2017
1/20/2018
11/16/2018
9/12/2019
7/8/2020
5/4/2021
2/28/2022
pH (s)
pH deep


Lake Louise Annual pH
pH
10
9
8
7
6
5
4
1/25/2017
11/21/2017
9/17/2018
7/14/2019
5/9/2020
3/5/2021
12/30/2021
pH (s)
pH deep


Waughop Annual pH
pH
10
9
8
7
6
5
4
1/5/2017
7/24/2017
2/9/2018
8/28/2018
3/16/2019
10/2/2019
4/19/2020
11/5/2020
5/24/2021
12/10/2021
pH (s)

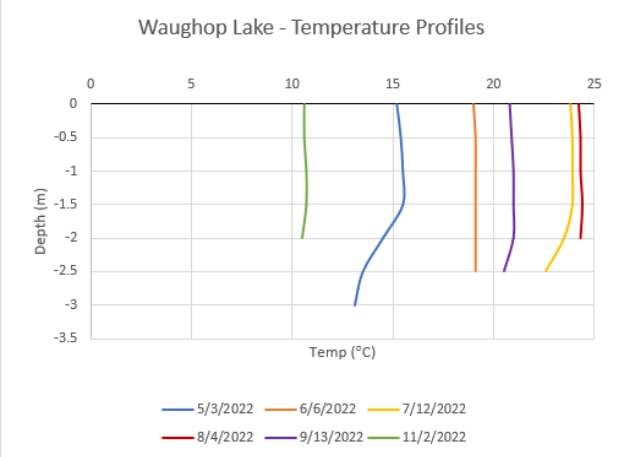
PIERCE CONSERVATION DISTRICT
Over 70 Years of Conservation

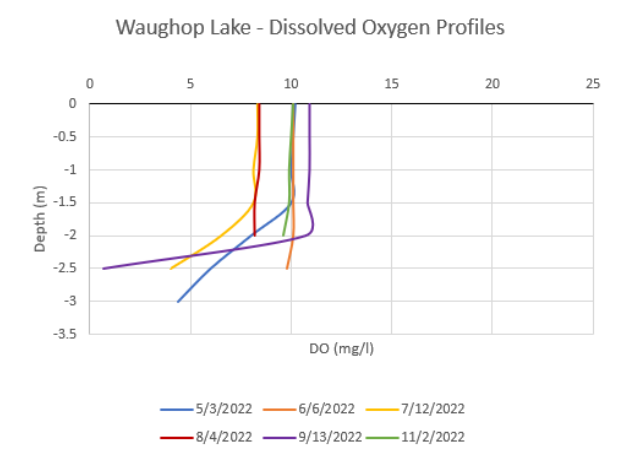
308 West Stewart Avenue
P.O. Box 1057
Puyallup, WA 98371
www.piercecd.org
253.845.9770
Toll Free: 866.845.9485

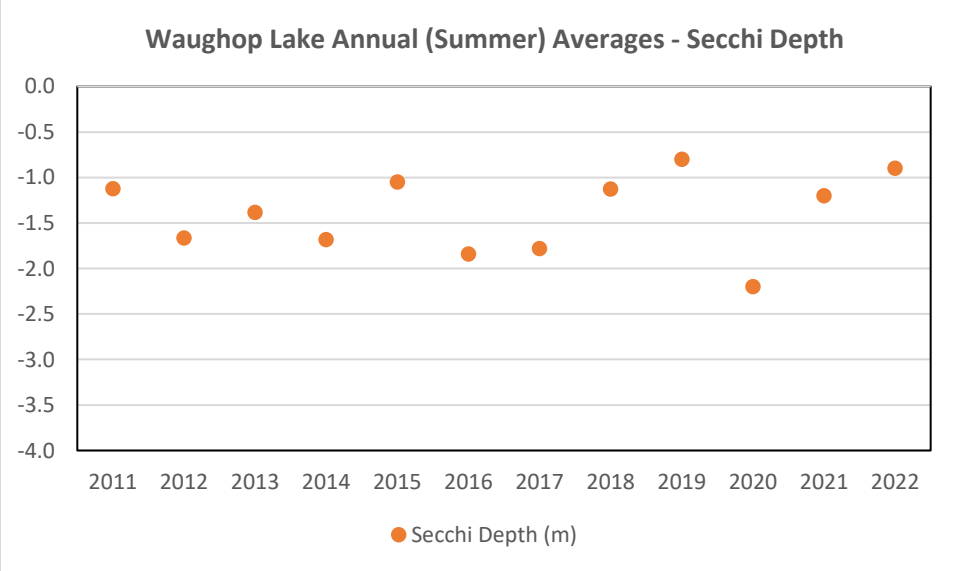
City of Lakewood

Waughop Lake Monitoring Program

During the 2022 Waughop monitoring season, 2 volunteers participated in lake monitoring with a total of 36 volunteer hours.







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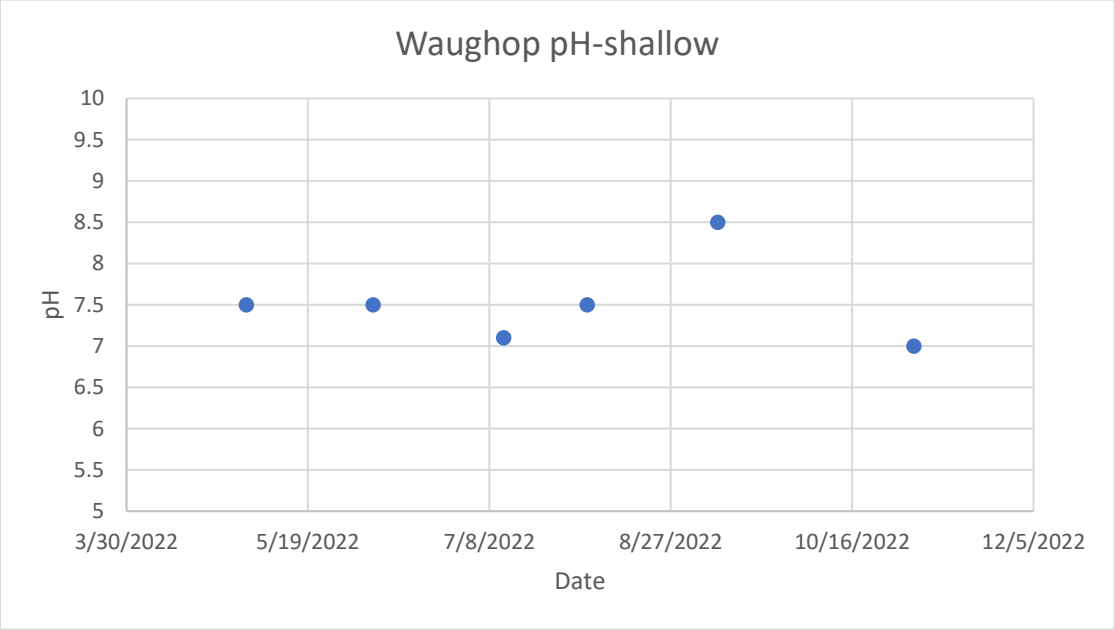

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Shoreline Observations

Location	Algae scum presence/% aquatic plant coverage					
Date		June	July	August	September	October
Site 1: Beach for boats	47.170887, -122.561897	None	None	None	Yes	No
Site 2: SE corner	47.169195, -122.562447	None	None	Yes	Yes	Yes
Site 3: South by trash can	47.168922, -122.563195	None/ 40%	None/ 50%	None/ 35%	Yes/33%	Yes/20% Spatterdock
Site 4: Dock	47.168762, -122.565413	None/ 60%	yes/ 85%	Yes/ 90%	Yes/90%	Yes/85% Spatterdock
Site 5: By college outfall	47.171458, -122.567353	None/ 30%	none/ 70%	Yes/ 40%	Yes/70%	Yes/65% Spatterdock
Site 6: N. fishing spot	47.172233, -122.563545	none	none	Yes	Yes	Yes

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Raw Data:

Date	Time	Site Depth (m)	Secchi Depth (m)	Air Temp (°C)	Water Temp (°C) Top	Dissolved Oxygen (mg/l) Top	Water Temp (°C) Bottom	Dissolved Oxygen (mg/l) Bottom	Lake Level (ft.)	Suspended Algae
5/2/2022	9:26 AM	4	0.6	11.8	15.2	10.2	12.7	0.6	7.5	Substantial algae bloom
6/6/2022	9:10 AM	3.7	1.1	14.3	19	10.1	18	0.7	7.25	Substantial algae bloom
7/12/2022	9:20 AM	3.1	1.1	25.4	23.8	8.3	22.6	4	6.72	Very soupy, a few small dots but mostly well dissolved
8/4/2022	9:12 AM	3.3	0.9	22.3	24.2	8.4	24.3	7.8	6.12	Heavy
9/9/2022	9:26 AM	2.9	0.6	19.7	20.8	10.9	20.5	0.7	5.35	
11/2/2022	9:40	2.9	1.2	8.7	10.6	10.1	10.8	3.3	4.75	Substantial algae bloom

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Date	pH (1m)	pH (surface)	TP (mg/l)	SRP (mg/l)	TN (mg/l)	Chla (ug/l)	Phaeo a (ug/l)	Sulfate (mg/l)	Alkalinity (mg CaCO3/l)	Total Aluminum (mg/l)
5/2/2022	7.5		0.039	0.002	1.15	23	9.1	51.2	37.5	0.286
6/6/2022	7.5	7.5	0.03	<0.001	0.709	7.6	3.3			
7/12/2022	7.1		0.29	<0.001	1.06	5.9	2			
8/4/2022	7.5		0.042	<0.001	0.851	12	6.2	45.2	47.6	0.415
9/9/2022	8.5		0.056	0.002	0.853	22	7.1			
11/2/2022	7		0.04	<0.001	1.11	13	6.1	41.7	58.2	0.177

If you have additional questions, reach out to Belinda Paterno at belindap@piercecd.org.

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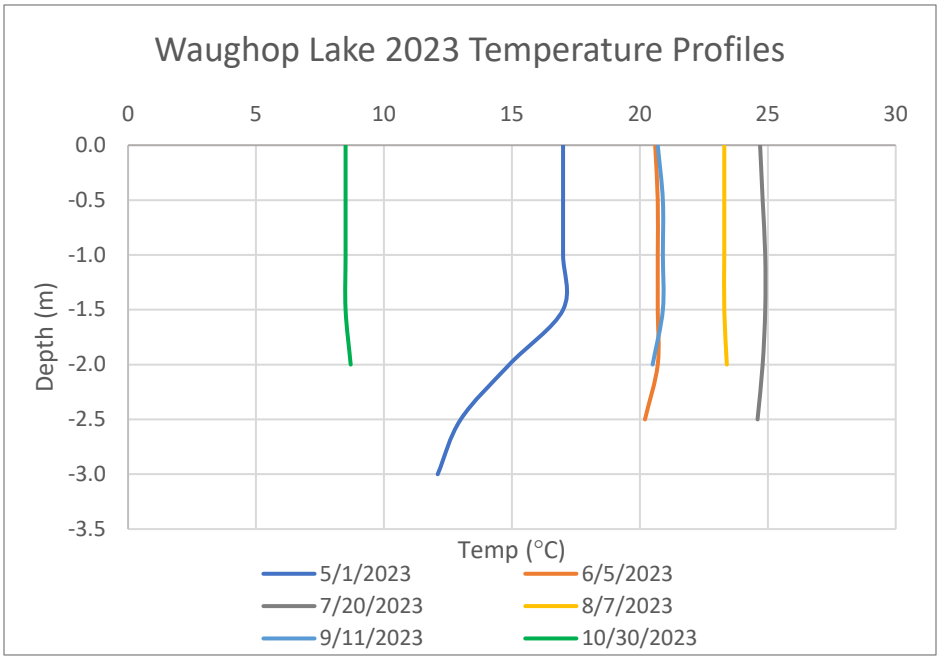
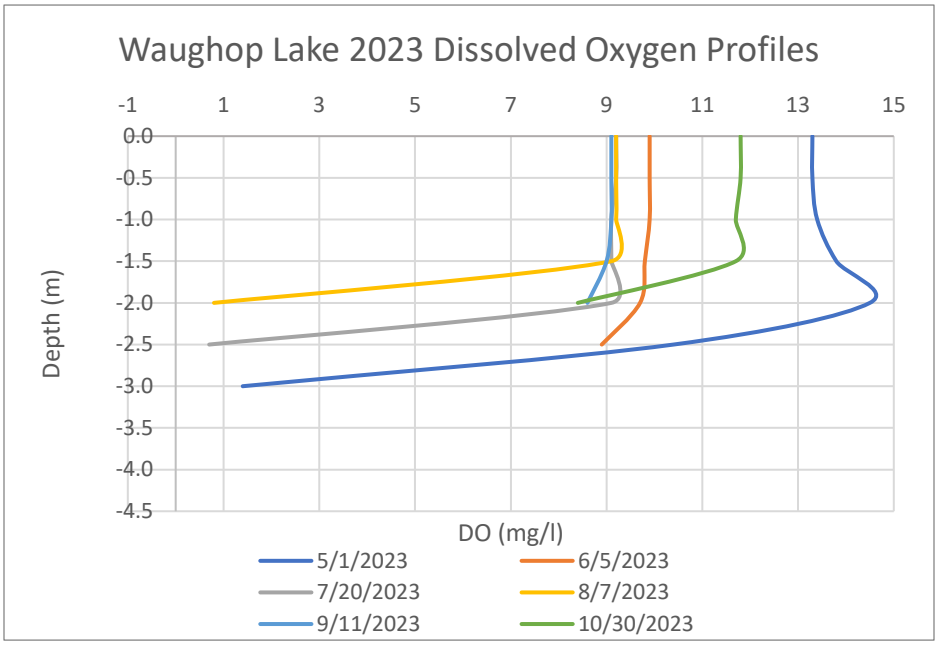
City of Lakewood

Waughop Lake Monitoring Program

During the 2023 Waughop monitoring season, 3 volunteers participated in lake monitoring with a total of 21 volunteer hours.





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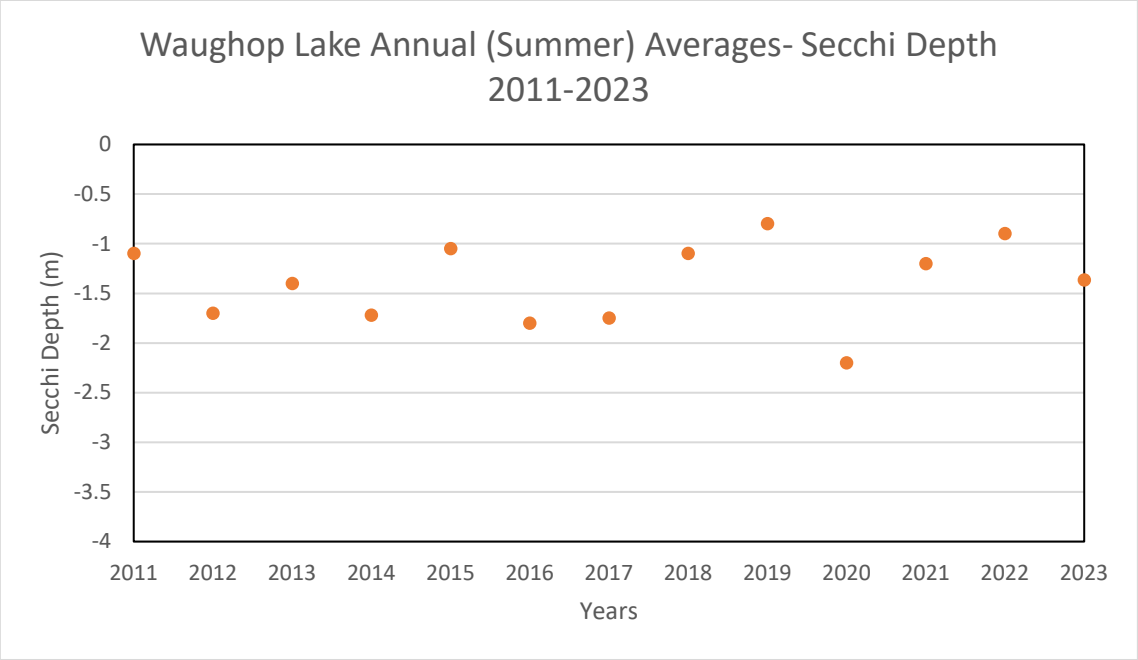

