2020 Annual Wastewater Treatment Plant Report

Resort Municipality of Whistler Wastewater Treatment Plant

Operational Certificate ME-01452

WHISTLER

Table of Contents

1.0 INTRODUCTION

Per section 3.6 Reporting of the Operation Certificate ME-01452 for the Resort Municipality of Whistler's (RMOW) Waste Water Treatment Plant (WWTP), the intent of this document is to report discharge and receiving environment data for the operating period. The report includes trend analysis data and interpretation from the receiving environment for the reported operating year and in comparison to previous years, in regards to the potential impact to the receiving environment. The report will also outline the past years achievement in regards to source control, water conservation programs, and environmental impact programs.

2.0 MONITORING AND REPORTING REQUIREMENTS

Per section 3.0 (Monitoring and Reporting Requirements) of the operational certificate, monitoring samples are taken by staff and collected for the WWTP to monitor discharge, receiving environment outfall and trucked waste.

Table 1 below highlights the samples taken and their frequency.

Table 1: Discharge Monitoring Sampling Parameters

Parameter	Unit of measure	Frequency	Sample Type
Chlorine residual *	mg/L	Daily	Grab
TSS	mg/L	5 times per week	Composite
Orthophosphate (as phosphorus)	mg/L	5 times per week	Composite
CBOD5**	mg/L	2 times per week	Composite
Fecal Coliform*	MPN/100mL	2 times per week	Grab
Total phosphorus	mg/L	Weekly	Composite
Iron	mg/L	Monthly	Composite
Fish Bioassay (rainbow trout) 96 hour LC50, %	% survival rate	2 times per year	Grab
Effluent volume discharge	m_3/day	1 per day over a 24 period	Composite

*if chlorine is used between May 15 and September 15 only

**COD may be used in place of $CBOD_5$ if $CBOD_5$ is examined with every 5^{th} sample

Table 2 highlights the sampling parameter requirements for the receiving environment.

Table 2: Receiving Environment Monitoring Sampling Parameters

Parameter	Unit of measure	Sample Type	Frequency
pH	-	3 times per year; winter low flow, spring freshet & fall flow	Grab
Conductivity	µmho/cm	3 times per year; winter low flow, spring freshet & fall flow	Grab
Turbidity	TU	3 times per year; winter low flow, spring freshet & fall flow	Grab
Orthophosphate (as phosphorus)	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab
Nitrate nitrogen	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab
Nitrite nitrogen	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab
Ammonia nitrogen	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab
Nitrate+Nitrite as N	mg/L	3 times per year; winter low flow, spring freshet & fall flow	Grab

Permit Excursions

The WWTP tracks and monitors the number of permit excursions that occur during the reporting period (Figure 1). For the reporting period, four (4) permit excursions were recorded per section 1.1.3 Nutrient loading for the discharge from May 15 – September 15 inclusive of Orthophosphate (as phosphorus) 36.6 kg/month maximum. The excursions are discussed further below. The Notices of Non-Compliance is attached in Appendix A.

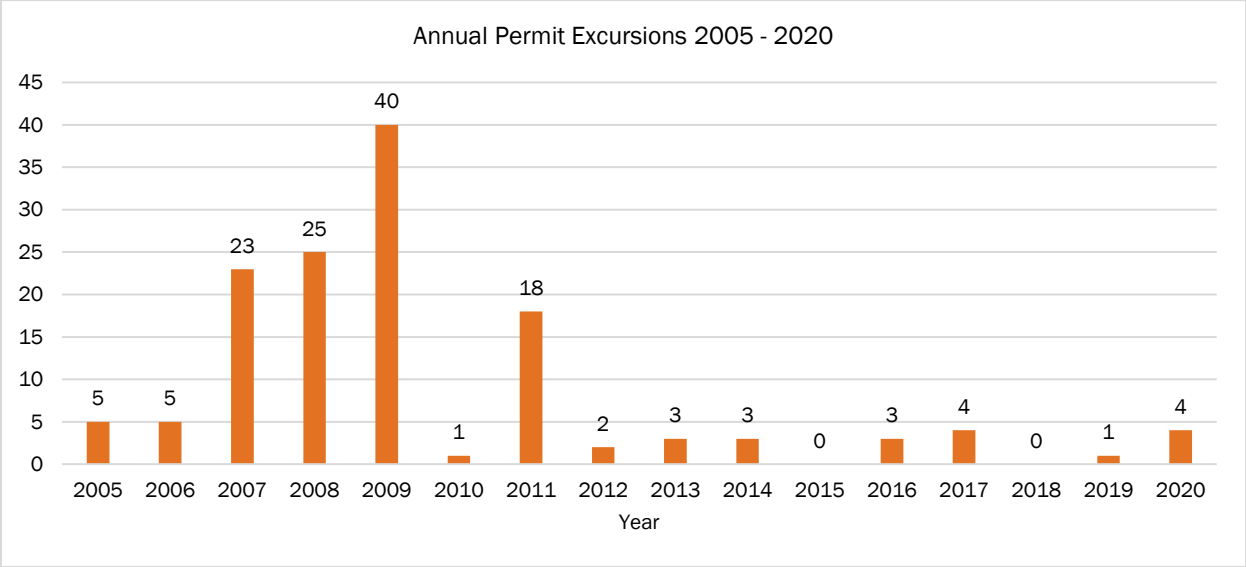


Figure 1: Quantity of Permit Excursions per year 2005-2020

Outfall Inspections

Section 3.4 of the Operational Certificate requires the outfall to be inspected once every **five** years by independent qualified personnel to ensure that it is in good condition.

The last outfall inspection was conducted by Cascade Environmental Resource Group in 2018. Recommendations from that inspection to cut back shrub vegetation were completed, and this task now forms part of preventative maintenance program for the outfall.

The next outfall inspection will be in 2023.

Website

Quarterly monitoring data is posted on an annual basis to the Resort Municipality of Whistler's website https://www.whistler.ca/services/water-and-wastewater/wastewater-treatment-plant.

Facility Staffing

The RMOW WWTP facility staff qualifications met EOCP requirements (Table 3) for the report period.

Table 3: WWTP faclility staffing list and certifications

Name	Position	Certification
Chris Wike	Utilities Group Manager (Acting)	
Wayne Dennien	Utilities Superintendent (Acting)	
Jenny James	Chief Operator Wastewater	
Elizabeth Toole	Operator IV	EOCP Level IV Municipal Wastewater Treatment
Hamish (Ty) MacFayden	Operator III	EOCP Level III Municipal Wastewater Treatment
Paul Kozin	Operator II	EOCP Level II Municipal Wastewater Treatment
Ahren Snikvalds	Operator I	EOCP Level I Municipal Wastewater Treatment
Kyle Quesnel	Operator I	EOCP Level I Municipal Wastewater Treatment
Ian McKeachie	Operator I	EOCP Small Water and Wastewater Systems
Trent Skatch	Operator I	EOCP Level I Municipal Wastewater Collection
Neil Kearns	Lab Technician	EOCP Level II Municipal Wastewater Treatment
Bruce Eckersley	Millwright	Red Seal Certified Millwright

Other Achievements

During the report period, no volume of effluent bypassed the WWTP as the raw sewage bypass line had been remove in 2010. Further to this, the operation had no emergency shut downs and zero (0) trucks were turned away due to hazardous waste.

The effluent treated by the WWTP is used to produce heat for the RMOW's District Energy System. This system provides radiant heat through its system to the residents and businesses of Cheakamus Crossing neighborhood of the RMOW.

3.0 DISCHARGE DISCUSSION AND ANALYSIS

Discharge Volume

The year is split into two seasons for purposes of reporting discharge. The dry season runs from May 15 – September 15 (inclusive), while the wet season is defined as January 1 – May 14 and September 16 – December 31.

Maximum allowable discharge during the dry season is 16,000 m^3/day while the maximum allowable discharge during the wet season is 25,000 m^3/day.

The average discharge during the dry season was 8,031 m^3/day and the average discharge during the wet season was 9,945 m^3/day.

The effluent discharge limit was exceeded once during the wet season on February 1st. The discharge on this day was 26,793 m^3.

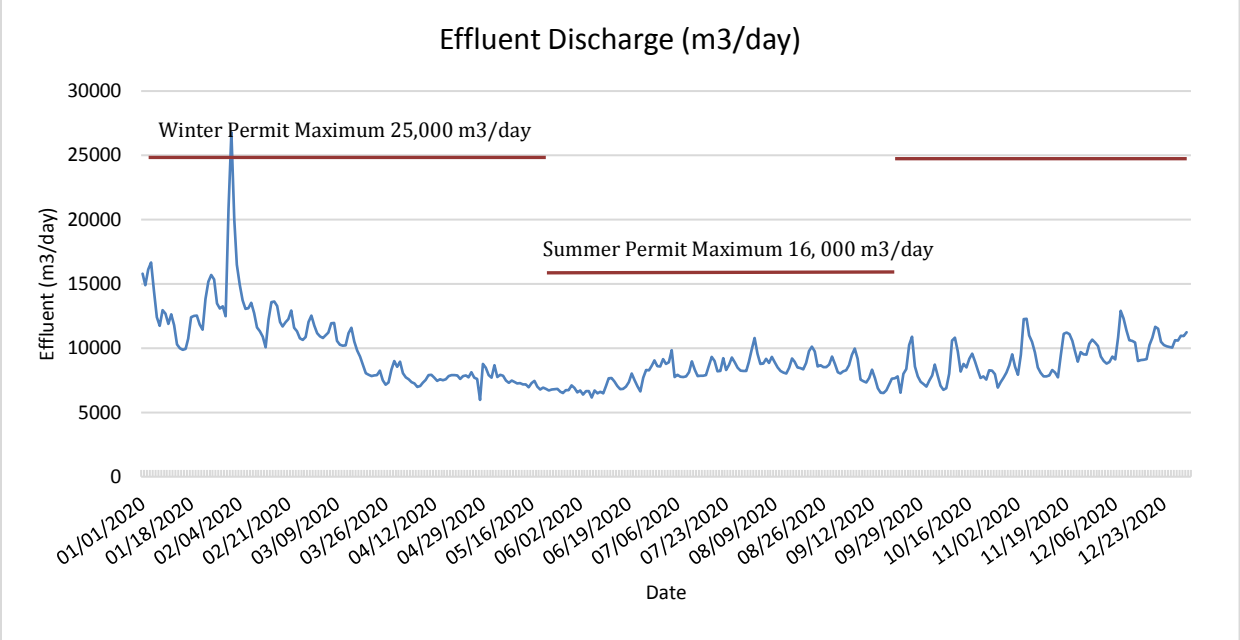


Figure 2: Whistler Wastewater Treatment Plant Daily Effluent Discharge Volume (m3/day) 2020

Table 4: Average and maximum daily discharge (m3) wet and dry values by year 2004-2020

Year	Max Discharge Dry	Max Discharge Wet	Month Max Discharge Dry	Month Max Discharge Wet
2004	10,160	14,681	August	January
2005	12,238	13,720	August	December
2005	11,402	17,174	July	January
2006	13,742	19,731	July	December
2007	13,991	24,247	August	March
2008	12,891	17,568	August	December
2009	11,623	17,859	June	April
2010	12,891	22,855	August	January
2011	12,153	19,472	July	January
2012	13,397	20,575	June	January
2013	12,525	19,351	June	March
2014	11,646	25,070	August	December
2015	11,447	25,019	August	February
2016	12,119	21,284	August	February
2017	11,670	19,852	July	March
2018	11,395	16,927	August	December
2019	11,535	15,670	June	March
2020	10,780	26,793	August	February

Orthophosphate as Phosphorous P04-P

Orthophosphate as Phosphorous P04-P concentration is permitted in discharge to a maximum of 1.75mg/L.

This was exceeded during a 3 day period from 21 May - 23 May, with respective values of 2.28 mg/L, 2.19 mg/L and 2.21 mg/L. This is shown below in Figure 3.

Figure 4 shows the final effluent total for the dry season on a monthly basis (the dry season defined as May 15 – September 15 inclusive). The total nutrient loading maximum for the discharge is 36.6 kg/month. This was exceeded 4 times in 2020:

- May 15 – June 14: Exceeded by 108.4kg for a total sum of 145.0kg
- June 15 – July 14: Exceeded by 2.7kg for a total sum of 39.3kg
- July 15 – August 14: Exceeded by 22.2kg for a total sum of 58.8kg
- August 15 – September 15: Exceeded by 7.6kg for a total sum of 44.2 kg

These environmental non-compliances were reported to the Ministry of Environment, and are attached in Appendix A.

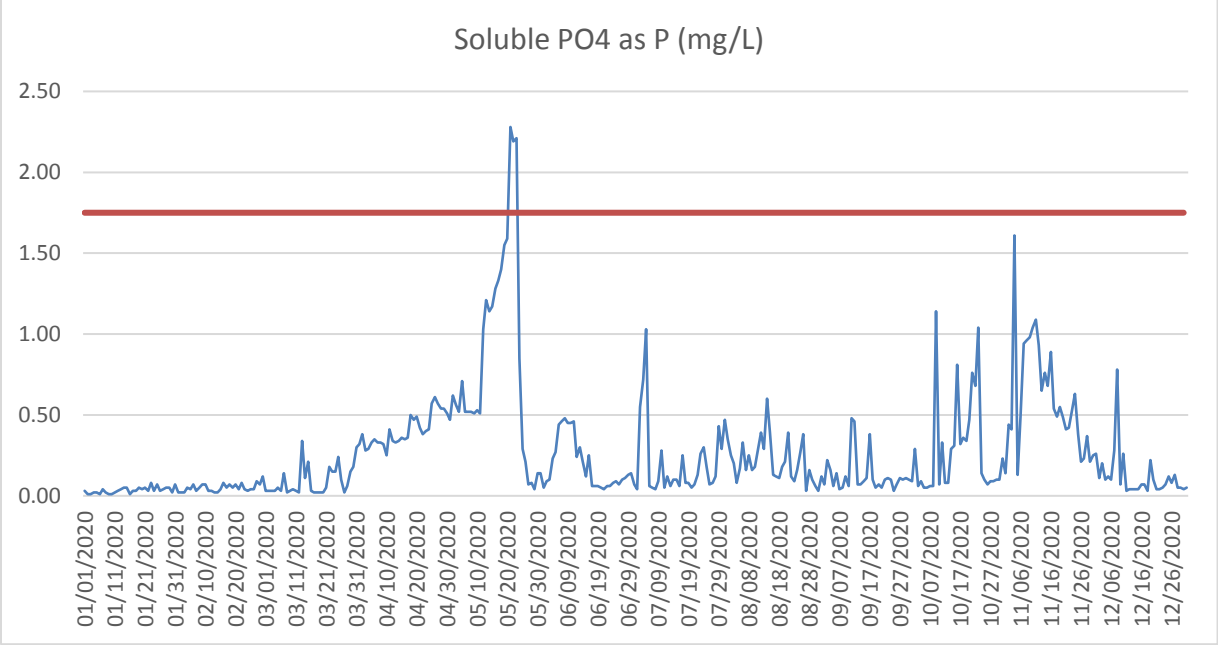


Figure 3: 2020 Final effluent daily Phosphorus (PO4-P) concentrations (mg/L)

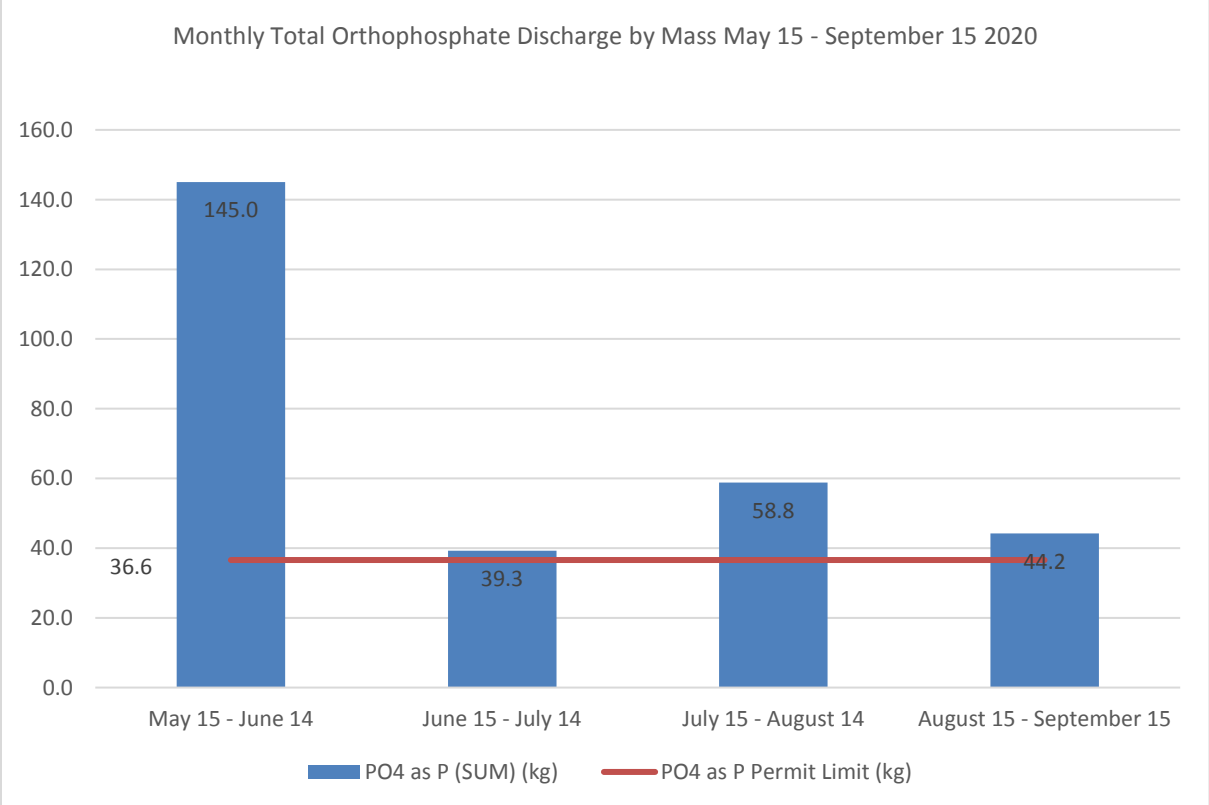


Figure 4: Final effluent total Phosphorus (PO4-P) discharge by month May 15 - September 15 2020

Total Phosphorous – Laboratory Results

Weekly final effluent samples are submitted to a certified laboratory for total phosphorous concentration analysis.

Figure 5 shows the laboratory results when compared to the limit (1.75mg/L). As per the lab results, this limit was exceeded once. This occurred on the November 4 sample, with a result of 1.85mg/L (0.1 mg above the limit).

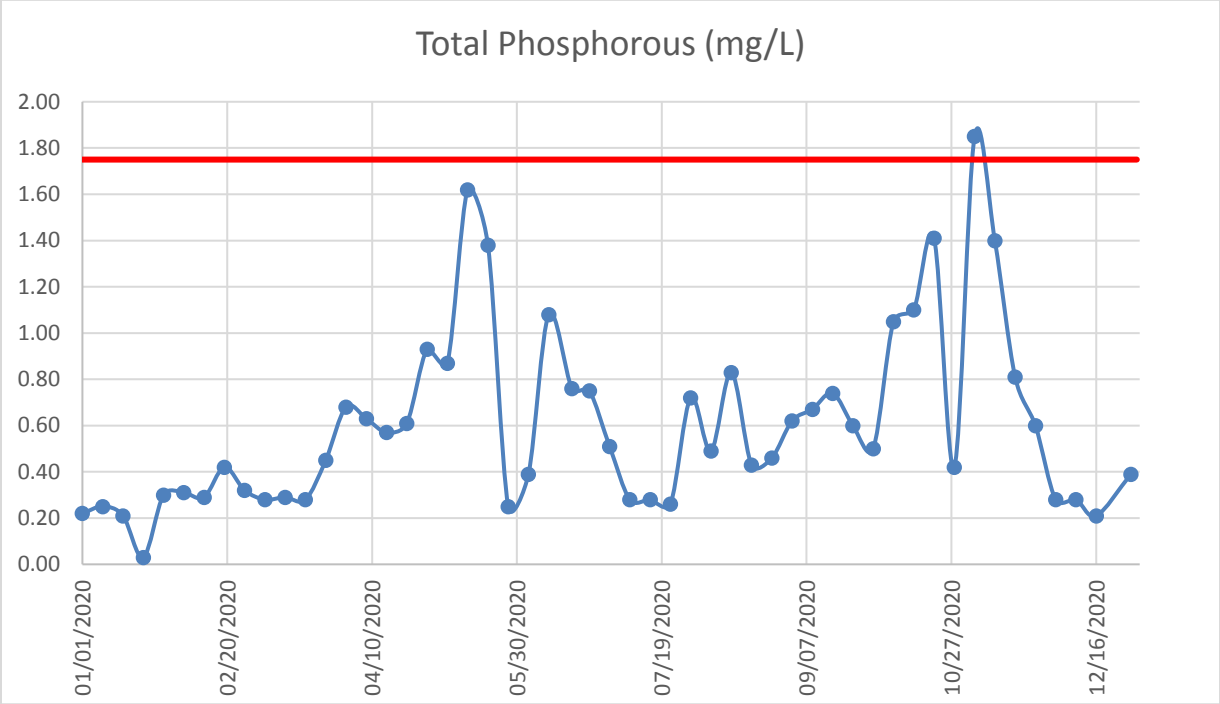


Figure 5: 2020 Final Effluent Weekly Phosphorous (PO4-P) Concentration Weekly Laboratory Data

Total Suspended Solids

Total suspended solids in monitored and reported daily. As per Section 1.1.2 of the Operational Certificate, the maximum limit is 40 mg/L.

In 2020 the Total Suspended Solids concentration did not exceed the permitted level, as highlighted in Figure 6.

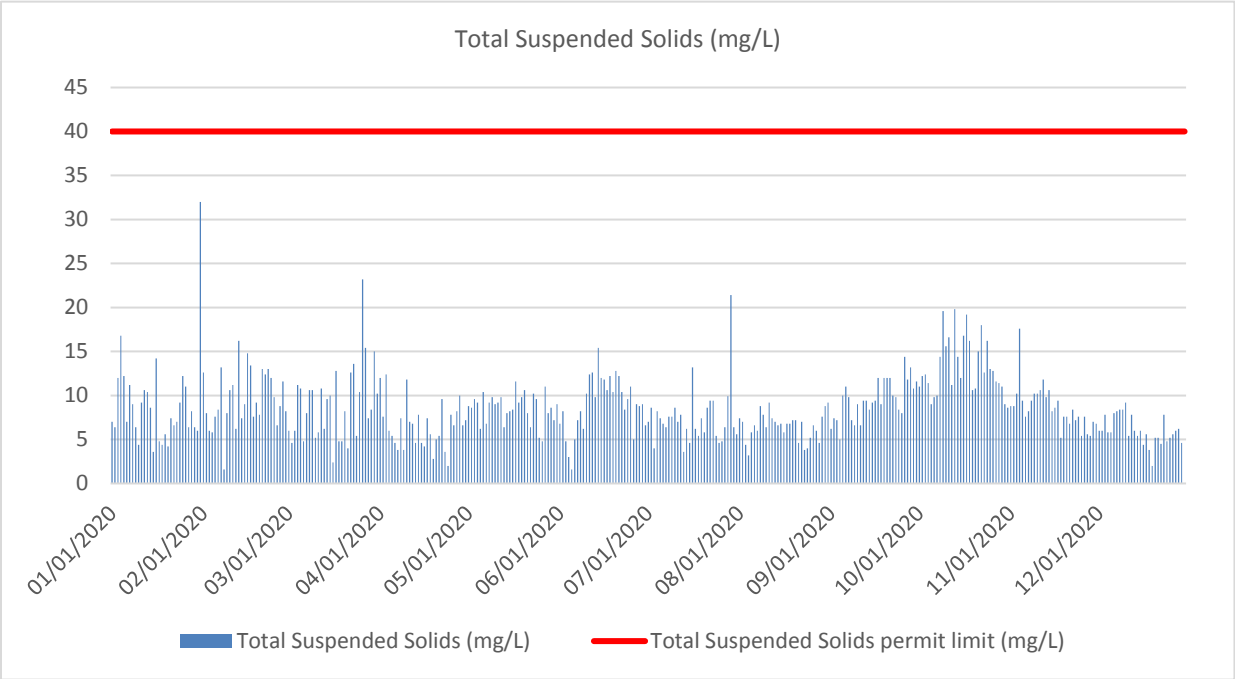


Figure 6: Daily Total Suspended Solids (mg/L) 2020

Figure 7 highlights the average Total Suspended Solids year on year from 2005 to 2020. The average TSS for 2020 was 9 mg/L.

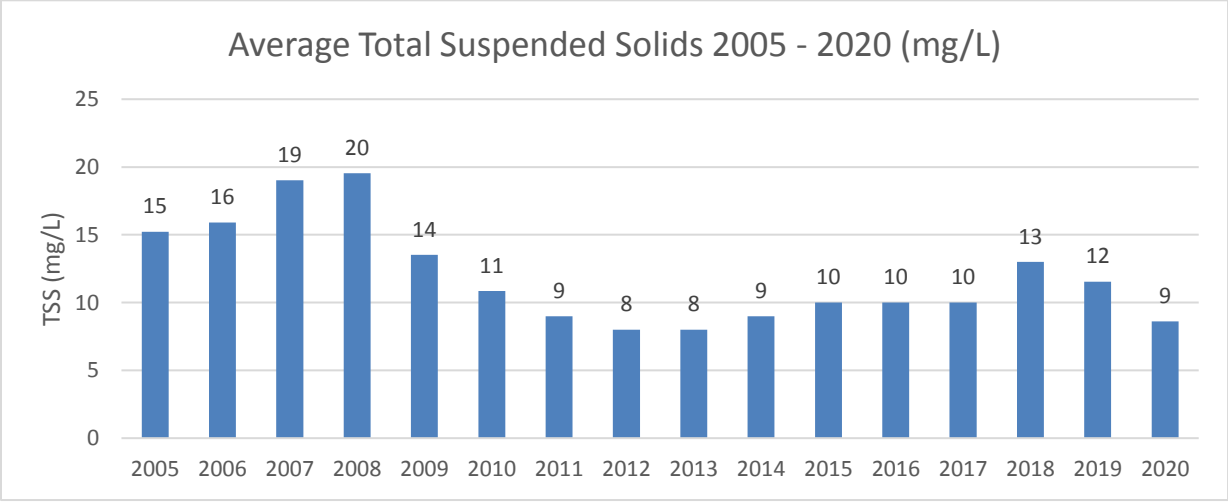


Figure 7: Annual Average Suspended Solids (mg/L) 2005 - 2020

Carbonaceous Biochemical Oxygen Demand (BOD)

As per section 1.1.2, the maximum Carbonaceous BOD limit is 30mg/L per day for the reporting period.

In 2020 the Carbonaceous BOD concentration did not exceed the permitted level, as highlighted in Figure 8 by the weekly lab results.

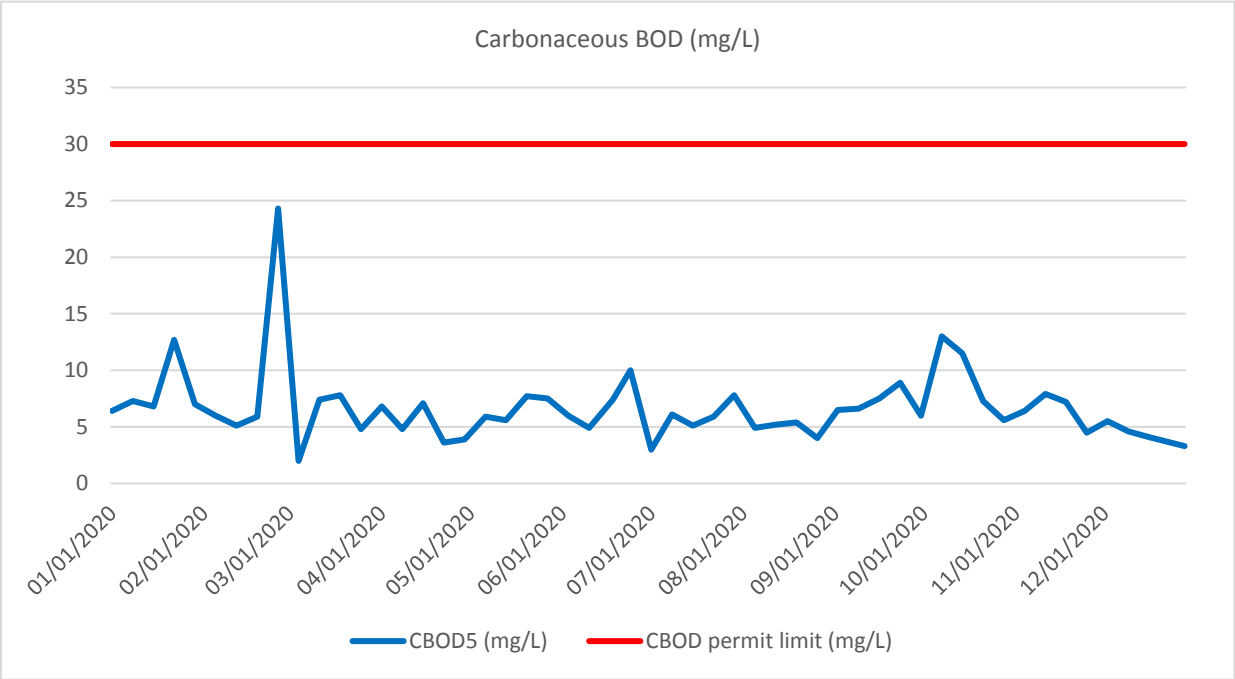


Figure 8: Weekly Carbonaceous BOD (mg/L) 2020

Effluent Disinfection

As a requirement of the Operational Certificate, the Whistler WWTP is required to disinfect the effluent using UV treatment from May 15 – October 15. The WWTP operates the UV disinfection system 12 months a year. Final effluent samples are taken twice weekly and submitted to a certified laboratory for fecal coliform analysis throughout the disinfection period in order to confirm the effectiveness of the UV disinfection system.

Figure 9 shows the results of the weekly lab tests for 2020. There is one outlier sample result with elevated fecal coliform levels on May 21. This was due to the sample being taken during the Bank 'B' rebuild when the UV was off.

Note: results determined to be less than detection limit are shown on the graph as the laboratory detection limit of 2.0 cfu/ 100 mL.

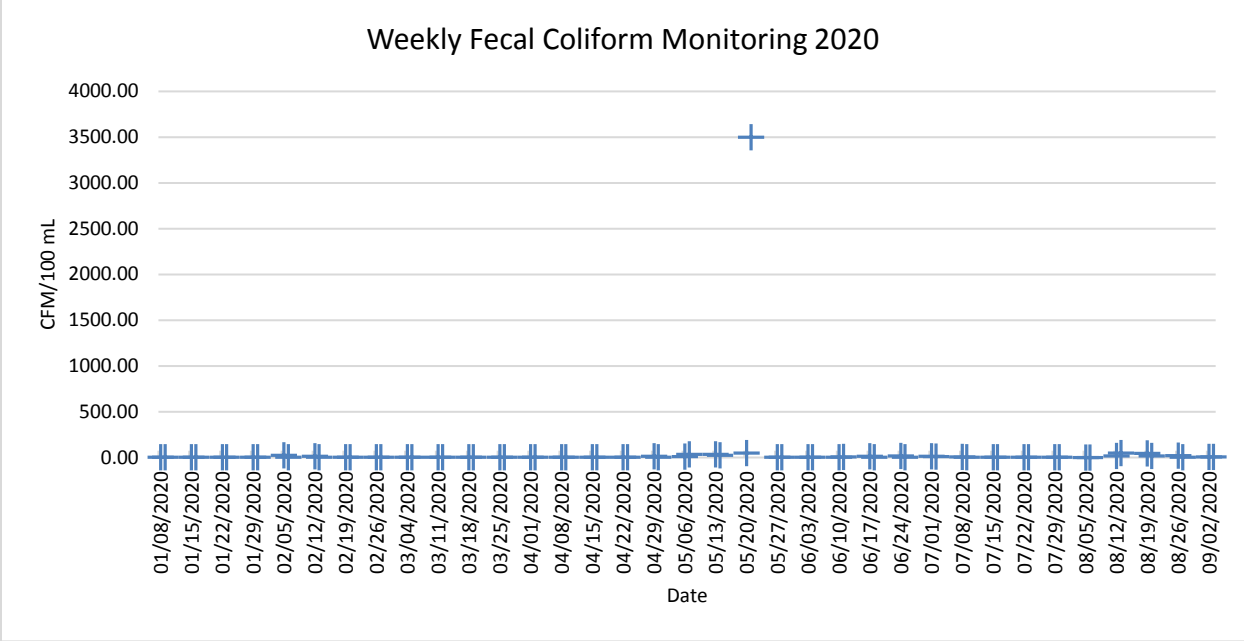


Figure 9: Weekly Fecal Coliform (CFM/mL) lab results 2020

Effluent Toxicity

Four (4) LC50 toxicity tests were performed during the report period.

Sample dates:

- 23 April
- 18 June
- 8 October
- 10 December

The results are 100% of rainbow trout fry surviving in raw (100% concentration) effluent for 96 hours. See Appendix B for results.

Receiving Environment Monitoring

The receiving environment (the Cheakamus River) is sampled once per month by WWTP staff, and the samples are submitted to a certified laboratory. Cascade Environmental completed an analysis of the Receiving Environment data for the reporting year and analysis can be found in Appendix E.

The operating certificate requires the RMOW monitor two sampling stations, with samples taken three times per year. The RMOW exceeds this requirement by sampling at three locations (known as Camp, Bridge and Station B) every month of the year.

Other Discharges

On November 4 a spill event occurred at the Whistler WWTP where hydrocarbons (waste oil) was discharged into the Cheakamus river. The cause of this was determined to be an automotive repair shop waste oil tank overflow overcoming oil separator capacity allowing waste oil to enter sanitary sewer collection system.

This was reported to the Ministry of Environment, and the spill report is attached in Appendix C.

4.0 CONCLUSION

This report fulfills the requirements for the Operational Certificated ME-01452. Any further inquiries can be directed to Chris Wike, Utilities Group Manager at (604) 935-8321 or cwike@whistler.ca.

APPENDIX A: NOTICES OF NON-COMPLIANCE

MINISTRY OF ENVIRONMENT
REGIONAL OPERATIONS BRANCH

NON-COMPLIANCE REPORTING MAILBOX NOTIFICATION

To: EnvironmentalNonCompliance@gov.bc.ca

Subject: 2019-06-18 Authorization # ME-01452 Section 1. Authorized Discharge, 1.1.3 Nutrient Loading for Discharge May 15 - September 15 Orthophosphate (as phosphorus) 36.6 kg/month

Attention: *Non-compliance Report for* ME-01452 Section 1. Authorized Discharge, 1.1.3 Nutrient Loading for Discharge of Orthophosphate (as phosphorus) 36.6 kg/month – 108.4 kg of Orthophosphate (as phosphorus) exceedance for period of May 15 – June 14, 2020.

Date of Non-compliance: 2020-05-15 00:00 / 2020-06-14 00:00

Location of Non-compliance: 50.08448, -123.041263

Nature of Non-compliance: The maximum Orthophosphate (as phosphorus) discharge from May 15 to September 15 shall not exceed 36.6kg/month. For the period of May 15 to June 14, 2020, the monthly limit was exceeded by 108.4 kg. The total Orthophosphate (as phosphorus) discharged for the period May 15 to June 14, 2020 was 145.0 kg. Graphs showing the phosphorus daily concentration, daily discharge, and cumulative discharged for the period are included in attachment 1.

As shown in attachment 1, the majority of the excess phosphorus was discharged during the first two weeks of the period (May 15 to June 1, 2020). During this half of the period, the operations team and process engineer worked to regain the full biological nutrient removal treatment, which led to an unavoidable increase of phosphorus discharge. After the biological nutrient removal treatment was regained to full capacity, the team started to optimize the operation, this plan is detailed in attachment 3 - memo from Tetra Tech.

Initial Response/Actions taken: Mid-March 2020 the Resort Municipality of Whistler (RMOW) engaged TetraTech (Process Engineer) to model the emergency low flow/low load conditions and, guide the team through the situation the wastewater treatment plant was/is facing.

This emergency and forecasted non-compliance was triggered by the decrease in occupancy in Whistler due to the Covid-19 pandemic. The RMOW has been working since mid-March 2020 to maintain compliance to ME 01452.

MINISTRY OF ENVIRONMENT
REGIONAL OPERATIONS BRANCH

NON-COMPLIANCE REPORTING MAILBOX NOTIFICATION

An email was sent to the Authorizations South, Regional Operations Branch, Environmental Protection Division, Ministry of Environment and Climate Change Strategy Group on May 11, 2020 to inform the Group of the upcoming emergency the WWTP was facing, per Section 2.5 Emergency Situation of the Operation Certificate ME 01452. The RMOW also forecasted a non-compliance for the May 15- June 14, and June 15 July 14 periods (emails shown in attachment 2).

Modifications to the operation of the plant included increases acetate dosing, re-seeding the plant with Thickened Waste Activated Sludge from the City of Kelowna's Biological Nutrient Removal Plant (BNR), and a partial bypass of the primary sedimentation tanks in order to counter the effect of the low loads entering the plant.

On May 20, 2020 the RMOW sent a letter detailing the compliance issues that it is facing, rationale that clearly states how the compliance issues are related to COVID-19, and mitigative measures that have been taken (email shown in attachment 2, Memo from TetraTech attachment 3).

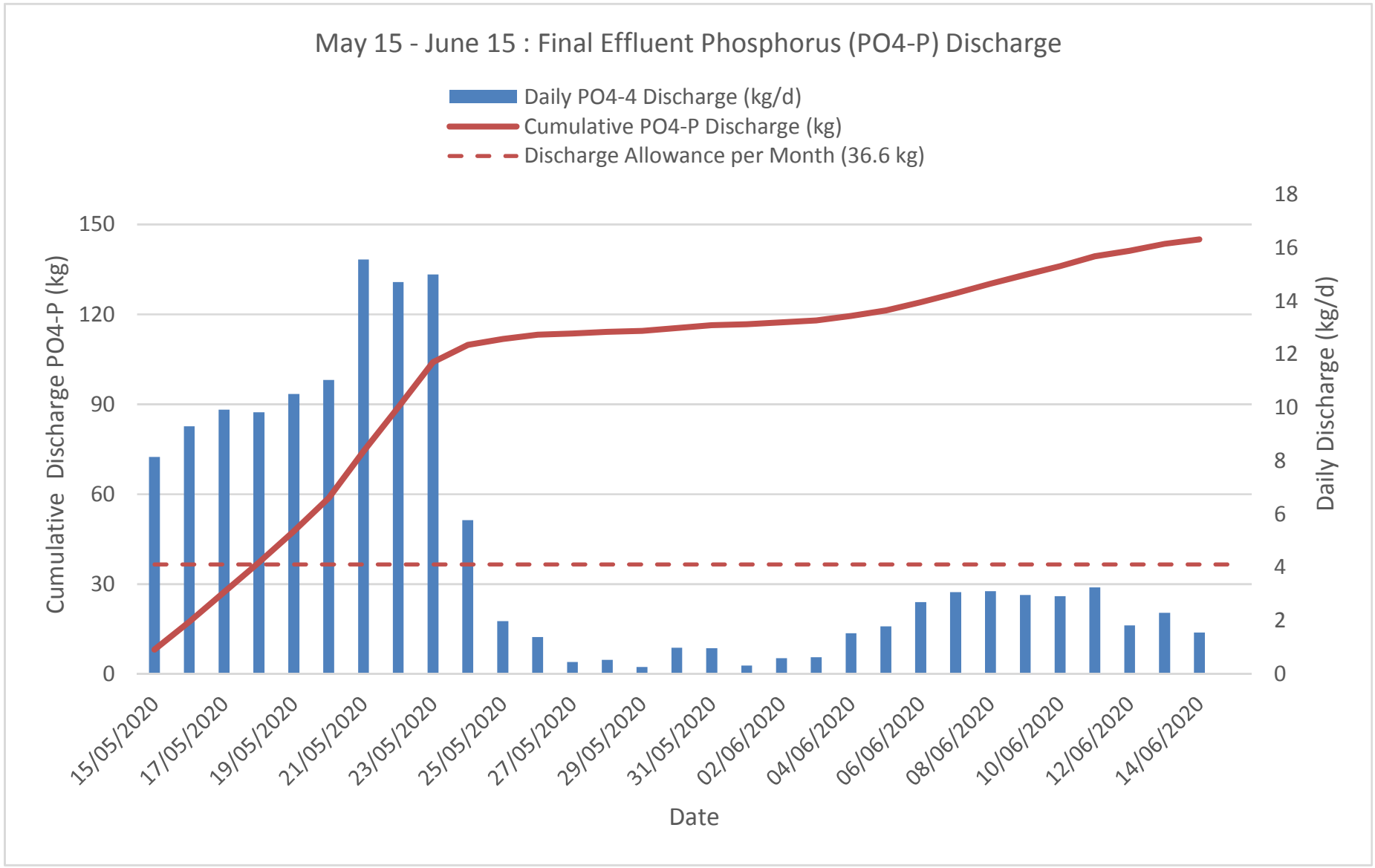
Monitoring conducted: Continuous phosphorus monitoring in both the bio reactor and the final effluent will continue. This data is shared with, and analyzed by the Process Engineer. The Process Engineer and the operations team meet minimum two times per week to discuss progress and modify the plan accordingly based on the model and the feedback from the operators.

Future action items: The Process Engineer has analyzed environmental conditions' and influent data to determine the reason for increased phosphorus effluent levels. This data analysis looks to produce recommendations that will address higher than expected phosphorus levels in the final effluent.

Contact information: For additional information, please contact Chelsey Roberts at 604-905-9462, or via email at croberts@whistler.ca.

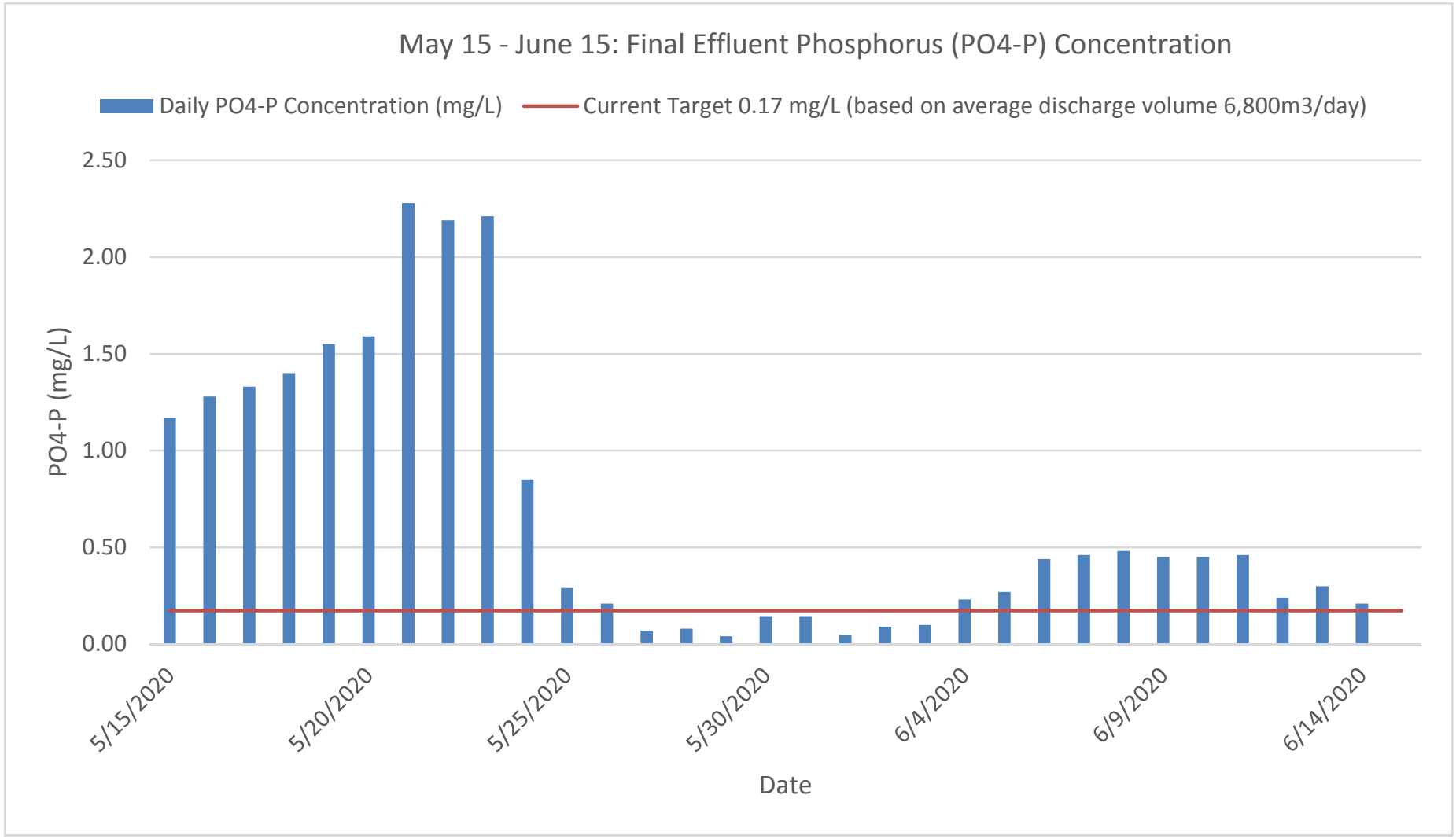
Attachment 1

Resort Municipality of Whistler Wastewater Treatment Plant
ME-01452



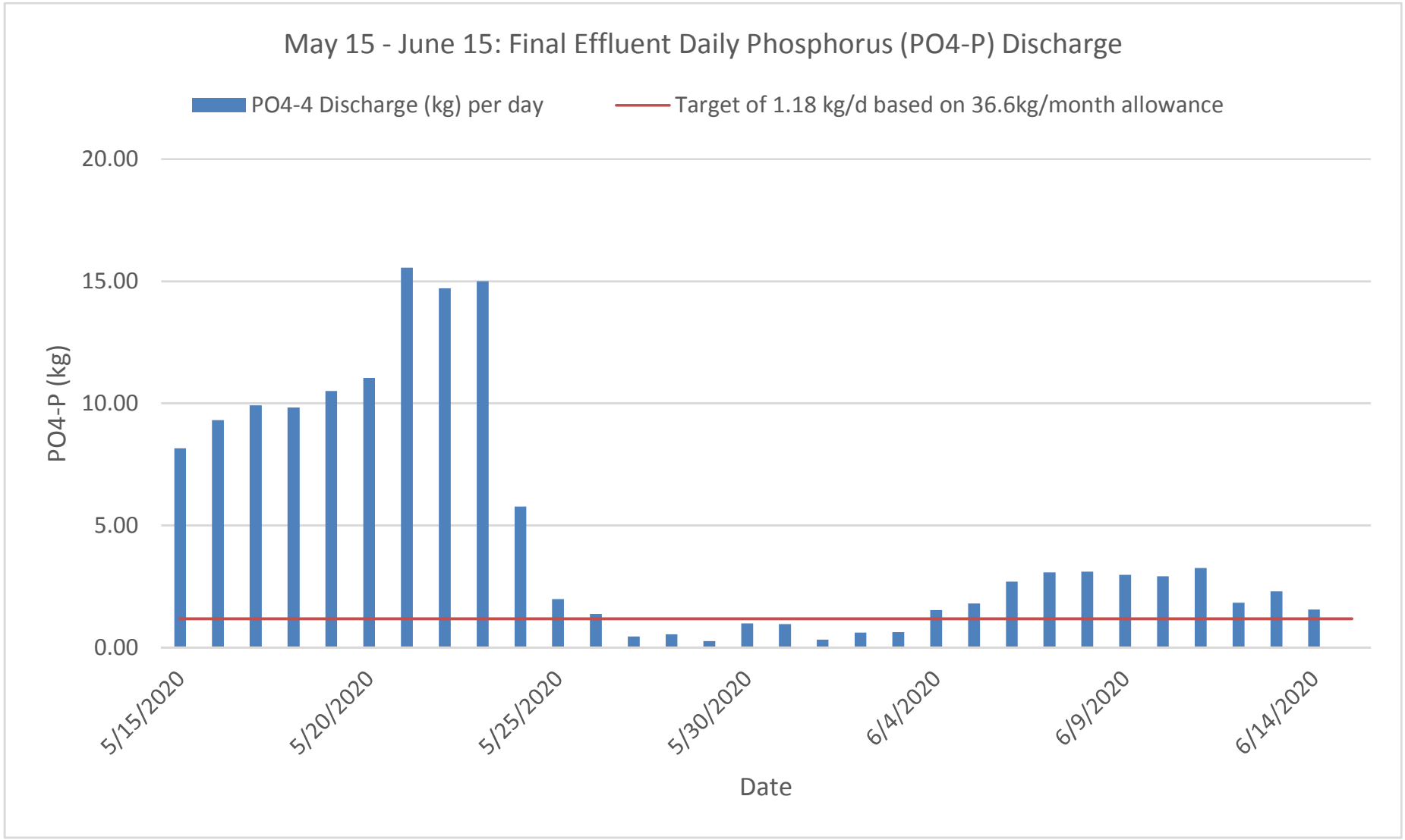
6/22/2020

Resort Municipality of Whistler Wastewater Treatment Plant
ME-01452



6/22/2020

Resort Municipality of Whistler Wastewater Treatment Plant
ME-01452



6/22/2020

Attachment 2

From:	Chelsey Roberts, AScT
To:	"EnvironmentalCompliance@gov.bc.ca"
Cc:	"Stoquart, Celine"; "Lemay, Janick"; James Hallisey; Chris Wike; "Manke, Hailey ENV:EX"
Subject:	RE: Whistler Treatment, ME-01452
Date:	Wednesday, May 20, 2020 9:27:00 AM
Attachments:	20200519-41385TTA-60ET-R1_Letter-to-MOE_signed.pdf
Importance:	High

Good morning,

As mentioned in the below email dated March 14, 2020, please see attached letter detailing the Resort Municipality of Whistler's Wastewater Treatment Plant compliance issues related to COVID-19, rationale that clearly states how the compliance issues are related to COVID-19, and mitigative measures being taken. The two non-compliance that are detailed in the letter are listed below:

1. ME 01452 Section 2 General Requirements, 2.3 bypass - the partial bypass of influent around the primary sedimentation tanks to increase nutrient load to the bioreactors.
2. ME 01452 Section 1 Authorization Discharge, 1.1.3 Nutrient loading for discharge May 15 – September 15 – Whilst the WWTP implements the plan to regain full biological nutrient removal, the plant will exceed the Orthophosphate (as phosphorus) discharge allowance of 36.6 kg/month maximum for the first two months of the permit season (May 15 – July 15).

Thank you,

Chelsey Roberts, AScT
RESORT MUNICIPALITY OF WHISTLER
TEL: 604-905-9462

From: Chelsey Roberts, AScT
Sent: Thursday, May 14, 2020 12:56 PM
To: 'EnvironmentalCompliance@gov.bc.ca' <EnvironmentalCompliance@gov.bc.ca>
Cc: Stoquart, Celine <Celine.Stoquart@tetratech.com>; Lemay, Janick <Janick.Lemay@tetratech.com>; James Hallisey <jhallisey@whistler.ca>; Chris Wike <CWike@whistler.ca>; 'Manke, Hailey ENV:EX' <Hailey.Manke@gov.bc.ca>
Subject: RE: Whistler Treatment, ME-01452
Importance: High

Good day,

This email is to inform you that on May 11, 2020 Resort Municipality of Whistlers (RMOW) Wastewater Treatment Plant (WWTP) informed the Authorization Group about an upcoming emergency per Section 2.5 Emergency Situation of the Operation Certificate ME 01452. This emergency was triggered by the decrease in occupancy at the RMOW due to the Covid-19 pandemic. The RMOW has been working since mid-March 2020 to maintain compliance to ME 01452. However, we do expect some non-compliance for the upcoming May 15- June 15, and June 15 July 15 periods. Modifications of the operation of the plant include increases acetate dosing and partial bypass of the primary sedimentation tanks in order to counter the effect of the low loads entering the plant.

The Authorization group has informed us that requests for approvals of bypasses due to covid-19 related issues are not being considered at this time. On Tuesday May 19, 2020 the RMOW will be sending a letter detailing the compliance issues that it is facing, rationale that clearly states how the compliance issues are related to COVID-19, and mitigative measures being taken. The two non-compliance that will be detailed in the letter are listed below:

1. ME 01452 Section 2 General Requirements, 2.3 bypass - the partial bypass of influent around the primary sedimentation tanks to increase nutrient load to the bioreactors.
2. ME 01452 Section 1 Authorization Discharge, 1.1.3 Nutrient loading for discharge May 15 – September 15 – Whilst the WWTP implements the plan to regain full biological nutrient removal, the plant will exceed the Orthophosphate (as phosphorus) discharge allowance of 36.6 kg/month maximum for the first two months of the permit season (May 15 – July 15).

Thank you,

Chelsey Roberts, AScT
RESORT MUNICIPALITY OF WHISTLER
TEL: 604-905-9462

From: Manke, Hailey ENV:EX [mailto:Hailey.Manke@gov.bc.ca]
Sent: Tuesday, May 12, 2020 4:09 PM
To: Chelsey Roberts, AScT <croberts@whistler.ca>
Cc: Stoquart, Celine <Celine.Stoquart@tetratech.com>; Lemay, Janick <Janick.Lemay@tetratech.com>; James Hallisey <JHallisey@whistler.ca>; Chris Wike <CWike@whistler.ca>
Subject: RE: Whistler Treatment, ME-01452

Hi Chelsey,

Thank you for taking the time to share the RMOW's options with regards to addressing the anticipated non-compliance with clause 1.1.3 of Operational Certificate (OC) ME-01452.

A bypass of designated works includes bypassing any portion of the treatment works outlined in clause 1.1.4 of the OC, this includes a portion of effluent bypassing the primary sedimentation tanks. For your awareness, the approval of the Statutory Decision Maker (director) must be obtained prior to bypassing any of the designated works. As authorization requirements will remain in effect during Covid-19, requests for approvals of bypasses due to covid-19 related issues are not being considered.

As you are anticipating the RMOW will be unable to meet the requirements of the OC, please provide notification to Compliance as per the directions outlined on the following webpage, Managing Authorizations & Compliance During Covid-19.

When the non-compliance occurs, also ensure you submit a Compliance Report as per the directions outlined on the Compliance Reporting Mailbox page.

As discussed, it is important that the efforts made by the RMOW to comply are documented to demonstrate that the RMOW has exercised their due diligence in addressing any non-compliance's that arise.

Again, thank you for reaching out. I will ensure documentation of our meeting and emails will be placed on the OC ME-01452's file for future reference. If you have any further questions, please don't hesitate to ask.

Thank you,
Hailey

Hailey Manke, BNRSc., A. Ag.
Environmental Authorizations Technologist, Municipal Liquid Waste
Authorizations – South | Regional Operations Branch | Environmental Protection Division
Ministry of Environment and Climate Change Strategy

250-312-6469 (**New Number**)| hailey.manke@gov.bc.ca
1259 Dalhousie Drive, Kamloops, BC, V2C 5Z5

From: Chelsey Roberts, AScT <croberts@whistler.ca>
Sent: May 11, 2020 4:38 PM
To: Manke, Hailey ENV:EX <Hailey.Manke@gov.bc.ca>
Cc: Stoquart, Celine <Celine.Stoquart@tetratech.com>; Lemay, Janick <Janick.Lemay@tetratech.com>; James Hallisey <JHallisey@whistler.ca>; Chris Wike <CWike@whistler.ca>
Subject: RE: Whistler Treatment, ME-01452

Hi Hailey,

No worries.

That is great your schedule is open tomorrow, I will schedule a call for 10:30am via WebEx.

Thank you,

Chelsey Roberts, AScT
RESORT MUNICIPALITY OF WHISTLER
TEL: 604-905-9462

From: Manke, Hailey ENV:EX [mailto:Hailey.Manke@gov.bc.ca]
Sent: Monday, May 11, 2020 4:24 PM
To: Chelsey Roberts, AScT <croberts@whistler.ca>
Cc: Stoquart, Celine <Celine.Stoquart@tetratech.com>; Lemay, Janick <Janick.Lemay@tetratech.com>; James Hallisey <JHallisey@whistler.ca>; Chris Wike <CWike@whistler.ca>
Subject: RE: Whistler Treatment, ME-01452

Hi Chelsey,

Sorry I missed your call earlier. My schedule is wide open tomorrow, I am available to discuss OC ME-01452 at any time. My hours of work are 8-4:30.

Thank you,
Hailey

Hailey Manke, BNRSc., A. Ag.
Environmental Authorizations Technologist, Municipal Liquid Waste
Authorizations – South | Regional Operations Branch | Environmental Protection Division
Ministry of Environment and Climate Change Strategy

250-312-6469 (**New Number**)| hailey.manke@gov.bc.ca
1259 Dalhousie Drive, Kamloops, BC, V2C 5Z5

From: Chelsey Roberts, AScT <croberts@whistler.ca>
Sent: May 11, 2020 3:38 PM
To: Manke, Hailey ENV:EX <Hailey.Manke@gov.bc.ca>
Cc: Stoquart, Celine <Celine.Stoquart@tetratech.com>; Lemay, Janick <Janick.Lemay@tetratech.com>; James Hallisey <JHallisey@whistler.ca>; Chris Wike <CWike@whistler.ca>
Subject: Whistler Treatment, ME-01452

Good afternoon Hailey,

As per section 2.5 of operational certificate ME-01452 the Resort Municipality of Whistler (RMOW) Waste Water Treatment Plant (WWTP) would like to inform you of an upcoming emergency (b).

Due to the decreased occupancy related to the COVID-19 pandemic the WWTP is currently facing unprecedented low influent flow and loads conditions for a sustained period. The unprecedented conditions impair the performance of the plant and are putting at risk the ability of the WWTP to comply with the upcoming orthophosphate (as Phosphorus) discharge of 36.6 kg/month applicable as of May 15th, 2020 as per section 1.1.3. of ME-01452. The RMOW would like to discuss the plan put in place to restore the performance of the plant as quickly as possible.

We would like to schedule a call with you tomorrow (May 12), please let me know your availability.

Thank you,

Chelsey Roberts, AScT
ENGINEERING TECHNOLOGIST
Infrastructure Services

RESORT MUNICIPALITY OF WHISTLER
4325 Blackcomb Way
Whistler, BC V8E 0X5
TEL: 604-905-9462
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Whistler was the proud Host Mountain Resort for the 2010 Olympic and Paralympic Winter Games

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Attachment 3

TETRA TECH

Boucherville, May 19 2020

To : EnvironmentalNonCompliance@gov.bc.ca

Subject: Emergency at RMOW preventing compliance to #ME-01452
Ref./N: Rev 1 - 41385TTA (60ET)

To whom it may concern,

As per section 2.5 of operational certificate #ME-01452:

"In the event of an emergency which prevents compliance with a requirement of this operational certificate, that requirement shall be suspended for such time as the emergency continues or until otherwise directed by the director provided that:

a) Due diligence was exercised in relation to the process, operation or event which caused the emergency and that the emergency occurred notwithstanding this exercise of diligence;
b) The manager is immediately notified of the emergency; and
c) It can be demonstrated that everything possible is being done to restore compliance in the shortest possible time.

Notwithstanding a), b) and c) above, the director may require the operation to be suspended or production levels to be reduced to protect the environment while the situation is corrected"

The wastewater treatment plant (WWTP) of the Resort Municipality of Whistler (Whistler) is currently facing unprecedented low influent flow and loading conditions for a sustained period due to the Covid-19 pandemic and the resulting loss of tourism infrastructure occupation. Those unprecedented conditions impair the performance of the plant. As a result, the WWTP will have trouble being compliant to its operational certificate. In particular, the orthophosphate (as Phosphorus) discharge of 36.6 kg/month applicable as of May 15, 2020 will not be met for the May 15 – July 14 period and in order to regain a better performance, a non-authorized partial bypass of the primary settlers will have to be put in place.

This letter is to inform you of the current emergency (b) due to sustained influent low flow and loading entering the plant for the past month (a). This letter also presents the measures that are put in place to restore the performance of the plant as quickly as possible (c).

Location of upcoming non-compliance: 50.08448, -123.041263

Expected dates of non-compliance: May 15 – July 14 2020

An email was sent to inform Mrs. Hailey Manke, Environmental Authorizations Technologist, Municipal Liquid Waste on May 11, 2020. As per Mrs Manke's recommendation, an email was sent to the Compliance Reporting Mailbox on May 14, 2020.

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Tetra Tech QI
1205 Ampère Street, Suite 310, Boucherville, QC J4B 7M6
Phone: 450 655-8440 Fax: 450 655-7121 tetratech.com

1. Cause of Emergency

Whistler's WWTP is a sophisticated enhanced biological phosphorus removal (EBPR) process mostly treating domestic sewage. The system builds on the carbon and nutrient loads entering the plant to grow a specialized biomass able to withdraw PO_4-P from the wastewater. The plant is also equipped with a standby alum dosage system. The WWTP is also equipped with a small standby acetate dosing system to boost the biomass growth if there is a lack of carbon at the inlet of the plant.

The restrictions put in place across Canada due to the Covid-19 pandemic in the spring of 2020 has led to the temporary closure of hotels and restaurants in Whistler, causing a significant decrease in the influent flow and load entering the WWTP. Whistler normally has an average of approximately 35,000 people in the resort, but with the sudden changes due to Covid-19, only the base residential population of approximately 12,000 people have remained in the resort. As of March 16, 2020, the influent flowrate at the plant started to drop. In April 2020 and for the two first weeks of May 2020, the influent flowrate of the plant was respectively 9 147 m³/d and 8 856 m³/d on average. Discharged flowrates to the Cheakamus River were 7 659 m³/d and 7 667 m³/d. The low influent flowrate occurred during the shoulder season, a season that is challenging for any wastewater treatment plant. The flowrates were 40 % lower than the design criteria of the plant and 20% lower than the observed average dry weather flow of 2018 and 2019. Those low flowrates are associated to the significant decrease of visitors in Whistler and are therefore associated with a significant decrease in carbon and nutrient load entering the bioreactors. Those low flowrates and loads are expected to be sustained as long as it takes for the tourism industry to recover in Whistler. Table 1 listing the monthly average influent flowrate and discharged flowrate in 2018, 2019 and 2020 is presented in an Appendix to this letter.

The corresponding nutrient loads entering the bioreactors in April 2020 and May 2020 were between 30 and 60 % of the the loads observed the year before during the average dry weather flow period of July and August. In particular, Total Phosphorus entering the plant is significantly lower (only 30% of the average dry weather condition). Whistler's WWTP has seen its influent load lowered significantly during a sustained period which prevented the plant from maintaining enough healthy biomass in the reactors. The result of those two months of sustained low flow and loads is that the current plant is too big for its current needs which proves difficult to operate. The biomass currently maintained in the reactors is currently less than half of normal and it is decreasing daily. Table 2 in the attached Appendix presents the average monthly loads that entered the bioreactors in 2018, 2019 and 2020.

2. Impact of the Crisis on Compliance and Early Actions

For the biological process to perform well, the biomass maintained in the bioreactors (measured as Mixed Liquor Suspended Solids or MLSS) needs to grow from the carbon and nutrients fed at the inlet of the plant. In the case of EBPR processes, any variation in substrate at the inlet of the plant will significantly affect the efficiency of the process. With low strength (low load) water and low temperature, the required anaerobic conditions for EBPR was hard to reach in the bioreactors and resulted in higher PO_4-P concentration at the effluent of the bioreactor.

As per usual, continuous PO_4-P monitoring in both the bioreactor and the final effluent is performed, consisting of daily PO_4-P testing on the 24 hour bio reactor and final effluent composites. The operators were able to maintain the compliance to the final effluent requirements in until May 14 2020, even under the influent low flow and load sustained period that started at the end of March 2020. This was done by turning on the Alum dosing to assist the reduction of PO_4-P at the final discharge.

As of May 15 2020, the final effluent PO_4-P concentration should be maintained on average below 0.1 mg PO_4-P /L in order to comply with the 36.6 kg PO_4-P /month discharge requirement. Figure 1 presented below shows both the measured effluent PO_4-P concentration (blue dots) and the measured effluent PO_4-P daily discharge (orange dots) measured since January 2020. Because of the reduced amounts of carbon and nutrients sent to the bioreactors, the efficiency of the process was significantly impacted, resulting in a steady increase of the PO_4-P concentration at the effluent of the plant since the beginning of April 2020.

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While still maintained largely below 1.75 mg/L, the PO_4-P concentration remains significantly higher than the 0.1 mg/L that will be required to comply with the 36.6 kg/month discharge requirement of the summer period. As introduced earlier, Alum was added upstream of the secondary clarifiers to polish phosphate removal and ensure the compliance to the WWTP's effluent requirements of 1.75 mg PO_4-P /L. Alum dosage was increased for the past month but did not allow to decrease the P-PO_4 concentration below 0.1 mg/L. Indeed, to meet a low PO_4-P concentration of 0.1 mg/L, the WWTP absolutely needs an efficient biological dephosphatation. Currently, the combination of low phosphate load and Alum dosage has led to the phosphate accumulating biomass to leave the reactor, turning the plant into a mainly chemical plant that cannot bring the phosphate concentration to 0.1 mg PO_4-P /L.

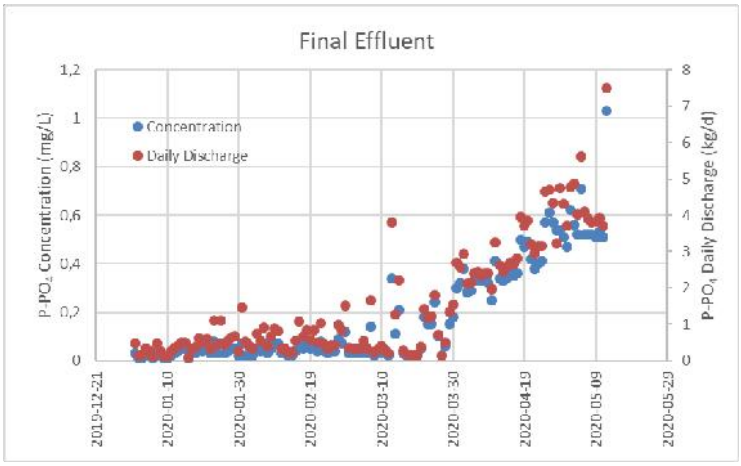

Figure 1: Final effluent PO_4-P concentration and PO_4-P Daily Discharge between January and May 2020

3. Plan of Action to Recover the Biological Treatment and Reach Compliance to Maintain Compliance to the Effluent Discharge Requirements Applicable as of May 15, 2020

As illustrated above, the Alum dosage is currently not sufficient to decrease the PO_4-P concentration below the required 0.1 mg/L needed to comply with a discharge of 36.6 kg/month. Furthermore, the biomass in the plant is very low due to the sustained low load entering the plant. As a result, Whistler is expecting some non-compliance and has been working on a plan of action to regain compliance as quickly as feasible.

a. Plan of Action

As soon as the Covid-19 pandemic triggered the vacation of the tourism infrastructure in Whistler, loads entering the plant decreased. Tetra Tech was mandated the week of March 26, 2020 to support the operation team of Whistler's WWTP during the influent low flow and loading conditions and provide them with recommendations to maintain the compliance to the discharge requirements of the Operational Certificate. Tetra Tech has simulated the current influent low flow and loads conditions and has provided recommendations to Whistler. The means identified to increase the phosphorus removal of the plant under the current conditions were the following:

- Demonstration that the existing acetate dosing capacity is too small for the needs of the plant;
- Implementation of acetate pump and line with increased dosing capacity to promote the growth of the phosphate accumulating biomass in the reactors;°
- Increase of the load entering the plant by sending a fraction of the raw influent directly to the bioreactors to further promote the growth of the biomass and improve the EBPR conditions (ie partial bypass of the primary settlers);

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- Speed-up the biomass recovery by re-seeding the bioreactor with imported healthy biomass from a wastewater treatment plant operating with the same process.
- As the rise in temperature with the upcoming spring and summer conditions will further challenge the EBPR performance due to the increase in nitrification capacity, acetate dosing and Solids Retention Time (SRT) management will be adapted if the low flow and loads conditions are sustained throughout the summer.

b. Implementation of Measures

The weeks of April 20 and April 27, 2020 were used by Whistler to implement the increased dosing capacity for the acetate dosing system and install a system to transfer some influent to the bioreactors. These systems required additional effort to maintain a safe operating environment for its operating team. The plan of action is currently implemented as follows:

- Acetate dosing was started on May 4, 2020 and regular coordination calls are scheduled every second day to ensure that all measures are properly put in place;
- To further boost the growth of the required phosphorus accumulating biomass, alum dosage was decreased as of May 12, 2020;
- On May 15 2020, a portion of the raw sewage was sent to the bioreactors to provide the biomass with the nutrients and carbon supporting further growth.
- During the week of May 18, some biomass from another municipality will be seeded to the bioreactor.

During these modifications at the plant, Whistler is diligently monitoring:

- The alum dosage;
- The amount of raw sewage sent to the bioreactors;
- The amount of acetate dosed.

Furthermore, additional grab samples will be taken frequently to closely monitor the PO_4-P concentration in the bioreactors and monitor the growth of the biomass.

c. Expected Non-Compliance

I. <u>ME 01452 Section 2 General Requirements, 2.3 bypass</u>

The WWTP has trouble maintaining its biomass, which is starving. In order to increase the food sent to the reactors, a partial bypass of the primary settling tanks had to be installed to send raw sewage directly to the reactors.

The Authorization Group of the MOE has informed Whistler that requests for approvals of bypasses due to Covid-19 related issues were not being considered at this time. Due to the risk of completely loosing the biomass, Whistler has implemented a temporary bypass with the objective of improving the performance of its plant. This temporary modification is not expected to be detrimental to the effluent quality as the partial bypass will be monitored closely and established to steadily grow a biomass. The overall loading entering the bioreactors will remain below the design criteria of the equipment.

II. <u>ME 01452 Section 1 Authorization Discharge, 1.1.3 Nutrient loading for discharge May 15 – September 15</u>

Whistler took immediately action by mandating Tetra Tech at the beginning of the Covid-19 but the delays associated with ensuring health and safety measures and to the inherent nature of the biological process is expected to lead to the excess of PO_4-P discharge (over 36.6 kg/month) for the May 15 – July 14 period.

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The expected sources of non-compliance are the following:

- Alum dosage has to be lowered to recover conditions suitable for the growth of the phosphorus removing biomass in the bioreactor. As a result, PO_4-P concentration will have to increase at the effluent of the plant. The increase of PO_4-P is required to ensure that enough phosphate is available for the regrowth of the phosphate accumulating biomass that ensures the biological dephosphatation;
- Biomass growth is a slow process. Completely regaining the biomass is a process that will take a month or two. During that period, PO_4-P concentration will be above 0.1 mg/L. A very small dosage of alum will be added to make sure that PO_4-P does not exceed the 1.5 mg/L;
- Re-seeding the bioreactor with external sludge will speed-up the biomass recovery process, however it could momentarily trigger a release of phosphorus in the plant that week. In the long run, it will decrease the length of the re-seeding period.

4. Conclusion

In summary, the unprecedented operating conditions that appeared following the vacation of the tourism infrastructure in Whistler has proven to be extremely challenging for the operation of Whistler's WWTP. Measures were put in place at the very beginning of the Covid-19 crisis. However, the delays associated to the adaptation of the plant to those new operating conditions will unfortunately lead to a non-compliance of the 36.6 kg PO_4-P /month for the May 15 – July 14 period.

Per Section 2.5 Emergency Procedures of the Operationl Certification ME-01452 Whistler would like to inform the Environmental Compliance group of the emergency situation Whistler's WWTP is facing and would like to request a suspension of the PO_4-P effluent discharge load requirement until the operation of the plant is stabilized.

We thank you for your consideration and are available to respond to any of your questions.

2020-05-19

Céline Stoquart, P.Eng., Ph.D.
Project Lead
OIQ #5067098

Janick Lemay, P.Eng., MBA.
Project Director
EGBC #45343

CS/JL/llh

cc. Chelsey Roberts, A.Sc.T., Resort Municipality of Whistler
James Hallisey, Resort Municipality of Whistler

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APPENDIX – INFLUENT FLOWS AND LOADINGS

Table 1: Average Monthly Raw Influent Flowrate and Discharged Flowrate in 2018, 2019 and 2020

Month	Average Monthly WWTP Influent Flowrate (m^3/d)	Average Monthly Discharged Flowrate (m^3/d)	Month	Average Monthly WWTP Influent Flowrate (m^3/d)	Average Monthly Discharged Flowrate (m^3/d)
January			**July**		
2018	14 730	12 171	**2018**	11 803	9 872
2019	14 258	12 227	**2019**	11 464	9 864
2020	15 423	13 186	**2020**		
February			**August**		
2018	16 192	13 347	**2018**	11 638	9 904
2019	13 116	11 239	**2019**	11 469	10 107
2020	15 378	13 157	**2020**		
March			**September**		
2018	13 948	11 683	**2018**	10 138	8 553
2019	13 442	11 472	**2019**	10 133	8 712
2020	11 244	9 608	**2020**		
April			**October**		
2018	13 102	11 118	**2018**	9 605	8 139
2019	13 574	11 357	**2019**	9 393	8 027
2020	**9 147**	**7 659**	**2020**		
May			**November**		
2018	10 776	8 993	**2018**	11 968	10 188
2019	10 317	8 586	**2019**	9 845	8 361
2020 (May 1 – May 14 only)	**8 856**	**7 667**	**2020**		
June			**December**		
2018	10 833	8 823	**2018**	14 819	12 475
2019	10 913	9 042	**2019**	12 756	10 930
2020			**2020**		
Design Criteria	14 700				

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Table 2: Observed Bioreactors Influent Load (Primary Settlers Effluent)

Date	Average TSS Loading (kg/d)	Average COD Loading (kg/d)	Average cBOD5 Loading (kg/d)	Average TKN Loading (kg/d)	Average NH3-N Loading (kg/d)	Average TP Loading (kg/d)	Average PO4-P Loading (kg/d)
January							
2018	1 963	4 883	2 051	606	339	107	56
2019	1 638	4 703	2 317	575		125	64
2020	1 713	4 552	2 573	577		110	51
February							
2018	1 792	4 761	2 181	564	374	121	65
2019	1 557	5 141	1 926	512	472	101	66
2020	1 553	4 896	1 796	527		102	51
March							
2018	1 617	4 332	2 098	471	371	102	62
2019	1 483	4 688	2 599	554		101	60
2020	1 151	4 574	1 985	460		82	48
April							
2018	1 380	3 305	1 554	395	356	80	46
2019	1 359	3 664	1 788	377		73	41
2020	**623**	**2 090**	**963**	**252**		**38**	**17**
May							
2018	1 064	2 868	1 391	280		76	34
2019	1 216	3 011	1 127	275		47	32
2020	**736**	**2 164***	**N/A**	**N/A**	**101**	**19**	**14**
June							
2018	1 324	2 349	1 368	376		57	35
2019	1 226	2 881	1 170	329		62	35
July							
2018	1 461	3 828	1 927	424		73	43
2019	1 270	3 085	1 186	406		71	41
August							
2018	1 440	3 402	1 644	418		74	43
2019	1 443	3 529	1 666	428		63	38
September							
2018	1 178	3 082	1 530	358	216	63	31
2019	1 327	2 751	1 390	366		59	33

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Date	Average TSS Loading (kg/d)	Average COD Loading (kg/d)	Average cBOD5 Loading (kg/d)	Average TKN Loading (kg/d)	Average NH3-N Loading (kg/d)	Average TP Loading (kg/d)	Average PO4-P Loading (kg/d)
October							
2018	995	2 791	982	248	175	45	24
2019	1 187	2 563	1 389	281		51	29
November							
2018	1 117	2 892	982	197	194	36	23
2019	1 183	2 672	1 395	289		49	24
December							
2018	1 384	4 799			279		48
2019	1 637	3 720	2 500	497		77	47

MINISTRY OF ENVIRONMENT
REGIONAL OPERATIONS BRANCH

NON-COMPLIANCE REPORTING MAILBOX NOTIFICATION

To: EnvironmentalNonCompliance@gov.bc.ca

Subject: 2019-06-18 Authorization # ME-01452 Section 1. Authorized Discharge, 1.1.3 Nutrient Loading for Discharge May 15 - September 15 Orthophosphate (as phosphorus) 36.6 kg/month

Attention: *Non-compliance Report for* ME-01452 Section 1. Authorized Discharge, 1.1.3 Nutrient Loading for Discharge of Orthophosphate (as phosphorus) 36.6 kg/month – 2.7 kg of Orthophosphate (as phosphorus) exceedance for period of June 15 – July 14, 2020.

Date of Non-compliance: 2020-06-15 00:00 / 2020-07-14 00:00

Location of Non-compliance: 50.08448, -123.041263

Nature of Non-compliance: The maximum Orthophosphate (as phosphorus) discharge from May 15 to September 15 shall not exceed 36.6kg/month. For the period of June 15 to July 14, 2020, the monthly limit was exceeded by 2.7 kg. The total Orthophosphate (as phosphorus) discharged for the period June 15 to July 14, 2020 was 39.3 kg. Graphs showing the phosphorus daily concentration, daily discharge, and cumulative discharged for the period are included in attachment 1.

As shown in attachment 1, the excess phosphorus was discharged on July 3, July 4, and July 5, 2020. During this time, there was a mechanical failure at the bioreactor causing an unavoidable increase of phosphorus discharge. The operations team worked quickly to rectify the mechanical failure. After the mechanical failure was rectified the biological nutrient removal treatment was regained to full capacity.

Initial Response/Actions taken: The team attended to the mechanical failure and replaced the equipment.

Monitoring conducted: The operations team and Wastewater Chief Operator will continue to check that all like mechanical equipment at the bioreactor is operational, and a rigorous preventative maintenance schedule is followed.

In addition to the above, continuous phosphorus monitoring in both the bio reactor and the final effluent will continue. This data is shared with, and analyzed by the Process Engineer. The Process Engineer and the operations team meet minimum two times per week to discuss progress and modify the plan accordingly based on the model and the feedback from the operators.

MINISTRY OF ENVIRONMENT
REGIONAL OPERATIONS BRANCH

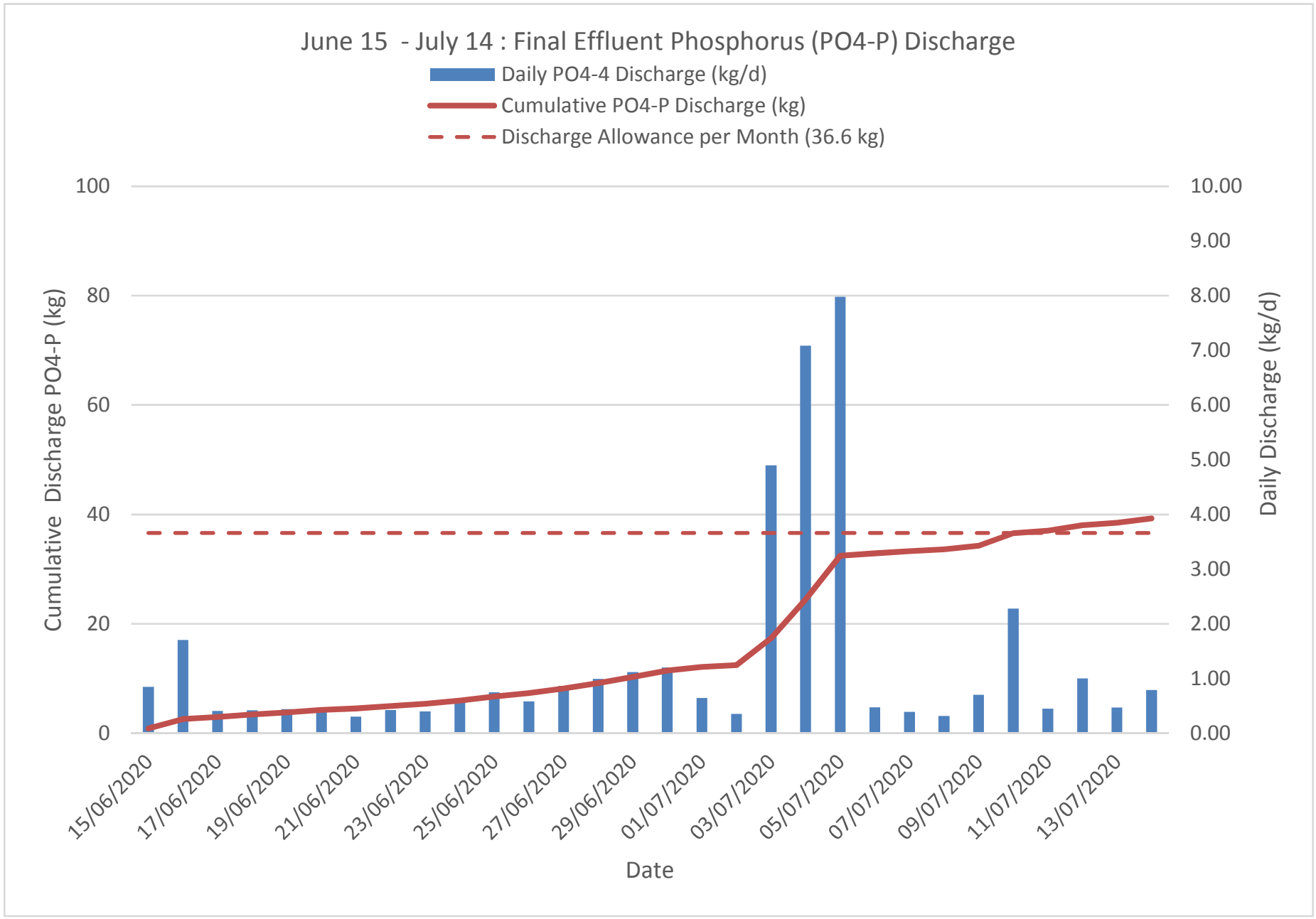
NON-COMPLIANCE REPORTING MAILBOX NOTIFICATION

Future action items: The operations team, Wastewater Chief Operator, and Utilities Superintendent have check all like mechanical equipment to ensure this type of failure does not repeat. The team has also confirmed there is spare equipment on site to ensure a quick response time should this mechanical failure occur again.

Contact information: For additional information, please contact Chelsey Roberts at 604-905-9462, or via email at croberts@whistler.ca.

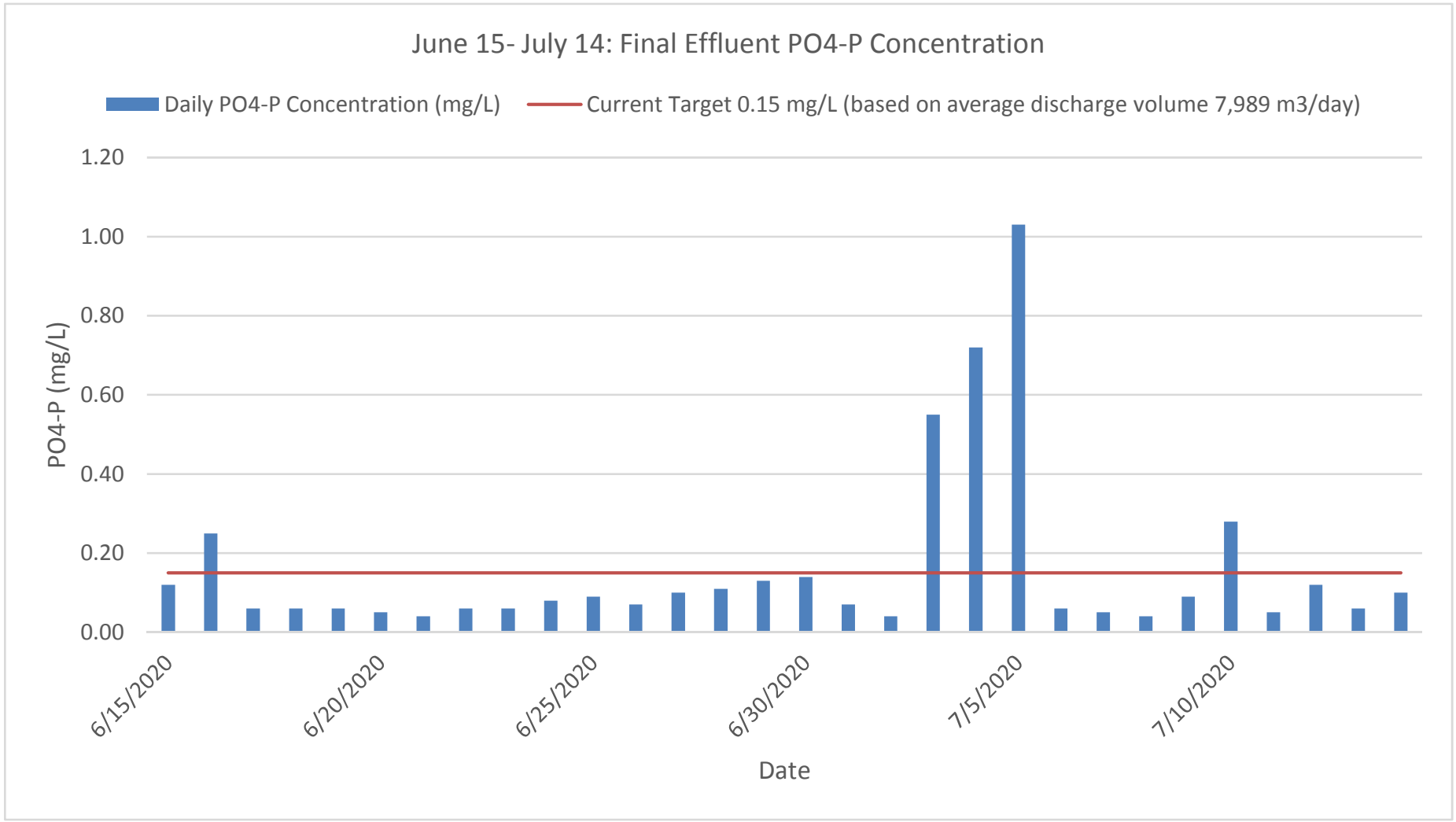
Attachment 1

Resort Municipality of Whistler Wastewater Treatment Plant
ME-01452



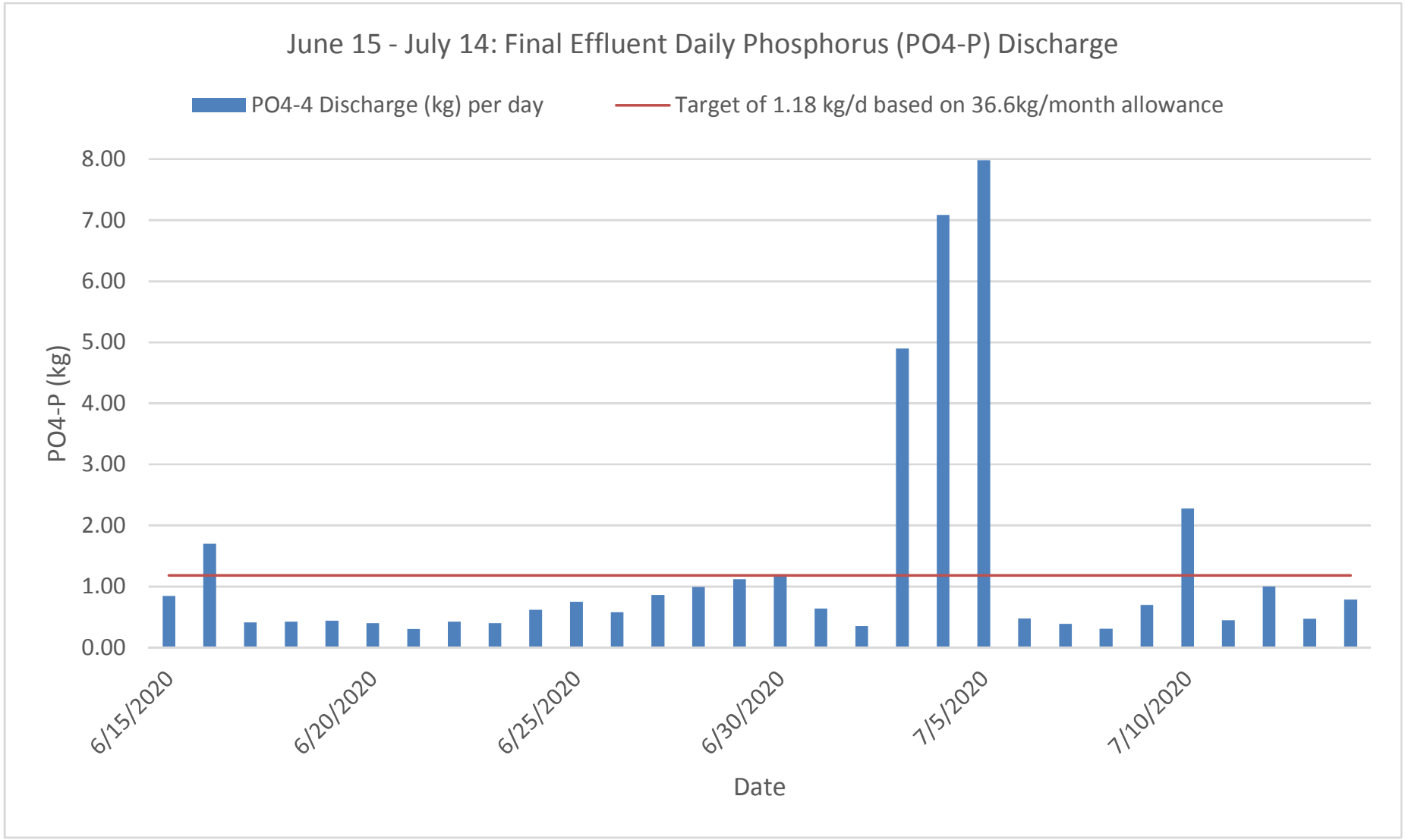
8/7/2020

Resort Municipality of Whistler Wastewater Treatment Plant ME-01452



8/7/2020

Resort Municipality of Whistler Wastewater Treatment Plant
ME-01452



8/7/2020

MINISTRY OF ENVIRONMENT
REGIONAL OPERATIONS BRANCH

NON-COMPLIANCE REPORTING MAILBOX NOTIFICATION

To: EnvironmentalNonCompliance@gov.bc.ca

Subject: 2020-09-22 Authorization # ME-01452 Section 1. Authorized Discharge, 1.1.3 Nutrient Loading for Discharge May 15 - September 15 Orthophosphate (as phosphorus) 36.6 kg/month

Attention: *Non-compliance Report for* ME-01452 Section 1. Authorized Discharge, 1.1.3 Nutrient Loading for Discharge of Orthophosphate (as phosphorus) 36.6 kg/month – 22.2 kg of Orthophosphate (as phosphorus) exceedance for period of July 15 – August 14, 2020.