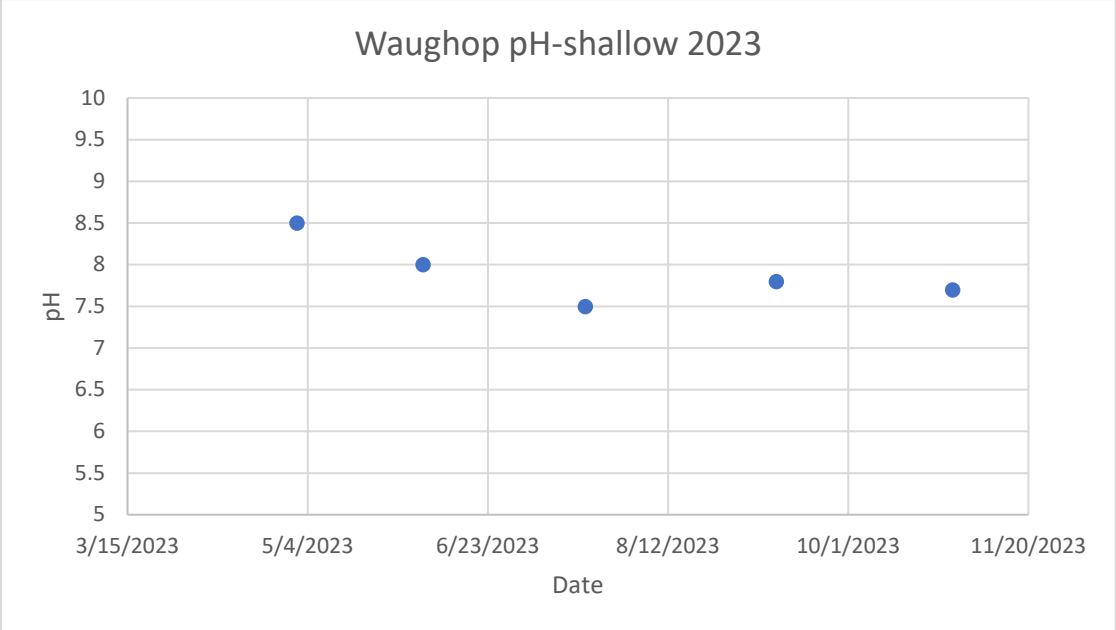

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Shoreline Observations

Location	Algae scum presence/% aquatic plant coverage					
Date		June	July	August	September	October
Site 1: Beach for boats	47.170887, -122.561897	None	None	Yes	None	None
Site 2: SE corner	47.169195, -122.562447	None	None	None	None	None
Site 3: South by trash can	47.168922, -122.563195	None/ 20%	None/ 20%	None/ 20%	None/15%	Water too far receded /30%
Site 4: Dock	47.168762, -122.565413	Yes/ 45%	None/ 85%	None/ 85%	Water too far receded /80%	Water too far receded /80%
Site 5: By college outfall	47.171458, -122.567353	None/ 35%	None/ 90%	None/ 90%	No/40%	None/45%
Site 6: N. fishing spot	47.172233, -122.563545	None	None	Yes	No	None

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Raw Data

Date	Time	Site Depth (m)	Secchi Depth (m)	Air Temp (C)	Water Temp (°C) Top	Dissolved Oxygen (mg/l) Top	Water Temp (°C) Bottom	Dissolved Oxygen (mg/l) Bottom	Lake Level (ft.)	Suspended Algae
5/1/2023	9:30 AM	3.5	0.6	13.2	17	13.3	12.1	1.4	5.84	Substantial
6/5/2023	9:00 AM	3	0.9	17.3	20.6	9.9	20.2	8.9	5.26	Substantial
7/20/2023	9:00 AM	2.8	2	21.9	24.7	9.2	24.6	0.7	5.26	Moderate to heavy
8/7/2023	9:50 AM	2.6	1.9	20.5	23.3	9.2	23.4	0.8	3.9	Moderate
9/11/2023	9:47 AM	2.5	1.9	25.2	20.7	9.1	20.5	8.6	3.8	Substantial
10/30/2023	9:39 AM	2.5	0.9	8.6	8.5	11.8	8.7	8.4	3.46	Moderate

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Date	pH (1 m)	pH (surface)	TP (mg/l)	SRP (mg/l)	TN (mg/l)	Chla (ug/l)	Phaeo a(ug/l)	Sulfate (mg/l)	Alkalinity (mg CaCO3/l)	Total Aluminum (mg/l)
5/1/2023	8.5		0.041	<0.001	0.931	19	9.3	25.3	48.7	0.499
6/5/2023	8		0.033	0.002	0.941	8	4			
7/20/2023	7.5		0.017	<0.001	0.619	3.6	2.9			
8/7/2023		7.6	0.025	<0.001	0.987	5.3	3.8	110	38.4	0.919
9/11/2023	7.8	7.9	0.026	<0.001	0.81	7.7	3.1			
10/30/2023	7.7	7.6	0.039	0.001	0.965	14	4.1	102	34.6	0.949

If you have additional questions, reach out to Bryan Mohlman at Bryanm@piercecd.org.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1747583 **PAGE 1**

REPORT DATE: 06/07/24

DATE SAMPLED: 05/06/24 **DATE RECEIVED:** 05/07/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Waughop 1m	0.050	0.007	22.9	0.843	26.9	7.50

SAMPLE ID	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	CONDUCTIVITY (umhos/cm)
Waughop 1m	0.4110	3.99	57.2	23	6.1	229

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Waughop 1m	6.04	0.953	2.88	19.0	25.6	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1747583 **PAGE 2**

REPORT DATE: 06/07/24

DATE SAMPLED: 05/06/24 **DATE RECEIVED:** 05/07/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	05/13/24	05/08/24	05/20/24	05/13/24	05/14/24	05/06/24
DETECTION LIMIT	0.002	0.001	0.250	0.050	1.00	0.10
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	
ORIGINAL	0.004	0.005	3.97	0.186	116	
DUPLICATE	0.004	0.005	4.05	0.179	116	
RPD	0.92%	2.45%	2.17%	3.84%	0.22%	NA
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.004	0.005	3.97	0.186		
SPIKED SAMPLE	0.052	0.026	8.48	1.14		
SPIKE ADDED	0.050	0.020	4.50	1.00		
% RECOVERY	96.69%	107.99%	100.29%	95.40%	NA	NA
QC CHECK						
FOUND	0.097	0.036	3.80	0.442	100	
TRUE	0.094	0.039	4.00	0.469	100	
% RECOVERY	103.19%	91.37%	95.00%	94.24%	100.00%	NA
BLANK	<0.002	<0.001	<0.250	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1747583 **PAGE 3**

REPORT DATE: 06/07/24

DATE SAMPLED: 05/06/24 **DATE RECEIVED:** 05/07/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	CONDUCTIVITY (umhos/cm)
METHOD	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H	EPA 120.1
DATE ANALYZED	05/08/24	05/20/24	05/31/24	05/30/24	05/30/24	06/04/24
DETECTION LIMIT	0.0030	0.50	1.00	0.1	0.1	0.10
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	Waughop 1m
ORIGINAL	0.0583	2.84	9570	2.7	7.0	229
DUPLICATE	0.0567	2.84	9720	2.7	7.0	234
RPD	2.91%	0.00%	1.56%	0.00%	0.00%	2.16%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH			
ORIGINAL	0.0583	2.84				
SPIKED SAMPLE	0.5782	13.0				
SPIKE ADDED	0.5000	10.0				
% RECOVERY	103.97%	101.95%	OR	NA	NA	NA
QC CHECK						
FOUND	0.5433	30.7	9.86			1414
TRUE	0.5000	30.0	10.0			1413
% RECOVERY	108.65%	102.33%	98.60%	NA	NA	100.07%
BLANK	<0.0030	<0.50	<1.00	NA	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
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NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1747583 **PAGE 4**

REPORT DATE: 06/07/24

DATE SAMPLED: 05/06/24 **DATE RECEIVED:** 05/07/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	05/11/24	05/11/24	05/11/24	05/11/24	05/14/24	05/14/24
DETECTION LIMIT	0.100	0.100	0.500	0.700	1.00	1.00
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	29.4	6.48	2.27	100		
DUPLICATE	29.6	6.54	2.26	101		
RPD	0.87%	0.82%	0.14%	0.86%	NA	NA
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH			
ORIGINAL	29.4	6.48	2.27			
SPIKED SAMPLE	40.4	17.1	13.1			
SPIKE ADDED	10.0	10.0	10.0			
% RECOVERY	110.90%	106.32%	108.64%	NA	NA	NA
QC CHECK						
FOUND	10.5	10.5	10.7	69.3		
TRUE	10.0	10.0	10.0	66.2		
% RECOVERY	105.19%	104.55%	107.42%	104.79%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.700	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
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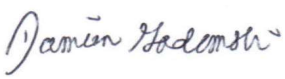
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

3600 Fremont Ave N
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

City of Lakewood
Bryan Mohlman
6000 Main St.
Lakewood, WA 98499

RE: Waughop Lake Sampling,
Work Order Number: 2405116

May 14, 2024

Attention Bryan Mohlman:

Fremont Analytical, Inc, an Alliance Technical Group company, received 2 sample(s) on 5/7/2024 for the analyses presented in the following report.

Total Sulfide by SM 4500-S2-D

All analyses were performed according to our accredited Quality Assurance program. Please contact the laboratory if you should have any questions about the results.

Please note, while the appearance of our logo and branding will update, our commitment to accuracy, speed, and customer service remain values celebrated and shared by Alliance Technical Group. Thank you for the opportunity to serve you.

Sincerely,

Brianna Barnes
Project Manager

CC:
Bryan Mohlman
Weston Ott

Date: *05/14/2024*

CLIENT: City of Lakewood
Project: Waughop Lake Sampling
Work Order: 2405116

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2405116-001	Total Sulfides @ 1 Meter	05/06/2024 10:15 AM	05/07/2024 9:36 AM
2405116-002	Total Sulfides @ 0.5 m from	05/06/2024 10:15 AM	05/07/2024 9:36 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Original

Case Narrative

WO#: **2405116**

Date: **5/14/2024**

CLIENT: City of Lakewood
Project: Waughop Lake Sampling

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2405116**
Date Reported: **5/14/2024**

CLIENT: City of Lakewood
Project: Waughop Lake Sampling

Lab ID: 2405116-001 **Collection Date:** 5/6/2024 10:15:00 AM
Client Sample ID: **Total Sulfides @ 1 Meter** **Matrix:** Water

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R91640		Analyst: SS
Sulfide	ND	0.0500		mg/L	1	5/13/2024 3:46:48 PM

Lab ID: 2405116-002 **Collection Date:** 5/6/2024 10:15:00 AM
Client Sample ID: **Total Sulfides @ 0.5 m from** **Matrix:** Water

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R91640		Analyst: SS
Sulfide	ND	0.0500		mg/L	1	5/13/2024 3:46:48 PM

Work Order: 2405116
CLIENT: City of Lakewood
Project: Waughop Lake Sampling

QC SUMMARY REPORT

Total Sulfide by SM 4500-S2-D

Sample ID: **MB-R91640**	SampType: **MBLK**	Units: **mg/L**	Prep Date: **5/13/2024**	RunNo: **91640**
Client ID: **MBLKW**	Batch ID: **R91640**		Analysis Date: **5/13/2024**	SeqNo: **1911464**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500									

Sample ID: **LCS-R91640**	SampType: **LCS**	Units: **mg/L**	Prep Date: **5/13/2024**	RunNo: **91640**
Client ID: **LCSW**	Batch ID: **R91640**		Analysis Date: **5/13/2024**	SeqNo: **1911465**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.190	0.0500	0.2000	0	94.9	80	120				

Sample ID: **2405116-001ADUP**	SampType: **DUP**	Units: **mg/L**	Prep Date: **5/13/2024**	RunNo: **91640**
Client ID: **Total Sulfides @ 1 Mete**	Batch ID: **R91640**		Analysis Date: **5/13/2024**	SeqNo: **1911467**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500						0		20	

Sample ID: **2405116-001AMS**	SampType: **MS**	Units: **mg/L**	Prep Date: **5/13/2024**	RunNo: **91640**
Client ID: **Total Sulfides @ 1 Mete**	Batch ID: **R91640**		Analysis Date: **5/13/2024**	SeqNo: **1911468**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.240	0.0500	0.2000	0.04024	99.9	80	120				

Sample ID: **2405116-001AMSD**	SampType: **MSD**	Units: **mg/L**	Prep Date: **5/13/2024**	RunNo: **91640**
Client ID: **Total Sulfides @ 1 Mete**	Batch ID: **R91640**		Analysis Date: **5/13/2024**	SeqNo: **1911469**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.247	0.0500	0.2000	0.04024	103	80	120	0.2400	2.72	20	

Work Order: 2405116
CLIENT: City of Lakewood
Project: Waughop Lake Sampling

QC SUMMARY REPORT

Total Sulfide by SM 4500-S2-D

Sample ID: **2405211-002CDUP** SampType: **DUP** Units: **mg/L** Prep Date: **5/13/2024** RunNo: **91640**
Client ID: **BATCH** Batch ID: **R91640** Analysis Date: **5/13/2024** SeqNo: **1911496**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500						0		20	

Sample ID: **2405211-002CMS** SampType: **MS** Units: **mg/L** Prep Date: **5/13/2024** RunNo: **91640**
Client ID: **BATCH** Batch ID: **R91640** Analysis Date: **5/13/2024** SeqNo: **1911497**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.190	0.0500	0.2000	0.01643	86.7	80	120				

Sample Log-In Check List

Client Name:	COL	Work Order Number:	2405116
Logged by:	Morgan Wilson	Date Received:	5/7/2024 9:36:00 AM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	FedEx		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☑	No ☐	NA ☐
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all hold times (except field parameters, pH e.g.) able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	5.9

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: 05/6/24 | Page: | of:

Laboratory Project No (internal): 2405116

Project Name: Waughop Lake Sampling

Special Remarks: Please send costs to "City of Lakewood"

Please report to Bryan Mohlman at

Email: BryanM@piercecd.org

Client: CIty of Lakewood

Project No:

Address: 6000 Main St.

Collected by: Pierce Conservation District (Graham)

City, State, Zip: Lakewood, WA 98499

Location: Waughop Lake

Telephone: 253-983-7725

Report To (PM): Bryan Mohlman email: bryanm@pierceCD.or

Disposal: Samples will be disposed in 30 days unless otherwise requested.
☐ Retain volume (specify above) ☐ Return to client

Email(s): Wott@cityoflakewood.us

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) / Dissolved (D)	Anions (IC)***	EDB (8011)	Total Sulfides				Comments
1	Total Sulfides @ 1 meter	05/6/24	10:15 Al	W	1											X					
2	Total Sulfides @ 0.5 m from	05/6/24	10:15A	W	1											X					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day _____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x [signature]	Bryan Mohlman	5/6/24 1pm	x [signature]	Gottein-Gipson	5/7/24 9:36
x			x		

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1748224**	**PAGE 1**	
REPORT DATE:	**06/28/24**		
DATE SAMPLED:	**06/03/24**	**DATE RECEIVED:**	**06/04/24**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Waughop 1m	0.037	<0.001	1.32	4.8	4.5