Date of Non-compliance: 2020-07-15 00:00 / 2020-08-14 00:00

Location of Non-compliance: 50.08448, -123.041263

Nature of Non-compliance: The maximum Orthophosphate (as phosphorus) discharge from May 15 to September 15 shall not exceed 36.6kg/month.
For the period of July 15 to August 14, 2020, the monthly limit was exceeded by 22.2 kg. The total Orthophosphate (as phosphorus) discharged for the period July 15 to August 14, 2020 was 58.8 kg.

The Resort Municipality of Whistler's WWTP is a Biological Nutrient Removal (BNR) plant that has been working on recovering its biomass since May 15th due to the COVID-19 pandemic. By reseeding the plant with biomass hauled from another BNR plant, the WWTP was able to rebuild its dephosphatation biomass. During the July 15th – August 14th period, the bioreactor performance decreased, which was reflected by an increase in P-PO_4 discharge the final effluent of the plant and led to a non-compliance to the 36.6 kg/month discharge.

Initial Response/Actions taken:

On July 26th and 27th, the bioreactor started to show some instability, reflected by sustained high concentration at its effluent. As soon as the operational team witnessed a degradation in the performance of the bioreactor, the acetate dosage schedule was modified to regain stability. After a couple of days, the first modifications in acetate dosage were not effective and the bioreactor performance deteriorated, leading to another increase in phosphorus discharge. The operational team then decided to dose Alum at the bioreactor effluent to counteract the bioreactor bad performance and precipitate the excess of phosphate discharged by the bioreactor. In parallel to the alum addition, acetate dosage was increased. Since biomass takes time to adapt to new operating conditions, it was decided to add an excess of acetate to boost the biomass growth. This strategy was applied up till the end of the period.

MINISTRY OF ENVIRONMENT
REGIONAL OPERATIONS BRANCH

NON-COMPLIANCE REPORTING MAILBOX NOTIFICATION

Monitoring conducted:
The operations team and Wastewater Chief Operator closely check the performance of the bioreactor to ensure that the biomass performs well. Phosphorus ($P\text{-}PO_4$) is continuously monitored at both the bio reactor influent and effluent and at the final effluent.
The continuous monitoring is what allowed the operational team to flag the loss of performance at the bioreactor on July 26th and July 27th. From July 27th till August 14th, the bioreactor performance was closely followed as modifications to the operation were performed to regain stability. In addition to the usual 24h composite samples taken at the plant, the operational team has also started to take grab samples in the anaerobic section of the bioreactor to monitor the phosphorus release in the anaerobic reactor, an indicator of a healthy biological dephosphatation. Samples were also taken in the secondary sludge to monitor any uncontrolled phosphorus release at the effluent of the plant.

The Process Engineer and the operations team met minimum two times per week to discuss progress, modify the plan of action to minimize as much as possible the $P\text{-}PO_4$ discharge and maintain compliance.

Every modification made to the operation was carefully logged by the operational team. This data log is shared with and analyzed by the Process Engineer who provides continuous feedbacks to the operational team.

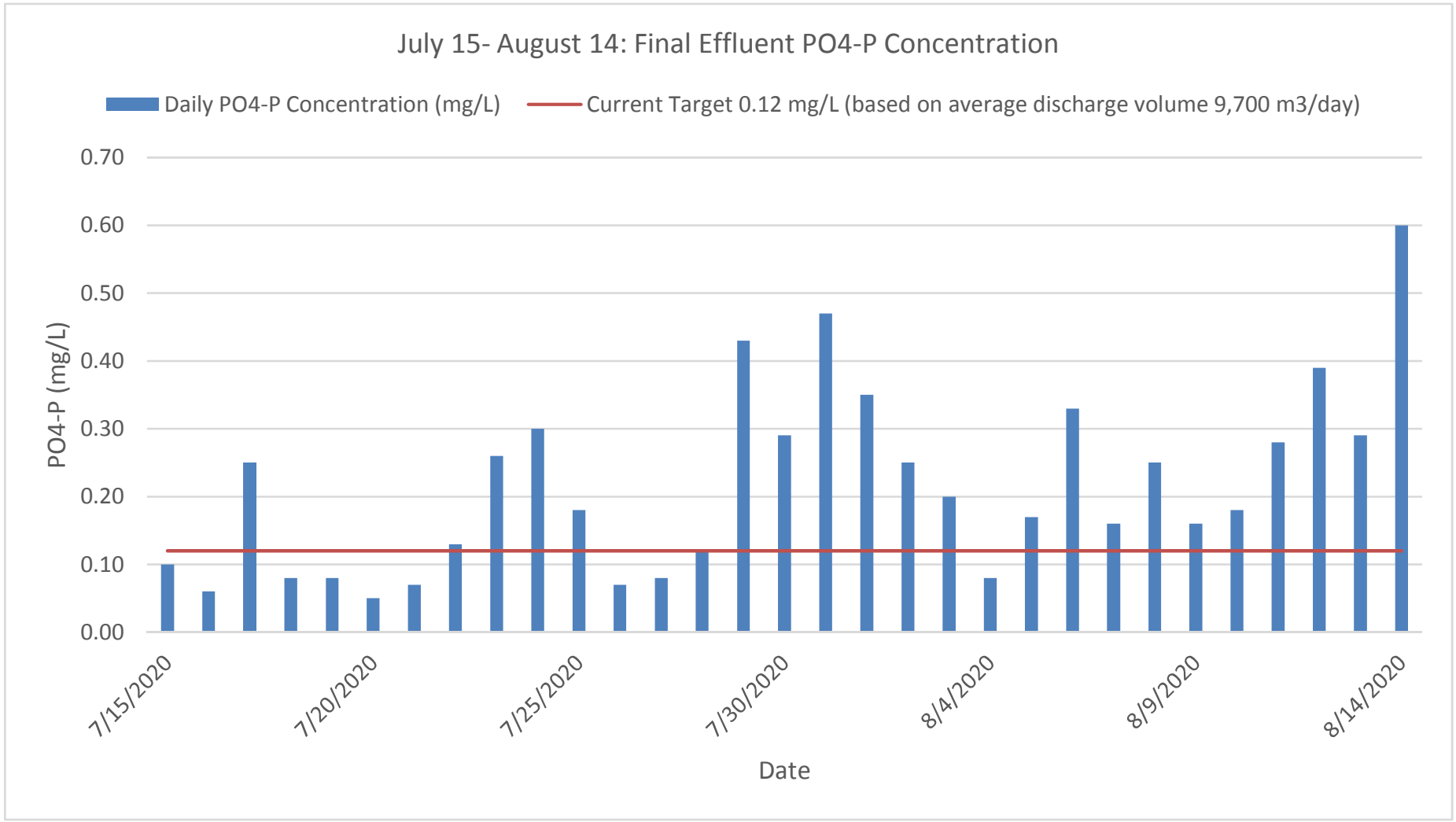
Future action items: The July 15th to August 14th 2020 operational period showed that the efficiency of the bioreactor for phosphorus removal was highly sensitive to the acetate dosage, especially as water temperature increases throughout the summer. The modelling performed by the Process engineer along with results at the plant demonstrated that a continuous dosage of acetate is required to maintain stable bioreactor performance under those conditions.

For the August 15th to September 14th period, it was decided to operate the bioreactor with an excess dosage of acetate to avoid any loss in performance as observed in the July 15th – August 14th period to avoid any additional non-compliance. Any excess of acetate that is not used by the dephosphatation biomass is oxidized in the aerated section of the bioreactor. Final effluent BOD_5 concentration is maintained below 10 mg/L.

A “lessons-learned” document illustrating the May 15th to September 14th 2020 operation challenges and solutions will be prepared by the Process Engineer. A presentation will be held with both the operational and the management team to ensure that adequate operational conditions are put in place.

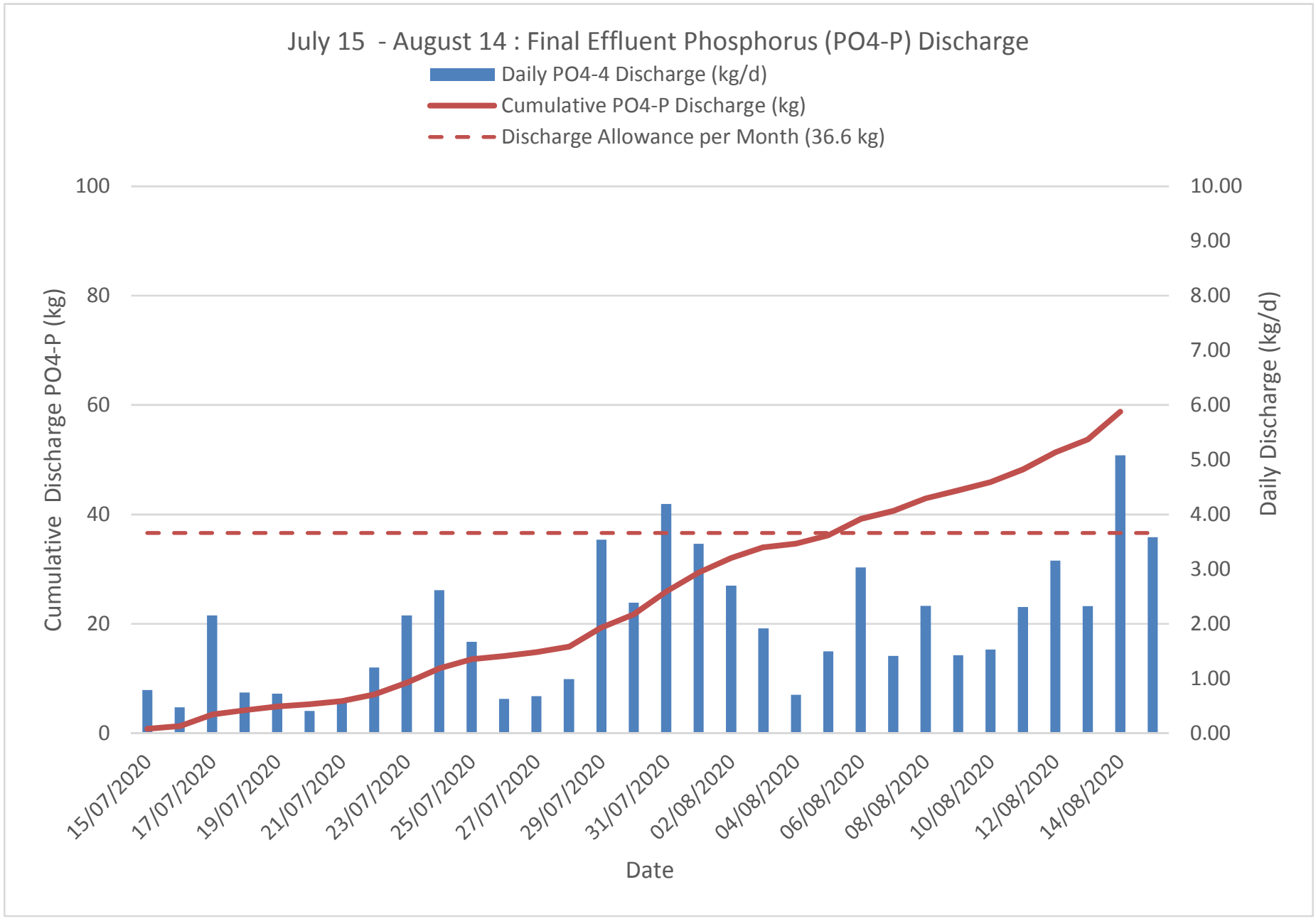
Contact information: For additional information, please contact Chelsey Roberts at 604-905-9462, or via email at croberts@whistler.ca.

Resort Municipality of Whistler Wastewater Treatment Plant ME-01452

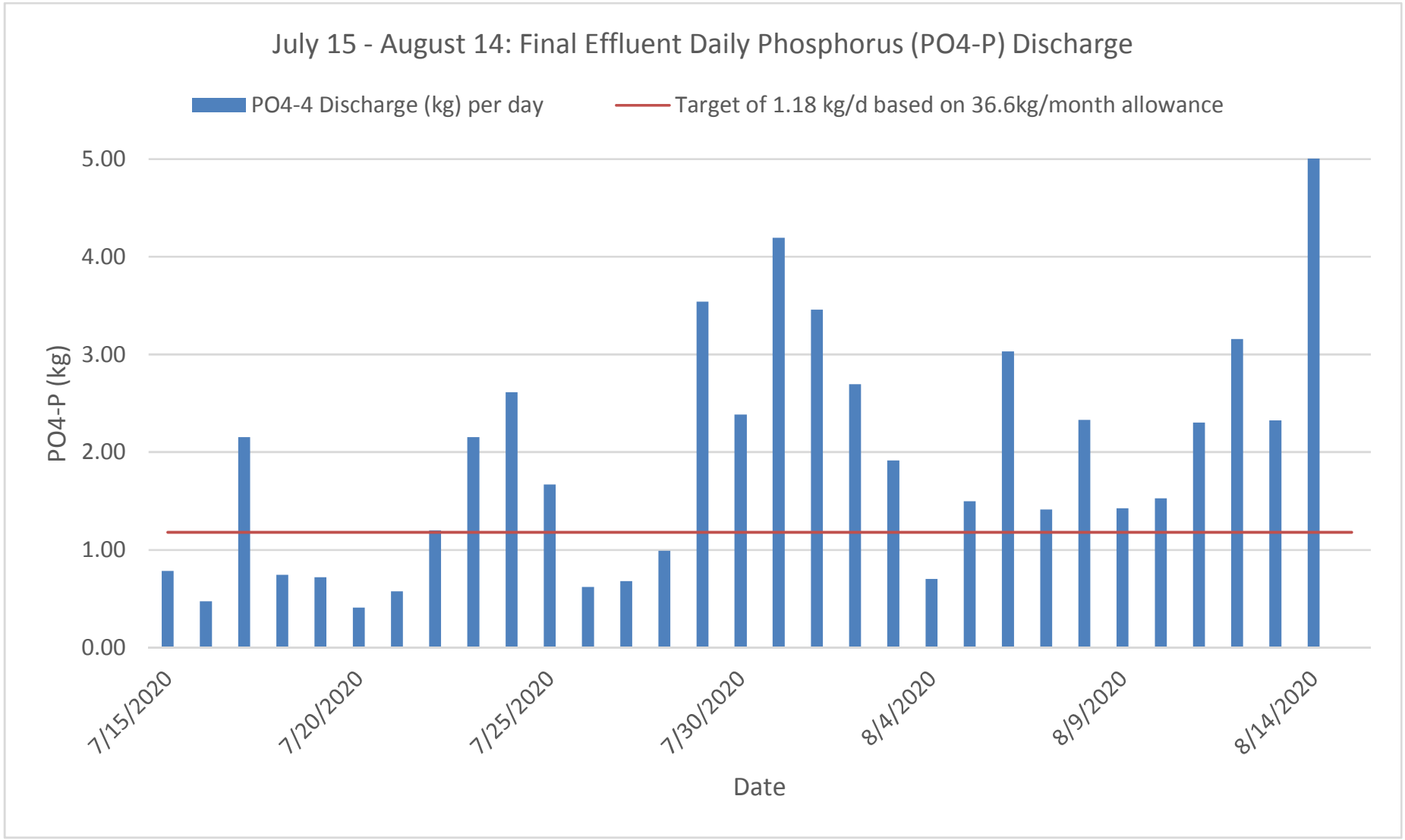


10/1/2020

Resort Municipality of Whister Wastewater Treatment Plant ME-01452



Resort Municipality of Whistler Wastewater Treatment Plant ME-01452



10/1/2020

MINISTRY OF ENVIRONMENT
REGIONAL OPERATIONS BRANCH

NON-COMPLIANCE REPORTING MAILBOX NOTIFICATION

To: EnvironmentalNonCompliance@gov.bc.ca

Subject: 2020-09-22 Authorization # ME-01452 Section 1. Authorized Discharge, 1.1.3 Nutrient Loading for Discharge May 15 - September 15 Orthophosphate (as phosphorus) 36.6 kg/month

Attention: *Non-compliance Report for* ME-01452 Section 1. Authorized Discharge, 1.1.3 Nutrient Loading for Discharge of Orthophosphate (as phosphorus) 36.6 kg/month – 7.6 kg of Orthophosphate (as phosphorus) exceedance for period of August 15 – September 15, 2020.

Date of Non-compliance: 2020-08-15 00:00 / 2020-09-15 00:00

Location of Non-compliance: 50.08448, -123.041263

Nature of Non-compliance: The maximum Orthophosphate (as phosphorus) discharge from May 15 to September 15 shall not exceed 36.6kg/month.
For the period of August 15th to September 15th, 2020, the monthly limit was exceeded by 7.6 kg. The total Orthophosphate (as phosphorus) discharged for the period August 15th to September 15th, 2020 was 44.2 kg.

A non-compliance in the July 15th to August 14th period was observed associated to a deterioration of the performance of the bioreactor. The strategy put in place during the July 15th – August 14th period was to add acetate in excess to boost the biological dephosphatation and maximize the bioreactor dephosphatation performance.

The automatic dosage of Alum was not triggered as excellent biological dephosphatation was achieved in the bioreactor, demonstrating that the operational strategy put in place during the preceding period was efficient in regaining stability of the bioreactor.

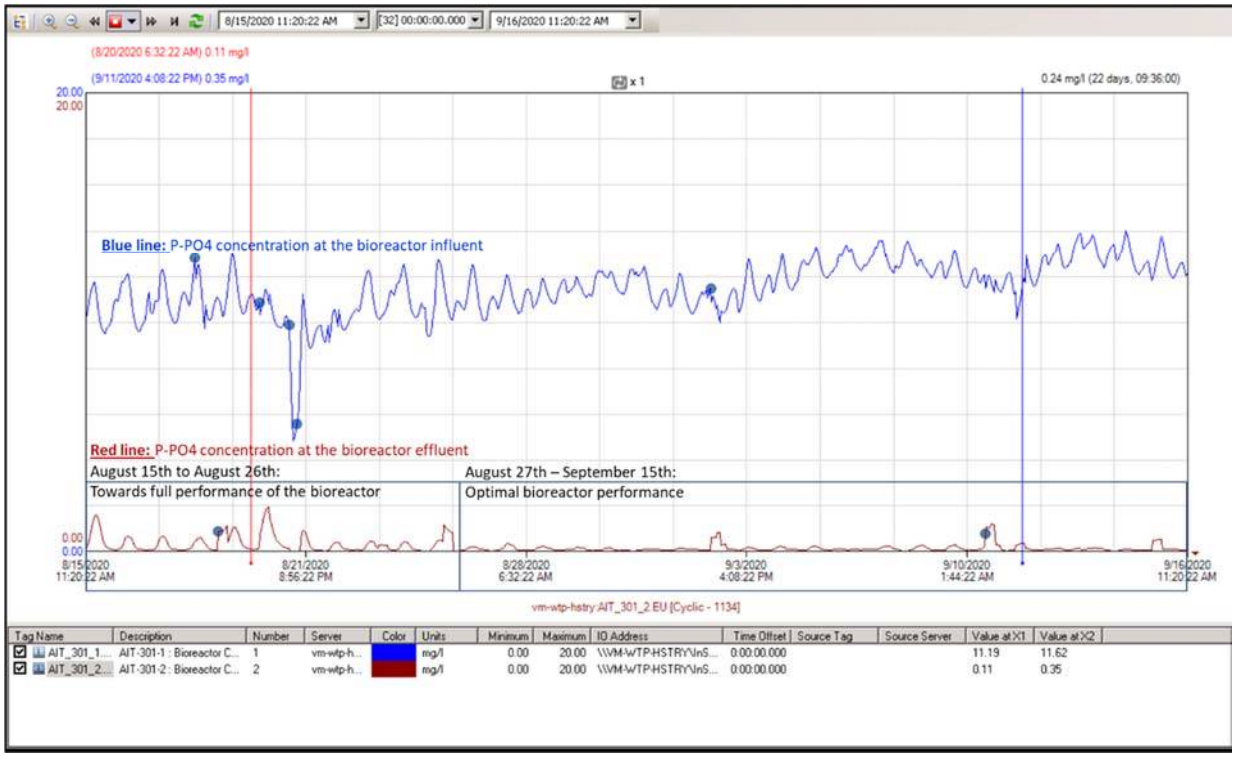
Non-compliance for the August 15th – September 15th period is due to the fact that 22.9 kg of P-PO_4 were discharged between August 15th and August 26th 2020 (period where the bioreactor performance was still below target). To comply with the 36.6 kg/month compliance requirement, the WWTP could only discharge 13.7 kg in the remaining 20 days, which corresponded to an average daily discharge of 0.7 kg/d.

Initial Response/Actions taken:
The operational team worked relentlessly since July 26th to regain full performance of their bioreactor. During the July 15th – August 14th period, an acetate dosage strategy was established to maximize biological dephosphatation, alum dosage was triggered to improve overall performance.

MINISTRY OF ENVIRONMENT
REGIONAL OPERATIONS BRANCH

NON-COMPLIANCE REPORTING MAILBOX NOTIFICATION

During the August 15th – September 15th period, the strategy was applied, and performance of the bioreactor carefully monitored. As illustrated by the Scada Screenshot provided here below, the performance of the bioreactor improved in August and full performance of the bioreactor was regained by August 26th, 2020. The need to add Alum was lifted.



As shown above, the operational team ensured optimal performance of the bioreactor between August 27th and September 15th. The corresponding average daily discharge at the final effluent was 1.06 kg $P\text{-}PO_4$/d (average final effluent concentration of 0.13 mg $P\text{-}PO_4$/L). That performance corresponds to the BNR's technology performance limit. Maintained over 31 days, it corresponds to 32.9 kg and ensures compliance to ME-01452.

Monitoring conducted:

As for the July 15th – August 14th period, the operations team and Wastewater Chief Operator closely check the performance of the bioreactor. Phosphorus ($P\text{-}PO_4$) concentration is continuously monitored at both the bio reactor influent and effluent and at the final effluent. In addition to the usual 24h composite samples taken at the plant, the operational team has also taken grab samples in the anaerobic section of the bioreactor to monitor the phosphorus release in the anaerobic reactor, an indicator of a healthy biological dephosphatation.

The Process Engineer and the operations team met once a week to discuss the operation and maintain optimal operation. Every observation was carefully logged by the operational team.

MINISTRY OF ENVIRONMENT
REGIONAL OPERATIONS BRANCH

NON-COMPLIANCE REPORTING MAILBOX NOTIFICATION

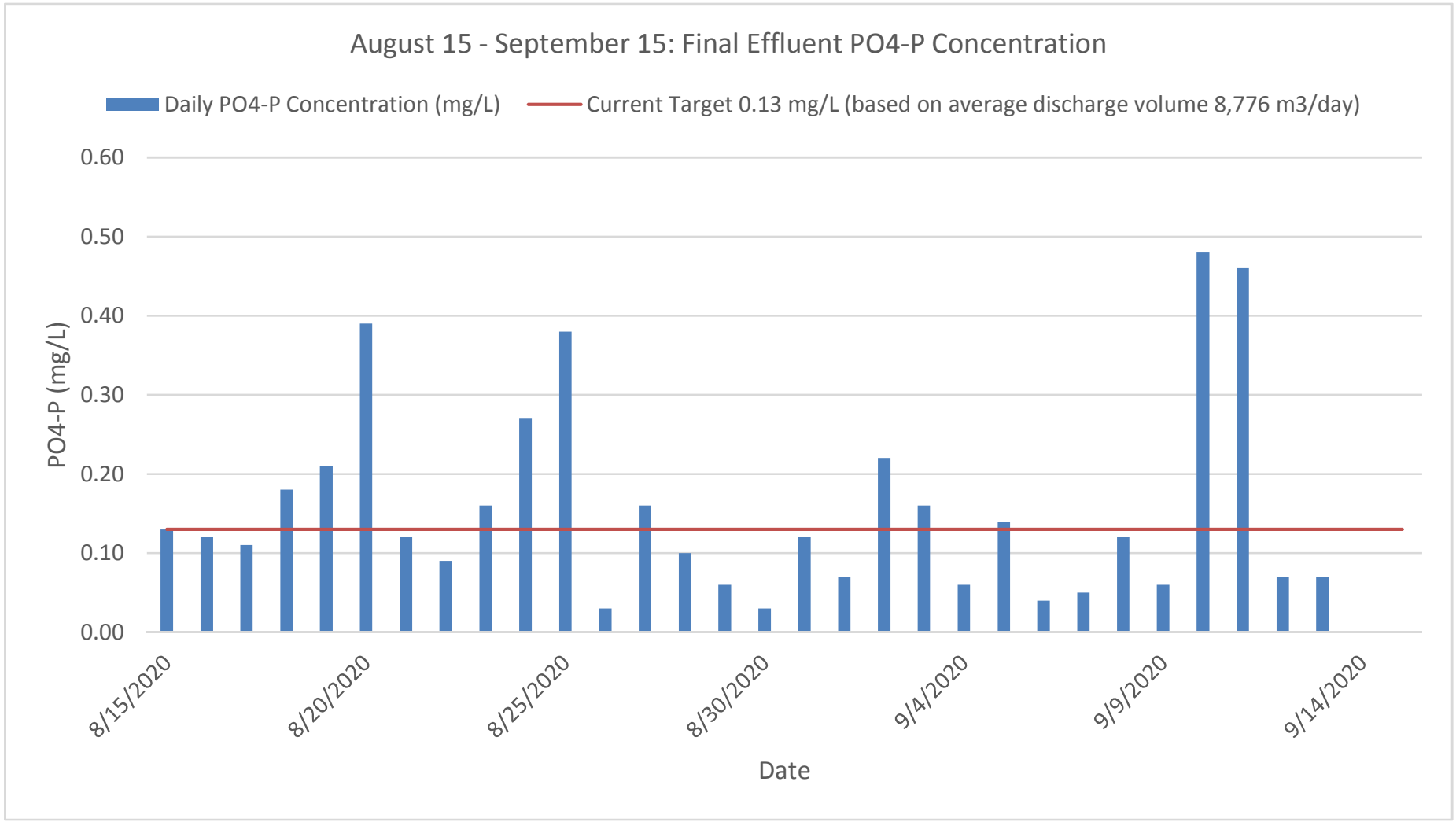
Future action items:
During the September 15th – October 15th period, the operational team will keep on working on the acetate dosage strategy to improve operational performance and ensure that the May 15th – September 15th 2021 effluent quality is optimal and meets ME-01452 effluent requirements.

A "lessons-learned" document illustrating the May 15th to September 14th 2020 operation challenges and solutions is under preparation by the Process Engineer. A presentation will be held with both the operational and the management team to ensure proper knowledge transfer for the 2021 summer period.

Since the WWTP has been facing a lot of operational issues over the May 15th – September 15th period, the RMOW is planning for future capital investment at the WWTP. The first step is a desktop study performed by an engineering consulting firm that will aim at identifying WWTP's potential deficiencies and assess the capital investment needs to meet population growth and regulatory compliance.

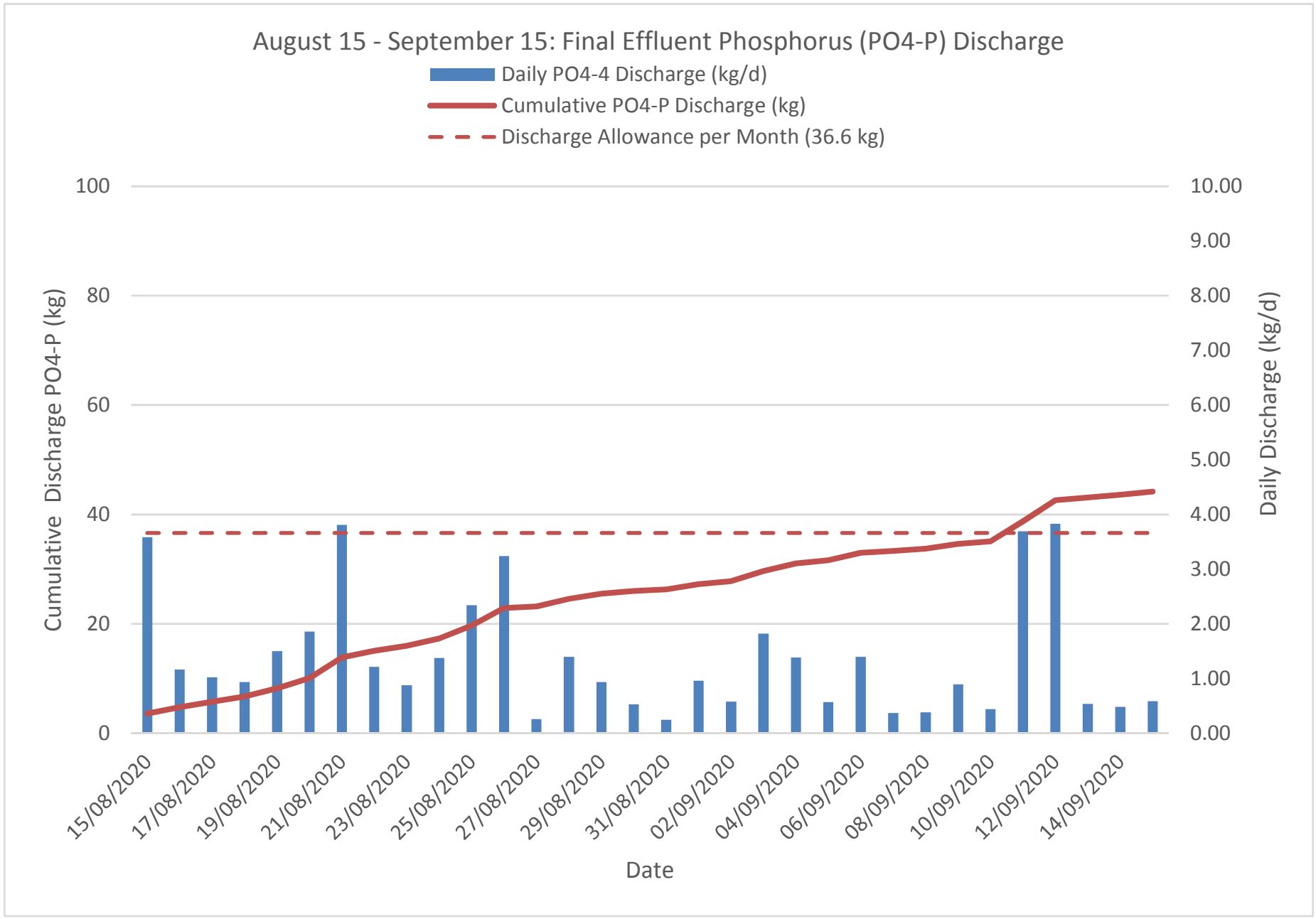
Contact information: For additional information, please contact Chelsey Roberts at 604-905-9462, or via email at croberts@whistler.ca.

Resort Municipality of Whistler Wastewater Treatment Plant ME-01452

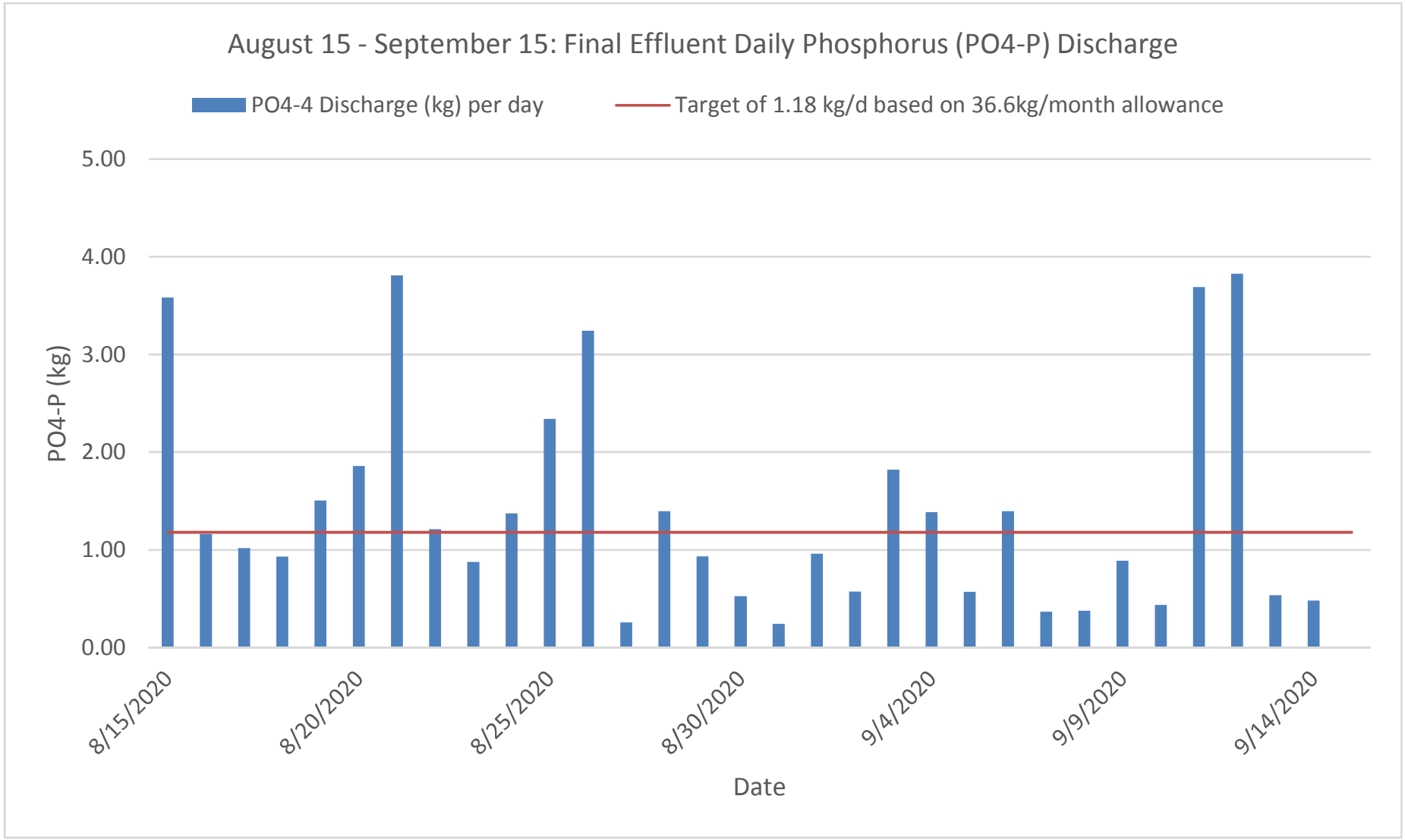


10/1/2020

Resort Municipality of Whister Wastewater Treatment Plant ME-01452



Resort Municipality of Whistler Wastewater Treatment Plant ME-01452



10/1/2020

APPENDIX B: ACUTE LETHALITY TEST RESULTS

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	Rainbow trout test initiation	
YVS108FE	23-Apr-20 at 0900h	23-Apr-20 at 1241h	23-Apr-20 at 1500h	11.8°C

TESTS

- Rainbow trout 96-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
YVS108FE	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	Rainbow trout
Reference toxicant LC50 (95% CL)	57.9 (43.4 – 77.2) µg/L Zn[1]
Reference toxicant historical mean (2 SD range)	96.8 (53.0 – 176.8) µg/L Zn
Reference toxicant CV	31%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1]Test Date: April 20, 2020, LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature*
	Collected	Received*	Rainbow trout test initiation*	
YVS108FE	18-Jun-20 at 0900h	23-Jun-20 at 0935h	23-Jun-20 at 1510h	18.2°C

* - Tested at Nautilus Environmental, Calgary location. Data provided by Nautilus Calgary.

TESTS

- Rainbow trout 96-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
YVS108FE	>100

LC = Lethal Concentration

QA/QC

QA/QC summary *	Rainbow trout
Reference toxicant LC50 (95% CL)	3.7 (3.2 – 4.1) g/L KCl[1]
Reference toxicant historical mean (2 SD range)	3.4 (2.4 – 4.8) g/L KCl
Reference toxicant CV	11%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1]Test Date: June 19, 2020, LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation
* - Data obtained from Nautilus Environmental, Calgary.

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	Rainbow trout test initiation	
YVS108FE	08-Oct-20 at 0900h	08-Oct-20 at 1254h	09-Oct-20 at 1135h	16.3-16.4°C

TESTS

- Rainbow trout 96-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
YVS108FE	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	Rainbow trout
Reference toxicant LC50 (95% CL)	201.0 (146.3 – 284.6) µg/L Zn[1]
Reference toxicant historical mean (2 SD range)	76.2 (32.2 – 180.4) µg/L Zn
Reference toxicant CV	45%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1]Test Date: October 07, 2020, LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation

The reference toxicant test was outside of the historical 2 SD range but within the 3 SD range.

SAMPLE INFORMATION

Sample ID	Dates			Receipt temperature
	Collected	Received	Rainbow trout test initiation	
YVS108FE	10-Dec-20 at 0900h	10-Dec-20 at 1320h	11-Dec-20 at 1532h	10.5-10.7°C

TESTS

- Rainbow trout 96-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v)
YVS108FE	>100

LC = Lethal Concentration

QA/QC

QA/QC summary	Rainbow trout
Reference toxicant LC50 (95% CL)	135.2 (93.8 – 181.4) µg/L Zn[1]
Reference toxicant historical mean (2 SD range)	77.6 (29.8 – 201.9) µg/L Zn
Reference toxicant CV	51%
Organism health history	Acceptable
Protocol deviations	None
Water quality range deviations	None
Control performance	Acceptable
Test performance	Valid

[1] Test Date: December 11, 2020, LC = Lethal Concentration, CL = Confidence Limits, SD = Standard Deviation, CV = Coefficient of Variation

APPENDIX C: END-OF-SPILL REPORT FORM

Update to Minister/End-of-Spill Report Form

Environmental Emergency Program
SpillReports@gov.bc.ca

This report template can be completed to satisfy the requirements of either the End-of-Spill Report or the Update to Minister Report. Please specify which report you are completing in section I of this form. If any of the fields of this form are not applicable to the spill for which this form is being completed, indicate 'N/A' in the field; reports with incomplete fields will be sent back to the responsible person.

End-of-Spill Report: Section 6 of the Spill Reporting Regulation outlines the requirements for the End-of-Spill Report. Responsible persons must submit a written End-of-Spill Report to the Ministry of Environment and Climate Change Strategy within 30 days following the emergency response completion date of a spill as outlined in section 6 (1) of the Spill Reporting Regulation. Responsible persons must submit a written report to the Ministry of Environment and Climate Change Strategy as soon as practicable if either of the following two conditions are present:

1. The spill entered, or was likely to enter, a body of water as defined in the Spill Reporting Regulation
2. The quantity of the substance spilled was, or was likely to be, equal to or greater than the listed quantity for the listed substance as outlined in the Spill Reporting Regulation

Update to Minister Report: Section 5 of the Spill Reporting Regulation outlines the requirements for the Update to Minister Report. Responsible persons must submit a written report to the Ministry of Environment and Climate Change Strategy as soon as practicable if any of the following three conditions are present:

1. On request of the Minister
2. At least once every 30 days after the date that the spill began
3. At any time that the responsible person has reason to believe that information previously reported in the Initial Report has become inaccurate or incomplete

Complete this form and submit it by email to SpillReports@gov.bc.ca. For additional information, please visit the British Columbia Environmental Emergency Program Report a Spill webpage.

Dangerous Goods Incident Report (DGIR) number:

Section I: Type of report **Sections 5 and 6 of Spill Reporting Regulation**	
This form is completed to satisfy the requirements of the:	
☐ Update to Minister Report	☐ End-of-Spill Report

Section II: Contact information **Section 6 (2) (a) of the Spill Reporting Regulation**	
Details for person filling out the report	Name of company representative:
	Company name:
	Email:
	Address:
	Telephone number:

Details for responsible person Same as above	Name of company representative:
	Company name:
	Email:
	Address:
	Telephone number:
Details for owner of the substance spilled Same as above	Name of company representative:
	Company name:
	Email:
	Address:
	Telephone number:

Section III: Timing of the spill
Section 6 (2) (b) of the Spill Reporting Regulation

Date of spill: Time of spill: Duration of the spill (days):

Date reported: Emergency response completion date[1]:

Section IV: Site description
Section 6 (2) (c) (d) of the Spill Reporting Regulation

Provide a description of the spill site and the sites affected by the spill. The description of the spill site may include a description of the receiving environment, the proximity to a nearby city/town/roadway, the type of vegetation in the area, how densely populated the area is, accessibility to spill site, nearby waterways, and any other defining characteristics of the area.