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1748224 **PAGE 2**

REPORT DATE: 06/28/24

DATE SAMPLED: 06/03/24 **DATE RECEIVED:** 06/04/24

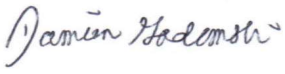
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	SM18 4500PF	SM18 4500PF	SM204500NC	SM1810200H	SM1810200H
DATE ANALYZED	06/10/24	06/05/24	06/11/24	06/28/24	06/28/24
DETECTION LIMIT	0.002	0.001	0.050	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	BATCH	Waughop 1m	Waughop 1m
ORIGINAL	0.007	<0.001	0.351	4.8	4.5
DUPLICATE	0.006	<0.001	0.359	4.3	3.8
RPD	4.98%	NC	2.25%	11.76%	16.87%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	BATCH		
ORIGINAL	0.007	<0.001	0.351		
SPIKED SAMPLE	0.058	0.021	1.41		
SPIKE ADDED	0.050	0.020	1.00		
% RECOVERY	102.83%	105.89%	106.10%	NA	NA
QC CHECK					
FOUND	0.094	0.040	0.443		
TRUE	0.094	0.039	0.469		
% RECOVERY	100.30%	102.56%	94.46%	NA	NA
BLANK	<0.002	<0.001	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:



Damien Gadomski, PhD
Laboratory Manager

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LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1748959**	**PAGE 1**	
REPORT DATE:	**07/19/24**		
DATE SAMPLED:	**07/01/24**	**DATE RECEIVED:**	**07/02/24**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Waughop 1m	0.041	<0.001	1.07	15	6.7

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1748959 **PAGE 2**

REPORT DATE: 07/19/24

DATE SAMPLED: 07/01/24 **DATE RECEIVED:** 07/02/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	SM18 4500PF	SM18 4500PF	SM204500NC	SM1810200H	SM1810200H
DATE ANALYZED	07/08/24	07/03/24	07/15/24	07/12/24	07/12/24
DETECTION LIMIT	0.002	0.001	0.050	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	BATCH	Waughop 1m	Waughop 1m
ORIGINAL	0.004	<0.001	0.329	15	6.7
DUPLICATE	0.004	<0.001	0.334	16	8.0
RPD	4.36%	NC	1.51%	6.90%	17.27%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	BATCH		
ORIGINAL	0.004	<0.001	0.329		
SPIKED SAMPLE	0.056	0.020	1.24		
SPIKE ADDED	0.050	0.020	1.00		
% RECOVERY	103.14%	100.00%	90.60%	NA	NA
QC CHECK					
FOUND	0.094	0.037	0.479		
TRUE	0.094	0.039	0.469		
% RECOVERY	100.30%	94.87%	102.13%	NA	NA
BLANK	<0.002	<0.001	<0.050	NA	NA

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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1749807 **PAGE 1**

REPORT DATE: 09/07/24

DATE SAMPLED: 08/05/24 **DATE RECEIVED:** 08/06/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Waughop 1m	0.056	0.002	11.4	1.21	48.6	7.42

SAMPLE ID	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	CONDUCTIVITY (umhos/cm)
Waughop 1m	0.8476	5.47	50.2	18	6.1	275

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Waughop 1m	8.06	1.18	3.59	25.0	44.7	<1.00

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1749807 **PAGE 2**

REPORT DATE: 09/07/24

DATE SAMPLED: 08/05/24 **DATE RECEIVED:** 08/06/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	08/12/24	08/07/24	08/26/24	08/13/24	08/08/24	08/07/24
DETECTION LIMIT	0.002	0.001	0.250	0.050	1.00	0.10
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	Waughop 1m	
ORIGINAL	0.006	0.003	0.865	0.269	48.6	
DUPLICATE	0.006	0.002	0.763	0.245	50.1	
RPD	1.09%	3.44%	12.60%	9.34%	3.12%	NA
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	0.006	0.003	0.865	0.269		
SPIKED SAMPLE	0.060	0.024	5.46	1.28		
SPIKE ADDED	0.050	0.020	4.50	1.00		
% RECOVERY	107.58%	105.20%	102.02%	100.80%	NA	NA
QC CHECK						
FOUND	0.095	0.042	4.05	0.449	107	
TRUE	0.094	0.039	4.00	0.469	100	
% RECOVERY	101.06%	106.60%	101.25%	95.74%	107.00%	NA
BLANK	<0.002	<0.001	<0.250	<0.050	NA	NA

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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1749807 **PAGE 3**

REPORT DATE: 09/07/24

DATE SAMPLED: 08/05/24 **DATE RECEIVED:** 08/06/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	CONDUCTIVITY (umhos/cm)
METHOD	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H	EPA 120.1
DATE ANALYZED	08/09/24	08/07/24	08/15/24	08/09/24	08/09/24	08/15/24
DETECTION LIMIT	0.0030	0.50	1.00	0.1	0.1	0.10
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.0566	4.83	1.80	6.9	12	613
DUPLICATE	0.0551	4.73	1.84	5.9	13	610
RPD	2.69%	2.20%	2.14%	16.67%	5.41%	0.49%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH			
ORIGINAL	0.0566	4.83	1.80			
SPIKED SAMPLE	0.5298	15.0	11.8			
SPIKE ADDED	0.5000	10.0	10.0			
% RECOVERY	94.64%	101.95%	100.33%	NA	NA	NA
QC CHECK						
FOUND	0.5156	33.0	18.0			1411
TRUE	0.5000	30.0	20.0			1413
% RECOVERY	103.12%	110.00%	90.00%	NA	NA	99.86%
BLANK	<0.0030	<0.50	<1.00	NA	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1749807 **PAGE 4**

REPORT DATE: 09/07/24

DATE SAMPLED: 08/05/24 **DATE RECEIVED:** 08/06/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	08/09/24	08/09/24	08/09/24	08/09/24	08/08/24	08/08/24
DETECTION LIMIT	0.100	0.100	0.500	0.700	1.00	1.00
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	31.0	6.71	2.29	105		
DUPLICATE	31.2	6.76	2.29	106		
RPD	0.65%	0.63%	0.17%	0.64%	NA	NA
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH			
ORIGINAL	31.0	6.71	2.29			
SPIKED SAMPLE	42.7	17.6	12.8			
SPIKE ADDED	10.0	10.0	10.0			
% RECOVERY	117.74%	109.13%	104.91%	NA	NA	NA
QC CHECK						
FOUND	10.9	10.7	10.4	71.2		
TRUE	10.0	10.0	10.0	66.2		
% RECOVERY	108.63%	107.12%	104.38%	107.69%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.700	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

3600 Fremont Ave N
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

City of Lakewood
Bryan Mohlman
6000 Main St
Lakewood, WA 98499

RE: Waughop Lake Sampling,
Work Order Number: 2408069

August 12, 2024

Attention Bryan Mohlman:

Fremont Analytical, Inc, an Alliance Technical Group company, received 2 sample(s) on 8/6/2024 for the analyses presented in the following report.

Total Sulfide by SM 4500-S2-D

All analyses were performed according to our accredited Quality Assurance program. Please contact the laboratory if you should have any questions about the results.

Please note, while the appearance of our logo and branding will update, our commitment to accuracy, speed, and customer service remain values celebrated and shared by Alliance Technical Group. Thank you for the opportunity to serve you.

Sincerely,

Brianna Barnes
Project Manager

DoD-ELAP Accreditation #79636 by PJLA, ISO/IEC 17025:2017 and QSM 5.4 for Environmental Testing
ORELAP Certification: WA 100009 (NELAP Recognized) for Environmental Testing
Washington State Department of Ecology Accredited for Environmental Testing, Lab ID C910

Original

Date: *08/12/2024*

CLIENT: City of Lakewood
Project: Waughop Lake Sampling
Work Order: 2408069

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2408069-001	1m Total Sulfides	08/05/2024 9:25 AM	08/06/2024 9:45 AM
2408069-002	0.5 from bot Total Sulfides	08/05/2024 9:30 AM	08/06/2024 9:45 AM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Original

Case Narrative

WO#: **2408069**

Date: **8/12/2024**

CLIENT: City of Lakewood
Project: Waughop Lake Sampling

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2408069**
Date Reported: **8/12/2024**

CLIENT: City of Lakewood
Project: Waughop Lake Sampling

Lab ID: 2408069-001 **Collection Date:** 8/5/2024 9:25:00 AM
Client Sample ID: **1m Total Sulfides** **Matrix:** Water

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R93564		Analyst: SLL
Sulfide	ND	0.0500		mg/L	1	8/12/2024 10:46:05 AM

Lab ID: 2408069-002 **Collection Date:** 8/5/2024 9:30:00 AM
Client Sample ID: **0.5 from bot Total Sulfides** **Matrix:** Water