Latitude: Degrees Minutes Seconds

Longitude: Degrees Minutes Seconds

or

Site civic address or location: Street

City Postal Code

or

DLS or BCNTS (if applicable): Site ID number (if applicable):

[1] For the definition of the *emergency response completion date*, please refer to B.C. Reg. 187/2017 Spill Reporting Regulation

Section V: Description of the source, type, and quantity of the spill **Section 6 (2) (e) (f) of the Spill Reporting Regulation**
Description of the source of the spill (pipeline, rail, truck, facility, etc.):
Type of substance spilled (common name):
United Nations (UN) number of substance spilled (if applicable):
Item number from the table in the Schedule in the Spill Reporting Regulation:
Quantity (in litres or kilograms) of the substance spilled – if the quantity is unknown, provide a reasonable estimate and explain why the quantity is unknown and cannot be determined:

Section VI: Description of the circumstances, cause, and impacts of the spill **Section 6 (2) (g) (i) (ii) (iii) of the Spill Reporting Regulation**
Provide a description of the activity during which the spill occurred (transportation, transfer of cargo, fuelling, cleaning, maintenance, etc.):
Provide a description of the incident leading to the spill (tank rupture, overfill, collision, rollover, derailment, fire, explosion, etc.):
Provide a description of the underlying cause of the spill (human error, external conditions, organizational or management failure, etc.):

Section VII: Impacts to human health, the environment, and infrastructure **Section 6 (2) (g) (iv) (v) of the Spill Reporting Regulation**
Describe any adverse effects of the spill on human health (please state 'N/A' if there were no adverse effects on human health):
Number of people evacuated:
Number of fatalities:
Number of people injured:
Describe any adverse impacts on infrastructure[2] (please state 'N/A' if there were no adverse impacts to infrastructure):
Impacts to water
Was there an impact to a body of water? Yes No

[2] For the definition of *infrastructure,* refer to section 91.1 of the *Environmental Management Act 2003*

Description of impact:	
Describe the body of water (stream, aquifer, fish habitat, naturally formed body of water, ditch, lake, etc.):	
Name of body of water:	
Impacts to the environment	
Was there an impact on flora (vegetation)? YES NO	If yes, list the common and species names:
Provide a description of the impact on flora (oiled, removed, etc.):	
Was there an impact on fauna (animals)? YES NO	If yes, list the common and species names:
Provide a description of impact on fauna (include injured, dead, etc.):	
Was there an impact on aquatic and/or terrestrial habitats? YES NO	If yes, list the type of habitat (riparian, breeding ground, etc.):
Provide a description of impact on aquatic and terrestrial habitats, including response actions taken to restore any of the impacts listed:	

Section VIII: Spill response actions **Section 6 (2) (h) of the Spill Reporting Regulation**		
Action taken to comply with section 91.2 of the *Environmental Management Act 2003*	Who took the action (company, person, contractor, etc.)	Date that the action was taken (click the arrow or enter the date using the format YYYY-MM-DD)

Section IX: Waste disposal (please state 'N/A' if no waste was produced) **Section 6 (2) (i) of the Spill Reporting Regulation**		
List the type of waste	Method of disposal	Location of disposal

Section X: Attached reports, maps, and photographs **Section 6 (2) (j) (k) of the Spill Reporting Regulation**	
Report of results of sampling, testing, monitoring, and/or assessing carried out during spill response actions (including reports from Qualified Professionals), if applicable	Copy attached ☐
Map of the incident site and areas surrounding the incident site (required)	Copy attached ☐
Photographs of the spill (required)	Copy attached ☐

Section XI: Agencies on scene or notified **Section 6 (2) (l) (m) of the Spill Reporting Regulation**
List the names of all agencies that were at the incident site:

List the names of other persons or agencies that were advised about the spill:

Section XII: Additional comments

Section XIII: Verification of information provided

I confirm that the above information is true and complete.

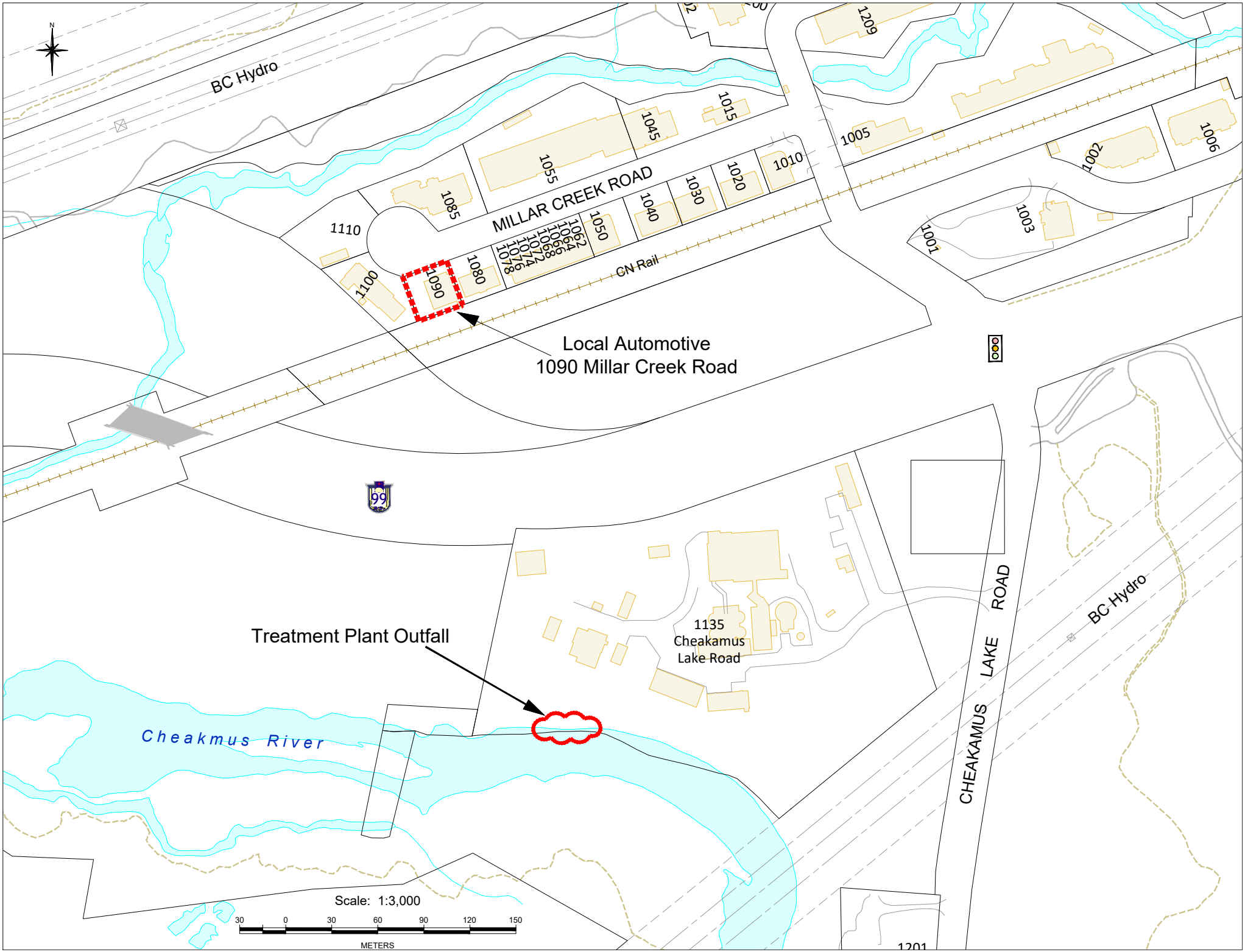
Name of person completing form: Date completed (YYYY-MM-DD)

Name of responsible person (person or company): Date completed (YYYY-MM-DD)

Section XIV: Approval - For internal use only

Reviewed by: Date completed (YYYY-MM-DD)

Attachment 1 - Map of incident site


BC Hydro
MILLAR CREEK ROAD
1110
1100
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1002
1006
1001
1003
1209
CN Rail
Local Automotive
1090 Millar Creek Road
Treatment Plant Outfall
1135
Cheakmus
Lake Road
CHEAKAMUS LAKE ROAD
BC Hydro
Cheakmus River
Scale: 1:3,000
30 0 30 60 90 120 150
METERS
1201

Attachment 2 - Impact of Oil Spill Discharge to the Wastewater Treatment Plant at the Resort Municipality of Whistler (Tetra Tech, December 07, 2020)

Attachment 2 - Potential effects of the November 4, 2020 oil contamination incident at the Whistler Wastewater Treatment Plant on biota in the Cheakamus River, memo number 1 (Limnotek, December 1, 2020)

Technical Memorandum

To: To whom it may concern

From: J. Lemay, P.Eng., EGBC #45343
C. Stoquart, Ph.D., OIQ #5067098

Date: December 07, 2020

Project: 41385TTA (60ET)

Revision: 00

Subject: **Impact of Oil Spill Discharge to the Wastewater Treatment Plant at the Resort Municipality of Whistler**

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1) General Information

On November 4, 2020, the laboratory technician working at the wastewater treatment plant (WWTP) of the Resort Municipality of Whistler (RMOW) reported seeing and smelling a fuel type substance in the bioreactor of the plant at 11:30 am.

Compliance to authorization #ME-01452 was maintained during the event. However, the WWTP is not designed to treat hydrocarbons. It is expected that hydrocarbons were discharged into the Cheakamus River on that day and grab samples were taken to try to quantify the concentration of hydrocarbon discharged to the Cheakamus River.

The biomass, which is the heart of the WWTP, was negatively affected by the spill. The WWTP effluent is still compliant to authorization #ME-01452 but amounts of phosphorus discharged in the River increased after the oil spill.

This Technical Memorandum is to provide further detail to the British Colombia's Ministry of Environment (BC MOE) on the oil spill event and its impact on the WWTP and the receiving body.

Location of hydrocarbon discharge: 50.08448,-123.041263
Expected date of hydrocarbon discharge: November 4, 2020

The spill was reported to the PEP Spill Report line 1-800-663-3456, reference number DGIR# 20279.

2) Description of Oil Spill Event – Discovery and Immediate Measures Taken

November 4, 2020:

- **11:30 am**: The operators notice a sudden increase in $P\text{-}PO_4$ concentrations at the WWTP discharge. At that time, the bioreactor effluent was at 0.38 mg/L but the final effluent had reached 2.64 mg/L (instantaneous value). The laboratory technician was sent to look at the bioreactor and notices a fuel smell and a sheen at the surface. Same smell was reported at the influent of the plant.
- **11:30am – 1 pm**: Chief Operator and Equipment Operations Lead investigated the potential source of the fuel on the wastewater collection line or from potential sanitation discharge without success. No event had been reported to the Fire Department either.
- **1:15 – 1:30 pm**: Fuel sheen is noticed at the end of the bioreactor, indicating that the floating portion of the fuel is approaching the end of the liquid chain.
- **2 pm**:
    - Operational meeting held with process engineer to determine what is the best course of action.
    - Heavy Alum dosage was put in to control the $P\text{-}PO_4$ discharge to the Cheakamus River and successfully maintain compliance to the operational certificate.
    - Grab samples were taken at the bioreactor effluent and final effluent of the plant;
    - No fuel smell of sheen observed at the surface of the secondary clarifiers; and
    - Fuel smell detected at the effluent of the plant but no sheen observed. This is probably due to turbulence but also to the hydraulic barrier between the bioreactor and the secondary clarifier, which tend to maintain all floating compounds in the bioreactor and do not let them pass to the secondary clarifiers.
- **2:25 pm**: S107 Lift station in the Industrial Park is reported to have a string smell of fuel by the WW Collection team.

- **3:00 pm**: Source of fuel is identified to be Manhole MH1001, which is a service from a local automotive company named “Local Automotive”. At that time, the owner was not aware of any type of substance entering the sewer system (call with the WWTP Chief Operator).
- **3:45pm – 4pm**: Grab sampling to confirm source of fuel smell at the WWTP;
    - Grab sample taken at MH1001. The sample had a strong smell of used motor oil, and visually had an oil layer to the sample; and
    - Grab sample taken at MH1002, upstream of MH1001. No oil layer in the sample.

Figure 1: Photos of MH1001 sample and MH1001

Figure 2: Photos of MH1002 sample and MH1002 located upstream of MH 001

Conclusion of the Day:

Source of the oil spill is identified by the WWTP operational team as an oil separation tank owned by Local Automotive. The tank is used to receive used oils and separate them from water. The water is sent to the MH1001 via a pipe.

The Local Automotive owner mentioned that the tank had been emptied three weeks prior to the event by GFL Environmental Inc. (GFL). However, when he checked on the tank, there seemed to be a large amount of oil still, indicating that either the tank had not been completely emptied three weeks prior or that a large amount of oil had been received in the three weeks that followed GFL’s visit.

November 5, 2020:

- **8:45am**: Pipe connecting the oil separator tank with MH1001 was capped and covered by Local Automotive owner. Owner confirmed no oil would be added to the tank until he had it was properly sucked out (3 weeks).

Figure 3: Photo of capped pipe in the oil separation tank from Local Automotive

- **10.30 am:**
  - MH1001 checked by WWTP team. No fuel type substance seemed to be entering the WW Collection system anymore. Chief Operator checked in with the person responsible on site from Local Automotive, and strongly reminded him the oil separator was not to be used until it had been cleaned/sucked out.
  - S107 lift station still had a strong smell of fuel.
- **2.00 pm:** S107 lift station sucked/cleaned out by McRae's Environmental Services Ltd. to avoid any further hydrocarbons sent to the WWTP.

Figure 4: Photo of MH1001 and S107 lift station on November 5, 2020

Conclusion of the day:

Confirmation that source of the oil spill is contained and that no more oil is sent to the WW Collection System.

S107 lift station downstream of MH1001 was impacted by the oil spill and was therefore cleaned out on the same day to remove any oil that would still be in the sewer system.

3) Characterization of grab samples

As mentioned above, grab samples were taken at four sampling points on November 4, 2020 in the afternoon:

- Sampling point #1: Bioreactor effluent at the WWTP;
- Sampling Point #2: Final effluent at the WWTP;
- Sampling point #3: MH1001 directly connected to the tank responsible of the spill; and
- Sampling point #4: MH1002 upstream of MH1001, sampled to confirm that oil spill comes from MH1001.

The water characterization for those samples is provided in Appendix to this Technical Memorandum. Main observations on the hydrocarbons detected in the grab samples are as follows:

- Oil spill was mostly consisting in Heavy Extractable Petroleum Hydrocarbons in water (HEPHw), as per the BC MOE Aggregate Hydrocarbons method (5,110,000 µg/L).
- HEPHw were 7,400 times less concentrated at the final effluent of the WWTP than at MH1001 (690 µg/L);
- Pyrene, a polycyclic aromatic hydrocarbon (PAH) had a concentration at the WWTP final effluent above the long-term working water quality guideline (WWQG) for freshwater aquatic life (0.068 µg/L). For other PAHs listed in the long-term WWQG for freshwater aquatic life, dilution by the WWTP was sufficient to decrease their concentration below the WWQG;
- Toluene, a volatile organic compound (VOC) was measured at 19 µg/L at the final effluent of the WWTP, diluted 60 times compared to concentration measured in MH1001. Other VOCs concentrations were maintained below detection limit.

In addition to hydrocarbons, high concentrations of dissolved and total phosphorus were measured in the grab samples:

- Oil spill sampled at MH1001) was highly concentrated in dissolved phosphorus (96.3 mg dissolved P/L) and total phosphorus (186 mg P/L).

The characterization of the grab samples therefore indicates:

- That the WWTP diluted significantly the HEPHw coming from MH1001. However, values above the long-term WWQG for freshwater aquatic life were measured at the final effluent of the plant;
- A significant amount of phosphorus was also sent to the WWTP, therefore increasing the load of phosphorus to be treated at the WWTP before.

4) Impact of the Oil Spill Event on the WWTP's Performance on November 4, 2020

The main observations in the supervisory control and data acquisition (SCADA) of the WWTP were as follows:

- P-PO_4 started to increase at the final effluent of the plant on November 4, 2020. Nothing was however detected at the bioreactor;
- Early increase of the P-PO_4 concentration at the final effluent could potentially be associated with an increased load from the oil spill. However, this is a hypothesis that can not be confirmed;
- Bioreactor started to behave abnormally with P-PO_4 concentration spiking at the bioreactor effluent to concentrations superior to normal bioreactor operation, indicating that the balance of the bioreactor was off, and that the biomass was most probably releasing a lot of phosphorus; and
- Alum was added continuously from Nov 4 at the bioreactor effluent to precipitate the dissolved phosphorus. Final effluent concentration 24h composite was 1.62 mg/L of P-PO_4.

The operational team was therefore able to maintain compliance to authorization #ME-01452 regarding the phosphorus discharge. However, a significant amount of P-PO_4 was discharged to the Cheakamus River that day.

Figures provided below are screenshots of the SCADA of the WWTP from November 3 to November 5, 2020. They illustrate the behavior of the bioreactor as well as the concentration in P-PO_4 measured continuously at the final effluent of the plant.

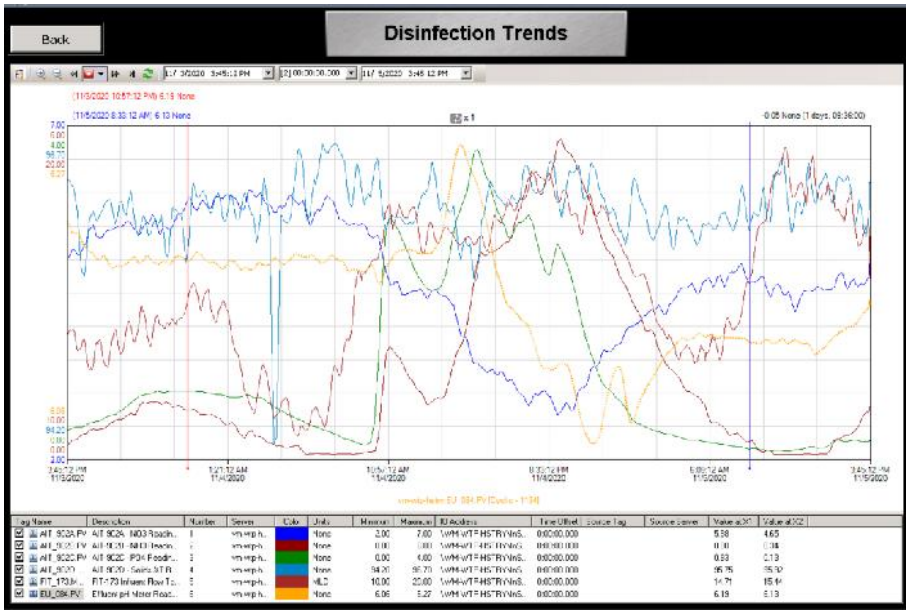

Figure 5: Screenshot of the SCADA of the WWTP – Final effluent PO_4-P concentration is in green

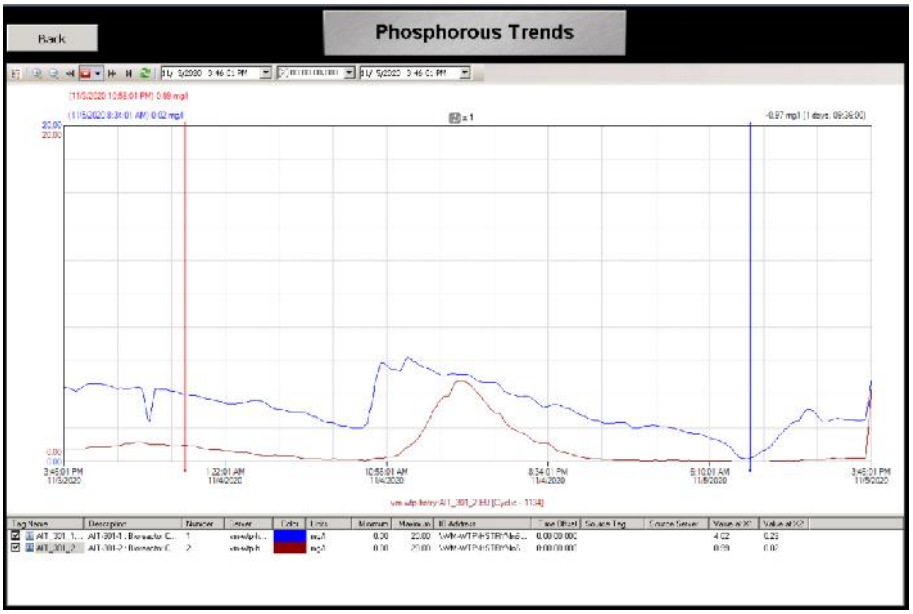

Figure 6: Screenshot of the SCADA of the WWTP – Bioreactor influent PO_4-P concentration is in blue and effluent concentration is in red

5) Mid-term impact of the Oil Spill event on the WWTP performance

After the oil spill event, performance of the WWTP for phosphorus removal has decreased. $P\text{-}PO_4$ concentration at the final effluent is still maintained well below the 1.75 mg/L limit set in authorization #ME-01452 (average of 0.78 mg/L). However, daily discharge is superior to that observed at the same time last year.

It is assumed that the oil spill affected negatively the biomass, potentially by limiting the biological kinetics and the oxygen transfer to the sludge in the aeration tanks.

Microscopic observations of the biomass by the laboratory technician of the WWTP on the day of the oil spill indicated that there seemed to be fewer living organisms than usual.

The following measures were put in place to ensure that WWTP performance is brought back fully:

- Acetate dosage to support phosphate accumulating biomass growth;
- Automated alum dosage to trim any bioreactor upset and minimize discharge to the Cheakamus River; and
- Weekly calls with process engineer.

In addition to operational measures put in place, a mandate was issued to Limnotek, a company that provides contract services in the freshwater sciences. Limnotek was the company that studied the effect of the discharge of the WWTP on the Cheakamus River in 2020. The objective of that mandate was to evaluate the impact the discharge of the WWTP at the time of the oil spill on the Cheakamus River but also to ensure that phosphorus discharge is not only compliant to authorization #ME-01452 but also maintained within values that are safe for the freshwater aquatic life of the Cheakamus River. The Technical Memorandum prepared by Limnotek is provided in Appendix to this Technical Memorandum.

6) Conclusions

Heavy hydrocarbons entered the RMOW's WWTP on November 4, 2020. The source of hydrocarbons was identified on the same day as motor oil coming from an oil separation tank from Local Automotive. The spill was contained.

The high wastewater volume treated at the WWTP on that day allowed to significantly dilute the hydrocarbons that entered the plant. However, hydrocarbons were detected in the grab sample taken at the effluent of the WWTP on that day. A Technical Memorandum by Limnotek is attached to this document and discusses the impact of the hydrocarbon discharge on aquatic life.

The oil spill not only sent heavy hydrocarbons to the WWTP but also phosphorus. Phosphate discharged to the Cheakamus River on that day was controlled by the operational team via the addition of high amounts of alum, a coagulant that precipitated the phosphate that could not be treated biologically.

Finally, the oil spill that entered the plant seems to have put the bioreactor off-balance. Since the event, treating phosphorus is more challenging. Compliance to authorization #ME-01452 is maintained, but phosphate discharge to the Cheakamus River increased. Therefore, a mandate was issued by the RMOW to Limnotek in order to receive feedbacks on the impact of the higher discharge on the aquatic life. The technical memorandum provided by Limnotek (see Appendix) will be used by the RMOW to ensure that the WWTP is brought back to balance without negatively affecting the aquatic life of the Cheakamus River. Since the event, the RMOW has been working continuously in regaining optimal operation of the bioreactor.

We thank you for your consideration and are available to respond to any of your questions.

Céline Stoquart, P.Eng., Ph.D.
Project Lead
OIQ #5067098

Janick Lemay, P.Eng., MBA.
Project manager
EGBC #45343

CS/JL/ah

Appendices Caro Analytical Services Results on Grab Samples - 20K0677_2 CARO-E1-noreg 2020 11 09 1618.pdf

Technical Memorandum by Limnotek dated Dec 1, 2020: "*Potential effects of a November 4, 2020 oil contamination incident at the Whistler Wastewater Treatment Plant on biota in the Cheakamus River*"

CERTIFICATE OF ANALYSIS

REPORTED TO	Whistler, Resort Municipality of 4325 Blackcomb Way Whistler, BC V8E 0X5
ATTENTION	Neil Kearns
PO NUMBER	6310.6663
PROJECT	WWTP
PROJECT INFO	

WORK ORDER	20K0677
RECEIVED / TEMP	2020-11-05 14:00 / 9°C
REPORTED	2020-11-09 16:18

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at rsundar@caro.ca

Authorized By:

Rochita Sundar
Junior Account Manager

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Bio Reactor Effluent (20K0677-01) | Matrix: Water | Sampled: 2020-11-04 14:30					
BCMOE Aggregate Hydrocarbons					
VHw (6-10)	< 100	100	µg/L	2020-11-06	
VPHw	< 100	100	µg/L wet	N/A	
EPHw10-19	< 250	250	µg/L	2020-11-06	
EPHw19-32	**2110**	250	µg/L	2020-11-06	
LEPHw	< 250	250	µg/L	N/A	
HEPHw	**2110**	250	µg/L	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*92*	*60-126*	%	*2020-11-06*	
Calculated Parameters					
Hardness, Total (as CaCO3)	**118**	0.500	mg/L	N/A	
Dissolved Metals					
Lithium, dissolved	**0.00247**	0.00010	mg/L	2020-11-06	
Aluminum, dissolved	**0.0096**	0.0050	mg/L	2020-11-06	
Antimony, dissolved	**0.00036**	0.00020	mg/L	2020-11-06	
Arsenic, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Barium, dissolved	**0.0055**	0.0050	mg/L	2020-11-06	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Boron, dissolved	**0.0643**	0.0500	mg/L	2020-11-06	
Cadmium, dissolved	**0.000021**	0.000010	mg/L	2020-11-06	
Calcium, dissolved	**37.9**	0.20	mg/L	2020-11-06	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Cobalt, dissolved	**0.00059**	0.00010	mg/L	2020-11-06	
Copper, dissolved	**0.0169**	0.00040	mg/L	2020-11-06	
Iron, dissolved	**0.456**	0.010	mg/L	2020-11-06	
Lead, dissolved	< 0.00020	0.00020	mg/L	2020-11-06	
Magnesium, dissolved	**5.60**	0.010	mg/L	2020-11-06	
Manganese, dissolved	**0.119**	0.00020	mg/L	2020-11-06	
Mercury, dissolved	< 0.000010	0.000010	mg/L	2020-11-06	
Molybdenum, dissolved	**0.00163**	0.00010	mg/L	2020-11-06	
Nickel, dissolved	**0.00205**	0.00040	mg/L	2020-11-06	
Phosphorus, dissolved	**9.59**	0.050	mg/L	2020-11-06	
Potassium, dissolved	**16.7**	0.10	mg/L	2020-11-06	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Silicon, dissolved	**5.0**	1.0	mg/L	2020-11-06	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-11-06	
Sodium, dissolved	**34.3**	0.10	mg/L	2020-11-06	
Strontium, dissolved	**0.216**	0.0010	mg/L	2020-11-06	
Sulfur, dissolved	**17.4**	3.0	mg/L	2020-11-06	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-11-06	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-11-06	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Bio Reactor Effluent (20K0677-01) | Matrix: Water | Sampled: 2020-11-04 14:30, Continued					
Dissolved Metals, Continued					
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-11-06	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-11-06	
Uranium, dissolved	< 0.000020	0.000020	mg/L	2020-11-06	
Vanadium, dissolved	< 0.0010	0.0010	mg/L	2020-11-06	
Zinc, dissolved	**0.0284**	0.0040	mg/L	2020-11-06	
Zirconium, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Non-Chlorinated Phenols					RS2, S04
Phenol	< 4.67	0.50	µg/L	2020-11-07	RS1
2-Methylphenol	< 4.67	0.50	µg/L	2020-11-07	RS1
3 & 4-Methylphenol	< 4.67	0.50	µg/L	2020-11-07	RS1
2,4-Dimethylphenol	< 4.67	0.50	µg/L	2020-11-07	RS1
2-Nitrophenol	< 4.67	0.50	µg/L	2020-11-07	RS1
4-Nitrophenol	< 4.67	0.50	µg/L	2020-11-07	RS1
2,4-Dinitrophenol	< 4.67	0.50	µg/L	2020-11-07	RS1
2-Methyl-4,6-dinitrophenol	< 4.67	0.50	µg/L	2020-11-07	RS1
Surrogate: 2,4-Dibromophenol	*51*	*60-130*	%	*2020-11-07*	RS1, S02
Surrogate: 2,4,6-Tribromophenol	*63*	*60-130*	%	*2020-11-07*	RS1
Polycyclic Aromatic Hydrocarbons (PAH)					
Acenaphthene	< 0.050	0.050	µg/L	2020-11-06	
Acenaphthylene	< 0.200	0.200	µg/L	2020-11-06	
Acridine	< 0.050	0.050	µg/L	2020-11-06	
Anthracene	< 0.010	0.010	µg/L	2020-11-06	
Benz(a)anthracene	< 0.010	0.010	µg/L	2020-11-06	
Benzo(a)pyrene	< 0.010	0.010	µg/L	2020-11-06	
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L	2020-11-06	
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L	2020-11-06	
Benzo(k)fluoranthene	< 0.050	0.050	µg/L	2020-11-06	
2-Chloronaphthalene	< 0.100	0.100	µg/L	2020-11-06	
Chrysene	< 0.050	0.050	µg/L	2020-11-06	
Dibenz(a,h)anthracene	< 0.010	0.010	µg/L	2020-11-06	
Fluoranthene	**0.034**	0.030	µg/L	2020-11-06	
Fluorene	< 0.050	0.050	µg/L	2020-11-06	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L	2020-11-06	
1-Methylnaphthalene	**0.575**	0.100	µg/L	2020-11-06	
2-Methylnaphthalene	**0.445**	0.100	µg/L	2020-11-06	
Naphthalene	< 0.200	0.200	µg/L	2020-11-06	
Phenanthrene	< 0.100	0.100	µg/L	2020-11-06	
Pyrene	**0.068**	0.020	µg/L	2020-11-06	
Quinoline	< 0.050	0.050	µg/L	2020-11-06	
Surrogate: Acridine-d9	*80*	*50-140*	%	*2020-11-06*	
Surrogate: Naphthalene-d8	*19*	*50-140*	%	*2020-11-06*	S02
Surrogate: Perylene-d12	*99*	*50-140*	%	*2020-11-06*	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Bio Reactor Effluent (20K0677-01) | Matrix: Water | Sampled: 2020-11-04 14:30, Continued					
Total Metals					
Aluminum, total	**0.0275**	0.0050	mg/L	2020-11-06	
Antimony, total	**0.00039**	0.00020	mg/L	2020-11-06	
Arsenic, total	< 0.00050	0.00050	mg/L	2020-11-06	
Barium, total	**0.0122**	0.0050	mg/L	2020-11-06	
Beryllium, total	< 0.00010	0.00010	mg/L	2020-11-06	
Bismuth, total	< 0.00010	0.00010	mg/L	2020-11-06	
Boron, total	**0.0707**	0.0500	mg/L	2020-11-06	
Cadmium, total	**0.000033**	0.000010	mg/L	2020-11-06	
Calcium, total	**38.6**	0.20	mg/L	2020-11-06	
Chromium, total	**0.00053**	0.00050	mg/L	2020-11-06	
Cobalt, total	**0.00075**	0.00010	mg/L	2020-11-06	
Copper, total	**0.0269**	0.00040	mg/L	2020-11-06	
Iron, total	**1.32**	0.010	mg/L	2020-11-06	
Lead, total	**0.00050**	0.00020	mg/L	2020-11-06	
Lithium, total	**0.00250**	0.00010	mg/L	2020-11-06	
Magnesium, total	**5.79**	0.010	mg/L	2020-11-06	
Manganese, total	**0.165**	0.00020	mg/L	2020-11-06	
Mercury, total	< 0.000010	0.000010	mg/L	2020-11-06	
Molybdenum, total	**0.00170**	0.00010	mg/L	2020-11-06	
Nickel, total	**0.00218**	0.00040	mg/L	2020-11-06	
Phosphorus, total	**10.5**	0.050	mg/L	2020-11-06	
Potassium, total	**17.2**	0.10	mg/L	2020-11-06	
Selenium, total	< 0.00050	0.00050	mg/L	2020-11-06	
Silicon, total	**5.6**	1.0	mg/L	2020-11-06	
Silver, total	**0.000050**	0.000050	mg/L	2020-11-06	
Sodium, total	**35.8**	0.10	mg/L	2020-11-06	
Strontium, total	**0.227**	0.0010	mg/L	2020-11-06	
Sulfur, total	**16.4**	3.0	mg/L	2020-11-06	
Tellurium, total	< 0.00050	0.00050	mg/L	2020-11-06	
Thallium, total	< 0.000020	0.000020	mg/L	2020-11-06	
Thorium, total	< 0.00010	0.00010	mg/L	2020-11-06	
Tin, total	**0.00033**	0.00020	mg/L	2020-11-06	
Titanium, total	< 0.0050	0.0050	mg/L	2020-11-06	
Tungsten, total	< 0.0010	0.0010	mg/L	2020-11-06	
Uranium, total	< 0.000020	0.000020	mg/L	2020-11-06	
Vanadium, total	**0.0013**	0.0010	mg/L	2020-11-06	
Zinc, total	**0.0379**	0.0040	mg/L	2020-11-06	
Zirconium, total	**0.00022**	0.00010	mg/L	2020-11-06	
Volatile Organic Compounds (VOC)					
Benzene	< 0.5	0.5	µg/L	2020-11-06	
Bromodichloromethane	< 1.0	1.0	µg/L	2020-11-06	
Bromoform	< 1.0	1.0	µg/L	2020-11-06	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Bio Reactor Effluent (20K0677-01) | Matrix: Water | Sampled: 2020-11-04 14:30, Continued					
Volatile Organic Compounds (VOC), Continued					
Carbon tetrachloride	< 0.5	0.5	µg/L	2020-11-06	
Chlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
Chloroethane	< 2.0	2.0	µg/L	2020-11-06	
Chloroform	< 1.0	1.0	µg/L	2020-11-06	
Dibromochloromethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dibromoethane	< 0.3	0.3	µg/L	2020-11-06	
Dibromomethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dichlorobenzene	< 0.5	0.5	µg/L	2020-11-06	
1,3-Dichlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
1,4-Dichlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
1,1-Dichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,1-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Dichloromethane	< 3.0	3.0	µg/L	2020-11-06	
1,2-Dichloropropane	< 1.0	1.0	µg/L	2020-11-06	
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L	2020-11-06	
Ethylbenzene	< 1.0	1.0	µg/L	2020-11-06	
Methyl tert-butyl ether	< 1.0	1.0	µg/L	2020-11-06	
Styrene	< 1.0	1.0	µg/L	2020-11-06	
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L	2020-11-06	
Tetrachloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Toluene	< 1.0	1.0	µg/L	2020-11-06	
1,1,1-Trichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,1,2-Trichloroethane	< 1.0	1.0	µg/L	2020-11-06	
Trichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Trichlorofluoromethane	< 1.0	1.0	µg/L	2020-11-06	
Vinyl chloride	< 1.0	1.0	µg/L	2020-11-06	
Xylenes (total)	**4.3**	2.0	µg/L	2020-11-06	
Surrogate: Toluene-d8	*68*	*70-130*	%	*2020-11-06*	S02
Surrogate: 4-Bromofluorobenzene	*81*	*70-130*	%	*2020-11-06*	
Surrogate: 1,4-Dichlorobenzene-d4	*96*	*70-130*	%	*2020-11-06*	
Final Effluent (20K0677-02) | Matrix: Water | Sampled: 2020-11-04 14:30					
BCMOE Aggregate Hydrocarbons					
VHw (6-10)	< 100	100	µg/L	2020-11-06	
VPHw	< 100	100	µg/L wet	N/A	
EPHw10-19	< 250	250	µg/L	2020-11-06	
EPHw19-32	**690**	250	µg/L	2020-11-06	
LEPHw	< 250	250	µg/L	N/A	
HEPHw	**690**	250	µg/L	N/A	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent (20K0677-02) | Matrix: Water | Sampled: 2020-11-04 14:30, Continued					
BCMOE Aggregate Hydrocarbons, Continued					
Surrogate: 2-Methylnonane (EPH/F2-4)	*94*	*60-126*	%	*2020-11-06*	
Calculated Parameters					
Hardness, Total (as CaCO3)	**107**	0.500	mg/L	N/A	
Dissolved Metals					
Lithium, dissolved	**0.00272**	0.00010	mg/L	2020-11-06	
Aluminum, dissolved	**0.0711**	0.0050	mg/L	2020-11-06	
Antimony, dissolved	**0.00033**	0.00020	mg/L	2020-11-06	
Arsenic, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Barium, dissolved	**0.0105**	0.0050	mg/L	2020-11-06	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Boron, dissolved	**0.0681**	0.0500	mg/L	2020-11-06	
Cadmium, dissolved	**0.000031**	0.000010	mg/L	2020-11-06	
Calcium, dissolved	**36.4**	0.20	mg/L	2020-11-06	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Cobalt, dissolved	**0.00057**	0.00010	mg/L	2020-11-06	
Copper, dissolved	**0.0161**	0.00040	mg/L	2020-11-06	
Iron, dissolved	**0.072**	0.010	mg/L	2020-11-06	
Lead, dissolved	**0.00021**	0.00020	mg/L	2020-11-06	
Magnesium, dissolved	**3.95**	0.010	mg/L	2020-11-06	
Manganese, dissolved	**0.129**	0.00020	mg/L	2020-11-06	
Mercury, dissolved	< 0.000010	0.000010	mg/L	2020-11-06	
Molybdenum, dissolved	**0.00118**	0.00010	mg/L	2020-11-06	
Nickel, dissolved	**0.00183**	0.00040	mg/L	2020-11-06	
Phosphorus, dissolved	**3.41**	0.050	mg/L	2020-11-06	
Potassium, dissolved	**10.2**	0.10	mg/L	2020-11-06	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Silicon, dissolved	**4.9**	1.0	mg/L	2020-11-06	
Silver, dissolved	**0.000083**	0.000050	mg/L	2020-11-06	
Sodium, dissolved	**33.9**	0.10	mg/L	2020-11-06	
Strontium, dissolved	**0.212**	0.0010	mg/L	2020-11-06	
Sulfur, dissolved	**17.5**	3.0	mg/L	2020-11-06	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-11-06	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Tin, dissolved	**0.00025**	0.00020	mg/L	2020-11-06	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-11-06	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-11-06	
Uranium, dissolved	< 0.000020	0.000020	mg/L	2020-11-06	
Vanadium, dissolved	< 0.0010	0.0010	mg/L	2020-11-06	
Zinc, dissolved	**0.0310**	0.0040	mg/L	2020-11-06	
Zirconium, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent (20K0677-02) | Matrix: Water | Sampled: 2020-11-04 14:30, Continued					
Non-Chlorinated Phenols					RS2, S04
Phenol	< 0.98	0.50	µg/L	2020-11-07	
2-Methylphenol	**1.24**	0.50	µg/L	2020-11-07	
3 & 4-Methylphenol	**54.4**	0.50	µg/L	2020-11-07	
2,4-Dimethylphenol	< 0.98	0.50	µg/L	2020-11-07	
2-Nitrophenol	< 0.98	0.50	µg/L	2020-11-07	
4-Nitrophenol	< 0.98	0.50	µg/L	2020-11-07	
2,4-Dinitrophenol	< 0.98	0.50	µg/L	2020-11-07	
2-Methyl-4,6-dinitrophenol	< 0.98	0.50	µg/L	2020-11-07	
Surrogate: 2,4-Dibromophenol	*79*	*60-130*	%	*2020-11-07*	
Surrogate: 2,4,6-Tribromophenol	*96*	*60-130*	%	*2020-11-07*	
Polycyclic Aromatic Hydrocarbons (PAH)					
Acenaphthene	< 0.050	0.050	µg/L	2020-11-06	
Acenaphthylene	< 0.200	0.200	µg/L	2020-11-06	
Acridine	< 0.050	0.050	µg/L	2020-11-06	
Anthracene	< 0.010	0.010	µg/L	2020-11-06	
Benz(a)anthracene	< 0.010	0.010	µg/L	2020-11-06	
Benzo(a)pyrene	< 0.010	0.010	µg/L	2020-11-06	
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L	2020-11-06	
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L	2020-11-06	
Benzo(k)fluoranthene	< 0.050	0.050	µg/L	2020-11-06	
2-Chloronaphthalene	< 0.100	0.100	µg/L	2020-11-06	
Chrysene	< 0.050	0.050	µg/L	2020-11-06	
Dibenz(a,h)anthracene	< 0.035	0.010	µg/L	2020-11-06	RA3
Fluoranthene	**0.051**	0.030	µg/L	2020-11-06	
Fluorene	< 0.050	0.050	µg/L	2020-11-06	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L	2020-11-06	
1-Methylnaphthalene	**1.50**	0.100	µg/L	2020-11-06	
2-Methylnaphthalene	**1.45**	0.100	µg/L	2020-11-06	
Naphthalene	< 0.200	0.200	µg/L	2020-11-06	
Phenanthrene	< 0.100	0.100	µg/L	2020-11-06	
Pyrene	< 0.020	0.020	µg/L	2020-11-06	
Quinoline	< 0.050	0.050	µg/L	2020-11-06	
Surrogate: Acridine-d9	*86*	*50-140*	%	*2020-11-06*	
Surrogate: Naphthalene-d8	*126*	*50-140*	%	*2020-11-06*	
Surrogate: Perylene-d12	*92*	*50-140*	%	*2020-11-06*	
Total Metals					
Aluminum, total	**0.213**	0.0050	mg/L	2020-11-06	
Antimony, total	**0.00034**	0.00020	mg/L	2020-11-06	
Arsenic, total	< 0.00050	0.00050	mg/L	2020-11-06	
Barium, total	**0.0139**	0.0050	mg/L	2020-11-06	
Beryllium, total	< 0.00010	0.00010	mg/L	2020-11-06	
Bismuth, total	< 0.00010	0.00010	mg/L	2020-11-06	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent (20K0677-02) | Matrix: Water | Sampled: 2020-11-04 14:30, Continued					
Total Metals, Continued					
Boron, total	**0.0761**	0.0500	mg/L	2020-11-06	
Cadmium, total	**0.000036**	0.000010	mg/L	2020-11-06	
Calcium, total	**39.5**	0.20	mg/L	2020-11-06	
Chromium, total	< 0.00050	0.00050	mg/L	2020-11-06	
Cobalt, total	**0.00064**	0.00010	mg/L	2020-11-06	
Copper, total	**0.0207**	0.00040	mg/L	2020-11-06	
Iron, total	**0.164**	0.010	mg/L	2020-11-06	
Lead, total	**0.00029**	0.00020	mg/L	2020-11-06	
Lithium, total	**0.00278**	0.00010	mg/L	2020-11-06	
Magnesium, total	**4.42**	0.010	mg/L	2020-11-06	
Manganese, total	**0.141**	0.00020	mg/L	2020-11-06	
Mercury, total	< 0.000010	0.000010	mg/L	2020-11-06	
Molybdenum, total	**0.00136**	0.00010	mg/L	2020-11-06	
Nickel, total	**0.00188**	0.00040	mg/L	2020-11-06	
Phosphorus, total	**4.07**	0.050	mg/L	2020-11-06	
Potassium, total	**11.3**	0.10	mg/L	2020-11-06	
Selenium, total	< 0.00050	0.00050	mg/L	2020-11-06	
Silicon, total	**5.3**	1.0	mg/L	2020-11-06	
Silver, total	**0.000087**	0.000050	mg/L	2020-11-06	
Sodium, total	**37.1**	0.10	mg/L	2020-11-06	
Strontium, total	**0.229**	0.0010	mg/L	2020-11-06	
Sulfur, total	**18.8**	3.0	mg/L	2020-11-06	
Tellurium, total	< 0.00050	0.00050	mg/L	2020-11-06	
Thallium, total	< 0.000020	0.000020	mg/L	2020-11-06	
Thorium, total	< 0.00010	0.00010	mg/L	2020-11-06	
Tin, total	**0.00036**	0.00020	mg/L	2020-11-06	
Titanium, total	< 0.0050	0.0050	mg/L	2020-11-06	
Tungsten, total	< 0.0010	0.0010	mg/L	2020-11-06	
Uranium, total	< 0.000020	0.000020	mg/L	2020-11-06	
Vanadium, total	**0.0012**	0.0010	mg/L	2020-11-06	
Zinc, total	**0.0364**	0.0040	mg/L	2020-11-06	
Zirconium, total	< 0.00010	0.00010	mg/L	2020-11-06	
Volatile Organic Compounds (VOC)					
Benzene	< 0.5	0.5	µg/L	2020-11-06	
Bromodichloromethane	< 1.0	1.0	µg/L	2020-11-06	
Bromoform	< 1.0	1.0	µg/L	2020-11-06	
Carbon tetrachloride	< 0.5	0.5	µg/L	2020-11-06	
Chlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
Chloroethane	< 2.0	2.0	µg/L	2020-11-06	
Chloroform	< 1.0	1.0	µg/L	2020-11-06	
Dibromochloromethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dibromoethane	< 0.3	0.3	µg/L	2020-11-06	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent (20K0677-02) | Matrix: Water | Sampled: 2020-11-04 14:30, Continued					
Volatile Organic Compounds (VOC), Continued					
Dibromomethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dichlorobenzene	< 0.5	0.5	µg/L	2020-11-06	
1,3-Dichlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
1,4-Dichlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
1,1-Dichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,1-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Dichloromethane	< 3.0	3.0	µg/L	2020-11-06	
1,2-Dichloropropane	< 1.0	1.0	µg/L	2020-11-06	
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L	2020-11-06	
Ethylbenzene	< 1.0	1.0	µg/L	2020-11-06	
Methyl tert-butyl ether	< 1.0	1.0	µg/L	2020-11-06	
Styrene	< 1.0	1.0	µg/L	2020-11-06	
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L	2020-11-06	
Tetrachloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Toluene	**19.0**	1.0	µg/L	2020-11-06	
1,1,1-Trichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,1,2-Trichloroethane	< 1.0	1.0	µg/L	2020-11-06	
Trichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Trichlorofluoromethane	< 1.0	1.0	µg/L	2020-11-06	
Vinyl chloride	< 1.0	1.0	µg/L	2020-11-06	
Xylenes (total)	< 2.0	2.0	µg/L	2020-11-06	
Surrogate: Toluene-d8	*69*	*70-130*	%	*2020-11-06*	S02
Surrogate: 4-Bromofluorobenzene	*77*	*70-130*	%	*2020-11-06*	
Surrogate: 1,4-Dichlorobenzene-d4	*86*	*70-130*	%	*2020-11-06*	
MH 1001 (20K0677-03) | Matrix: Water | Sampled: 2020-11-04 15:45					
BCMOE Aggregate Hydrocarbons					
VHw (6-10)	**30800**	100	µg/L	2020-11-06	EST, RA10
VPHw	**23200**	100	µg/L wet	N/A	
EPHw10-19	**255000**	250	µg/L	2020-11-07	
EPHw19-32	**5110000**	250	µg/L	2020-11-07	
LEPHw	**254000**	12500	µg/L	N/A	
HEPHw	**5110000**	12500	µg/L	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*33*	*60-126*	%	*2020-11-07*	
Calculated Parameters					
Hardness, Total (as CaCO3)	**196**	0.500	mg/L	N/A	
Dissolved Metals					

TEST RESULTS

REPORTED TO Whistler, Resort Municipality of
PROJECT WWTP

WORK ORDER 20K0677
REPORTED 2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
MH 1001 (20K0677-03) | Matrix: Water | Sampled: 2020-11-04 15:45, Continued					
Dissolved Metals, Continued					
Lithium, dissolved	**0.00985**	0.00010	mg/L	2020-11-06	
Aluminum, dissolved	**0.0176**	0.0050	mg/L	2020-11-06	
Antimony, dissolved	**0.00588**	0.00020	mg/L	2020-11-06	
Arsenic, dissolved	**0.00076**	0.00050	mg/L	2020-11-06	
Barium, dissolved	**0.0102**	0.0050	mg/L	2020-11-06	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Boron, dissolved	**0.808**	0.0500	mg/L	2020-11-06	
Cadmium, dissolved	**0.000368**	0.000010	mg/L	2020-11-06	
Calcium, dissolved	**23.1**	0.20	mg/L	2020-11-06	
Chromium, dissolved	**0.00071**	0.00050	mg/L	2020-11-06	
Cobalt, dissolved	**0.00012**	0.00010	mg/L	2020-11-06	
Copper, dissolved	**0.0485**	0.00040	mg/L	2020-11-06	
Iron, dissolved	**0.086**	0.010	mg/L	2020-11-06	
Lead, dissolved	**0.00732**	0.00020	mg/L	2020-11-06	
Magnesium, dissolved	**33.6**	0.010	mg/L	2020-11-06	
Manganese, dissolved	**0.0950**	0.00020	mg/L	2020-11-06	
Mercury, dissolved	**0.000100**	0.000010	mg/L	2020-11-06	
Molybdenum, dissolved	**0.0652**	0.00010	mg/L	2020-11-06	
Nickel, dissolved	**0.00311**	0.00040	mg/L	2020-11-06	
Phosphorus, dissolved	**96.3**	0.050	mg/L	2020-11-06	
Potassium, dissolved	**171**	0.10	mg/L	2020-11-06	
Selenium, dissolved	**0.00370**	0.00050	mg/L	2020-11-06	
Silicon, dissolved	**27.8**	1.0	mg/L	2020-11-06	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-11-06	
Sodium, dissolved	**65.2**	0.10	mg/L	2020-11-06	
Strontium, dissolved	**0.0928**	0.0010	mg/L	2020-11-06	
Sulfur, dissolved	**29.6**	3.0	mg/L	2020-11-06	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Thallium, dissolved	**0.000022**	0.000020	mg/L	2020-11-06	
Thorium, dissolved	**0.00012**	0.00010	mg/L	2020-11-06	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-11-06	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-11-06	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-11-06	
Uranium, dissolved	< 0.000020	0.000020	mg/L	2020-11-06	
Vanadium, dissolved	**0.0013**	0.0010	mg/L	2020-11-06	
Zinc, dissolved	**5.99**	0.0040	mg/L	2020-11-06	
Zirconium, dissolved	**0.00018**	0.00010	mg/L	2020-11-06	
Non-Chlorinated Phenols					RS1, RS2, S04
Phenol	**80.1**	0.50	µg/L	2020-11-07	
2-Methylphenol	< 49.2	0.50	µg/L	2020-11-07	
3 & 4-Methylphenol	< 49.2	0.50	µg/L	2020-11-07	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
MH 1001 (20K0677-03) | Matrix: Water | Sampled: 2020-11-04 15:45, Continued					
Non-Chlorinated Phenols, Continued					RS1, RS2, S04
2,4-Dimethylphenol	< 49.2	0.50	µg/L	2020-11-07	
2-Nitrophenol	< 49.2	0.50	µg/L	2020-11-07	
4-Nitrophenol	< 49.2	0.50	µg/L	2020-11-07	
2,4-Dinitrophenol	< 49.2	0.50	µg/L	2020-11-07	
2-Methyl-4,6-dinitrophenol	< 49.2	0.50	µg/L	2020-11-07	
Surrogate: 2,4-Dibromophenol	*59*	*60-130*	%	*2020-11-07*	S02
Surrogate: 2,4,6-Tribromophenol	*66*	*60-130*	%	*2020-11-07*	
Polycyclic Aromatic Hydrocarbons (PAH)					RS1, S04, S06
Acenaphthene	**26.2**	0.050	µg/L	2020-11-07	
Acenaphthylene	< 30.3	0.200	µg/L	2020-11-07	
Acridine	< 33.9	0.050	µg/L	2020-11-07	RA1
Anthracene	**63.7**	0.010	µg/L	2020-11-07	
Benz(a)anthracene	**96.0**	0.010	µg/L	2020-11-07	
Benzo(a)pyrene	**27.2**	0.010	µg/L	2020-11-07	
Benzo(b+j)fluoranthene	< 38.8	0.050	µg/L	2020-11-07	RA1
Benzo(g,h,i)perylene	**38.5**	0.050	µg/L	2020-11-07	
Benzo(k)fluoranthene	**16.7**	0.050	µg/L	2020-11-07	
2-Chloronaphthalene	< 15.1	0.100	µg/L	2020-11-07	
Chrysene	**73.9**	0.050	µg/L	2020-11-07	
Dibenz(a,h)anthracene	< 5.79	0.010	µg/L	2020-11-07	RA3
Fluoranthene	**155**	0.030	µg/L	2020-11-07	
Fluorene	< 24.4	0.050	µg/L	2020-11-07	RA1
Indeno(1,2,3-cd)pyrene	**10.0**	0.050	µg/L	2020-11-07	
1-Methylnaphthalene	**1000**	0.100	µg/L	2020-11-07	
2-Methylnaphthalene	**2150**	0.100	µg/L	2020-11-07	
Naphthalene	**988**	0.200	µg/L	2020-11-07	
Phenanthrene	**183**	0.100	µg/L	2020-11-07	
Pyrene	**357**	0.020	µg/L	2020-11-07	
Quinoline	< 26.5	0.050	µg/L	2020-11-07	RA1
Surrogate: Acridine-d9		*50-140*	%	*2020-11-07*	S02
Surrogate: Naphthalene-d8	*54*	*50-140*	%	*2020-11-07*	
Surrogate: Perylene-d12	*136*	*50-140*	%	*2020-11-07*	
Total Metals					
Aluminum, total	**1.08**	0.0050	mg/L	2020-11-06	
Antimony, total	**0.645**	0.00020	mg/L	2020-11-06	
Arsenic, total	**0.00663**	0.00050	mg/L	2020-11-06	
Barium, total	**0.146**	0.0050	mg/L	2020-11-06	
Beryllium, total	**0.00029**	0.00010	mg/L	2020-11-06	
Bismuth, total	**0.0254**	0.00010	mg/L	2020-11-06	
Boron, total	**13.3**	0.0500	mg/L	2020-11-06	
Cadmium, total	**0.00791**	0.000010	mg/L	2020-11-06	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
MH 1001 (20K0677-03) | Matrix: Water | Sampled: 2020-11-04 15:45, Continued					
Total Metals, Continued					
Calcium, total	**129**	0.20	mg/L	2020-11-06	
Chromium, total	**0.0181**	0.00050	mg/L	2020-11-06	
Cobalt, total	**0.00209**	0.00010	mg/L	2020-11-06	
Copper, total	**2.81**	0.00040	mg/L	2020-11-06	
Iron, total	**15.3**	0.010	mg/L	2020-11-06	
Lead, total	**1.17**	0.00020	mg/L	2020-11-06	
Lithium, total	**0.0861**	0.00010	mg/L	2020-11-06	
Magnesium, total	**59.9**	0.010	mg/L	2020-11-06	
Manganese, total	**0.482**	0.00020	mg/L	2020-11-06	
Mercury, total	**0.000189**	0.000010	mg/L	2020-11-06	
Molybdenum, total	**9.05**	0.00010	mg/L	2020-11-06	
Nickel, total	**0.0733**	0.00040	mg/L	2020-11-06	
Phosphorus, total	**186**	0.050	mg/L	2020-11-06	
Potassium, total	**182**	0.10	mg/L	2020-11-06	
Selenium, total	**0.00570**	0.00050	mg/L	2020-11-06	
Silicon, total	**30.0**	1.0	mg/L	2020-11-06	
Silver, total	**0.0414**	0.000050	mg/L	2020-11-06	
Sodium, total	**70.9**	0.10	mg/L	2020-11-06	
Strontium, total	**0.316**	0.0010	mg/L	2020-11-06	
Sulfur, total	**104**	3.0	mg/L	2020-11-06	
Tellurium, total	< 0.00050	0.00050	mg/L	2020-11-06	
Thallium, total	**0.000142**	0.000020	mg/L	2020-11-06	
Thorium, total	**0.00012**	0.00010	mg/L	2020-11-06	
Tin, total	**0.0567**	0.00020	mg/L	2020-11-06	
Titanium, total	**0.235**	0.0050	mg/L	2020-11-06	
Tungsten, total	**0.0031**	0.0010	mg/L	2020-11-06	
Uranium, total	**0.00114**	0.000020	mg/L	2020-11-06	
Vanadium, total	**0.0268**	0.0010	mg/L	2020-11-06	
Zinc, total	**58.7**	0.0040	mg/L	2020-11-06	
Zirconium, total	**0.00146**	0.00010	mg/L	2020-11-06	
Volatile Organic Compounds (VOC)					S03, S04
Benzene	**243**	0.5	µg/L	2020-11-06	EST, RA10
Bromodichloromethane	< 1.0	1.0	µg/L	2020-11-06	
Bromoform	< 1.0	1.0	µg/L	2020-11-06	
Carbon tetrachloride	< 0.5	0.5	µg/L	2020-11-06	
Chlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
Chloroethane	< 2.0	2.0	µg/L	2020-11-06	
Chloroform	< 1.0	1.0	µg/L	2020-11-06	
Dibromochloromethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dibromoethane	< 1.7	0.3	µg/L	2020-11-06	RA1
Dibromomethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dichlorobenzene	< 1.0	0.5	µg/L	2020-11-06	RA1

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
MH 1001 (20K0677-03) | Matrix: Water | Sampled: 2020-11-04 15:45, Continued					
Volatile Organic Compounds (VOC), Continued					S03, S04
1,3-Dichlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
1,4-Dichlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
1,1-Dichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dichloroethane	< 1.2	1.0	µg/L	2020-11-06	RA1
1,1-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Dichloromethane	< 3.0	3.0	µg/L	2020-11-06	
1,2-Dichloropropane	< 1.0	1.0	µg/L	2020-11-06	
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L	2020-11-06	
Ethylbenzene	**1780**	1.0	µg/L	2020-11-06	EST, RA10
Methyl tert-butyl ether	< 1.0	1.0	µg/L	2020-11-06	
Styrene	< 26.2	1.0	µg/L	2020-11-06	RA1
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L	2020-11-06	
Tetrachloroethylene	**125**	1.0	µg/L	2020-11-06	EST, RA10
Toluene	**1170**	1.0	µg/L	2020-11-06	EST, RA10
1,1,1-Trichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,1,2-Trichloroethane	< 18.4	1.0	µg/L	2020-11-06	RA1
Trichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Trichlorofluoromethane	< 1.0	1.0	µg/L	2020-11-06	
Vinyl chloride	< 1.0	1.0	µg/L	2020-11-06	
Xylenes (total)	**4380**	2.0	µg/L	2020-11-06	EST, RA10
Surrogate: Toluene-d8	*40*	*70-130*	%	*2020-11-06*	
Surrogate: 4-Bromofluorobenzene	*68*	*70-130*	%	*2020-11-06*	
Surrogate: 1,4-Dichlorobenzene-d4	*39*	*70-130*	%	*2020-11-06*	
MH 1002 (20K0677-04) | Matrix: Water | Sampled: 2020-11-04 16:00					
BCMOE Aggregate Hydrocarbons					
VHw (6-10)	**171**	100	µg/L	2020-11-06	
VPHw	**169**	100	µg/L wet	N/A	
EPHw10-19	**1180**	250	µg/L	2020-11-06	
EPHw19-32	**10300**	250	µg/L	2020-11-06	
LEPHw	**1180**	250	µg/L	N/A	
HEPHw	**10300**	250	µg/L	N/A	
Surrogate: 2-Methylnonane (EPH/F2-4)	*88*	*60-126*	%	*2020-11-06*	
Calculated Parameters					
Hardness, Total (as CaCO3)	**124**	0.500	mg/L	N/A	
Dissolved Metals					
Lithium, dissolved	**0.00291**	0.00010	mg/L	2020-11-06	
Aluminum, dissolved	**0.100**	0.0050	mg/L	2020-11-06	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
MH 1002 (20K0677-04) | Matrix: Water | Sampled: 2020-11-04 16:00, Continued					
Dissolved Metals, Continued					
Antimony, dissolved	**0.00094**	0.00020	mg/L	2020-11-06	
Arsenic, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Barium, dissolved	**0.0253**	0.0050	mg/L	2020-11-06	
Beryllium, dissolved	**0.00055**	0.00010	mg/L	2020-11-06	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-11-06	
Boron, dissolved	< 0.0500	0.0500	mg/L	2020-11-06	
Cadmium, dissolved	**0.000020**	0.000010	mg/L	2020-11-06	
Calcium, dissolved	**18.1**	0.20	mg/L	2020-11-06	
Chromium, dissolved	**0.00078**	0.00050	mg/L	2020-11-06	
Cobalt, dissolved	**0.00020**	0.00010	mg/L	2020-11-06	
Copper, dissolved	**0.134**	0.00040	mg/L	2020-11-06	
Iron, dissolved	**0.032**	0.010	mg/L	2020-11-06	
Lead, dissolved	**0.00048**	0.00020	mg/L	2020-11-06	
Magnesium, dissolved	**19.1**	0.010	mg/L	2020-11-06	
Manganese, dissolved	**0.0780**	0.00020	mg/L	2020-11-06	
Mercury, dissolved	**0.320**	0.000010	mg/L	2020-11-06	
Molybdenum, dissolved	**0.00092**	0.00010	mg/L	2020-11-06	
Nickel, dissolved	**0.00395**	0.00040	mg/L	2020-11-06	
Phosphorus, dissolved	**64.3**	0.050	mg/L	2020-11-06	
Potassium, dissolved	**86.5**	0.10	mg/L	2020-11-06	
Selenium, dissolved	**0.00072**	0.00050	mg/L	2020-11-06	
Silicon, dissolved	**10.7**	1.0	mg/L	2020-11-06	
Silver, dissolved	**0.00222**	0.000050	mg/L	2020-11-06	
Sodium, dissolved	**58.0**	0.10	mg/L	2020-11-06	
Strontium, dissolved	**0.155**	0.0010	mg/L	2020-11-06	
Sulfur, dissolved	**19.1**	3.0	mg/L	2020-11-06	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-11-06	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-11-06	
Thorium, dissolved	**0.00075**	0.00010	mg/L	2020-11-06	
Tin, dissolved	**0.00047**	0.00020	mg/L	2020-11-06	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-11-06	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-11-06	
Uranium, dissolved	< 0.000020	0.000020	mg/L	2020-11-06	
Vanadium, dissolved	**0.0015**	0.0010	mg/L	2020-11-06	
Zinc, dissolved	**0.0062**	0.0040	mg/L	2020-11-06	
Zirconium, dissolved	**0.00025**	0.00010	mg/L	2020-11-06	
Non-Chlorinated Phenols					RS1, RS2, S04
Phenol	**25.1**	0.50	µg/L	2020-11-07	
2-Methylphenol	< 5.39	0.50	µg/L	2020-11-07	
3 & 4-Methylphenol	**12.6**	0.50	µg/L	2020-11-07	
2,4-Dimethylphenol	< 5.39	0.50	µg/L	2020-11-07	
2-Nitrophenol	< 5.39	0.50	µg/L	2020-11-07	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
MH 1002 (20K0677-04) | Matrix: Water | Sampled: 2020-11-04 16:00, Continued					
Non-Chlorinated Phenols, Continued					RS1, RS2, S04
4-Nitrophenol	< 5.39	0.50	µg/L	2020-11-07	
2,4-Dinitrophenol	< 5.39	0.50	µg/L	2020-11-07	
2-Methyl-4,6-dinitrophenol	< 5.39	0.50	µg/L	2020-11-07	
Surrogate: 2,4-Dibromophenol	*52*	*60-130*	%	*2020-11-07*	S02
Surrogate: 2,4,6-Tribromophenol	*63*	*60-130*	%	*2020-11-07*	
Polycyclic Aromatic Hydrocarbons (PAH)					S04
Acenaphthene	< 0.050	0.050	µg/L	2020-11-07	
Acenaphthylene	< 0.200	0.200	µg/L	2020-11-07	
Acridine	< 0.050	0.050	µg/L	2020-11-07	
Anthracene	**0.044**	0.010	µg/L	2020-11-07	
Benz(a)anthracene	**0.051**	0.010	µg/L	2020-11-07	
Benzo(a)pyrene	**0.021**	0.010	µg/L	2020-11-07	
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L	2020-11-07	
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L	2020-11-07	
Benzo(k)fluoranthene	< 0.050	0.050	µg/L	2020-11-07	
2-Chloronaphthalene	< 0.180	0.100	µg/L	2020-11-07	RA1
Chrysene	< 0.050	0.050	µg/L	2020-11-07	
Dibenz(a,h)anthracene	< 0.010	0.010	µg/L	2020-11-07	
Fluoranthene	**0.067**	0.030	µg/L	2020-11-07	
Fluorene	< 0.050	0.050	µg/L	2020-11-07	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L	2020-11-07	
1-Methylnaphthalene	< 0.100	0.100	µg/L	2020-11-07	
2-Methylnaphthalene	**0.437**	0.100	µg/L	2020-11-07	
Naphthalene	< 0.200	0.200	µg/L	2020-11-07	
Phenanthrene	**0.106**	0.100	µg/L	2020-11-07	
Pyrene	**0.189**	0.020	µg/L	2020-11-07	
Quinoline	< 1.80	0.050	µg/L	2020-11-07	RA1
Surrogate: Acridine-d9	*46*	*50-140*	%	*2020-11-07*	
Surrogate: Naphthalene-d8	*0.5*	*50-140*	%	*2020-11-07*	
Surrogate: Perylene-d12	*46*	*50-140*	%	*2020-11-07*	
Total Metals					
Aluminum, total	**0.120**	0.0050	mg/L	2020-11-06	
Antimony, total	**0.00098**	0.00020	mg/L	2020-11-06	
Arsenic, total	< 0.00050	0.00050	mg/L	2020-11-06	
Barium, total	**0.0268**	0.0050	mg/L	2020-11-06	
Beryllium, total	< 0.00010	0.00010	mg/L	2020-11-06	
Bismuth, total	< 0.00010	0.00010	mg/L	2020-11-06	
Boron, total	**0.102**	0.0500	mg/L	2020-11-06	
Cadmium, total	**0.000044**	0.000010	mg/L	2020-11-06	
Calcium, total	**19.6**	0.20	mg/L	2020-11-06	
Chromium, total	**0.00086**	0.00050	mg/L	2020-11-06	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
MH 1002 (20K0677-04) | Matrix: Water | Sampled: 2020-11-04 16:00, Continued					
Total Metals, Continued					
Cobalt, total	**0.00026**	0.00010	mg/L	2020-11-06	
Copper, total	**0.142**	0.00040	mg/L	2020-11-06	
Iron, total	**0.098**	0.010	mg/L	2020-11-06	
Lead, total	**0.00109**	0.00020	mg/L	2020-11-06	
Lithium, total	**0.00305**	0.00010	mg/L	2020-11-06	
Magnesium, total	**20.7**	0.010	mg/L	2020-11-06	
Manganese, total	**0.0876**	0.00020	mg/L	2020-11-06	
Mercury, total	**0.226**	0.000010	mg/L	2020-11-06	
Molybdenum, total	**0.00333**	0.00010	mg/L	2020-11-06	
Nickel, total	**0.00441**	0.00040	mg/L	2020-11-06	
Phosphorus, total	**68.2**	0.050	mg/L	2020-11-06	
Potassium, total	**96.1**	0.10	mg/L	2020-11-06	
Selenium, total	**0.00053**	0.00050	mg/L	2020-11-06	
Silicon, total	**11.6**	1.0	mg/L	2020-11-06	
Silver, total	**0.00124**	0.000050	mg/L	2020-11-06	
Sodium, total	**62.3**	0.10	mg/L	2020-11-06	
Strontium, total	**0.173**	0.0010	mg/L	2020-11-06	
Sulfur, total	**24.3**	3.0	mg/L	2020-11-06	
Tellurium, total	< 0.00050	0.00050	mg/L	2020-11-06	
Thallium, total	< 0.000020	0.000020	mg/L	2020-11-06	
Thorium, total	< 0.00010	0.00010	mg/L	2020-11-06	
Tin, total	**0.00069**	0.00020	mg/L	2020-11-06	
Titanium, total	**0.0141**	0.0050	mg/L	2020-11-06	
Tungsten, total	< 0.0010	0.0010	mg/L	2020-11-06	
Uranium, total	< 0.000020	0.000020	mg/L	2020-11-06	
Vanadium, total	**0.0020**	0.0010	mg/L	2020-11-06	
Zinc, total	**0.0323**	0.0040	mg/L	2020-11-06	
Zirconium, total	**0.00014**	0.00010	mg/L	2020-11-06	
Volatile Organic Compounds (VOC)					
Benzene	< 0.5	0.5	µg/L	2020-11-06	
Bromodichloromethane	< 1.0	1.0	µg/L	2020-11-06	
Bromoform	< 1.0	1.0	µg/L	2020-11-06	
Carbon tetrachloride	< 0.5	0.5	µg/L	2020-11-06	
Chlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
Chloroethane	< 2.0	2.0	µg/L	2020-11-06	
Chloroform	< 1.0	1.0	µg/L	2020-11-06	
Dibromochloromethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dibromoethane	< 0.3	0.3	µg/L	2020-11-06	
Dibromomethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dichlorobenzene	< 0.5	0.5	µg/L	2020-11-06	
1,3-Dichlorobenzene	< 1.0	1.0	µg/L	2020-11-06	
1,4-Dichlorobenzene	< 1.0	1.0	µg/L	2020-11-06	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Analyzed	Qualifier
MH 1002 (20K0677-04) | Matrix: Water | Sampled: 2020-11-04 16:00, Continued					
Volatile Organic Compounds (VOC), Continued					
1,1-Dichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,2-Dichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,1-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Dichloromethane	< 3.0	3.0	µg/L	2020-11-06	
1,2-Dichloropropane	< 1.0	1.0	µg/L	2020-11-06	
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L	2020-11-06	
Ethylbenzene	< 1.0	1.0	µg/L	2020-11-06	
Methyl tert-butyl ether	< 1.0	1.0	µg/L	2020-11-06	
Styrene	< 1.0	1.0	µg/L	2020-11-06	
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L	2020-11-06	
Tetrachloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Toluene	**2.3**	1.0	µg/L	2020-11-06	
1,1,1-Trichloroethane	< 1.0	1.0	µg/L	2020-11-06	
1,1,2-Trichloroethane	< 1.0	1.0	µg/L	2020-11-06	
Trichloroethylene	< 1.0	1.0	µg/L	2020-11-06	
Trichlorofluoromethane	< 1.0	1.0	µg/L	2020-11-06	
Vinyl chloride	< 1.0	1.0	µg/L	2020-11-06	
Xylenes (total)	< 2.0	2.0	µg/L	2020-11-06	
Surrogate: Toluene-d8	*59*	*70-130*	%	*2020-11-06*	S02
Surrogate: 4-Bromofluorobenzene	*80*	*70-130*	%	*2020-11-06*	
Surrogate: 1,4-Dichlorobenzene-d4	*103*	*70-130*	%	*2020-11-06*	

Sample Qualifiers:

EST	This is an estimated value.
RA1	The Reporting Limit has been raised due to matrix interference.
RA10	This is an estimated value. The result was over the calibration range and further dilution was not performed at this time.
RA3	The Reporting Limit has been raised due to comparable level detected in the blank(s).
RS1	The Reporting Limits for this sample have been raised due to high analyte concentration and/or matrix interference.
RS2	The Reporting Limits for this sample have been raised due to limited sample volume.
S01	The surrogate recovery for this sample is not available due to sample dilution required from high analyte concentration and/or matrix interference.
S02	Surrogate recovery outside of control limits. Data accepted based on acceptable recovery of other surrogates.
S03	The surrogate recovery for this sample is outside of established control limits due to a sample matrix effect.
S04	Sample contains excessive sediment, results may be biased high due to inclusion of non-dissolved analyte(s).
S06	The surrogate recovery for this sample is outside of established control limits due to an emulsion.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
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Analysis Description	Method Ref.	Technique	Accredited	Location
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
EPH in Water	EPA 3511* / BCMOE EPHw	Hexane MicroExtraction (Base/Neutral) / Gas Chromatography (GC-FID)	✓	Richmond
Hardness in Water	SM 2340 B (2017)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
HEPHw in Water	BCMOE LEPH/HEPH	Calculation		N/A
LEPHw in Water	BCMOE LEPH/HEPH	Calculation		N/A
Mercury, dissolved in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Phenols, Non-Chlorinated in Water	EPA 3510C* / EPA 8270D	Liquid-Liquid DCM Extraction (Acidic) / GC-MSD (SIM)	✓	Richmond
Polycyclic Aromatic Hydrocarbons in Water	EPA 3511* / EPA 8270D	Hexane MicroExtraction (Base/Neutral) / GC-MSD (SIM)	✓	Richmond
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
VH in Water	EPA 5030B / BCMOE VHw	Purge&Trap / Gas Chromatography (GC-FID)	✓	Richmond
Volatile Organic Compounds in Water	EPA 5030B / EPA 8260D	Purge&Trap / GC-MSD (SIM)	✓	Richmond
VPHw in Water	BCMOE VPH	Calculation: VH - (Benzene + Toluene + Ethylbenzene + Xylenes + Styrene)		N/A

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/L	Milligrams per litre
µg/L	Micrograms per litre
BCMOE	British Columbia Environmental Laboratory Manual, British Columbia Ministry of Environment
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
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The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
BCMOE Aggregate Hydrocarbons, Batch B0K0505										
Blank (B0K0505-BLK1)				Prepared: 2020-11-05, Analyzed: 2020-11-06						
EPHw10-19	< 250	250	µg/L							
EPHw19-32	< 250	250	µg/L							
Surrogate: 2-Methylnonane (EPH/F2-4)	*377*		*µg/L*	444		*85*	*60-126*			
LCS (B0K0505-BS2)				Prepared: 2020-11-05, Analyzed: 2020-11-06						
EPHw10-19	13800	250	µg/L	15600		89	70-117			
EPHw19-32	19400	250	µg/L	22200		87	70-113			
Surrogate: 2-Methylnonane (EPH/F2-4)	*382*		*µg/L*	444		*86*	*60-126*			
LCS Dup (B0K0505-BSD2)				Prepared: 2020-11-05, Analyzed: 2020-11-06						
EPHw10-19	15100	250	µg/L	15600		97	70-117	9	20	
EPHw19-32	21100	250	µg/L	22200		95	70-113	8	20	
Surrogate: 2-Methylnonane (EPH/F2-4)	*429*		*µg/L*	444		*97*	*60-126*			
BCMOE Aggregate Hydrocarbons, Batch B0K0530										
Blank (B0K0530-BLK1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
VHw (6-10)	< 100	100	µg/L							
LCS (B0K0530-BS2)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
VHw (6-10)	2200	100	µg/L	2690		82	70-130			
Dissolved Metals, Batch B0K0544										
Blank (B0K0544-BLK1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Aluminum, dissolved	< 0.0050	0.0050	mg/L							
Antimony, dissolved	< 0.00020	0.00020	mg/L							
Arsenic, dissolved	< 0.00050	0.00050	mg/L							
Barium, dissolved	< 0.0050	0.0050	mg/L							
Beryllium, dissolved	< 0.00010	0.00010	mg/L							
Bismuth, dissolved	< 0.00010	0.00010	mg/L							
Boron, dissolved	< 0.0500	0.0500	mg/L							
Cadmium, dissolved	< 0.000010	0.000010	mg/L							
Calcium, dissolved	< 0.20	0.20	mg/L							

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0K0544, Continued										
Blank (B0K0544-BLK1), Continued				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Chromium, dissolved	< 0.00050	0.00050	mg/L							
Cobalt, dissolved	< 0.00010	0.00010	mg/L							
Copper, dissolved	< 0.00040	0.00040	mg/L							
Iron, dissolved	< 0.010	0.010	mg/L							
Lead, dissolved	< 0.00020	0.00020	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	mg/L							
Molybdenum, dissolved	< 0.00010	0.00010	mg/L							
Nickel, dissolved	< 0.00040	0.00040	mg/L							
Phosphorus, dissolved	< 0.050	0.050	mg/L							
Potassium, dissolved	< 0.10	0.10	mg/L							
Selenium, dissolved	< 0.00050	0.00050	mg/L							
Silicon, dissolved	< 1.0	1.0	mg/L							
Silver, dissolved	< 0.000050	0.000050	mg/L							
Sodium, dissolved	< 0.10	0.10	mg/L							
Strontium, dissolved	< 0.0010	0.0010	mg/L							
Sulfur, dissolved	< 3.0	3.0	mg/L							
Tellurium, dissolved	< 0.00050	0.00050	mg/L							
Thallium, dissolved	< 0.000020	0.000020	mg/L							
Thorium, dissolved	< 0.00010	0.00010	mg/L							
Tin, dissolved	< 0.00020	0.00020	mg/L							
Titanium, dissolved	< 0.0050	0.0050	mg/L							
Tungsten, dissolved	< 0.0010	0.0010	mg/L							
Uranium, dissolved	< 0.000020	0.000020	mg/L							
Vanadium, dissolved	< 0.0010	0.0010	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B0K0544-BS1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Lithium, dissolved	0.0220	0.00010	mg/L	0.0200		110	80-120			
Aluminum, dissolved	0.0229	0.0050	mg/L	0.0199		115	80-120			
Antimony, dissolved	0.0196	0.00020	mg/L	0.0200		98	80-120			
Arsenic, dissolved	0.0206	0.00050	mg/L	0.0200		103	80-120			
Barium, dissolved	0.0206	0.0050	mg/L	0.0198		104	80-120			
Beryllium, dissolved	0.0210	0.00010	mg/L	0.0198		106	80-120			
Bismuth, dissolved	0.0211	0.00010	mg/L	0.0200		106	80-120			
Boron, dissolved	< 0.0500	0.0500	mg/L	0.0200		113	80-120			
Cadmium, dissolved	0.0199	0.000010	mg/L	0.0199		100	80-120			
Calcium, dissolved	2.29	0.20	mg/L	2.02		113	80-120			
Chromium, dissolved	0.0195	0.00050	mg/L	0.0198		98	80-120			
Cobalt, dissolved	0.0201	0.00010	mg/L	0.0199		101	80-120			
Copper, dissolved	0.0215	0.00040	mg/L	0.0200		107	80-120			
Iron, dissolved	1.90	0.010	mg/L	2.02		94	80-120			
Lead, dissolved	0.0225	0.00020	mg/L	0.0199		113	80-120			
Magnesium, dissolved	2.15	0.010	mg/L	2.02		106	80-120			
Manganese, dissolved	0.0191	0.00020	mg/L	0.0199		96	80-120			
Molybdenum, dissolved	0.0195	0.00010	mg/L	0.0200		98	80-120			
Nickel, dissolved	0.0206	0.00040	mg/L	0.0200		103	80-120			
Phosphorus, dissolved	1.87	0.050	mg/L	2.00		93	80-120			
Potassium, dissolved	1.98	0.10	mg/L	2.02		98	80-120			
Selenium, dissolved	0.0203	0.00050	mg/L	0.0200		101	80-120			
Silicon, dissolved	2.1	1.0	mg/L	2.00		107	80-120			
Silver, dissolved	0.0193	0.000050	mg/L	0.0200		96	80-120			
Sodium, dissolved	2.11	0.10	mg/L	2.02		104	80-120			
Strontium, dissolved	0.0196	0.0010	mg/L	0.0200		98	80-120			
Sulfur, dissolved	4.7	3.0	mg/L	5.00		93	80-120			

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0K0544, Continued										
LCS (B0K0544-BS1), Continued				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Tellurium, dissolved	0.0194	0.00050	mg/L	0.0200		97	80-120			
Thallium, dissolved	0.0202	0.000020	mg/L	0.0199		101	80-120			
Thorium, dissolved	0.0197	0.00010	mg/L	0.0200		99	80-120			
Tin, dissolved	0.0208	0.00020	mg/L	0.0200		104	80-120			
Titanium, dissolved	0.0186	0.0050	mg/L	0.0200		93	80-120			
Tungsten, dissolved	0.0216	0.0010	mg/L	0.0200		108	80-120			
Uranium, dissolved	0.0205	0.000020	mg/L	0.0200		103	80-120			
Vanadium, dissolved	0.0191	0.0010	mg/L	0.0200		96	80-120			
Zinc, dissolved	0.0227	0.0040	mg/L	0.0200		113	80-120			
Zirconium, dissolved	0.0202	0.00010	mg/L	0.0200		101	80-120			
Reference (B0K0544-SRM1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Lithium, dissolved	0.113	0.00010	mg/L	0.100		113	70-130			
Aluminum, dissolved	0.220	0.0050	mg/L	0.235		94	70-130			
Antimony, dissolved	0.0461	0.00020	mg/L	0.0431		107	70-130			
Arsenic, dissolved	0.455	0.00050	mg/L	0.423		108	70-130			
Barium, dissolved	3.06	0.0050	mg/L	3.30		93	70-130			
Beryllium, dissolved	0.233	0.00010	mg/L	0.209		112	70-130			
Boron, dissolved	1.77	0.0500	mg/L	1.65		107	70-130			
Cadmium, dissolved	0.224	0.000010	mg/L	0.221		101	70-130			
Calcium, dissolved	8.21	0.20	mg/L	7.72		106	70-130			
Chromium, dissolved	0.436	0.00050	mg/L	0.434		100	70-130			
Cobalt, dissolved	0.128	0.00010	mg/L	0.124		103	70-130			
Copper, dissolved	0.856	0.00040	mg/L	0.815		105	70-130			
Iron, dissolved	1.26	0.010	mg/L	1.27		99	70-130			
Lead, dissolved	0.127	0.00020	mg/L	0.110		116	70-130			
Magnesium, dissolved	7.32	0.010	mg/L	6.59		111	70-130			
Manganese, dissolved	0.332	0.00020	mg/L	0.342		97	70-130			
Molybdenum, dissolved	0.415	0.00010	mg/L	0.404		103	70-130			
Nickel, dissolved	0.877	0.00040	mg/L	0.835		105	70-130			
Phosphorus, dissolved	0.527	0.050	mg/L	0.499		106	70-130			
Potassium, dissolved	3.07	0.10	mg/L	2.88		107	70-130			
Selenium, dissolved	0.0354	0.00050	mg/L	0.0324		109	70-130			
Sodium, dissolved	19.3	0.10	mg/L	18.0		107	70-130			
Strontium, dissolved	0.920	0.0010	mg/L	0.935		98	70-130			
Thallium, dissolved	0.0401	0.000020	mg/L	0.0385		104	70-130			
Uranium, dissolved	0.256	0.000020	mg/L	0.258		99	70-130			
Vanadium, dissolved	0.862	0.0010	mg/L	0.873		99	70-130			
Zinc, dissolved	0.883	0.0040	mg/L	0.848		104	70-130			
Dissolved Metals, Batch B0K0577										
Blank (B0K0577-BLK1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Duplicate (B0K0577-DUP1)				**Source: 20K0677-01**		Prepared: 2020-11-06, Analyzed: 2020-11-06				
Mercury, dissolved	< 0.000010	0.000010	mg/L		< 0.000010				20	
Reference (B0K0577-SRM1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Mercury, dissolved	0.00582	0.000010	mg/L	0.00581		100	70-130			
Non-Chlorinated Phenols, Batch B0K0549										
Blank (B0K0549-BLK1)				Prepared: 2020-11-06, Analyzed: 2020-11-07						
Phenol	< 0.50	0.50	µg/L							
2-Methylphenol	< 0.50	0.50	µg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Non-Chlorinated Phenols, Batch B0K0549, Continued										
Blank (B0K0549-BLK1), Continued				Prepared: 2020-11-06, Analyzed: 2020-11-07						
3 & 4-Methylphenol	< 0.50	0.50	µg/L							
2,4-Dimethylphenol	< 0.50	0.50	µg/L							
2-Nitrophenol	< 0.50	0.50	µg/L							
4-Nitrophenol	< 0.50	0.50	µg/L							
2,4-Dinitrophenol	< 0.50	0.50	µg/L							
2-Methyl-4,6-dinitrophenol	< 0.50	0.50	µg/L							
Surrogate: 2,4-Dibromophenol	*2.32*		*µg/L*	2.02		*115*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*2.89*		*µg/L*	2.00		*144*	*60-130*			*S02*
LCS (B0K0549-BS1)				Prepared: 2020-11-06, Analyzed: 2020-11-07						
Phenol	7.01	0.50	µg/L	10.0		70	60-130			
2-Methylphenol	8.49	0.50	µg/L	10.0		85	60-115			
3 & 4-Methylphenol	16.6	0.50	µg/L	20.0		83	60-109			
2,4-Dimethylphenol	9.25	0.50	µg/L	10.0		92	60-130			
2-Nitrophenol	7.85	0.50	µg/L	10.0		78	57-117			
4-Nitrophenol	9.89	0.50	µg/L	10.0		99	63-130			
2,4-Dinitrophenol	11.0	0.50	µg/L	9.95		111	35-130			
2-Methyl-4,6-dinitrophenol	9.65	0.50	µg/L	10.0		96	53-130			
Surrogate: 2,4-Dibromophenol	*1.71*		*µg/L*	2.02		*85*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*2.00*		*µg/L*	2.00		*100*	*60-130*			
LCS Dup (B0K0549-BSD1)				Prepared: 2020-11-06, Analyzed: 2020-11-07						
Phenol	8.45	0.50	µg/L	10.0		84	60-130	19	23	
2-Methylphenol	9.88	0.50	µg/L	10.0		99	60-115	15	20	
3 & 4-Methylphenol	20.6	0.50	µg/L	20.0		103	60-109	21	16	RPD
2,4-Dimethylphenol	11.2	0.50	µg/L	10.0		112	60-130	19	24	
2-Nitrophenol	9.79	0.50	µg/L	10.0		98	57-117	22	22	
4-Nitrophenol	11.4	0.50	µg/L	10.0		114	63-130	14	40	
2,4-Dinitrophenol	12.2	0.50	µg/L	9.95		123	35-130	10	27	
2-Methyl-4,6-dinitrophenol	11.4	0.50	µg/L	10.0		113	53-130	16	20	
Surrogate: 2,4-Dibromophenol	*2.24*		*µg/L*	2.02		*111*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*2.39*		*µg/L*	2.00		*119*	*60-130*			
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0K0505										
Blank (B0K0505-BLK1)				Prepared: 2020-11-05, Analyzed: 2020-11-06						
Acenaphthene	< 0.050	0.050	µg/L							
Acenaphthylene	< 0.200	0.200	µg/L							
Acridine	< 0.050	0.050	µg/L							
Anthracene	< 0.010	0.010	µg/L							
Benz(a)anthracene	< 0.010	0.010	µg/L							
Benzo(a)pyrene	< 0.010	0.010	µg/L							
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L							
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L							
Benzo(k)fluoranthene	< 0.050	0.050	µg/L							
2-Chloronaphthalene	< 0.100	0.100	µg/L							
Chrysene	< 0.050	0.050	µg/L							
Dibenz(a,h)anthracene	0.014	0.010	µg/L							BLK
Fluoranthene	< 0.030	0.030	µg/L							
Fluorene	< 0.050	0.050	µg/L							
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L							
1-Methylnaphthalene	< 0.100	0.100	µg/L							
2-Methylnaphthalene	< 0.100	0.100	µg/L							
Naphthalene	< 0.200	0.200	µg/L							
Phenanthrene	< 0.100	0.100	µg/L							
Pyrene	< 0.020	0.020	µg/L							