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R93564		Analyst: SLL
Sulfide	ND	0.0500		mg/L	1	8/12/2024 10:46:05 AM

Work Order: 2408069
CLIENT: City of Lakewood
Project: Waughop Lake Sampling

QC SUMMARY REPORT

Total Sulfide by SM 4500-S2-D

Sample ID: **MB-R93564**	SampType: **MBLK**	Units: **mg/L**	Prep Date: **8/12/2024**	RunNo: **93564**
Client ID: **MBLKW**	Batch ID: **R93564**		Analysis Date: **8/12/2024**	SeqNo: **1953246**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500									

Sample ID: **LCS-R93564**	SampType: **LCS**	Units: **mg/L**	Prep Date: **8/12/2024**	RunNo: **93564**
Client ID: **LCSW**	Batch ID: **R93564**		Analysis Date: **8/12/2024**	SeqNo: **1953247**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.207	0.0500	0.2000	0	104	80	120				

Sample ID: **2408076-001CDUP**	SampType: **DUP**	Units: **mg/L**	Prep Date: **8/12/2024**	RunNo: **93564**
Client ID: **BATCH**	Batch ID: **R93564**		Analysis Date: **8/12/2024**	SeqNo: **1953251**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.278	0.0500						0.2619	5.98	20	

Sample ID: **2408076-001CMS**	SampType: **MS**	Units: **mg/L**	Prep Date: **8/12/2024**	RunNo: **93564**
Client ID: **BATCH**	Batch ID: **R93564**		Analysis Date: **8/12/2024**	SeqNo: **1953252**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.433	0.0500	0.2000	0.2619	85.7	80	120				

Sample ID: **2408076-001CMSD**	SampType: **MSD**	Units: **mg/L**	Prep Date: **8/12/2024**	RunNo: **93564**
Client ID: **BATCH**	Batch ID: **R93564**		Analysis Date: **8/12/2024**	SeqNo: **1953253**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.430	0.0500	0.2000	0.2619	83.8	80	120	0.4333	0.864	20	

Work Order: 2408069
CLIENT: City of Lakewood
Project: Waughop Lake Sampling

QC SUMMARY REPORT

Total Sulfide by SM 4500-S2-D

Sample ID: **2408139-002BDUP**	SampType: **DUP**			Units: **mg/L**		Prep Date: **8/12/2024**		RunNo: **93564**		
Client ID: **BATCH**	Batch ID: **R93564**					Analysis Date: **8/12/2024**		SeqNo: **1953264**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500						0		20	

Sample ID: **2408139-002BMS**	SampType: **MS**			Units: **mg/L**		Prep Date: **8/12/2024**		RunNo: **93564**		
Client ID: **BATCH**	Batch ID: **R93564**					Analysis Date: **8/12/2024**		SeqNo: **1953265**		
Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.174	0.0500	0.2000	0	86.9	80	120				

Sample Log-In Check List

Client Name:	COL	Work Order Number:	2408069
Logged by:	Morgan Wilson	Date Received:	8/6/2024 9:45:00 AM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	FedEx		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☑	No ☐	NA ☐
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all hold times (except field parameters, pH e.g.) able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☑ No ☐ NA ☐

Person Notified:	Bryan Mohlman	Date:	8/6/2024
By Whom:	Morgan Wilson	Via:	☑ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:	Run Per Historical - Total Sulfide		
Client Instructions:	Proceed per Historical		

17. Additional remarks:

Item Information

Item #	Temp ºC
Sample	6.0

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Chain of Custody Record & Laboratory Services Agreement

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Date: 08/05/2024 Page: 1 of: 1

Laboratory Project No (internal): 2408069

Project Name: Waughop Lake Sampling

Special Remarks: Please invoice City of Lakewood and report findings to me at BryanM@PierceCD.org

Client: City of Lakewood

Project No:

Address: 6000 Main St.

Collected by: Pierce Conservation District

City, State, Zip: Lakewood, WA, 98371

Location: Waughop Lake, Lakewood WA

Telephone: 253-983-7725

Report To (PM): Bryan Mohlman; BryanM@PierceCD.org

Disposal: Samples will be disposed in 30 days unless otherwise requested. ☐ Retain volume (specify above) ☐ Return to client

Email(s): Wott@cityoflakewood.us; BryanM@piercecd.org

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	Comments
1	1m Total Sulfides	08/05/24	9:25	W													
2	0.5 from bot Total Sulfides	08/05/24	9:30	W													
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x	Jaqueline Breuden	08/05/24	x	Briana Ballard	8/6 9:45AM
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

Chain of Custody Record & Laboratory Services Agreement

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Date: 08/05/2024 Page: 1 of: 1

Laboratory Project No (internal): 2408069

Project Name: Waughop Lake Sampling

Special Remarks: Please invoice City of Lakewood and report findings to me at BryanM@PierceCD.org

Update per historical & BM -mw 8/6/24

Client: City of Lakewood

Project No:

Address: 6000 Main St.

Collected by: Pierce Conservation District

City, State, Zip: Lakewood, WA, 98371

Location: Waughop Lake, Lakewood WA

Telephone: 253-983-7725

Report To (PM): Bryan Mohlman; BryanM@PierceCD.org

Disposal: Samples will be disposed in 30 days unless otherwise requested. ☐ Retain volume (specify above) ☐ Return to client

Email(s): Wott@cityoflakewood.us; BryanM@piercecd.org

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8) Total (T) | Dissolved (D)	Anions (IC)***	EDB (8011)	Total Sulfide				Comments
1	1m Total Sulfides	08/05/24	9:25	W													X				
2	0.5 from bot Total Sulfides	08/05/24	9:30	W													X				
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☒ Standard ☐ Next Day ☐ 3 Day ☐ Same Day ☐ 2 Day (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x	Jaqueline Greuden	08/05/24	x	Briana Ballard	8/6 9:45AM
Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x			x		

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1750639**	**PAGE 1**	
REPORT DATE:	**09/28/24**		
DATE SAMPLED:	**09/09/24**	**DATE RECEIVED:**	**09/10/24**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Waughop 1m	0.051	0.002	1.22	33	4.9

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1750639 **PAGE 2**

REPORT DATE: 09/28/24

DATE SAMPLED: 09/09/24 **DATE RECEIVED:** 09/10/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	SM18 4500PF	SM18 4500PF	SM204500NC	SM1810200H	SM1810200H
DATE ANALYZED	09/16/24	09/11/24	09/18/24	09/17/24	09/17/24
DETECTION LIMIT	0.002	0.001	0.050	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.006	0.007	0.298	0.7	0.5
DUPLICATE	0.006	0.008	0.304	0.6	0.5
RPD	0.81%	9.77%	1.99%	15.38%	14.29%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	BATCH		
ORIGINAL	0.006	0.007	0.298		
SPIKED SAMPLE	0.056	0.026	1.27		
SPIKE ADDED	0.050	0.020	1.00		
% RECOVERY	101.16%	95.98%	97.10%	NA	NA
QC CHECK					
FOUND	0.094	0.039	0.448		
TRUE	0.094	0.039	0.469		
% RECOVERY	100.30%	100.00%	95.52%	NA	NA
BLANK	<0.002	<0.001	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1751398**	**PAGE 1**	
REPORT DATE:	**11/11/24**		
DATE SAMPLED:	**10/07/24**	**DATE RECEIVED:**	**10/08/24**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Waughop 1m	0.048	0.005	1.26	26	3.0

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1751398 **PAGE 2**

REPORT DATE: 11/11/24

DATE SAMPLED: 10/07/24 **DATE RECEIVED:** 10/08/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	SM18 4500PF	SM18 4500PF	SM204500NC	SM1810200H	SM1810200H
DATE ANALYZED	10/14/24	10/10/24	10/15/24	10/29/24	10/29/24
DETECTION LIMIT	0.002	0.001	0.050	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.058	0.002	0.196	44	8.7
DUPLICATE	0.058	0.002	0.197	40	8.5
RPD	0.16%	0.50%	0.51%	8.51%	2.06%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	BATCH		
ORIGINAL	0.058	0.002	0.196		
SPIKED SAMPLE	0.108	0.022	1.21		
SPIKE ADDED	0.050	0.020	1.00		
% RECOVERY	99.73%	100.92%	101.70%	NA	NA
QC CHECK					
FOUND	0.095	0.040	0.434		
TRUE	0.094	0.039	0.469		
% RECOVERY	101.06%	102.56%	92.54%	NA	NA
BLANK	<0.002	<0.001	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1752340 **PAGE 1**

REPORT DATE: 12/05/24

DATE SAMPLED: 11/08/24 **DATE RECEIVED:** 11/08/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
Waughop 1m	0.052	0.002	20.7	1.08	47.2	7.38

SAMPLE ID	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	CONDUCTIVITY (umhos/cm)
Waughop 1m	0.5930	4.62	38.2	49	14	262

SAMPLE ID	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
Waughop 1m	6.67	1.11	3.82	21.2	43.1	<1.00

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1752340 **PAGE 2**

REPORT DATE: 12/05/24

DATE SAMPLED: 11/08/24 **DATE RECEIVED:** 11/08/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	DOC (mg/L)	TOTAL-N (mg/L)	ALKALINITY (mgCaCO3/L)	pH
METHOD	SM20 4500PF	SM20 4500PF	EPA 415.1	SM204500NC	SM20 2320B	EPA 150.1
DATE ANALYZED	11/12/24	11/08/24	11/12/24	11/12/24	11/14/24	11/08/24
DETECTION LIMIT	0.002	0.001	0.250	0.050	1.00	0.10
DUPLICATE						
SAMPLE ID	BATCH	Waughop 1m	BATCH	BATCH	Waughop 1m	
ORIGINAL	0.002	0.002	<0.250	0.221	47.2	
DUPLICATE	0.002	0.002	<0.250	0.235	46.4	
RPD	0.74%	2.04%	NC	6.14%	1.71%	NA
SPIKE SAMPLE						
SAMPLE ID	BATCH	Waughop 1m	BATCH	BATCH		
ORIGINAL	0.002	0.002	<0.250	0.221		
SPIKED SAMPLE	0.056	0.021	4.46	1.11		
SPIKE ADDED	0.050	0.020	4.50	1.00		
% RECOVERY	107.56%	95.37%	99.16%	88.71%	NA	NA
QC CHECK						
FOUND	0.094	0.042	3.85	0.468	105	
TRUE	0.094	0.039	4.00	0.469	100	
% RECOVERY	100.00%	106.60%	96.25%	99.79%	105.00%	NA
BLANK	<0.002	<0.001	<0.250	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1752340 **PAGE 3**

REPORT DATE: 12/05/24

DATE SAMPLED: 11/08/24 **DATE RECEIVED:** 11/08/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL ALUMINUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)	CONDUCTIVITY (umhos/cm)
METHOD	EPA 200.8	EPA 325.3	EPA 375.4	SM2010200H	SM2010200H	EPA 120.1
DATE ANALYZED	11/13/24	11/18/24	11/13/24	11/13/24	11/13/24	11/18/24
DETECTION LIMIT	0.0030	0.50	1.00	0.1	0.1	0.10
DUPLICATE						
SAMPLE ID	BATCH	BATCH	Waughop 1m	BATCH	BATCH	BATCH
ORIGINAL	<0.0030	225	38.2	5.3	2.9	1387
DUPLICATE	<0.0030	228	39.1	5.3	2.9	1381
RPD	NC	0.93%	2.17%	0.00%	0.00%	0.43%
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	Waughop 1m			
ORIGINAL	<0.0030		38.2			
SPIKED SAMPLE	0.5125		77.1			
SPIKE ADDED	0.5000		40.0			
% RECOVERY	102.50%	OR	97.12%	NA	NA	NA
QC CHECK						
FOUND	0.4988	29.2	9.13			1411
TRUE	0.5000	30.0	10.0			1413
% RECOVERY	99.76%	97.33%	91.30%	NA	NA	99.86%
BLANK	<0.0030	<0.50	<1.00	NA	NA	NA

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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1752340 **PAGE 4**

REPORT DATE: 12/05/24

DATE SAMPLED: 11/08/24 **DATE RECEIVED:** 11/08/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	CALCIUM (mg/l)	MAGNESIUM (mg/l)	POTASSIUM (mg/l)	HARDNESS (mgCaCO3/l)	HCO3 (mgCaCO3/l)	CO3 (mgCaCO3/l)
METHOD	EPA 200.7	EPA 200.7	EPA 200.7	SM18 2340B	EPA 310.1	EPA 310.1
DATE ANALYZED	11/13/24	11/13/24	11/13/24	11/13/24	11/13/24	11/13/24
DETECTION LIMIT	0.100	0.100	0.500	0.700	1.00	1.00
DUPLICATE						
SAMPLE ID	BATCH	BATCH	BATCH	BATCH		
ORIGINAL	65.2	12.4	2.32	214		
DUPLICATE	65.0	12.3	2.30	213		
RPD	0.32%	0.40%	1.10%	0.34%	NA	NA
SPIKE SAMPLE						
SAMPLE ID	BATCH	BATCH	BATCH			
ORIGINAL	65.2	12.4	2.32			
SPIKED SAMPLE	76.2	23.0	12.9			
SPIKE ADDED	10.0	10.0	10.0			
% RECOVERY	110.11%	106.40%	105.63%	NA	NA	NA
QC CHECK						
FOUND	10.5	10.6	10.5	69.7		
TRUE	10.0	10.0	10.0	66.2		
% RECOVERY	104.52%	105.79%	105.00%	105.31%	NA	NA
BLANK	<0.100	<0.100	<0.500	<0.700	NA	NA

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OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski

Damien Gadomski, PhD
Laboratory Manager

3600 Fremont Ave N
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

City of Lakewood
Bryan Mohlman
6000 Main St
Lakewood, WA 98499

RE: Waughop Lake Sampling,
Work Order Number: 2411161

November 15, 2024

Attention Bryan Mohlman:

Fremont Analytical, Inc, an Alliance Technical Group company, received 2 sample(s) on 11/8/2024 for the analyses presented in the following report.

Total Sulfide by SM 4500-S2-D

All analyses were performed according to our accredited Quality Assurance program. Please contact the laboratory if you should have any questions about the results.

Please note, while the appearance of our logo and branding will update, our commitment to accuracy, speed, and customer service remain values celebrated and shared by Alliance Technical Group. Thank you for the opportunity to serve you.

Sincerely,

Brianna Barnes
Project Manager

DoD-ELAP Accreditation #79636 by PJLA, ISO/IEC 17025:2017 and QSM 5.4 for Environmental Testing
ORELAP Certification: WA 100009 (NELAP Recognized) for Environmental Testing
Washington State Department of Ecology Accredited for Environmental Testing, Lab ID C910

Original

Date: *11/15/2024*

CLIENT: City of Lakewood
Project: Waughop Lake Sampling
Work Order: 2411161

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2411161-001	1m Total Sulfides	11/08/2024 12:00 AM	11/08/2024 12:19 PM
2411161-002	0.5 from bottom TS	11/08/2024 12:00 AM	11/08/2024 12:19 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2411161**

Date: **11/15/2024**

CLIENT: City of Lakewood

Project: Waughop Lake Sampling

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Results are reported on a wet weight basis unless dry-weight correction is denoted in the units field on the analytical report ("mg/kg-dry" or "ug/kg-dry").