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0K0505, Continued										
Blank (B0K0505-BLK1), Continued				Prepared: 2020-11-05, Analyzed: 2020-11-06						
Quinoline	< 0.050	0.050	µg/L							
Surrogate: Acridine-d9	*0.300*		*µg/L*	0.460		*65*	*50-140*			
Surrogate: Naphthalene-d8	*4.97*		*µg/L*	4.47		*111*	*50-140*			
Surrogate: Perylene-d12	*4.09*		*µg/L*	4.47		*92*	*50-140*			
LCS (B0K0505-BS1)				Prepared: 2020-11-05, Analyzed: 2020-11-06						
Acenaphthene	3.61	0.050	µg/L	4.44		81	55-137			
Acenaphthylene	3.50	0.200	µg/L	4.44		79	53-140			
Acridine	3.04	0.050	µg/L	4.44		68	50-120			
Anthracene	3.64	0.010	µg/L	4.44		82	64-130			
Benz(a)anthracene	4.25	0.010	µg/L	4.44		96	57-140			
Benzo(a)pyrene	3.44	0.010	µg/L	4.44		77	63-133			
Benzo(b+j)fluoranthene	7.16	0.050	µg/L	8.89		81	60-129			
Benzo(g,h,i)perylene	3.57	0.050	µg/L	4.44		80	52-139			
Benzo(k)fluoranthene	3.37	0.050	µg/L	4.44		76	50-138			
2-Chloronaphthalene	3.66	0.100	µg/L	4.38		84	50-139			
Chrysene	4.37	0.050	µg/L	4.44		98	59-140			
Dibenz(a,h)anthracene	3.54	0.010	µg/L	4.44		80	53-136			
Fluoranthene	4.37	0.030	µg/L	4.44		98	67-135			
Fluorene	3.54	0.050	µg/L	4.44		80	57-134			
Indeno(1,2,3-cd)pyrene	3.46	0.050	µg/L	4.44		78	52-129			
1-Methylnaphthalene	3.43	0.100	µg/L	4.44		77	50-140			
2-Methylnaphthalene	4.23	0.100	µg/L	4.44		95	50-140			
Naphthalene	4.51	0.200	µg/L	4.44		101	50-140			
Phenanthrene	3.70	0.100	µg/L	4.44		83	61-134			
Pyrene	4.34	0.020	µg/L	4.44		98	66-131			
Quinoline	5.43	0.050	µg/L	4.44		122	50-140			
Surrogate: Acridine-d9	*0.318*		*µg/L*	0.460		*69*	*50-140*			
Surrogate: Naphthalene-d8	*5.13*		*µg/L*	4.47		*115*	*50-140*			
Surrogate: Perylene-d12	*3.78*		*µg/L*	4.47		*85*	*50-140*			
LCS Dup (B0K0505-BSD1)				Prepared: 2020-11-05, Analyzed: 2020-11-06						
Acenaphthene	3.90	0.050	µg/L	4.44		88	55-137	8	18	
Acenaphthylene	3.86	0.200	µg/L	4.44		87	53-140	10	20	
Acridine	3.85	0.050	µg/L	4.44		87	50-120	23	30	
Anthracene	4.00	0.010	µg/L	4.44		90	64-130	10	15	
Benz(a)anthracene	4.77	0.010	µg/L	4.44		107	57-140	12	25	
Benzo(a)pyrene	3.81	0.010	µg/L	4.44		86	63-133	10	18	
Benzo(b+j)fluoranthene	7.95	0.050	µg/L	8.89		89	60-129	10	17	
Benzo(g,h,i)perylene	3.92	0.050	µg/L	4.44		88	52-139	10	22	
Benzo(k)fluoranthene	3.76	0.050	µg/L	4.44		85	50-138	11	26	
2-Chloronaphthalene	3.92	0.100	µg/L	4.38		89	50-139	7	23	
Chrysene	4.87	0.050	µg/L	4.44		110	59-140	11	23	
Dibenz(a,h)anthracene	3.91	0.010	µg/L	4.44		88	53-136	10	21	
Fluoranthene	4.82	0.030	µg/L	4.44		109	67-135	10	18	
Fluorene	3.95	0.050	µg/L	4.44		89	57-134	11	18	
Indeno(1,2,3-cd)pyrene	3.85	0.050	µg/L	4.44		87	52-129	11	21	
1-Methylnaphthalene	3.81	0.100	µg/L	4.44		86	50-140	10	20	
2-Methylnaphthalene	4.75	0.100	µg/L	4.44		107	50-140	12	21	
Naphthalene	5.11	0.200	µg/L	4.44		115	50-140	13	22	
Phenanthrene	4.06	0.100	µg/L	4.44		91	61-134	9	17	
Pyrene	4.78	0.020	µg/L	4.44		108	66-131	10	19	
Quinoline	13.6	0.050	µg/L	4.44		306	50-140	86	14	RPD, SPK1
Surrogate: Acridine-d9	*0.363*		*µg/L*	0.460		*79*	*50-140*			
Surrogate: Naphthalene-d8	*5.59*		*µg/L*	4.47		*125*	*50-140*			

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0K0505, Continued										
LCS Dup (B0K0505-BSD1), Continued				Prepared: 2020-11-05, Analyzed: 2020-11-06						
Surrogate: Perylene-d12	*4.13*		*µg/L*	4.47		*92*	*50-140*			
Total Metals, Batch B0K0546										
Blank (B0K0546-BLK1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Beryllium, total	< 0.00010	0.00010	mg/L							
Bismuth, total	< 0.00010	0.00010	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Phosphorus, total	< 0.050	0.050	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Silicon, total	< 1.0	1.0	mg/L							
Silver, total	< 0.000050	0.000050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Sulfur, total	< 3.0	3.0	mg/L							
Tellurium, total	< 0.00050	0.00050	mg/L							
Thallium, total	< 0.000020	0.000020	mg/L							
Thorium, total	< 0.00010	0.00010	mg/L							
Tin, total	< 0.00020	0.00020	mg/L							
Titanium, total	< 0.0050	0.0050	mg/L							
Tungsten, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Vanadium, total	< 0.0010	0.0010	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B0K0546-BS1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Aluminum, total	0.0185	0.0050	mg/L	0.0199		93	80-120			
Antimony, total	0.0214	0.00020	mg/L	0.0200		107	80-120			
Arsenic, total	0.0214	0.00050	mg/L	0.0200		107	80-120			
Barium, total	0.0206	0.0050	mg/L	0.0198		104	80-120			
Beryllium, total	0.0229	0.00010	mg/L	0.0198		116	80-120			
Bismuth, total	0.0224	0.00010	mg/L	0.0200		112	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		120	80-120			
Cadmium, total	0.0208	0.000010	mg/L	0.0199		104	80-120			
Calcium, total	2.41	0.20	mg/L	2.02		119	80-120			
Chromium, total	0.0208	0.00050	mg/L	0.0198		105	80-120			
Cobalt, total	0.0211	0.00010	mg/L	0.0199		106	80-120			
Copper, total	0.0222	0.00040	mg/L	0.0200		111	80-120			

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0K0546, Continued										
LCS (B0K0546-BS1), Continued				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Iron, total	2.03	0.010	mg/L	2.02		101	80-120			
Lead, total	0.0239	0.00020	mg/L	0.0199		120	80-120			
Lithium, total	0.0241	0.00010	mg/L	0.0200		120	80-120			
Magnesium, total	2.30	0.010	mg/L	2.02		114	80-120			
Manganese, total	0.0204	0.00020	mg/L	0.0199		103	80-120			
Molybdenum, total	0.0203	0.00010	mg/L	0.0200		102	80-120			
Nickel, total	0.0215	0.00040	mg/L	0.0200		108	80-120			
Phosphorus, total	2.11	0.050	mg/L	2.00		105	80-120			
Potassium, total	2.14	0.10	mg/L	2.02		106	80-120			
Selenium, total	0.0209	0.00050	mg/L	0.0200		105	80-120			
Silicon, total	2.0	1.0	mg/L	2.00		98	80-120			
Silver, total	0.0203	0.000050	mg/L	0.0200		101	80-120			
Sodium, total	2.28	0.10	mg/L	2.02		113	80-120			
Strontium, total	0.0206	0.0010	mg/L	0.0200		103	80-120			
Sulfur, total	4.0	3.0	mg/L	5.00		80	80-120			
Tellurium, total	0.0209	0.00050	mg/L	0.0200		104	80-120			
Thallium, total	0.0213	0.000020	mg/L	0.0199		107	80-120			
Thorium, total	0.0191	0.00010	mg/L	0.0200		96	80-120			
Tin, total	0.0217	0.00020	mg/L	0.0200		109	80-120			
Titanium, total	0.0216	0.0050	mg/L	0.0200		108	80-120			
Tungsten, total	0.0222	0.0010	mg/L	0.0200		111	80-120			
Uranium, total	0.0214	0.000020	mg/L	0.0200		107	80-120			
Vanadium, total	0.0211	0.0010	mg/L	0.0200		106	80-120			
Zinc, total	0.0213	0.0040	mg/L	0.0200		107	80-120			
Zirconium, total	0.0183	0.00010	mg/L	0.0200		91	80-120			
Reference (B0K0546-SRM1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Aluminum, total	0.294	0.0050	mg/L	0.299		98	70-130			
Antimony, total	0.0521	0.00020	mg/L	0.0517		101	70-130			
Arsenic, total	0.125	0.00050	mg/L	0.119		105	70-130			
Barium, total	0.807	0.0050	mg/L	0.801		101	70-130			
Beryllium, total	0.0546	0.00010	mg/L	0.0501		109	70-130			
Boron, total	4.23	0.0500	mg/L	4.11		103	70-130			
Cadmium, total	0.0506	0.000010	mg/L	0.0503		101	70-130			
Calcium, total	10.9	0.20	mg/L	10.7		102	70-130			
Chromium, total	0.254	0.00050	mg/L	0.250		101	70-130			
Cobalt, total	0.0400	0.00010	mg/L	0.0384		104	70-130			
Copper, total	0.515	0.00040	mg/L	0.487		106	70-130			
Iron, total	0.498	0.010	mg/L	0.504		99	70-130			
Lead, total	0.304	0.00020	mg/L	0.278		109	70-130			
Lithium, total	0.460	0.00010	mg/L	0.398		115	70-130			
Magnesium, total	4.15	0.010	mg/L	3.59		116	70-130			
Manganese, total	0.107	0.00020	mg/L	0.111		97	70-130			
Molybdenum, total	0.202	0.00010	mg/L	0.196		103	70-130			
Nickel, total	0.261	0.00040	mg/L	0.248		105	70-130			
Phosphorus, total	0.248	0.050	mg/L	0.213		117	70-130			
Potassium, total	6.36	0.10	mg/L	5.89		108	70-130			
Selenium, total	0.123	0.00050	mg/L	0.120		102	70-130			
Sodium, total	9.91	0.10	mg/L	8.71		114	70-130			
Strontium, total	0.399	0.0010	mg/L	0.393		102	70-130			
Thallium, total	0.0809	0.000020	mg/L	0.0787		103	70-130			
Uranium, total	0.0355	0.000020	mg/L	0.0344		103	70-130			
Vanadium, total	0.393	0.0010	mg/L	0.391		101	70-130			
Zinc, total	2.51	0.0040	mg/L	2.50		101	70-130			

Total Metals, Batch B0K0578

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0K0578, Continued										
Blank (B0K0578-BLK1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Mercury, total	< 0.000010	0.000010	mg/L							
Reference (B0K0578-SRM1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Mercury, total	0.00580	0.000010	mg/L	0.00581		100	70-130			
Volatile Organic Compounds (VOC), Batch B0K0530										
Blank (B0K0530-BLK1)				Prepared: 2020-11-06, Analyzed: 2020-11-06						
Benzene	< 0.5	0.5	µg/L							
Bromodichloromethane	< 1.0	1.0	µg/L							
Bromoform	< 1.0	1.0	µg/L							
Carbon tetrachloride	< 0.5	0.5	µg/L							
Chlorobenzene	< 1.0	1.0	µg/L							
Chloroethane	< 2.0	2.0	µg/L							
Chloroform	2.0	1.0	µg/L							BLK
Dibromochloromethane	< 1.0	1.0	µg/L							
1,2-Dibromoethane	< 0.3	0.3	µg/L							
Dibromomethane	< 1.0	1.0	µg/L							
1,2-Dichlorobenzene	< 0.5	0.5	µg/L							
1,3-Dichlorobenzene	< 1.0	1.0	µg/L							
1,4-Dichlorobenzene	< 1.0	1.0	µg/L							
1,1-Dichloroethane	< 1.0	1.0	µg/L							
1,2-Dichloroethane	< 1.0	1.0	µg/L							
1,1-Dichloroethylene	< 1.0	1.0	µg/L							
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L							
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L							
Dichloromethane	< 3.0	3.0	µg/L							
1,2-Dichloropropane	< 1.0	1.0	µg/L							
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L							
Ethylbenzene	< 1.0	1.0	µg/L							
Methyl tert-butyl ether	< 1.0	1.0	µg/L							
Styrene	< 1.0	1.0	µg/L							
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L							
Tetrachloroethylene	< 1.0	1.0	µg/L							
Toluene	< 1.0	1.0	µg/L							
1,1,1-Trichloroethane	< 1.0	1.0	µg/L							
1,1,2-Trichloroethane	< 1.0	1.0	µg/L							
Trichloroethylene	< 1.0	1.0	µg/L							
Trichlorofluoromethane	< 1.0	1.0	µg/L							
Vinyl chloride	< 1.0	1.0	µg/L							
Xylenes (total)	< 2.0	2.0	µg/L							
Surrogate: Toluene-d8	*19.6*		*µg/L*	26.5		*74*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*20.6*		*µg/L*	24.9		*83*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*23.9*		*µg/L*	25.5		*94*	*70-130*			
LCS (B0K0530-BS1)				Prepared: 2020-11-05, Analyzed: 2020-11-05						
Benzene	17.3	0.5	µg/L	20.0		87	70-130			
Bromodichloromethane	16.3	1.0	µg/L	20.0		82	70-130			
Bromoform	14.6	1.0	µg/L	20.1		73	70-130			
Carbon tetrachloride	15.3	0.5	µg/L	20.2		76	70-130			
Chlorobenzene	17.8	1.0	µg/L	20.1		88	70-130			
Chloroethane	22.8	2.0	µg/L	20.0		114	60-140			
Chloroform	19.6	1.0	µg/L	20.1		98	70-130			
Dibromochloromethane	15.4	1.0	µg/L	20.2		76	70-130			
1,2-Dibromoethane	15.6	0.3	µg/L	20.0		78	70-130			
Dibromomethane	16.6	1.0	µg/L	20.0		83	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

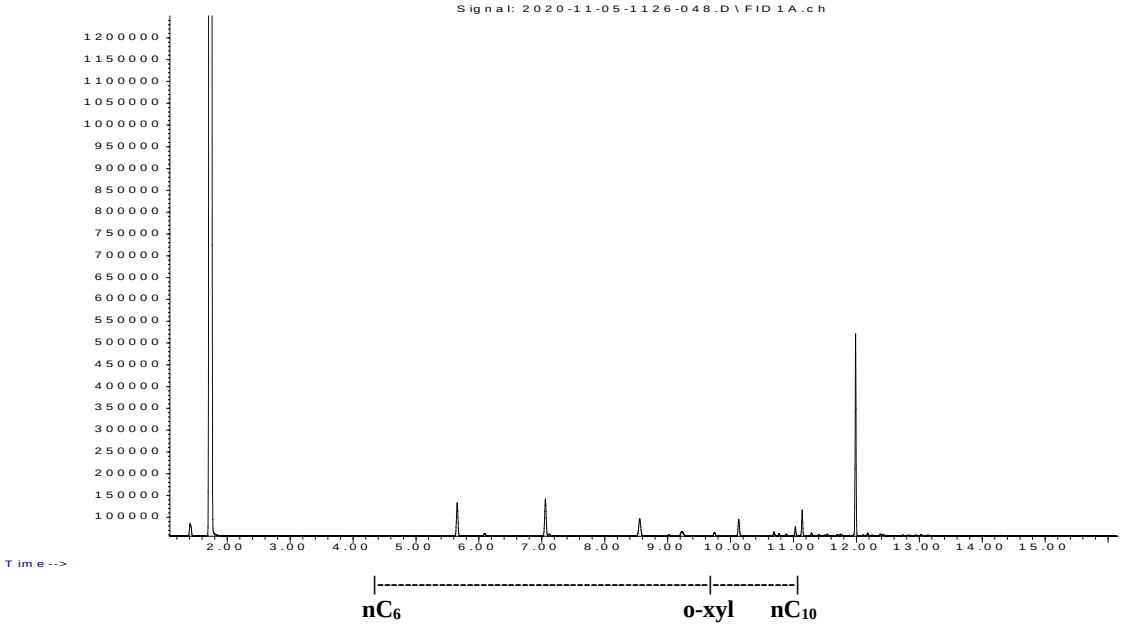
REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20K0677
PROJECT	WWTP	**REPORTED**	2020-11-09 16:18

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Volatile Organic Compounds (VOC), Batch B0K0530, Continued										
LCS (B0K0530-BS1), Continued				Prepared: 2020-11-05, Analyzed: 2020-11-05						
1,2-Dichlorobenzene	16.3	0.5	µg/L	20.1		81	70-130			
1,3-Dichlorobenzene	16.5	1.0	µg/L	20.1		82	70-130			
1,4-Dichlorobenzene	17.0	1.0	µg/L	20.1		84	70-130			
1,1-Dichloroethane	18.0	1.0	µg/L	20.1		89	70-130			
1,2-Dichloroethane	16.9	1.0	µg/L	20.1		84	70-130			
1,1-Dichloroethylene	18.5	1.0	µg/L	20.1		92	70-130			
cis-1,2-Dichloroethylene	17.3	1.0	µg/L	20.0		87	70-130			
trans-1,2-Dichloroethylene	18.3	1.0	µg/L	20.0		91	70-130			
Dichloromethane	19.0	3.0	µg/L	20.1		95	70-130			
1,2-Dichloropropane	16.7	1.0	µg/L	20.1		83	70-130			
1,3-Dichloropropene (cis + trans)	30.2	1.0	µg/L	40.0		75	70-130			
Ethylbenzene	15.4	1.0	µg/L	20.0		77	70-130			
Methyl tert-butyl ether	18.4	1.0	µg/L	20.0		92	70-130			
Styrene	15.5	1.0	µg/L	20.0		78	70-130			
1,1,2,2-Tetrachloroethane	13.9	0.5	µg/L	20.1		69	70-130			SPK1
Tetrachloroethylene	17.5	1.0	µg/L	20.1		87	70-130			
Toluene	17.3	1.0	µg/L	20.0		86	70-130			
1,1,1-Trichloroethane	15.5	1.0	µg/L	20.0		78	70-130			
1,1,2-Trichloroethane	16.0	1.0	µg/L	20.1		79	70-130			
Trichloroethylene	18.2	1.0	µg/L	20.1		90	70-130			
Trichlorofluoromethane	20.4	1.0	µg/L	20.0		102	60-140			
Vinyl chloride	26.1	1.0	µg/L	20.0		130	60-140			
Xylenes (total)	45.6	2.0	µg/L	60.0		76	70-130			
Surrogate: Toluene-d8	*18.8*		*µg/L*	26.5		*71*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*24.5*		*µg/L*	24.9		*98*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*30.0*		*µg/L*	25.5		*117*	*70-130*			

QC Qualifiers:

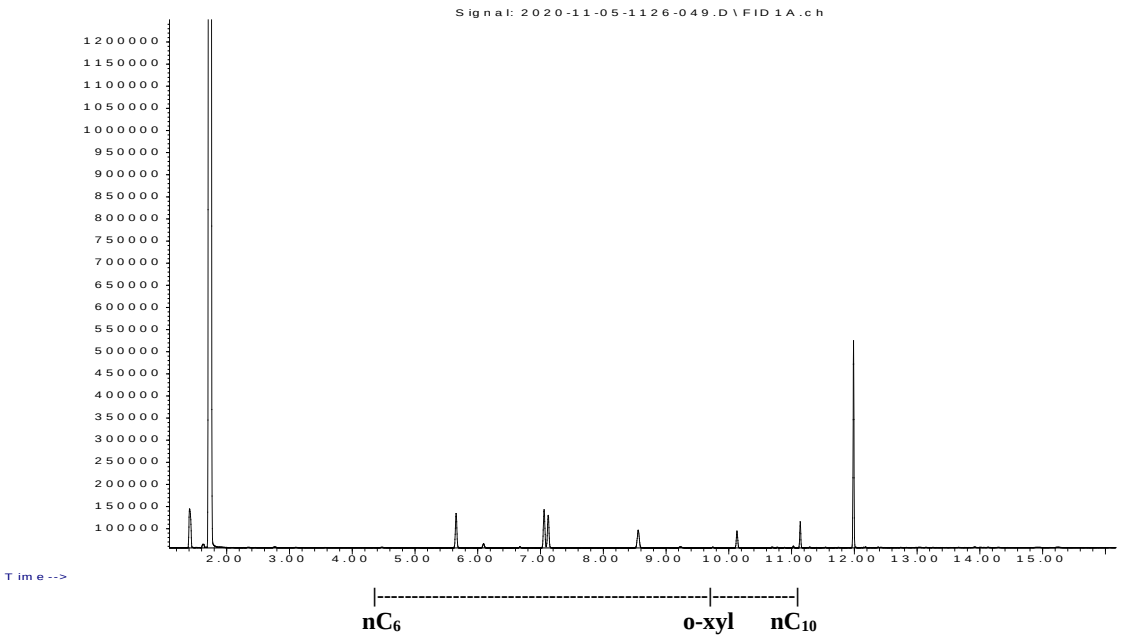
BLK	Analyte concentration in the Method Blank is above the Reporting Limit (RL).
RPD	Relative percent difference (RPD) of duplicate analysis are outside of control limits for unknown reason(s).
S02	Surrogate recovery outside of control limits. Data accepted based on acceptable recovery of other surrogates.
SPK1	The recovery of this analyte was outside of established control limits. The data was accepted based on performance of other batch QC.

Sample ID: Bio Reactor Effluent
Caro ID: 20K0677-01



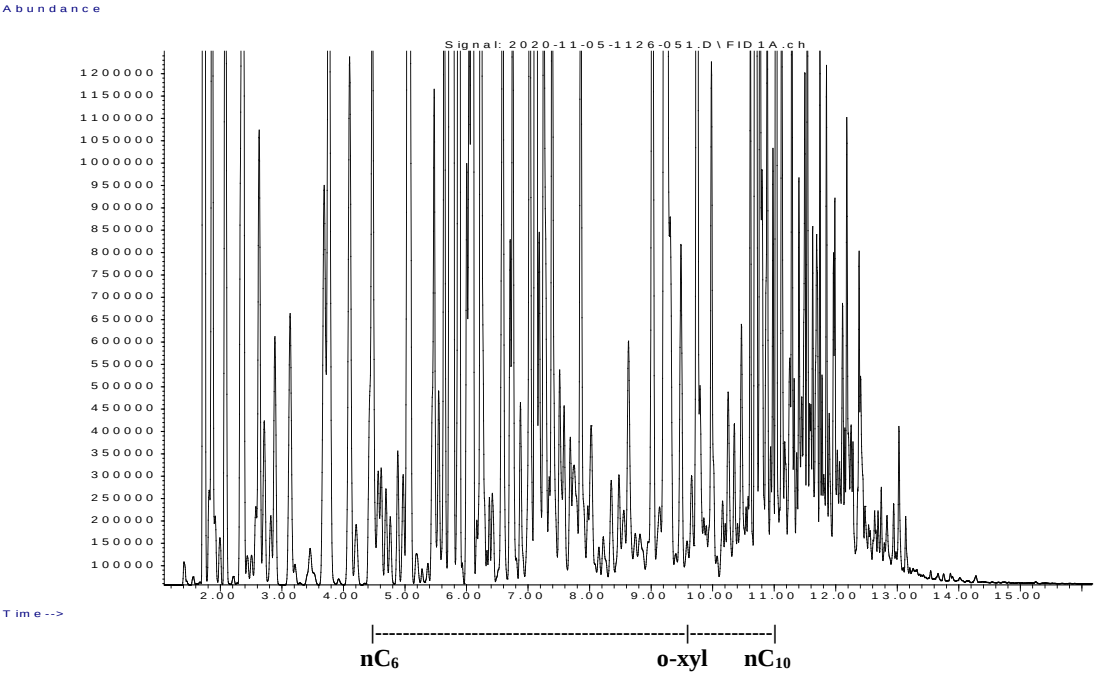
|----------|----------|
nC$_6$ **o-xyl** **nC$_{10}$**

Sample ID: Final Effluent
Caro ID: 20K0677-02

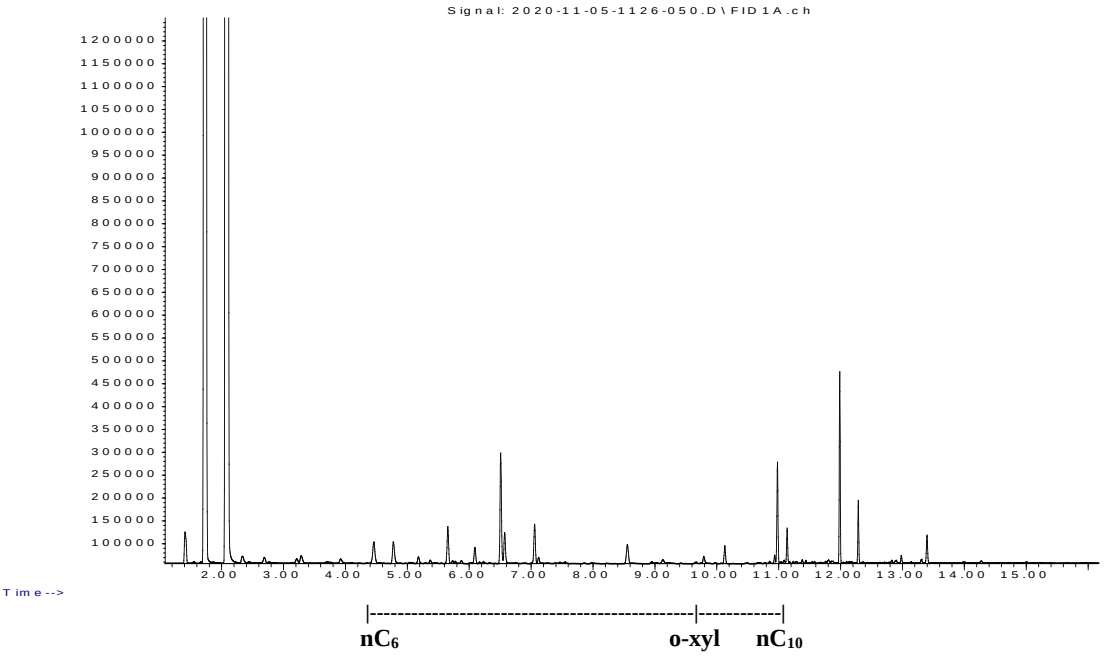


|----------|----------|
nC$_6$ **o-xyl** **nC$_{10}$**

Sample ID: MH 1001
Caro ID: 20K0677-03

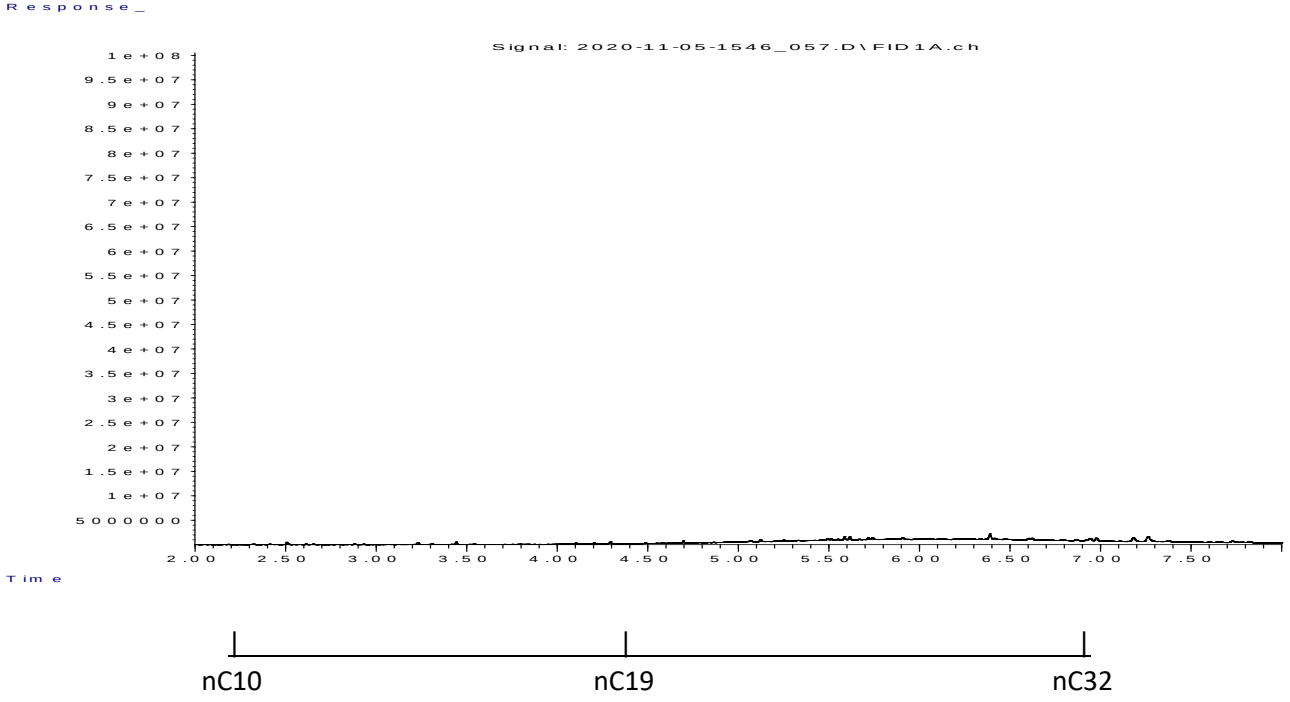


Sample ID: MH 1002
Caro ID: 20K0677-04



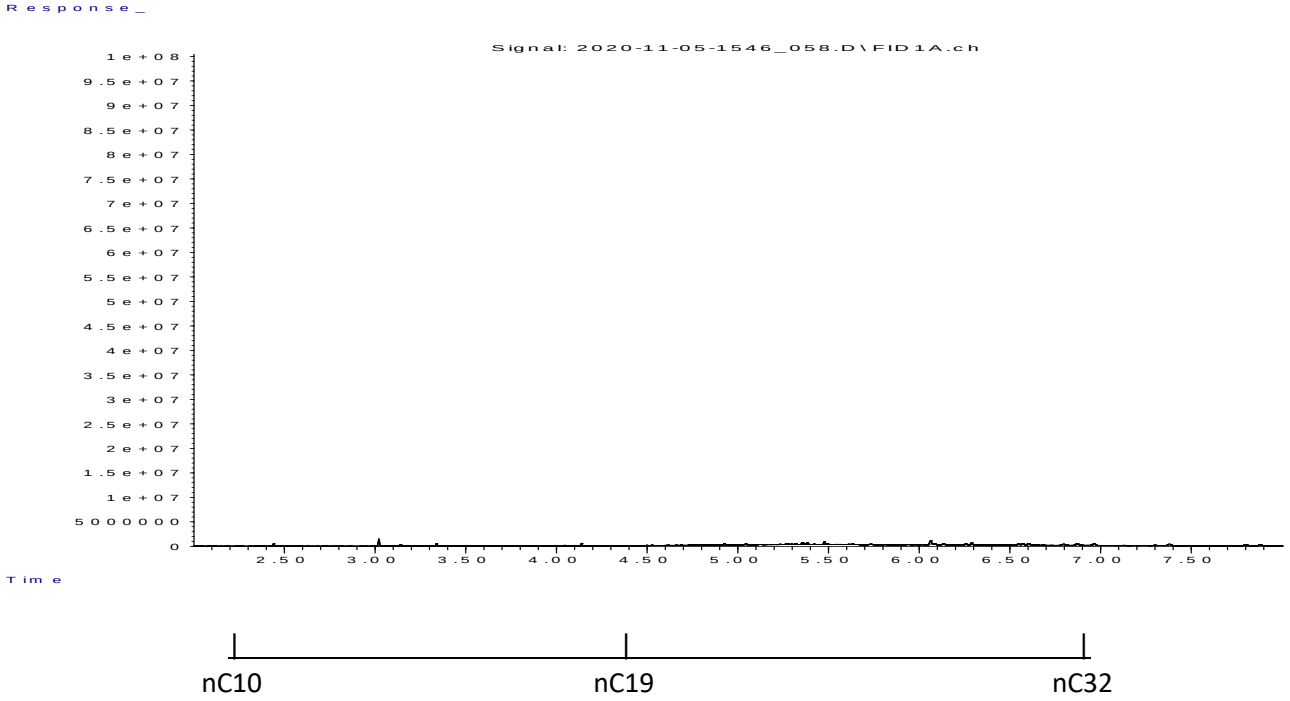
Client ID: Bio Reactor Effluent

Caro ID: 20K0677-01



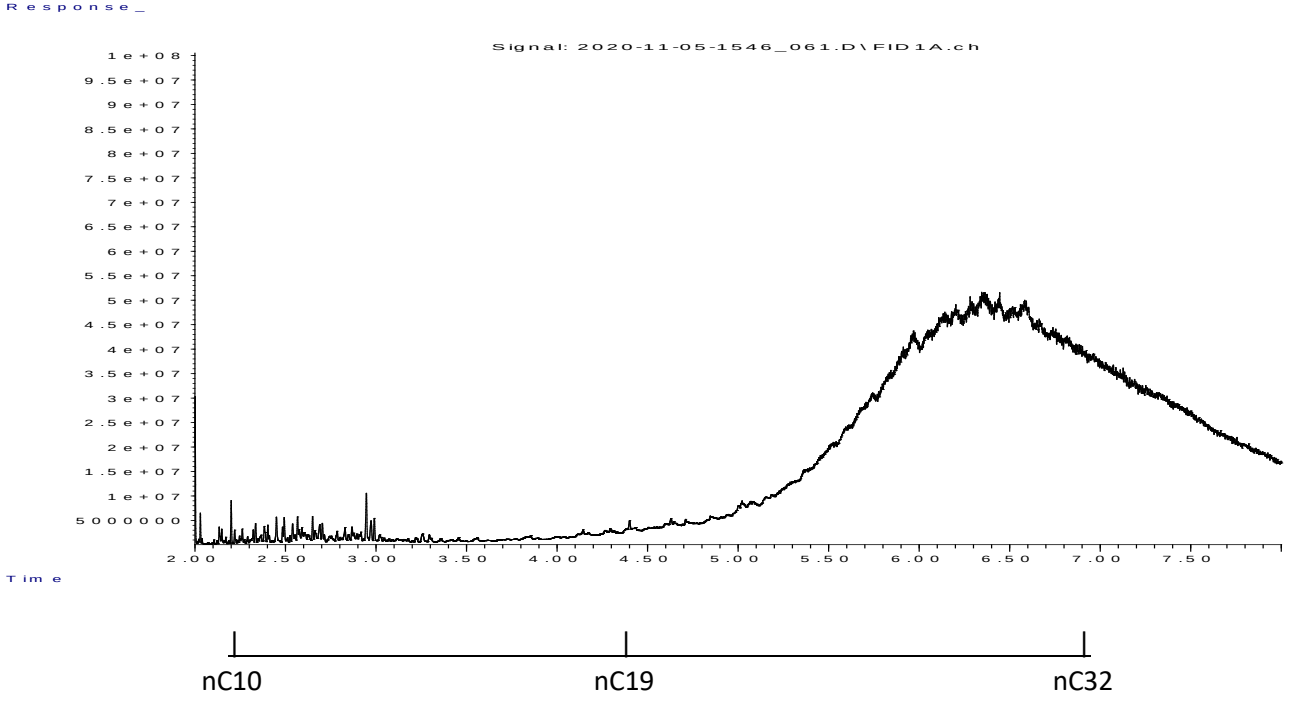
Client ID: Final Effluent

Caro ID: 20K0677-02



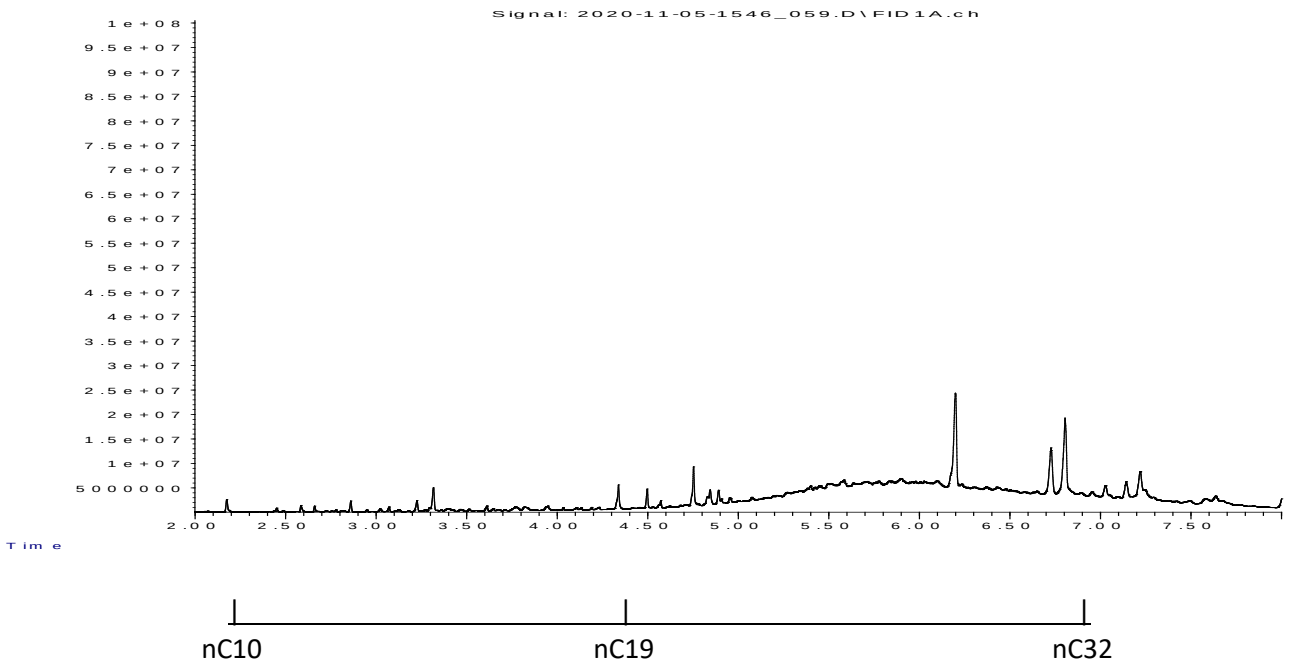
Client ID: MH 1001

Caro ID: 20K0677-03 (**50x dilution**)



Client ID: MH 1002

Caro ID: 20K0677-04



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TECHNICAL MEMORANDUM

Date: December 1, 2020
To: Mr. Chris Wike, Superintendent - Utilities
From: Chris Perrin, MSc. RPBio
Shauna Bennett, MSc. RPBio..
Re: Potential effects of a November 4, 2020 oil contamination incident at the Whistler Wastewater Treatment Plant on biota in the Cheakamus River

INTRODUCTION

This memorandum presents an analysis of potential effects on biota in the Cheakamus River from oil contamination adversely affecting operation of the Whistler Wastewater Treatment Plant (WWTP) bioreactor on November 4, 2020 (TetraTech, 2020[1]). The incident led to anomalous discharge of phosphorus to the Cheakamus River and a one-day discharge of hydrocarbons to the Cheakamus River as the oil contamination passed plant processes. Staff of the Resort Municipality of Whistler (RMOW) were immediately aware of the incident and took remedial action to limit phosphorus discharge using chemical precipitation (alum). Despite these actions, staff remain concerned about river health. Several weeks will be needed to restore operation of the bioreactor. In that time, phosphorus loading to the river may produce amounts of algal biomass that exceed water quality guidelines. The form of phosphorus of interest is called soluble reactive phosphorus (SRP) that is mostly the PO_4 ion that is the most bio-available form of phosphorus. The short-term discharge of hydrocarbons may have produced toxicity among biota in the river.

PHOSPHORUS AND ALGAE

As part of normal operations, staff of the WWTP collect daily samples for analysis of SRP concentrations in final plant effluent and at other places in the treatment train. Those data from final plant effluent are shown before, during, and after the oil contamination incident in Figure 1. A SRP spike of 1600 $\mu g \cdot L^{-1}$ (1.6 $mg \cdot L^{-1}$) in the final effluent was detected on the day of the incident (November 4, 2020). It was caused by oil contamination in the bioreactor that is responsible for phosphorus removal (Tetra Tech 2020).

[1] Tetra Tech. 2020. Impact of oil spill discharge to the Whistler Treatment Plant at the Resort Municipality of Whistler. Technical Memorandum. November 25, 2020.

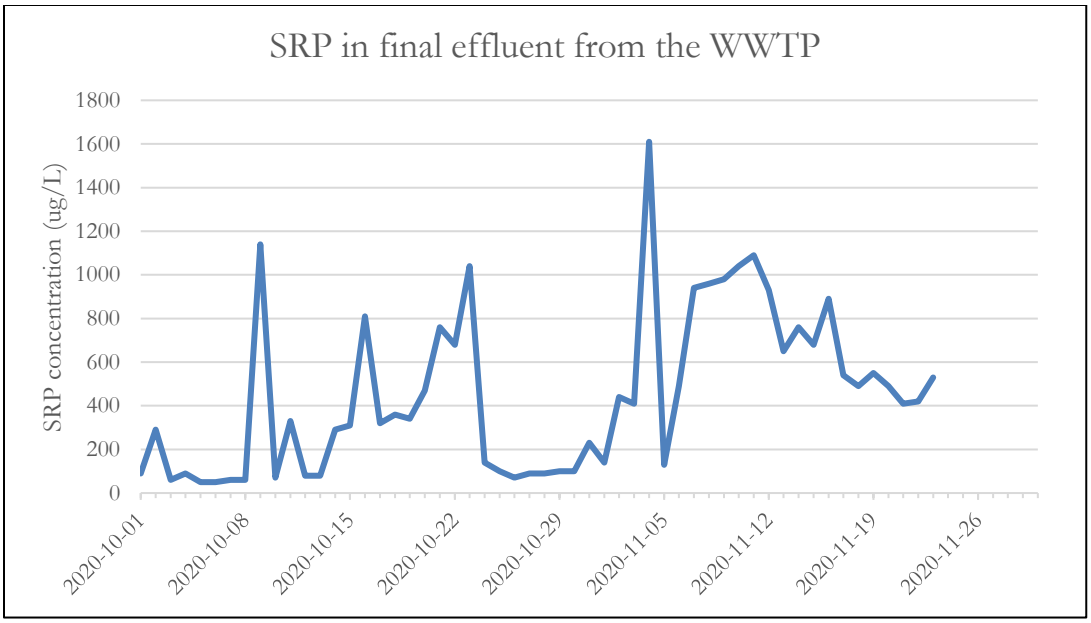

Figure 1. Concentration of soluble reactive phosphorus (SRP, also known as PO_4-P) in final effluent discharged from the Whistler Wastewater Treatment Plant, October 1 – November 23, 2020.