Matrix Spike (MS) and MS Duplicate (MSD) samples are tested from an analytical batch of "like" matrix to check for possible matrix effect. The MS and MSD will provide site specific matrix data only for those samples which are spiked by the laboratory. The sample chosen for spike purposes may or may not have been a sample submitted in this sample delivery group. The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS) and the Method Blank (MB). The LCS and the MB are processed with the samples and the MS/MSD to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

CLIENT: City of Lakewood
Project: Waughop Lake Sampling

Lab ID: 2411161-001 **Collection Date:** 11/8/2024
Client Sample ID: **1m Total Sulfides** **Matrix:** Water

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R95602		Analyst: BB
Sulfide	0.0520	0.0500		mg/L	1	11/11/2024 8:49:51 AM

Lab ID: 2411161-002 **Collection Date:** 11/8/2024
Client Sample ID: **0.5 from bottom TS** **Matrix:** Water

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Total Sulfide by SM 4500-S2-D				Batch ID: R95602		Analyst: BB
Sulfide	0.0520	0.0500		mg/L	1	11/11/2024 8:49:51 AM

Work Order: 2411161
CLIENT: City of Lakewood
Project: Waughop Lake Sampling

QC SUMMARY REPORT

Total Sulfide by SM 4500-S2-D

Sample ID: **MB-R95602**	SampType: **MBLK**	Units: **mg/L**	Prep Date: **11/11/2024**	RunNo: **95602**
Client ID: **MBLKW**	Batch ID: **R95602**		Analysis Date: **11/11/2024**	SeqNo: **1995109**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	ND	0.0500									

Sample ID: **LCS-R95602**	SampType: **LCS**	Units: **mg/L**	Prep Date: **11/11/2024**	RunNo: **95602**
Client ID: **LCSW**	Batch ID: **R95602**		Analysis Date: **11/11/2024**	SeqNo: **1995110**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.194	0.0500	0.2000	0	96.8	80	120				

Sample ID: **2411161-001ADUP**	SampType: **DUP**	Units: **mg/L**	Prep Date: **11/11/2024**	RunNo: **95602**
Client ID: **1m Total Sulfides**	Batch ID: **R95602**		Analysis Date: **11/11/2024**	SeqNo: **1995112**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.0545	0.0500						0.05200	4.67	20	

Sample ID: **2411161-001AMS**	SampType: **MS**	Units: **mg/L**	Prep Date: **11/11/2024**	RunNo: **95602**
Client ID: **1m Total Sulfides**	Batch ID: **R95602**		Analysis Date: **11/11/2024**	SeqNo: **1995113**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.215	0.0500	0.2000	0.05200	81.4	80	120				

Sample ID: **2411161-001AMSD**	SampType: **MSD**	Units: **mg/L**	Prep Date: **11/11/2024**	RunNo: **95602**
Client ID: **1m Total Sulfides**	Batch ID: **R95602**		Analysis Date: **11/11/2024**	SeqNo: **1995114**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Sulfide	0.217	0.0500	0.2000	0.05200	82.6	80	120	0.2147	1.15	20	

Sample Log-In Check List

Client Name:	COL	Work Order Number:	2411161
Logged by:	Morgan Wilson	Date Received:	11/8/2024 12:19:00 PM

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
4.	Was an attempt made to cool the samples?	Yes ☑	No ☐	NA ☐
5.	Were all items received at a temperature of >2°C to 6°C *	Yes ☑	No ☐	NA ☐
6.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
7.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
8.	Are samples properly preserved?	Yes ☑	No ☐	
9.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
10.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
11.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
12.	Does paperwork match bottle labels?	Yes ☑	No ☐	
13.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
14.	Is it clear what analyses were requested?	Yes ☑	No ☐	
15.	Were all hold times (except field parameters, pH e.g.) able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified:		Date:	
By Whom:		Via:	☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding:			
Client Instructions:			

17. Additional remarks:

Item Information

Item #	Temp °C
Sample	0.2

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical
An Alliance Technical Group Company
3600 Fremont Ave N.
Seattle, WA 98103
Tel: 206-352-3790

Chain of Custody Record & Laboratory Services Agreement

Date: 11/8/24 Page: 1 of: 1

Laboratory Project No (internal): 2411161

Project Name: Waughop lake Sampling

Special Remarks: Please invoice City of Lakewood and report findings to me at BryanM@piercecd.org

Client: City of Lakewood

Project No:

Address: 6000 Main St

Collected by: Pierce conservation district

City, State, Zip: Lakewood, WA, 98371

Location: Waughop Lake, Lakewood WA

Telephone: 253-983-7725

Report To (PM): Bryan Mohlman; BryanM@piercecd.org

Disposal: Samples will be disposed in 30 days unless otherwise requested. ☐ Retain volume (specify above) ☐ Return to client

Email(s): Wolf@cityoflakewood.us; BryanM@piercecd.org

	Sample Name	Sample Date	Sample Time	Sample Type (Matrix)*	# of Cont.	VOCs (EPA 8260 / 624)	BTEX	Gasoline Range Organics (GX)	Hydrocarbon Identification (HCID)	Diesel/Heavy Oil Range Organics (DX)	SVOCs (EPA 8270 / 625)	PAHs (EPA 8270 - SIM)	PCBs (EPA 8082 / 608)	Metals** (EPA 6020 / 200.8)	Total (T)	Dissolved (D)	Anions (IC)***	EDB (8011)	Total Sulfides			Comments
1	1m total sulfides	11/8/24		W																		
2	0.5 from bottom TS	11/8/24		W																		
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						

*Matrix: A = Air, AQ = Aqueous, B = Bulk, O = Other, P = Product, S = Soil, SD = Sediment, SL = Solid, W = Water, DW = Drinking Water, GW = Ground Water, SW = Storm Water, WW = Waste Water

**Metals (Circle): MTCA-5 RCRA-8 Priority Pollutants TAL *Individual:* Ag Al As B Ba Be Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Sr Sn Ti Tl V Zn

***Anions (Circle): Nitrate Nitrite Chloride Sulfate Bromide O-Phosphate Fluoride Nitrate+Nitrite

Turn-around Time:
☐ Standard ☐ Next Day
☐ 3 Day ☐ Same Day
☐ 2 Day ☐ _____ (specify)

I represent that I am authorized to enter into this Agreement with Fremont Analytical on behalf of the Client named above, that I have verified Client's agreement to each of the terms on the front and backside of this Agreement.

Relinquished (Signature)	Print Name	Date/Time	Received (Signature)	Print Name	Date/Time
x	Jaqueline Snaden	11/8/24 12:18	x	Briana Ballard	11/8 12:19pm
x			x		

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	**1752954**		**PAGE 1**
REPORT DATE:	**12/12/24**		
DATE SAMPLED:	**12/02/24**	**DATE RECEIVED:**	**12/03/24**

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

CASE NARRATIVE

One water sample was received by the laboratory in good condition and analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
Waughop 1m	0.051	<0.001	1.66	109	7.3

IEH ANALYTICAL LABORATORIES

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: 1752954 **PAGE 2**

REPORT DATE: 12/12/24

DATE SAMPLED: 12/02/24 **DATE RECEIVED:** 12/03/24

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM PIERCE CONSERVATION DISTRICT

QA/QC DATA

QC PARAMETER	TOTAL-P (mg/L)	SRP (mg/L)	TOTAL-N (mg/L)	CHLOR_a (ug/L)	PHAEO_a (ug/L)
METHOD	SM18 4500PF	SM18 4500PF	SM204500NC	SM1810200H	SM1810200H
DATE ANALYZED	12/09/24	12/04/24	12/10/24	12/11/24	12/11/24
DETECTION LIMIT	0.002	0.001	0.050	0.1	0.1
DUPLICATE					
SAMPLE ID	BATCH	BATCH	BATCH	BATCH	BATCH
ORIGINAL	0.007	<0.001	0.207	111	11
DUPLICATE	0.007	<0.001	0.193	105	9.5
RPD	1.59%	NC	7.00%	4.94%	14.86%
SPIKE SAMPLE					
SAMPLE ID	BATCH	BATCH	BATCH		
ORIGINAL	0.007	<0.001	0.207		
SPIKED SAMPLE	0.057	0.021	1.29		
SPIKE ADDED	0.050	0.020	1.00		
% RECOVERY	100.74%	105.00%	108.30%	NA	NA
QC CHECK					
FOUND	0.095	0.039	0.437		
TRUE	0.094	0.039	0.469		
% RECOVERY	101.06%	100.00%	93.18%	NA	NA
BLANK	<0.002	<0.001	<0.050	NA	NA

RPD = RELATIVE PERCENT DIFFERENCE.
NA = NOT APPLICABLE OR NOT AVAILABLE.
NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES BEING BELOW THE DETECTION LIMIT.
OR = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE OR SPIKE TOO LOW RELATIVE TO SAMPLE CONCENTRATION.

SUBMITTED BY:

Damien Gadomski, PhD
Laboratory Manager