SRP concentration in the Cheakamus River was needed for assessment of an algal response to the phosphorus load. SRP concentration in the river (S_r) was calculated as

$$S_r = S_w + S_c \qquad \text{Equation 1}$$

Where:

S_w was SRP concentration in the river that was from the WWTP and S_c was SRP concentration in the Cheakamus River naturally occurring upstream of the WWTP diffuser.

S_w was calculated as:

$$S_w = S_p * D \qquad \text{Equation 2}$$

Where :

S_p was SRP concentration in final WWTP effluent and D was a dilution factor calculated as:

$$D = \frac{Q_w}{(Q_w + Q_r)} \qquad \text{Equation 3}$$

Where:

Q_w was rate of discharge of final effluent from the WWTP and

Q_r was rate of flow in the Cheakamus River at a point of full mixing of discharge from the WWTP.

The point of full mixing was located 6.6 km downstream of the WWTP diffuser, known as sampling site CH2 in recent water quality monitoring[2]. Q_r at CH2 was calculated as flow at Water Survey of Canada hydrometric station 08GA072 located 200 m upstream of the diffuser corrected for watershed area. Data from 08GA072 were downloaded from the Water Survey of Canada web site.

S_c for SRP was not measured during the incident so was assumed as the mean SRP concentration during fall 2000, the latest time it was measured during fall months as part of a monitoring study. That SRP concentration was 1.4 µg·L^{-1}.

Using Equation 2, S_w for the same period shown in Figure 1 is shown in Figure 2. Values for S_r can be determined by adding 1.4 µg·L^{-1} to those shown in Figure 2. Results show that on November 4, 2020, the day of the oil contamination, SRP concentration in the river that originated at the WWTP was 5.3 µg·L^{-1}. This concentration was in the range of previous peaks in fall 2020 that were 3.7 µg·L^{-1} (October 9, 2020) to 7.8 µg·L^{-1} (October 23, 2020). Those peaks occurred during operations before the oil contamination. A large drop in S_w (SRP concentration in the river from WWTP discharge; 0.3 µg·L^{-1}) occurred on the day following the oil contamination. This change can be attributed to the alum treatment applied at the WWTP to contain phosphorus discharge. In following days, S_w increased and reached a larger peak than on the day of the incident (8 µg·L^{-1} of SRP). Thereafter S_w declined and was 4.9 µg·L^{-1} on November 23, the final day of data accessed from RMOW. These fluxes were caused by interactions between dilution and concentrations of SRP in plant final effluent.

It is noteworthy that dilution rates in fall 2020 were relatively high (low value of D) because of low rates of discharge from the WWTP. Average D during the period of record in Figure 2 was 0.006 compared to 0.02 in winter 2020 (low river flow) and 0.003 during summer 2019 (high river flow). The fall period D value was the same as that in 2000, the last time that biological sampling was done in the fall in the upper Cheakamus River to examine effects of WWTP discharges (Limnotek data records).

[2] Perrin, C.J. and S. Bennett. 2020. Effect of discharge from the Whistler wastewater treatment plant on water quality and benthic biota in the upper Cheakamus River, 2020. Report prepared by Limnotek Research and Development Inc. for the Resort Municipality of Whistler. 45p.

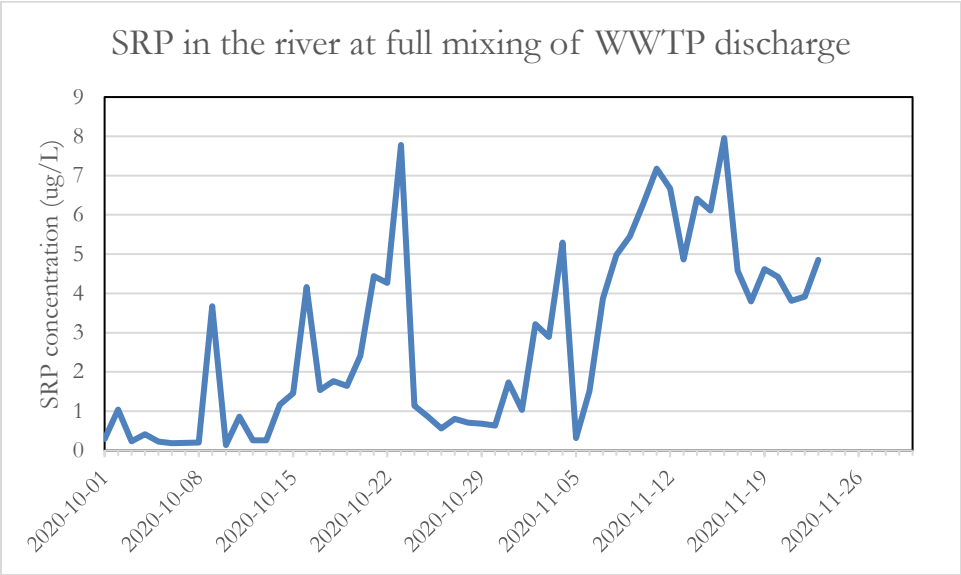

Figure 2. Concentration of soluble reactive phosphorus (SRP, also known as PO_4-P) from the WWTP and fully diluted in the Cheakamus River (Equation 2), October 1 – November 23, 2020.

Using an existing linear model that was recently compiled for the Resort Municipality of Whistler (RMOW) (Perrin and Bennett 2020), simulations were run to show potential change in algal biomass in the Cheakamus River as a function of phosphorus discharge from the WWTP. The model is based on empirical data from several years of monitoring relationships between phosphorus discharge from the WWTP and biota in the river. It predicts peak biomass of benthic algae (PB) during accrual over seven weeks on a river substrate. This criterion means that the model requires average SRP concentrations in the river over a period of about seven weeks, the time for algal community development. The peak biomass value is related to growth of algae on the substrata and can be compared to water quality guidelines.

In a form that can be used for the present simulation the model equation is:

$$PB = 0.8 + 1.33(S_r) \qquad \text{Equation 4}$$

This simple equation explains 67% of the variance in PB found in the upper Cheakamus River (Perrin and Bennett 2020), which is adequate for purposes of this memo. The time series used for this memo (October 1 – November 23, 2020) was divided into two parts for running Equation 4: A “before incident” period was October 1 to November 3 and an “after incident” period was November 4 – 23. Results in Table 1 show that predicted PB increased from 4.7 µg chl-a·cm^{-2} before the incident to 9.1 µg chl-a·cm^{-2} after the incident. Remember that these values are based on average SRP concentrations in the river over seven weeks, the standard time for measurement of algal accrual to reach PB. Given that both time periods were less than seven weeks,

the value for S_r for a total accrual period was assumed to be the same as that found in the shorter periods.

Table 1. Predicted mean peak biomass of benthic algae before and after the oil contamination incident compared to water quality guidelines.

Time window in 2020	Predicted PB (µg chl-a·cm^{-2}	BC MOE water quality guideline for benthic algae (µg chl-a·cm^{-2})[3]
Before incident (October 1 – November 3)	4.7	10
After incident (November 4 – 23)	9.1	

The estimated PB concentration following the oil contamination incident of 9.1 µg chl-a·cm^{-2} was less than the Provincial water quality guideline for benthic algal biomass of 10 µg chl-a·cm^{-2} (Nordin 2001). Given these close values, one can expect that some places in the river will host amounts of benthic algae that are greater than the guideline and some places will host less. The model output is an estimate explaining 67% of the variance. These results do show that the oil incident did not cause phosphorus concentrations and algal biomass values to far exceed water quality guidelines at the point of full mixing of final effluent in the river.

Continued attention to phosphorus retention at the WWTP is needed as river flows decline during late fall 2020 and winter 2021. Dilution was a large reason why an algal response to the disruption at the WWTP was tempered. That dilution will decline in coming weeks and contribute to rising SRP concentrations at full mixing downstream of the WWTP with present measures using alum to capture and settle phosphorus. It is recommended that aggressive measures be taken to restore functioning of the bioreactor as quickly as possible to avoid unwanted algal biomass with declining river flows in late 2020 and early 2021.

Calculations above focussed on SRP concentrations at full mixing in the Cheakamus River. Higher concentrations would have occurred within the pollutant plume immediately downstream of the diffuser. Benthic algae on river substrata contacted within that plume would have been exposed to those higher SRP concentrations than would have occurred at the point of full mixing. That exposure may have produced greater algal biomass within the plume than is predicted in Table 1. Computations to predict responses within the plume were beyond the scope of this memo.

[3] Nordin, R.N. 2001. Water quality criteria for nutrients and algae. B.C. Ministry of Environment. Victoria, B.C.

HYDROCARBONS AND OTHER CONTAMINANTS

WWTP staff collected samples for measurement of concentrations of hydrocarbons and other contaminants at various places in the treatment train during the afternoon of November 4, 2020, following detection of oil contamination (Tetra Tech 2020). One place was final effluent discharged to the Cheakamus River. One sample was collected at that point. Among many analytes tested in the lab, those reported in both Provincial water quality guidelines from 2019[4] and 2020[5], separate Provincial guidelines for phenols[6] and Federal water quality guidelines[7] were extracted. Dilution calculations were run using equations 1 to 3 above, replacing SRP with each of the contaminants. Contaminant values for S_c (concentrations upstream of the WWTP) were assumed to be zero. Fully mixed concentrations of the range of contaminants at full mixing in the river are shown in Table 2. They include polycyclic aromatic hydrocarbons, selected dissolved metals that are relevant for comparison to water quality guidelines, non-chlorinated phenols, and volatile organic compounds. In all cases, contaminant concentrations at full mixing in the river were less than water quality guideline values.

This outcome does not mean that contaminants did not affect biota in the Cheakamus River. With only one sample from final effluent collected for analysis at one time, the hydrocarbon load and pattern of change in that load over time of potential discharge to the river on November 4 cannot be determined. Hence, potential toxicity in the river also cannot be determined.

RMOW is aware of this limited data and has scheduled three more sampling dates over the next two weeks to measure the same analytes as were reported from the November 4 sampling. Resulting data will show if hydrocarbon contamination has dissipated. A second memo will be prepared to report on those findings after results are received from the lab.

As was done with phosphorus, calculations focussed on contaminant concentrations at full mixing in the Cheakamus River. Higher concentrations would have occurred within the pollutant plume immediately downstream of the diffuser. Biota within that plume would have been exposed to those higher concentrations than would have occurred at the point of full mixing. That exposure may have produced toxicity not apparent at the

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[4] B.C. Ministry of Environment and Climate Change Strategy 2019. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture. Summary Report. Prov. B.C., Victoria, B.C.

[5] B.C. Ministry of Environment and Climate Change Strategy 2020. Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Quality Guideline Series, WQG-07. Prov. B.C., Victoria B.C.

[6] B.C. Ministry of Water, Air and Climate Change Branch. 2002. Ambient Interim Water Quality Guidelines for Phenols: Summary Report. Prov. B.C., Victoria, B.C.

[7] Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life In: Canadian environmental quality guidelines, 1999. Canadian Council for Ministers of the Environment, Winnipeg.

point of full mixing. Computations to predict responses within the plume were beyond the scope of this memo.

Table 2. Comparison of contaminant concentrations in one sample of final effluent and calculated concentrations from that one sample at full mixing in the Cheakamus River with water quality guidelines. Blank cells indicate no guideline value.

Category	Analyte	Concentration in Final Effluent (ug/L)	Calculated concentration in river at full mixing downstream of WWTP (ug/L)	BC Freshwater chronic guideline (ug/L)	BC Freshwater acute guideline (ug/L)	Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater Long Term (ug/L)
Polycyclic Aromatic Hydrocarbons (PAH)	Acenaphthne	<0.050	<0.0002	6		5.8
Polycyclic Aromatic Hydrocarbons (PAH)	Acridine	<0.050	<0.0002	3	0.05	4.4
Polycyclic Aromatic Hydrocarbons (PAH)	Anthracene	<0.010	<0.000032	4	0.1	0.012
Polycyclic Aromatic Hydrocarbons (PAH)	Benz(a)anthracene	<0.010	<0.000032	0.1	0.1	0.018
Polycyclic Aromatic Hydrocarbons (PAH)	Benzo(a)pyrene	<0.010	<0.000032	0.01		0.015
Polycyclic Aromatic Hydrocarbons (PAH)	Fluoranthene	0.051	0.00017	4	0.2	0.04

Category	Analyte	Concentration in Final Effluent (ug/L)	Calculated concentration in river at full mixing downstream of WWTP (ug/L)	BC Freshwater chronic guideline (ug/L)	BC Freshwater acute guideline (ug/L)	Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater Long Term (ug/L)
Polycyclic Aromatic Hydrocarbons (PAH)	Fluorene	<0.050	<0.0002	12		3
Polycyclic Aromatic Hydrocarbons (PAH)	Naphthalene	<0.200	<0.00065	1		1.1
Polycyclic Aromatic Hydrocarbons (PAH)	Phenanthrene	<0.100	<0.000032	0.3		0.4
Polycyclic Aromatic Hydrocarbons (PAH)	Pyrene	<0.020	<0.000065		0.02	0.025
Polycyclic Aromatic Hydrocarbons (PAH)	Quinoline	<0.050	<0.0002			3.4
Dissolved Metals	Aluminum, dissolved	71.1	0.228	50	100	100
Dissolved Metals	Cadmium, dissolved	0.031	0.0001	0.127	0.288	0.17
Dissolved Metals	Copper, dissolved	16.1	0.05	2		2.51
Dissolved Metals	Lead, dissolved	0.21	0.0007	4.63	33.77	3.47
Dissolved Metals	Zinc, dissolved	31	0.1	7.5	33	

Category	Analyte	Concentration in Final Effluent (ug/L)	Calculated concentration in river at full mixing downstream of WWTP (ug/L)	BC Freshwater chronic guideline (ug/L)	BC Freshwater acute guideline (ug/L)	Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater Long Term (ug/L)
Non-Chlorinated Phenols	Phenol	<0.98	<0.0031	4.5 for 4-hydroxyphenol 12.5 for 3-hydroxyphenol 50 for all other phenols		
Polycyclic Aromatic Hydrocarbons (PAH)	Fluorene	<0.050	<0.0002	12		3
Polycyclic Aromatic Hydrocarbons (PAH)	Naphthalene	<0.200	<0.00065	1		1.1
Polycyclic Aromatic Hydrocarbons (PAH)	Phenanthrene	<0.100	<0.000032	0.3		0.4
Polycyclic Aromatic Hydrocarbons (PAH)	Pyrene	<0.020	<0.000065		0.02	0.025
Polycyclic Aromatic Hydrocarbons (PAH)	Quinoline	<0.050	<0.0002			3.4
Volatile Organic Compounds (VOC)	1,1,2,2-Tetrachloroethane	<0.5	<0.0016	110		

Category	Analyte	Concentration in Final Effluent (ug/L)	Calculated concentration in river at full mixing downstream of WWTP (ug/L)	BC Freshwater chronic guideline (ug/L)	BC Freshwater acute guideline (ug/L)	Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater Long Term (ug/L)
Volatile Organic Compounds (VOC)	1,1,2-Trichloroethane	<1.0	<0.0032	21		
Volatile Organic Compounds (VOC)	1,2-Dichlorobenzene	<0.5	<0.0016			0.7
Volatile Organic Compounds (VOC)	1,4-Dichlorobenzene	<1.0	<0.0032			26
Volatile Organic Compounds (VOC)	Benzene	<0.5	<0.0016	40		370
Volatile Organic Compounds (VOC)	Ethylbenzene	<1.0	<0.0032	200		90
Volatile Organic Compounds (VOC)	Methyl tert-butyl ether	<1.0	<0.0032		3,400*	10,000
Volatile Organic Compounds (VOC)	Toluene	19	0.06	0.5		2
Volatile Organic Compounds (VOC)	Xylenes (total)	<2.0	<0.0064	30		

CLOSING

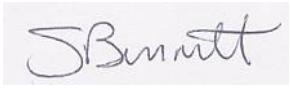
Oil contamination in the Whistler Wastewater Treatment Plant contributed to anomalous discharge of phosphorus and hydrocarbons in final effluent to the Cheakamus River on November 4, 2020. The phosphorus is thought to have come from disruption of the bioreactor that removes phosphorus in the treatment train.

Computations and application of an existing model showed that the phosphorus discharge was not enough to cause an increase in algal biomass above Provincial Water Quality Guidelines at places of full mixing of effluent in the river. Much of this outcome was related to high dilution. Potential biomass response may have been greater within the pollutant plume upstream of the point of full mixing.

It is recommended that measures be taken to restore functioning of the bioreactor as quickly as possible to avoid unwanted algal biomass that may occur with declining river flows and lower dilution of final effluent in the river in late 2020 and early 2021.

Further computations showed that contaminant concentrations at the point of full mixing of final effluent in the Cheakamus River did not exceed water quality guidelines. This finding was based on only one sample at one point in time on the day of the oil contamination incident. This sampling was not sufficient with which to determine potential toxicity in the Cheakamus River. Additional sampling is scheduled over the next two weeks to determine if contaminants have dissipated. Another memo will be prepared after results are received from the lab to report on those findings.

Regards:



Chris Perrin, MSc. RPBio.
Principal

Shauna Bennett, MSc. RPBio
Systems Ecologist.

Attachment 3 - Potential effects of a November 4, 2020 oil contamination incident at the Whistler Wastewater Treatment Plant on biota in the Cheakamus River, memo number 2 (Limnotek, January 19, 2021)

LIMNOTEK RESEARCH
& DEVELOPMENT INC

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TECHNICAL MEMORANDUM

Date: January 19, 2021
To: Mr. Chris Wike, Superintendent - Utilities
From: Chris Perrin, MSc. RPBio
Re: Potential effects of a November 4, 2020 oil contamination incident at the Whistler Wastewater Treatment Plant on biota in the Cheakamus River, memo number 2.

INTRODUCTION

This memorandum is the second in a pair presenting an analysis of potential effects on biota in the Cheakamus River from oil contamination adversely affecting operation of the Whistler Wastewater Treatment Plant (WWTP) bioreactor on November 4, 2020 (TetraTech, 2020[1]). The incident led to anomalous discharge of phosphorus to the Cheakamus River because of interference with phosphorus removal processes in the bioreactor. The incident also produced a one-day discharge of hydrocarbons to the Cheakamus River as the oil contamination passed plant processes. Staff of the Resort Municipality of Whistler (RMOW) were immediately aware of the incident and took remedial action to limit phosphorus discharge using chemical precipitation (alum). Potential effects of that phosphorus discharge were described in the first memo that was dated December 1, 2020 and will not be repeated here. As of December 1, 2020 only one sample for analysis of hydrocarbon contaminants in final effluent before discharge to the Cheakamus River was collected. A recommendation in the December 1, 2020 memo was to collect additional water samples from final effluent over three weeks to improve precision and sample size to describe contaminant concentrations in final effluent and contaminant concentrations after full mixing of WWTP discharge in the Cheakamus River. This memo provides those descriptions and a comparison of fully mixed contaminant concentrations in the river to water quality guidelines.

WWTP staff collected samples for measurement of concentrations of hydrocarbons and other contaminants at various places in the treatment train during the afternoon of November 4, 2020, following detection of oil contamination (Tetra Tech 2020). One place was final effluent discharged to the Cheakamus River. An additional sample from the final effluent was collected on each of December 2, 9, and 16. Among many analytes tested in the lab, those reported in both Provincial water quality

[1] Tetra Tech. 2020. Impact of oil spill discharge to the Whistler Treatment Plant at the Resort Municipality of Whistler. Technical Memorandum. November 25, 2020.

guidelines from 2019[2] and 2020[3], separate Provincial guidelines for phenols[4] and Federal water quality guidelines[5] were extracted.

A concentration for each hydrocarbon contaminant in the Cheakamus River was needed for comparison to water quality guidelines. A chemical concentration in the river (S_r) was calculated as

$$S_r = S_w + S_c \quad \text{Equation 1}$$

Where:

S_w was the chemical concentration in the river that was from the WWTP and S_c was the chemical concentration in the Cheakamus River upstream of the WWTP diffuser and assumed to be zero.

S_w was calculated as:

$$S_w = S_p * D \quad \text{Equation 2}$$

Where :

S_p was the chemical concentration in final WWTP effluent and D was a dilution factor calculated as:

$$D = \frac{Q_w}{(Q_w + Q_r)} \quad \text{Equation 3}$$

Where:

Q_w was the average rate of discharge of final effluent from the WWTP on the day of measurement of the chemical concentrations in final effluent and

Q_r was the average rate of flow in the Cheakamus River on the day of measurement of the chemical concentrations in final effluent at a point of full mixing of discharge from the WWTP.

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[2] B.C. Ministry of Environment and Climate Change Strategy 2019. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture. Summary Report. Prov. B.C., Victoria, B.C.

[3] B.C. Ministry of Environment and Climate Change Strategy 2020. Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Quality Guideline Series, WQG-07. Prov. B.C., Victoria B.C.

[4] B.C. Ministry of Water, Air and Climate Change Branch. 2002. Ambient Interim Water Quality Guidelines for Phenols: Summary Report. Prov. B.C., Victoria, B.C.

[5] Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life In: Canadian environmental quality guidelines, 1999. Canadian Council for Ministers of the Environment, Winnipeg.

The point of full mixing was located 6.6 km downstream of the WWTP diffuser, known as sampling site CH2 in recent water quality monitoring[6]. Q_r at CH2 was calculated as flow at Water Survey of Canada hydrometric station 08GA072 located 200 m upstream of the diffuser, corrected for watershed area. Data from 08GA072 were downloaded from the Water Survey of Canada web site (https://wateroffice.ec.gc.ca/search/real_time_e.html).

Concentrations of each chemical at full mixing in the river are shown in Table 1. They include polycyclic aromatic hydrocarbons, selected dissolved metals that are relevant for comparison to water quality guidelines, non-chlorinated phenols, and volatile organic compounds. Concentrations of all chemicals at full mixing in the river on all dates were less than water quality guideline values. Concentrations of the PAH's fully mixed in the river were 100 to 10000 times lower than guideline values for protection of aquatic life. Metals concentrations were 10 to 10000 times lower than guideline values. Similar differences were found for phenols and volatile organic compounds. These large and consistent differences between in-river concentrations of potential contaminants and guidelines for protection of aquatic life show that risk of toxicity to river biota from the oil contamination incident was negligible. Negligible means no detectable change to water quality for support of aquatic organisms.

Calculations focussed on contaminant concentrations at full mixing in the Cheakamus River. Higher concentrations would have occurred within the pollutant plume immediately downstream of the diffuser. Biota within that plume would have been exposed to those higher concentrations than would have occurred at the point of full mixing. That exposure may have produced toxicity not apparent at the point of full mixing. Computations to predict responses within the plume were beyond the scope of this memo.

[6] Perrin, C.J. and S. Bennett. 2020. Effect of discharge from the Whistler wastewater treatment plant on water quality and benthic biota in the upper Cheakamus River, 2020. Report prepared by Limnotek Research and Development Inc. for the Resort Municipality of Whistler. 45p.

Table 1. Comparison of contaminant concentrations in final effluent and calculated concentrations at full mixing in the Cheakamus River with water quality guidelines.

Category	Analyte	Concentration in final effluent shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	Calculated concentration in river at full mixing downstream of WWTP shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	BC Freshwater chronic guideline (ug/L)	BC Freshwater acute guideline (ug/L)	Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater Long Term (ug/L)
Polycyclic Aromatic Hydrocarbons (PAH)	Acenaphthne	<0.050 all dates	0.0002, 0.0007, 0.0006, 0.0006	6	No guideline	5.8
Polycyclic Aromatic Hydrocarbons (PAH)	Acridine	<0.050 all dates	0.0002, 0.0007, 0.0006, 0.0006	3	0.05	4.4
Polycyclic Aromatic Hydrocarbons (PAH)	Anthracene	<0.010 all dates	0.00003, 0.0001, 0.0001, 0.0001	4	0.1	0.012
Polycyclic Aromatic Hydrocarbons (PAH)	Benz(a)anthracene	<0.010 all dates	0.00003, 0.0001, 0.0001, 0.0001	0.1	0.1	0.018

Category	Analyte	Concentration in final effluent shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	Calculated concentration in river at full mixing downstream of WWTP shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	BC Freshwater chronic guideline (ug/L)	BC Freshwater acute guideline (ug/L)	Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater Long Term (ug/L)
Polycyclic Aromatic Hydrocarbons (PAH)	Benzo(a)pyrene	<0.010 all dates	0.00003, 0.0001, 0.0001, 0.0001	0.01	No guideline	0.015
Polycyclic Aromatic Hydrocarbons (PAH)	Fluoranthene	0.051, <0.03, <0.03, <0.03	0.0002, 0.0004, 0.0003, 0.0004	4	0.2	0.04
Polycyclic Aromatic Hydrocarbons (PAH)	Fluorene	<0.050 all dates	0.0002, 0.0007, 0.0006, 0.0006	12	No guideline	3
Polycyclic Aromatic Hydrocarbons (PAH)	Naphthalene	<0.2 all dates	0.0007, 0.003, 0.002, 0.003	1	No guideline	1.1
Polycyclic Aromatic Hydrocarbons (PAH)	Phenanthrene	<0.1 all dates	0.0003, 0.001, 0.001, 0.001	0.3	No guideline	0.4
Polycyclic Aromatic Hydrocarbons (PAH)	Pyrene	<0.020 all dates	0.00007, 0.0003, 0.0002, 0.0003	No guideline	0.02	0.025

Category	Analyte	Concentration in final effluent shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	Calculated concentration in river at full mixing downstream of WWTP shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	BC Freshwater chronic guideline (ug/L)	BC Freshwater acute guideline (ug/L)	Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater Long Term (ug/L)
Polycyclic Aromatic Hydrocarbons (PAH)	Quinoline	<0.050	0.0002, 0.0007, 0.0006, 0.0006	No guideline	No guideline	3.4
Dissolved Metals	Aluminum, dissolved	71.1, 52.5*, 33.6, 32.8 *total Al	0.23, 0.69*, 0.38, 0.43 *total Al	50	100	100
Dissolved Metals	Cadmium, dissolved	0.031, 0.049*, 0.029, 0.056 *total Cd	0.0001, 0.0006*, 0.0003, 0.0007 *total Cd	0.127	0.288	0.17
Dissolved Metals	Copper, dissolved	16.1, 28.5*, 27.3, 12.5 *total Cu	0.05, 0.38*, 0.3, 0.16 *total Cu	2	No guideline	2.51
Dissolved Metals	Lead, dissolved	0.21, 0.3*, 0.2, 0.2 *total Pb	0.0007, 0.004*, 0.002, 0.002 *total Pb	4.63	33.77	3.47
Dissolved Metals	Zinc, dissolved	31.0, 47.4*, 39.7, 47.2 *total Zn	0.12, 0.62*, 0.45, 0.61 *total Zn	7.5	33	No guideline

Category	Analyte	Concentration in final effluent shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	Calculated concentration in river at full mixing downstream of WWTP shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	BC Freshwater chronic guideline (ug/L)	BC Freshwater acute guideline (ug/L)	Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater Long Term (ug/L)
Non-Chlorinated Phenols	Phenol	<0.98, <0.5, <0.5, <0.5	0.0031, 0.007, 0.006, 0.006	4.5 for 4-hydroxyphenol 12.5 for 3-hydroxyphenol 50 for all other phenols	No guideline	No guideline
Volatile Organic Compounds (VOC)	1,1,2,2-Tetrachloroethane	<0.5 all dates	0.002, 0.007, 0.006, 0.006	110	No guideline	No guideline
Volatile Organic Compounds (VOC)	1,1,2-Trichloroethane	<1.0 all dates	0.003, 0.013, 0.011, 0.013	21	No guideline	No guideline
Volatile Organic Compounds (VOC)	1,2-Dichlorobenzene	<0.5 all dates	0.002, 0.007, 0.006, 0.006	No guideline	No guideline	0.7
Volatile Organic Compounds (VOC)	1,4-Dichlorobenzene	<1.0 all dates	0.003, 0.013, 0.011, 0.013	No guideline	No guideline	26
Volatile Organic Compounds (VOC)	Benzene	<0.5 all dates	0.002, 0.007, 0.006, 0.006	40	No guideline	370
Volatile Organic Compounds (VOC)	Ethylbenzene	<1.0 all dates	0.003, 0.013, 0.011, 0.013	200	No guideline	90

Category	Analyte	Concentration in final effluent shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	Calculated concentration in river at full mixing downstream of WWTP shown as comma separated values for consecutive dates Nov 4, Dec 2, Dec 9, Dec 16 (ug/L)	BC Freshwater chronic guideline (ug/L)	BC Freshwater acute guideline (ug/L)	Canadian Water Quality Guidelines for the Protection of Aquatic Life - Freshwater Long Term (ug/L)
Volatile Organic Compounds (VOC)	Methyl tert-butyl ether	<1.0 all dates	0.003, 0.013, 0.011, 0.013	No guideline	3,400*	10,000
Volatile Organic Compounds (VOC)	Toluene	19, <1.0, <1.0, <1.0	0.06, 0.013, 0.011, 0.013	0.5	No guideline	2
Volatile Organic Compounds (VOC)	Xylenes (total)	<2.0 all dates	0.006, 0.026, 0.023, 0.026	30	No guideline	No guideline

CLOSING

Oil contamination in the Whistler Wastewater Treatment Plant contributed to anomalous discharge of phosphorus and hydrocarbons in final effluent to the Cheakamus River on November 4, 2020. Interpretation of effects on river biota from the phosphorus discharge was described in a previous memo.

Four sampling episodes following the oil contamination incident showed that hydrocarbon and other potential contaminant concentrations at the point of full mixing of final effluent in the Cheakamus River were 10 to 10,000 times lower than water quality guidelines for the protection of aquatic life. These large and consistent differences between in-river concentrations of potential contaminants and guidelines for protection of aquatic life show that risk of toxicity to river biota from the oil contamination incident was negligible, where negligible means no detectable change to water quality for support of aquatic organisms.

Regards:

Chris Perrin, MSc. RPBio.
Principal

Attachment 4 Final Effluent Sample data
December 2, 2020
December 9, 2020
December 16, 2020

CERTIFICATE OF ANALYSIS

REPORTED TO	Whistler, Resort Municipality of 4325 Blackcomb Way Whistler, BC V8E 0X5
ATTENTION	Neil Kearns
PO NUMBER	6310.6663
PROJECT	WWTP
PROJECT INFO	Fuel Spill

WORK ORDER	20L0471
RECEIVED / TEMP	2020-12-03 13:30 / 8°C
REPORTED	2020-12-10 15:57

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at rsundar@caro.ca

Authorized By:

Rochita Sundar
Junior Account Manager

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L0471
PROJECT	WWTP	**REPORTED**	2020-12-10 15:57

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L0471-01) | Matrix: Water | Sampled: 2020-12-02 14:00					CT1a
BCMOE Aggregate Hydrocarbons					CT8
VHw (6-10)	< 100	100	µg/L	2020-12-05	
VPHw	< 100	100	µg/L wet	N/A	
Calculated Parameters					
Hardness, Total (as CaCO3)	**115**	0.500	mg/L	N/A	
Non-Chlorinated Phenols					CT1, CT5
Phenol	< 0.50	0.50	µg/L	2020-12-09	
2-Methylphenol	< 0.50	0.50	µg/L	2020-12-09	
3 & 4-Methylphenol	< 0.50	0.50	µg/L	2020-12-09	
2,4-Dimethylphenol	< 0.50	0.50	µg/L	2020-12-09	
2-Nitrophenol	< 0.50	0.50	µg/L	2020-12-09	
4-Nitrophenol	< 0.50	0.50	µg/L	2020-12-09	
2,4-Dinitrophenol	< 0.50	0.50	µg/L	2020-12-09	
2-Methyl-4,6-dinitrophenol	< 0.50	0.50	µg/L	2020-12-09	
Surrogate: 2,4-Dibromophenol	*64*	*60-130*	%	*2020-12-09*	
Surrogate: 2,4,6-Tribromophenol	*76*	*60-130*	%	*2020-12-09*	
Polycyclic Aromatic Hydrocarbons (PAH)					
Acenaphthene	< 0.050	0.050	µg/L	2020-12-05	
Acenaphthylene	< 0.200	0.200	µg/L	2020-12-05	
Acridine	< 0.050	0.050	µg/L	2020-12-05	
Anthracene	< 0.010	0.010	µg/L	2020-12-05	
Benz(a)anthracene	< 0.010	0.010	µg/L	2020-12-05	
Benzo(a)pyrene	< 0.010	0.010	µg/L	2020-12-05	
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L	2020-12-05	
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L	2020-12-05	
Benzo(k)fluoranthene	< 0.050	0.050	µg/L	2020-12-05	
2-Chloronaphthalene	< 0.100	0.100	µg/L	2020-12-05	
Chrysene	< 0.050	0.050	µg/L	2020-12-05	
Dibenz(a,h)anthracene	< 0.010	0.010	µg/L	2020-12-05	
Fluoranthene	< 0.030	0.030	µg/L	2020-12-05	
Fluorene	< 0.050	0.050	µg/L	2020-12-05	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L	2020-12-05	
1-Methylnaphthalene	< 0.100	0.100	µg/L	2020-12-05	
2-Methylnaphthalene	< 0.100	0.100	µg/L	2020-12-05	
Naphthalene	< 0.200	0.200	µg/L	2020-12-05	
Phenanthrene	< 0.100	0.100	µg/L	2020-12-05	
Pyrene	< 0.020	0.020	µg/L	2020-12-05	
Quinoline	< 0.050	0.050	µg/L	2020-12-05	
Surrogate: Acridine-d9	*93*	*50-140*	%	*2020-12-05*	
Surrogate: Naphthalene-d8	*91*	*50-140*	%	*2020-12-05*	
Surrogate: Perylene-d12	*96*	*50-140*	%	*2020-12-05*	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L0471
PROJECT	WWTP	**REPORTED**	2020-12-10 15:57

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L0471-01) | Matrix: Water | Sampled: 2020-12-02 14:00, Continued					CT1a
Total Metals					
Aluminum, total	**0.0525**	0.0050	mg/L	2020-12-04	
Antimony, total	< 0.00020	0.00020	mg/L	2020-12-04	
Arsenic, total	< 0.00050	0.00050	mg/L	2020-12-04	
Barium, total	**0.0165**	0.0050	mg/L	2020-12-04	
Beryllium, total	< 0.00010	0.00010	mg/L	2020-12-04	
Bismuth, total	< 0.00010	0.00010	mg/L	2020-12-04	
Boron, total	**0.0849**	0.0500	mg/L	2020-12-04	
Cadmium, total	**0.000049**	0.000010	mg/L	2020-12-04	
Calcium, total	**40.6**	0.20	mg/L	2020-12-04	
Chromium, total	< 0.00050	0.00050	mg/L	2020-12-04	
Cobalt, total	**0.00080**	0.00010	mg/L	2020-12-04	
Copper, total	**0.0285**	0.00040	mg/L	2020-12-04	
Iron, total	**0.075**	0.010	mg/L	2020-12-04	
Lead, total	**0.00030**	0.00020	mg/L	2020-12-04	
Lithium, total	**0.00282**	0.00010	mg/L	2020-12-04	
Magnesium, total	**3.30**	0.010	mg/L	2020-12-04	
Manganese, total	**0.144**	0.00020	mg/L	2020-12-04	
Molybdenum, total	**0.00094**	0.00010	mg/L	2020-12-04	
Nickel, total	**0.00193**	0.00040	mg/L	2020-12-04	
Phosphorus, total	**0.220**	0.050	mg/L	2020-12-04	
Potassium, total	**9.07**	0.10	mg/L	2020-12-04	
Selenium, total	< 0.00050	0.00050	mg/L	2020-12-04	
Silicon, total	**5.2**	1.0	mg/L	2020-12-04	
Silver, total	< 0.000050	0.000050	mg/L	2020-12-04	
Sodium, total	**42.6**	0.10	mg/L	2020-12-04	
Strontium, total	**0.241**	0.0010	mg/L	2020-12-04	
Sulfur, total	**20.4**	3.0	mg/L	2020-12-04	
Tellurium, total	< 0.00050	0.00050	mg/L	2020-12-04	
Thallium, total	< 0.000020	0.000020	mg/L	2020-12-04	
Thorium, total	< 0.00010	0.00010	mg/L	2020-12-04	
Tin, total	< 0.00020	0.00020	mg/L	2020-12-04	
Titanium, total	< 0.0050	0.0050	mg/L	2020-12-04	
Tungsten, total	< 0.0010	0.0010	mg/L	2020-12-04	
Uranium, total	< 0.000020	0.000020	mg/L	2020-12-04	
Vanadium, total	< 0.0010	0.0010	mg/L	2020-12-04	
Zinc, total	**0.0474**	0.0040	mg/L	2020-12-04	
Zirconium, total	< 0.00010	0.00010	mg/L	2020-12-04	
Volatile Organic Compounds (VOC)					CT8
Benzene	< 0.5	0.5	µg/L	2020-12-05	
Bromodichloromethane	< 1.0	1.0	µg/L	2020-12-05	
Bromoform	< 1.0	1.0	µg/L	2020-12-05	
Carbon tetrachloride	< 0.5	0.5	µg/L	2020-12-05	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L0471
PROJECT	WWTP	**REPORTED**	2020-12-10 15:57

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L0471-01) | Matrix: Water | Sampled: 2020-12-02 14:00, Continued					CT1a
Volatile Organic Compounds (VOC), Continued					CT8
Chlorobenzene	< 1.0	1.0	µg/L	2020-12-05	
Chloroethane	< 2.0	2.0	µg/L	2020-12-05	
Chloroform	< 1.0	1.0	µg/L	2020-12-05	
Dibromochloromethane	< 1.0	1.0	µg/L	2020-12-05	
1,2-Dibromoethane	< 0.3	0.3	µg/L	2020-12-05	
Dibromomethane	< 1.0	1.0	µg/L	2020-12-05	
1,2-Dichlorobenzene	< 0.5	0.5	µg/L	2020-12-05	
1,3-Dichlorobenzene	< 1.0	1.0	µg/L	2020-12-05	
1,4-Dichlorobenzene	< 1.0	1.0	µg/L	2020-12-05	
1,1-Dichloroethane	< 1.0	1.0	µg/L	2020-12-05	
1,2-Dichloroethane	< 1.0	1.0	µg/L	2020-12-05	
1,1-Dichloroethylene	< 1.0	1.0	µg/L	2020-12-05	
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-12-05	
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-12-05	
Dichloromethane	< 3.0	3.0	µg/L	2020-12-05	
1,2-Dichloropropane	< 1.0	1.0	µg/L	2020-12-05	
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L	2020-12-05	
Ethylbenzene	< 1.0	1.0	µg/L	2020-12-05	
Methyl tert-butyl ether	< 1.0	1.0	µg/L	2020-12-05	
Styrene	< 1.0	1.0	µg/L	2020-12-05	
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L	2020-12-05	
Tetrachloroethylene	< 1.0	1.0	µg/L	2020-12-05	
Toluene	< 1.0	1.0	µg/L	2020-12-05	
1,1,1-Trichloroethane	< 1.0	1.0	µg/L	2020-12-05	
1,1,2-Trichloroethane	< 1.0	1.0	µg/L	2020-12-05	
Trichloroethylene	< 1.0	1.0	µg/L	2020-12-05	
Trichlorofluoromethane	< 1.0	1.0	µg/L	2020-12-05	
Vinyl chloride	< 1.0	1.0	µg/L	2020-12-05	
Xylenes (total)	< 2.0	2.0	µg/L	2020-12-05	
Surrogate: Toluene-d8	*97*	*70-130*	%	*2020-12-05*	
Surrogate: 4-Bromofluorobenzene	*89*	*70-130*	%	*2020-12-05*	
Surrogate: 1,4-Dichlorobenzene-d4	*80*	*70-130*	%	*2020-12-05*	

Sample Qualifiers:

CT1	Incorrect Container(s) supplied for Non-Chlorinated Phenols analysis
CT1a	Incorrect Container(s) supplied for Phenols NC analysis
CT5	This sample has been incorrectly preserved for Non-Chlorinated Phenols analysis
CT8	Headspace in sample container is greater than 5% volume - VOC results may be compromised

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L0471
PROJECT	WWTP	**REPORTED**	2020-12-10 15:57

Analysis Description	Method Ref.	Technique	Accredited	Location
Hardness in Water	SM 2340 B* (2017)	Calculation: 2.497 [total Ca] + 4.118 [total Mg] (Est)	✓	N/A
Phenols, Non-Chlorinated in Water	EPA 3510C* / EPA 8270D	Liquid-Liquid DCM Extraction (Acidic) / GC-MSD (SIM)	✓	Richmond
Polycyclic Aromatic Hydrocarbons in Water	EPA 3511* / EPA 8270D	Hexane MicroExtraction (Base/Neutral) / GC-MSD (SIM)	✓	Richmond
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
VH in Water	EPA 5030B / BCMOE VHw	Purge&Trap / Gas Chromatography (GC-FID)	✓	Richmond
Volatile Organic Compounds in Water	EPA 5030B / EPA 8260D	Purge&Trap / GC-MSD (SIM)	✓	Richmond
VPHw in Water	BCMOE VPH	Calculation: VH - (Benzene + Toluene + Ethylbenzene + Xylenes + Styrene)		N/A

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/L	Milligrams per litre
µg/L	Micrograms per litre
BCMOE	British Columbia Environmental Laboratory Manual, British Columbia Ministry of Environment
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L0471
PROJECT	WWTP	**REPORTED**	2020-12-10 15:57

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in “batches” and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
BCMOE Aggregate Hydrocarbons, Batch B0L0382										
Blank (B0L0382-BLK1)				Prepared: 2020-12-04, Analyzed: 2020-12-04						
VHw (6-10)	< 100	100	µg/L							
LCS (B0L0382-BS2)				Prepared: 2020-12-04, Analyzed: 2020-12-04						
VHw (6-10)	2660	100	µg/L	2690		99	70-130			
Non-Chlorinated Phenols, Batch B0L0806										
Blank (B0L0806-BLK1)				Prepared: 2020-12-09, Analyzed: 2020-12-09						
Phenol	< 0.50	0.50	µg/L							
2-Methylphenol	< 0.50	0.50	µg/L							
3 & 4-Methylphenol	< 0.50	0.50	µg/L							
2,4-Dimethylphenol	< 0.50	0.50	µg/L							
2-Nitrophenol	< 0.50	0.50	µg/L							
4-Nitrophenol	< 0.50	0.50	µg/L							
2,4-Dinitrophenol	< 0.50	0.50	µg/L							
2-Methyl-4,6-dinitrophenol	< 0.50	0.50	µg/L							
Surrogate: 2,4-Dibromophenol	*1.30*		*µg/L*	2.02		*64*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*1.39*		*µg/L*	2.00		*69*	*60-130*			
LCS (B0L0806-BS1)				Prepared: 2020-12-09, Analyzed: 2020-12-09						
Phenol	7.62	0.50	µg/L	10.0		76	60-130			
2-Methylphenol	8.51	0.50	µg/L	10.0		85	60-115			
3 & 4-Methylphenol	16.2	0.50	µg/L	20.0		81	60-109			
2,4-Dimethylphenol	10.1	0.50	µg/L	10.0		101	60-130			
2-Nitrophenol	7.50	0.50	µg/L	10.0		75	57-117			
4-Nitrophenol	9.74	0.50	µg/L	10.0		97	63-130			
2,4-Dinitrophenol	8.12	0.50	µg/L	9.95		82	35-130			
2-Methyl-4,6-dinitrophenol	7.07	0.50	µg/L	10.0		70	53-130			
Surrogate: 2,4-Dibromophenol	*1.77*		*µg/L*	2.02		*88*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*1.77*		*µg/L*	2.00		*89*	*60-130*			
LCS Dup (B0L0806-BSD1)				Prepared: 2020-12-09, Analyzed: 2020-12-09						
Phenol	7.48	0.50	µg/L	10.0		74	60-130	2	23	
2-Methylphenol	8.25	0.50	µg/L	10.0		83	60-115	3	20	
3 & 4-Methylphenol	16.4	0.50	µg/L	20.0		82	60-109	1	16	
2,4-Dimethylphenol	9.04	0.50	µg/L	10.0		90	60-130	11	24	

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L0471
PROJECT	WWTP	**REPORTED**	2020-12-10 15:57

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Non-Chlorinated Phenols, Batch B0L0806, Continued										
LCS Dup (B0L0806-BSD1), Continued				Prepared: 2020-12-09, Analyzed: 2020-12-09						
2-Nitrophenol	7.20	0.50	µg/L	10.0		72	57-117	4	22	
4-Nitrophenol	9.01	0.50	µg/L	10.0		90	63-130	8	40	
2,4-Dinitrophenol	7.92	0.50	µg/L	9.95		80	35-130	3	27	
2-Methyl-4,6-dinitrophenol	7.26	0.50	µg/L	10.0		72	53-130	3	20	
Surrogate: 2,4-Dibromophenol	*1.63*		*µg/L*	2.02		*81*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*1.61*		*µg/L*	2.00		*81*	*60-130*			
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0L0446										
Blank (B0L0446-BLK1)				Prepared: 2020-12-04, Analyzed: 2020-12-05						
Acenaphthene	< 0.050	0.050	µg/L							
Acenaphthylene	< 0.200	0.200	µg/L							
Acridine	< 0.050	0.050	µg/L							
Anthracene	< 0.010	0.010	µg/L							
Benz(a)anthracene	< 0.010	0.010	µg/L							
Benzo(a)pyrene	< 0.010	0.010	µg/L							
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L							
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L							
Benzo(k)fluoranthene	< 0.050	0.050	µg/L							
2-Chloronaphthalene	< 0.100	0.100	µg/L							
Chrysene	< 0.050	0.050	µg/L							
Dibenz(a,h)anthracene	< 0.010	0.010	µg/L							
Fluoranthene	< 0.030	0.030	µg/L							
Fluorene	< 0.050	0.050	µg/L							
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L							
1-Methylnaphthalene	< 0.100	0.100	µg/L							
2-Methylnaphthalene	< 0.100	0.100	µg/L							
Naphthalene	< 0.200	0.200	µg/L							
Phenanthrene	< 0.100	0.100	µg/L							
Pyrene	< 0.020	0.020	µg/L							
Quinoline	< 0.050	0.050	µg/L							
Surrogate: Acridine-d9	*0.308*		*µg/L*	0.464		*66*	*50-140*			
Surrogate: Naphthalene-d8	*4.28*		*µg/L*	4.47		*96*	*50-140*			
Surrogate: Perylene-d12	*4.57*		*µg/L*	4.47		*102*	*50-140*			
LCS (B0L0446-BS1)				Prepared: 2020-12-04, Analyzed: 2020-12-05						
Acenaphthene	4.11	0.050	µg/L	4.44		92	55-137			
Acenaphthylene	4.22	0.200	µg/L	4.44		95	53-140			
Acridine	3.56	0.050	µg/L	4.44		80	50-120			
Anthracene	4.11	0.010	µg/L	4.44		93	64-130			
Benz(a)anthracene	4.24	0.010	µg/L	4.44		95	57-140			
Benzo(a)pyrene	4.26	0.010	µg/L	4.44		96	63-133			
Benzo(b+j)fluoranthene	8.04	0.050	µg/L	8.89		90	60-129			
Benzo(g,h,i)perylene	4.50	0.050	µg/L	4.44		101	52-139			
Benzo(k)fluoranthene	4.22	0.050	µg/L	4.44		95	50-138			
2-Chloronaphthalene	3.80	0.100	µg/L	4.38		87	50-139			
Chrysene	4.33	0.050	µg/L	4.44		97	59-140			
Dibenz(a,h)anthracene	4.30	0.010	µg/L	4.44		97	53-136			
Fluoranthene	4.57	0.030	µg/L	4.44		103	67-135			
Fluorene	4.11	0.050	µg/L	4.44		92	57-134			
Indeno(1,2,3-cd)pyrene	3.67	0.050	µg/L	4.44		82	52-129			
1-Methylnaphthalene	4.05	0.100	µg/L	4.44		91	50-140			
2-Methylnaphthalene	3.93	0.100	µg/L	4.44		88	50-140			
Naphthalene	3.88	0.200	µg/L	4.44		87	50-140			
Phenanthrene	4.36	0.100	µg/L	4.44		98	61-134			
Pyrene	4.60	0.020	µg/L	4.44		103	66-131			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L0471
PROJECT	WWTP	**REPORTED**	2020-12-10 15:57

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0L0446, Continued										
LCS (B0L0446-BS1), Continued				Prepared: 2020-12-04, Analyzed: 2020-12-05						
Quinoline	5.84	0.050	µg/L	4.44		131	50-140			
Surrogate: Acridine-d9	*0.408*		*µg/L*	0.464		*88*	*50-140*			
Surrogate: Naphthalene-d8	*3.94*		*µg/L*	4.47		*88*	*50-140*			
Surrogate: Perylene-d12	*4.24*		*µg/L*	4.47		*95*	*50-140*			
LCS Dup (B0L0446-BSD1)				Prepared: 2020-12-04, Analyzed: 2020-12-05						
Acenaphthene	4.18	0.050	µg/L	4.44		94	55-137	2	18	
Acenaphthylene	4.32	0.200	µg/L	4.44		97	53-140	2	20	
Acridine	3.24	0.050	µg/L	4.44		73	50-120	10	30	
Anthracene	4.04	0.010	µg/L	4.44		91	64-130	2	15	
Benz(a)anthracene	4.36	0.010	µg/L	4.44		98	57-140	3	25	
Benzo(a)pyrene	4.34	0.010	µg/L	4.44		98	63-133	2	18	
Benzo(b+j)fluoranthene	8.42	0.050	µg/L	8.89		95	60-129	5	17	
Benzo(g,h,i)perylene	4.46	0.050	µg/L	4.44		100	52-139	< 1	22	
Benzo(k)fluoranthene	4.25	0.050	µg/L	4.44		96	50-138	< 1	26	
2-Chloronaphthalene	3.97	0.100	µg/L	4.38		91	50-139	4	23	
Chrysene	4.45	0.050	µg/L	4.44		100	59-140	3	23	
Dibenz(a,h)anthracene	4.27	0.010	µg/L	4.44		96	53-136	< 1	21	
Fluoranthene	4.50	0.030	µg/L	4.44		101	67-135	2	18	
Fluorene	4.16	0.050	µg/L	4.44		94	57-134	1	18	
Indeno(1,2,3-cd)pyrene	3.65	0.050	µg/L	4.44		82	52-129	< 1	21	
1-Methylnaphthalene	4.27	0.100	µg/L	4.44		96	50-140	5	20	
2-Methylnaphthalene	4.15	0.100	µg/L	4.44		93	50-140	6	21	
Naphthalene	4.14	0.200	µg/L	4.44		93	50-140	6	22	
Phenanthrene	4.54	0.100	µg/L	4.44		102	61-134	4	17	
Pyrene	4.47	0.020	µg/L	4.44		101	66-131	3	19	
Quinoline	5.86	0.050	µg/L	4.44		132	50-140	< 1	14	
Surrogate: Acridine-d9	*0.386*		*µg/L*	0.464		*83*	*50-140*			
Surrogate: Naphthalene-d8	*4.19*		*µg/L*	4.47		*94*	*50-140*			
Surrogate: Perylene-d12	*4.30*		*µg/L*	4.47		*96*	*50-140*			
Total Metals, Batch B0L0375										
Blank (B0L0375-BLK1)				Prepared: 2020-12-04, Analyzed: 2020-12-04						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Beryllium, total	< 0.00010	0.00010	mg/L							
Bismuth, total	< 0.00010	0.00010	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Phosphorus, total	< 0.050	0.050	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0L0375, Continued										
Blank (B0L0375-BLK1), Continued				Prepared: 2020-12-04, Analyzed: 2020-12-04						
Silicon, total	< 1.0	1.0	mg/L							
Silver, total	< 0.000050	0.000050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Sulfur, total	< 3.0	3.0	mg/L							
Tellurium, total	< 0.00050	0.00050	mg/L							
Thallium, total	< 0.000020	0.000020	mg/L							
Thorium, total	< 0.00010	0.00010	mg/L							
Tin, total	< 0.00020	0.00020	mg/L							
Titanium, total	< 0.0050	0.0050	mg/L							
Tungsten, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Vanadium, total	< 0.0010	0.0010	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B0L0375-BS1)				Prepared: 2020-12-04, Analyzed: 2020-12-04						
Aluminum, total	0.0227	0.0050	mg/L	0.0199		114	80-120			
Antimony, total	0.0213	0.00020	mg/L	0.0200		106	80-120			
Arsenic, total	0.0207	0.00050	mg/L	0.0200		104	80-120			
Barium, total	0.0201	0.0050	mg/L	0.0198		101	80-120			
Beryllium, total	0.0209	0.00010	mg/L	0.0198		106	80-120			
Bismuth, total	0.0208	0.00010	mg/L	0.0200		104	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		112	80-120			
Cadmium, total	0.0203	0.000010	mg/L	0.0199		102	80-120			
Calcium, total	2.25	0.20	mg/L	2.02		111	80-120			
Chromium, total	0.0195	0.00050	mg/L	0.0198		99	80-120			
Cobalt, total	0.0198	0.00010	mg/L	0.0199		99	80-120			
Copper, total	0.0200	0.00040	mg/L	0.0200		100	80-120			
Iron, total	2.04	0.010	mg/L	2.02		101	80-120			
Lead, total	0.0201	0.00020	mg/L	0.0199		101	80-120			
Lithium, total	0.0211	0.00010	mg/L	0.0200		106	80-120			
Magnesium, total	2.21	0.010	mg/L	2.02		109	80-120			
Manganese, total	0.0201	0.00020	mg/L	0.0199		101	80-120			
Molybdenum, total	0.0198	0.00010	mg/L	0.0200		99	80-120			
Nickel, total	0.0199	0.00040	mg/L	0.0200		99	80-120			
Phosphorus, total	2.00	0.050	mg/L	2.00		100	80-120			
Potassium, total	2.06	0.10	mg/L	2.02		102	80-120			
Selenium, total	0.0208	0.00050	mg/L	0.0200		104	80-120			
Silicon, total	2.0	1.0	mg/L	2.00		100	80-120			
Silver, total	0.0201	0.000050	mg/L	0.0200		101	80-120			
Sodium, total	2.14	0.10	mg/L	2.02		106	80-120			
Strontium, total	0.0196	0.0010	mg/L	0.0200		98	80-120			
Sulfur, total	4.7	3.0	mg/L	5.00		94	80-120			
Tellurium, total	0.0197	0.00050	mg/L	0.0200		99	80-120			
Thallium, total	0.0198	0.000020	mg/L	0.0199		100	80-120			
Thorium, total	0.0200	0.00010	mg/L	0.0200		100	80-120			
Tin, total	0.0214	0.00020	mg/L	0.0200		107	80-120			
Titanium, total	0.0192	0.0050	mg/L	0.0200		96	80-120			
Tungsten, total	0.0206	0.0010	mg/L	0.0200		103	80-120			
Uranium, total	0.0207	0.000020	mg/L	0.0200		104	80-120			
Vanadium, total	0.0206	0.0010	mg/L	0.0200		103	80-120			
Zinc, total	0.0213	0.0040	mg/L	0.0200		107	80-120			
Zirconium, total	0.0201	0.00010	mg/L	0.0200		100	80-120			
Reference (B0L0375-SRM1)				Prepared: 2020-12-04, Analyzed: 2020-12-04						
Aluminum, total	0.317	0.0050	mg/L	0.299		106	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L0471
PROJECT	WWTP	**REPORTED**	2020-12-10 15:57

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0L0375, Continued										
Reference (B0L0375-SRM1), Continued				Prepared: 2020-12-04, Analyzed: 2020-12-04						
Antimony, total	0.0527	0.00020	mg/L	0.0517		102	70-130			
Arsenic, total	0.127	0.00050	mg/L	0.119		107	70-130			
Barium, total	0.792	0.0050	mg/L	0.801		99	70-130			
Beryllium, total	0.0541	0.00010	mg/L	0.0501		108	70-130			
Boron, total	4.01	0.0500	mg/L	4.11		97	70-130			
Cadmium, total	0.0503	0.000010	mg/L	0.0503		100	70-130			
Calcium, total	10.9	0.20	mg/L	10.7		102	70-130			
Chromium, total	0.248	0.00050	mg/L	0.250		99	70-130			
Cobalt, total	0.0385	0.00010	mg/L	0.0384		100	70-130			
Copper, total	0.488	0.00040	mg/L	0.487		100	70-130			
Iron, total	0.517	0.010	mg/L	0.504		103	70-130			
Lead, total	0.278	0.00020	mg/L	0.278		100	70-130			
Lithium, total	0.434	0.00010	mg/L	0.398		109	70-130			
Magnesium, total	4.05	0.010	mg/L	3.59		113	70-130			
Manganese, total	0.109	0.00020	mg/L	0.111		98	70-130			
Molybdenum, total	0.200	0.00010	mg/L	0.196		102	70-130			
Nickel, total	0.249	0.00040	mg/L	0.248		100	70-130			
Phosphorus, total	0.230	0.050	mg/L	0.213		108	70-130			
Potassium, total	6.29	0.10	mg/L	5.89		107	70-130			
Selenium, total	0.126	0.00050	mg/L	0.120		105	70-130			
Sodium, total	9.53	0.10	mg/L	8.71		109	70-130			
Strontium, total	0.393	0.0010	mg/L	0.393		100	70-130			
Thallium, total	0.0815	0.000020	mg/L	0.0787		104	70-130			
Uranium, total	0.0355	0.000020	mg/L	0.0344		103	70-130			
Vanadium, total	0.382	0.0010	mg/L	0.391		98	70-130			
Zinc, total	2.59	0.0040	mg/L	2.50		104	70-130			
Volatile Organic Compounds (VOC), Batch B0L0382										
Blank (B0L0382-BLK1)				Prepared: 2020-12-04, Analyzed: 2020-12-04						
Benzene	< 0.5	0.5	µg/L							
Bromodichloromethane	< 1.0	1.0	µg/L							
Bromoform	< 1.0	1.0	µg/L							
Carbon tetrachloride	< 0.5	0.5	µg/L							
Chlorobenzene	< 1.0	1.0	µg/L							
Chloroethane	< 2.0	2.0	µg/L							
Chloroform	< 1.0	1.0	µg/L							
Dibromochloromethane	< 1.0	1.0	µg/L							
1,2-Dibromoethane	< 0.3	0.3	µg/L							
Dibromomethane	< 1.0	1.0	µg/L							
1,2-Dichlorobenzene	< 0.5	0.5	µg/L							
1,3-Dichlorobenzene	< 1.0	1.0	µg/L							
1,4-Dichlorobenzene	< 1.0	1.0	µg/L							
1,1-Dichloroethane	< 1.0	1.0	µg/L							
1,2-Dichloroethane	< 1.0	1.0	µg/L							
1,1-Dichloroethylene	< 1.0	1.0	µg/L							
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L							
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L							
Dichloromethane	< 3.0	3.0	µg/L							
1,2-Dichloropropane	< 1.0	1.0	µg/L							
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L							
Ethylbenzene	< 1.0	1.0	µg/L							
Methyl tert-butyl ether	< 1.0	1.0	µg/L							
Styrene	< 1.0	1.0	µg/L							
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L							
Tetrachloroethylene	< 1.0	1.0	µg/L							

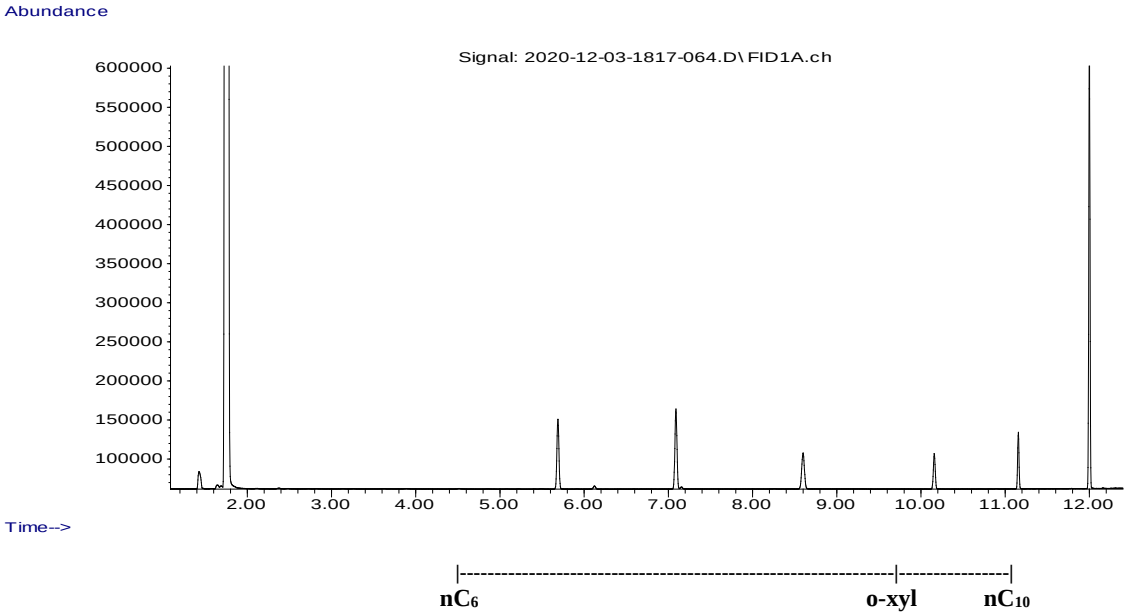
APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L0471
PROJECT	WWTP	**REPORTED**	2020-12-10 15:57

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Volatile Organic Compounds (VOC), Batch B0L0382, Continued										
Blank (B0L0382-BLK1), Continued				Prepared: 2020-12-04, Analyzed: 2020-12-04						
Toluene	< 1.0	1.0	µg/L							
1,1,1-Trichloroethane	< 1.0	1.0	µg/L							
1,1,2-Trichloroethane	< 1.0	1.0	µg/L							
Trichloroethylene	< 1.0	1.0	µg/L							
Trichlorofluoromethane	< 1.0	1.0	µg/L							
Vinyl chloride	< 1.0	1.0	µg/L							
Xylenes (total)	< 2.0	2.0	µg/L							
Surrogate: Toluene-d8	*23.5*		*µg/L*	26.5		*89*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*20.8*		*µg/L*	24.9		*84*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*19.1*		*µg/L*	25.5		*75*	*70-130*			
LCS (B0L0382-BS1)				Prepared: 2020-12-04, Analyzed: 2020-12-04						
Benzene	20.3	0.5	µg/L	20.0		102	70-130			
Bromodichloromethane	19.9	1.0	µg/L	20.0		100	70-130			
Bromoform	19.6	1.0	µg/L	20.1		97	70-130			
Carbon tetrachloride	17.2	0.5	µg/L	20.2		85	70-130			
Chlorobenzene	20.5	1.0	µg/L	20.1		102	70-130			
Chloroethane	22.6	2.0	µg/L	20.0		113	60-140			
Chloroform	20.6	1.0	µg/L	20.1		102	70-130			
Dibromochloromethane	19.7	1.0	µg/L	20.2		98	70-130			
1,2-Dibromoethane	19.4	0.3	µg/L	20.0		97	70-130			
Dibromomethane	20.2	1.0	µg/L	20.0		101	70-130			
1,2-Dichlorobenzene	21.0	0.5	µg/L	20.1		104	70-130			
1,3-Dichlorobenzene	20.8	1.0	µg/L	20.1		103	70-130			
1,4-Dichlorobenzene	21.6	1.0	µg/L	20.1		107	70-130			
1,1-Dichloroethane	21.8	1.0	µg/L	20.1		109	70-130			
1,2-Dichloroethane	20.3	1.0	µg/L	20.1		101	70-130			
1,1-Dichloroethylene	20.7	1.0	µg/L	20.1		103	70-130			
cis-1,2-Dichloroethylene	19.8	1.0	µg/L	20.0		99	70-130			
trans-1,2-Dichloroethylene	20.6	1.0	µg/L	20.0		103	70-130			
Dichloromethane	21.4	3.0	µg/L	20.1		106	70-130			
1,2-Dichloropropane	20.1	1.0	µg/L	20.1		100	70-130			
1,3-Dichloropropene (cis + trans)	34.7	1.0	µg/L	40.0		87	70-130			
Ethylbenzene	19.1	1.0	µg/L	20.0		96	70-130			
Methyl tert-butyl ether	20.2	1.0	µg/L	20.0		101	70-130			
Styrene	17.6	1.0	µg/L	20.0		88	70-130			
1,1,2,2-Tetrachloroethane	18.1	0.5	µg/L	20.1		90	70-130			
Tetrachloroethylene	20.5	1.0	µg/L	20.1		102	70-130			
Toluene	25.0	1.0	µg/L	20.0		125	70-130			
1,1,1-Trichloroethane	19.6	1.0	µg/L	20.0		98	70-130			
1,1,2-Trichloroethane	20.6	1.0	µg/L	20.1		102	70-130			
Trichloroethylene	22.1	1.0	µg/L	20.1		110	70-130			
Trichlorofluoromethane	22.5	1.0	µg/L	20.0		112	60-140			
Vinyl chloride	27.8	1.0	µg/L	20.0		139	60-140			
Xylenes (total)	59.3	2.0	µg/L	60.0		99	70-130			
Surrogate: Toluene-d8	*24.9*		*µg/L*	26.5		*94*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*27.7*		*µg/L*	24.9		*111*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*27.1*		*µg/L*	25.5		*106*	*70-130*			

QC Qualifiers:

Sample ID: Final Effluent 2:00pm
Caro ID: 20L0471-01



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nC$_6$ **o-xyl** **nC$_{10}$**

CERTIFICATE OF ANALYSIS

REPORTED TO	Whistler, Resort Municipality of 4325 Blackcomb Way Whistler, BC V8E 0X5
ATTENTION	Neil Kearns
PO NUMBER	6310.6663
PROJECT	WWTP
PROJECT INFO	Fuel Spill

WORK ORDER	20L1218
RECEIVED / TEMP	2020-12-10 13:30 / 5°C
REPORTED	2020-12-17 15:04

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at rsundar@caro.ca

Authorized By:

Rochita Sundar
Junior Account Manager

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L1218-01) | Matrix: Water | Sampled: 2020-12-09 14:00					
BCMOE Aggregate Hydrocarbons					
VHw (6-10)	< 100	100	µg/L	2020-12-13	
VPHw	< 100	100	µg/L wet	N/A	
Calculated Parameters					
Hardness, Total (as CaCO3)	**86.2**	0.500	mg/L	N/A	
Dissolved Metals					
Lithium, dissolved	**0.00215**	0.00010	mg/L	2020-12-11	
Aluminum, dissolved	**0.0336**	0.0050	mg/L	2020-12-11	
Antimony, dissolved	< 0.00020	0.00020	mg/L	2020-12-11	
Arsenic, dissolved	< 0.00050	0.00050	mg/L	2020-12-11	
Barium, dissolved	**0.0106**	0.0050	mg/L	2020-12-11	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-12-11	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-12-11	
Boron, dissolved	**0.0548**	0.0500	mg/L	2020-12-11	
Cadmium, dissolved	**0.000029**	0.000010	mg/L	2020-12-11	
Calcium, dissolved	**30.4**	0.20	mg/L	2020-12-11	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-12-11	
Cobalt, dissolved	**0.00070**	0.00010	mg/L	2020-12-11	
Copper, dissolved	**0.0273**	0.00040	mg/L	2020-12-11	
Iron, dissolved	**0.039**	0.010	mg/L	2020-12-11	
Lead, dissolved	< 0.00020	0.00020	mg/L	2020-12-11	
Magnesium, dissolved	**2.50**	0.010	mg/L	2020-12-11	
Manganese, dissolved	**0.126**	0.00020	mg/L	2020-12-11	
Mercury, dissolved	< 0.000010	0.000010	mg/L	2020-12-11	
Molybdenum, dissolved	**0.00122**	0.00010	mg/L	2020-12-11	
Nickel, dissolved	**0.00164**	0.00040	mg/L	2020-12-11	
Phosphorus, dissolved	< 0.050	0.050	mg/L	2020-12-11	
Potassium, dissolved	**6.69**	0.10	mg/L	2020-12-11	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-12-11	
Silicon, dissolved	**4.7**	1.0	mg/L	2020-12-11	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-12-11	
Sodium, dissolved	**34.2**	0.10	mg/L	2020-12-11	
Strontium, dissolved	**0.199**	0.0010	mg/L	2020-12-11	
Sulfur, dissolved	**15.4**	3.0	mg/L	2020-12-11	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-12-11	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-12-11	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-12-11	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-12-11	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-12-11	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-12-11	
Uranium, dissolved	< 0.000020	0.000020	mg/L	2020-12-11	
Vanadium, dissolved	**0.0024**	0.0010	mg/L	2020-12-11	
Zinc, dissolved	**0.0397**	0.0040	mg/L	2020-12-11	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L1218-01) | Matrix: Water | Sampled: 2020-12-09 14:00, Continued					
Dissolved Metals, Continued					
Zirconium, dissolved	< 0.00010	0.00010	mg/L	2020-12-11	
Non-Chlorinated Phenols					
Phenol	< 0.50	0.50	µg/L	2020-12-17	
2-Methylphenol	< 0.50	0.50	µg/L	2020-12-17	
3 & 4-Methylphenol	< 0.50	0.50	µg/L	2020-12-17	
2,4-Dimethylphenol	< 0.50	0.50	µg/L	2020-12-17	
2-Nitrophenol	< 0.50	0.50	µg/L	2020-12-17	
4-Nitrophenol	< 0.50	0.50	µg/L	2020-12-17	
2,4-Dinitrophenol	< 0.50	0.50	µg/L	2020-12-17	
2-Methyl-4,6-dinitrophenol	< 0.50	0.50	µg/L	2020-12-17	
Surrogate: 2,4-Dibromophenol	*78*	*60-130*	%	*2020-12-17*	
Surrogate: 2,4,6-Tribromophenol	*82*	*60-130*	%	*2020-12-17*	
Polycyclic Aromatic Hydrocarbons (PAH)					
Acenaphthene	< 0.050	0.050	µg/L	2020-12-15	
Acenaphthylene	< 0.200	0.200	µg/L	2020-12-15	
Acridine	< 0.050	0.050	µg/L	2020-12-15	
Anthracene	< 0.010	0.010	µg/L	2020-12-15	
Benz(a)anthracene	< 0.010	0.010	µg/L	2020-12-15	
Benzo(a)pyrene	< 0.010	0.010	µg/L	2020-12-15	
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L	2020-12-15	
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L	2020-12-15	
Benzo(k)fluoranthene	< 0.050	0.050	µg/L	2020-12-15	
2-Chloronaphthalene	< 0.100	0.100	µg/L	2020-12-15	
Chrysene	< 0.050	0.050	µg/L	2020-12-15	
Dibenz(a,h)anthracene	< 0.010	0.010	µg/L	2020-12-15	
Fluoranthene	< 0.030	0.030	µg/L	2020-12-15	
Fluorene	< 0.050	0.050	µg/L	2020-12-15	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L	2020-12-15	
1-Methylnaphthalene	< 0.100	0.100	µg/L	2020-12-15	
2-Methylnaphthalene	< 0.100	0.100	µg/L	2020-12-15	
Naphthalene	< 0.200	0.200	µg/L	2020-12-15	
Phenanthrene	< 0.100	0.100	µg/L	2020-12-15	
Pyrene	< 0.020	0.020	µg/L	2020-12-15	
Quinoline	< 0.050	0.050	µg/L	2020-12-15	
Surrogate: Acridine-d9	*80*	*50-140*	%	*2020-12-15*	
Surrogate: Naphthalene-d8	*69*	*50-140*	%	*2020-12-15*	
Surrogate: Perylene-d12	*73*	*50-140*	%	*2020-12-15*	
Total Metals					
Aluminum, total	**0.0582**	0.0050	mg/L	2020-12-16	
Antimony, total	**0.00021**	0.00020	mg/L	2020-12-16	
Arsenic, total	< 0.00050	0.00050	mg/L	2020-12-16	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L1218-01) | Matrix: Water | Sampled: 2020-12-09 14:00, Continued					
Total Metals, Continued					
Barium, total	**0.0134**	0.0050	mg/L	2020-12-16	
Beryllium, total	< 0.00010	0.00010	mg/L	2020-12-16	
Bismuth, total	< 0.00010	0.00010	mg/L	2020-12-16	
Boron, total	**0.0631**	0.0500	mg/L	2020-12-16	
Cadmium, total	**0.000024**	0.000010	mg/L	2020-12-16	
Calcium, total	**33.3**	0.20	mg/L	2020-12-16	
Chromium, total	< 0.00050	0.00050	mg/L	2020-12-16	
Cobalt, total	**0.00076**	0.00010	mg/L	2020-12-16	
Copper, total	**0.0150**	0.00040	mg/L	2020-12-16	
Iron, total	**0.079**	0.010	mg/L	2020-12-16	
Lead, total	< 0.00020	0.00020	mg/L	2020-12-16	
Lithium, total	**0.00232**	0.00010	mg/L	2020-12-16	
Magnesium, total	**2.67**	0.010	mg/L	2020-12-16	
Manganese, total	**0.139**	0.00020	mg/L	2020-12-16	
Mercury, total	< 0.000010	0.000010	mg/L	2020-12-11	
Molybdenum, total	**0.00114**	0.00010	mg/L	2020-12-16	
Nickel, total	**0.00197**	0.00040	mg/L	2020-12-16	
Phosphorus, total	**0.226**	0.050	mg/L	2020-12-16	
Potassium, total	**7.22**	0.10	mg/L	2020-12-16	
Selenium, total	< 0.00050	0.00050	mg/L	2020-12-16	
Silicon, total	**4.9**	1.0	mg/L	2020-12-16	
Silver, total	< 0.000050	0.000050	mg/L	2020-12-16	
Sodium, total	**35.9**	0.10	mg/L	2020-12-16	
Strontium, total	**0.221**	0.0010	mg/L	2020-12-16	
Sulfur, total	**19.5**	3.0	mg/L	2020-12-16	
Tellurium, total	< 0.00050	0.00050	mg/L	2020-12-16	
Thallium, total	< 0.000020	0.000020	mg/L	2020-12-16	
Thorium, total	< 0.00010	0.00010	mg/L	2020-12-16	
Tin, total	< 0.00020	0.00020	mg/L	2020-12-16	
Titanium, total	< 0.0050	0.0050	mg/L	2020-12-16	
Tungsten, total	< 0.0010	0.0010	mg/L	2020-12-16	
Uranium, total	< 0.000020	0.000020	mg/L	2020-12-16	
Vanadium, total	**0.0020**	0.0010	mg/L	2020-12-16	
Zinc, total	**0.0435**	0.0040	mg/L	2020-12-16	
Zirconium, total	< 0.00010	0.00010	mg/L	2020-12-16	
Volatile Organic Compounds (VOC)					
Benzene	< 0.5	0.5	µg/L	2020-12-13	
Bromodichloromethane	< 1.0	1.0	µg/L	2020-12-13	
Bromoform	< 1.0	1.0	µg/L	2020-12-13	
Carbon tetrachloride	< 0.5	0.5	µg/L	2020-12-13	
Chlorobenzene	< 1.0	1.0	µg/L	2020-12-13	
Chloroethane	< 2.0	2.0	µg/L	2020-12-13	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L1218-01) | Matrix: Water | Sampled: 2020-12-09 14:00, Continued					
Volatile Organic Compounds (VOC), Continued					
Chloroform	< 1.0	1.0	µg/L	2020-12-13	
Dibromochloromethane	< 1.0	1.0	µg/L	2020-12-13	
1,2-Dibromoethane	< 0.3	0.3	µg/L	2020-12-13	
Dibromomethane	< 1.0	1.0	µg/L	2020-12-13	
1,2-Dichlorobenzene	< 0.5	0.5	µg/L	2020-12-13	
1,3-Dichlorobenzene	< 1.0	1.0	µg/L	2020-12-13	
1,4-Dichlorobenzene	< 1.0	1.0	µg/L	2020-12-13	
1,1-Dichloroethane	< 1.0	1.0	µg/L	2020-12-13	
1,2-Dichloroethane	< 1.0	1.0	µg/L	2020-12-13	
1,1-Dichloroethylene	< 1.0	1.0	µg/L	2020-12-13	
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-12-13	
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-12-13	
Dichloromethane	< 3.0	3.0	µg/L	2020-12-13	
1,2-Dichloropropane	< 1.0	1.0	µg/L	2020-12-13	
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L	2020-12-13	
Ethylbenzene	< 1.0	1.0	µg/L	2020-12-13	
Methyl tert-butyl ether	< 1.0	1.0	µg/L	2020-12-13	
Styrene	< 1.0	1.0	µg/L	2020-12-13	
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L	2020-12-13	
Tetrachloroethylene	< 1.0	1.0	µg/L	2020-12-13	
Toluene	< 1.0	1.0	µg/L	2020-12-13	
1,1,1-Trichloroethane	< 1.0	1.0	µg/L	2020-12-13	
1,1,2-Trichloroethane	< 1.0	1.0	µg/L	2020-12-13	
Trichloroethylene	< 1.0	1.0	µg/L	2020-12-13	
Trichlorofluoromethane	< 1.0	1.0	µg/L	2020-12-13	
Vinyl chloride	< 1.0	1.0	µg/L	2020-12-13	
Xylenes (total)	< 2.0	2.0	µg/L	2020-12-13	
Surrogate: Toluene-d8	*100*	*70-130*	%	*2020-12-13*	
Surrogate: 4-Bromofluorobenzene	*78*	*70-130*	%	*2020-12-13*	
Surrogate: 1,4-Dichlorobenzene-d4	*72*	*70-130*	%	*2020-12-13*	

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analysis Description	Method Ref.	Technique	Accredited	Location
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Hardness in Water	SM 2340 B (2017)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Mercury, dissolved in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Phenols, Non-Chlorinated in Water	EPA 3510C* / EPA 8270D	Liquid-Liquid DCM Extraction (Acidic) / GC-MSD (SIM)	✓	Richmond
Polycyclic Aromatic Hydrocarbons in Water	EPA 3511* / EPA 8270D	Hexane MicroExtraction (Base/Neutral) / GC-MSD (SIM)	✓	Richmond
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
VH in Water	EPA 5030B / BCMOE VHw	Purge&Trap / Gas Chromatography (GC-FID)	✓	Richmond
Volatile Organic Compounds in Water	EPA 5030B / EPA 8260D	Purge&Trap / GC-MSD (SIM)	✓	Richmond
VPHw in Water	BCMOE VPH	Calculation: VH - (Benzene + Toluene + Ethylbenzene + Xylenes + Styrene)		N/A

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/L	Milligrams per litre
µg/L	Micrograms per litre
BCMOE	British Columbia Environmental Laboratory Manual, British Columbia Ministry of Environment
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in “batches” and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
BCMOE Aggregate Hydrocarbons, Batch B0L1198										
Blank (B0L1198-BLK1)				Prepared: 2020-12-13, Analyzed: 2020-12-13						
VHw (6-10)	< 100	100	µg/L							
LCS (B0L1198-BS2)				Prepared: 2020-12-13, Analyzed: 2020-12-13						
VHw (6-10)	2410	100	µg/L	2690		90	70-130			
Duplicate (B0L1198-DUP1)		**Source: 20L1218-01**		Prepared: 2020-12-13, Analyzed: 2020-12-13						
VHw (6-10)	< 100	100	µg/L		< 100				19	
Dissolved Metals, Batch B0L1095										
Blank (B0L1095-BLK1)				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Aluminum, dissolved	< 0.0050	0.0050	mg/L							
Antimony, dissolved	< 0.00020	0.00020	mg/L							
Arsenic, dissolved	< 0.00050	0.00050	mg/L							
Barium, dissolved	< 0.0050	0.0050	mg/L							
Beryllium, dissolved	< 0.00010	0.00010	mg/L							
Bismuth, dissolved	< 0.00010	0.00010	mg/L							
Boron, dissolved	< 0.0500	0.0500	mg/L							
Cadmium, dissolved	< 0.000010	0.000010	mg/L							
Calcium, dissolved	< 0.20	0.20	mg/L							
Chromium, dissolved	< 0.00050	0.00050	mg/L							
Cobalt, dissolved	< 0.00010	0.00010	mg/L							
Copper, dissolved	< 0.00040	0.00040	mg/L							
Iron, dissolved	< 0.010	0.010	mg/L							
Lead, dissolved	< 0.00020	0.00020	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	mg/L							
Molybdenum, dissolved	< 0.00010	0.00010	mg/L							
Nickel, dissolved	< 0.00040	0.00040	mg/L							
Phosphorus, dissolved	< 0.050	0.050	mg/L							
Potassium, dissolved	< 0.10	0.10	mg/L							
Selenium, dissolved	< 0.00050	0.00050	mg/L							
Silicon, dissolved	< 1.0	1.0	mg/L							
Silver, dissolved	< 0.000050	0.000050	mg/L							
Sodium, dissolved	< 0.10	0.10	mg/L							

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0L1095, Continued										
Blank (B0L1095-BLK1), Continued				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Strontium, dissolved	< 0.0010	0.0010	mg/L							
Sulfur, dissolved	< 3.0	3.0	mg/L							
Tellurium, dissolved	< 0.00050	0.00050	mg/L							
Thallium, dissolved	< 0.000020	0.000020	mg/L							
Thorium, dissolved	< 0.00010	0.00010	mg/L							
Tin, dissolved	< 0.00020	0.00020	mg/L							
Titanium, dissolved	< 0.0050	0.0050	mg/L							
Tungsten, dissolved	< 0.0010	0.0010	mg/L							
Uranium, dissolved	< 0.000020	0.000020	mg/L							
Vanadium, dissolved	< 0.0010	0.0010	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B0L1095-BS1)				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Lithium, dissolved	0.0210	0.00010	mg/L	0.0200		105	80-120			
Aluminum, dissolved	0.0233	0.0050	mg/L	0.0199		117	80-120			
Antimony, dissolved	0.0200	0.00020	mg/L	0.0200		100	80-120			
Arsenic, dissolved	0.0200	0.00050	mg/L	0.0200		100	80-120			
Barium, dissolved	0.0201	0.0050	mg/L	0.0198		101	80-120			
Beryllium, dissolved	0.0200	0.00010	mg/L	0.0198		101	80-120			
Bismuth, dissolved	0.0199	0.00010	mg/L	0.0200		100	80-120			
Boron, dissolved	< 0.0500	0.0500	mg/L	0.0200		111	80-120			
Cadmium, dissolved	0.0189	0.000010	mg/L	0.0199		95	80-120			
Calcium, dissolved	1.87	0.20	mg/L	2.02		92	80-120			
Chromium, dissolved	0.0200	0.00050	mg/L	0.0198		101	80-120			
Cobalt, dissolved	0.0198	0.00010	mg/L	0.0199		99	80-120			
Copper, dissolved	0.0201	0.00040	mg/L	0.0200		100	80-120			
Iron, dissolved	2.03	0.010	mg/L	2.02		101	80-120			
Lead, dissolved	0.0197	0.00020	mg/L	0.0199		99	80-120			
Magnesium, dissolved	2.05	0.010	mg/L	2.02		101	80-120			
Manganese, dissolved	0.0199	0.00020	mg/L	0.0199		100	80-120			
Molybdenum, dissolved	0.0207	0.00010	mg/L	0.0200		103	80-120			
Nickel, dissolved	0.0200	0.00040	mg/L	0.0200		100	80-120			
Phosphorus, dissolved	2.17	0.050	mg/L	2.00		109	80-120			
Potassium, dissolved	1.95	0.10	mg/L	2.02		96	80-120			
Selenium, dissolved	0.0184	0.00050	mg/L	0.0200		92	80-120			
Silicon, dissolved	2.3	1.0	mg/L	2.00		115	80-120			
Silver, dissolved	0.0196	0.000050	mg/L	0.0200		98	80-120			
Sodium, dissolved	2.03	0.10	mg/L	2.02		101	80-120			
Strontium, dissolved	0.0200	0.0010	mg/L	0.0200		100	80-120			
Sulfur, dissolved	4.9	3.0	mg/L	5.00		97	80-120			
Tellurium, dissolved	0.0200	0.00050	mg/L	0.0200		100	80-120			
Thallium, dissolved	0.0198	0.000020	mg/L	0.0199		99	80-120			
Thorium, dissolved	0.0195	0.00010	mg/L	0.0200		98	80-120			
Tin, dissolved	0.0234	0.00020	mg/L	0.0200		117	80-120			
Titanium, dissolved	0.0215	0.0050	mg/L	0.0200		107	80-120			
Tungsten, dissolved	0.0210	0.0010	mg/L	0.0200		105	80-120			
Uranium, dissolved	0.0202	0.000020	mg/L	0.0200		101	80-120			
Vanadium, dissolved	0.0224	0.0010	mg/L	0.0200		112	80-120			
Zinc, dissolved	0.0224	0.0040	mg/L	0.0200		112	80-120			
Zirconium, dissolved	0.0204	0.00010	mg/L	0.0200		102	80-120			
Reference (B0L1095-SRM1)				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Lithium, dissolved	0.107	0.00010	mg/L	0.100		107	70-130			
Aluminum, dissolved	0.246	0.0050	mg/L	0.235		105	70-130			
Antimony, dissolved	0.0481	0.00020	mg/L	0.0431		112	70-130			
Arsenic, dissolved	0.455	0.00050	mg/L	0.423		108	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0L1095, Continued										
Reference (B0L1095-SRM1), Continued				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Barium, dissolved	3.00	0.0050	mg/L	3.30		91	70-130			
Beryllium, dissolved	0.220	0.00010	mg/L	0.209		105	70-130			
Boron, dissolved	1.66	0.0500	mg/L	1.65		100	70-130			
Cadmium, dissolved	0.214	0.000010	mg/L	0.221		97	70-130			
Calcium, dissolved	7.44	0.20	mg/L	7.72		96	70-130			
Chromium, dissolved	0.445	0.00050	mg/L	0.434		102	70-130			
Cobalt, dissolved	0.128	0.00010	mg/L	0.124		103	70-130			
Copper, dissolved	0.833	0.00040	mg/L	0.815		102	70-130			
Iron, dissolved	1.34	0.010	mg/L	1.27		106	70-130			
Lead, dissolved	0.110	0.00020	mg/L	0.110		100	70-130			
Magnesium, dissolved	6.86	0.010	mg/L	6.59		104	70-130			
Manganese, dissolved	0.337	0.00020	mg/L	0.342		99	70-130			
Molybdenum, dissolved	0.426	0.00010	mg/L	0.404		105	70-130			
Nickel, dissolved	0.857	0.00040	mg/L	0.835		103	70-130			
Phosphorus, dissolved	0.552	0.050	mg/L	0.499		111	70-130			
Potassium, dissolved	3.05	0.10	mg/L	2.88		106	70-130			
Selenium, dissolved	0.0302	0.00050	mg/L	0.0324		93	70-130			
Sodium, dissolved	19.0	0.10	mg/L	18.0		106	70-130			
Strontium, dissolved	0.929	0.0010	mg/L	0.935		99	70-130			
Thallium, dissolved	0.0386	0.000020	mg/L	0.0385		100	70-130			
Uranium, dissolved	0.249	0.000020	mg/L	0.258		96	70-130			
Vanadium, dissolved	0.884	0.0010	mg/L	0.873		101	70-130			
Zinc, dissolved	0.863	0.0040	mg/L	0.848		102	70-130			
Dissolved Metals, Batch B0L1099										
Blank (B0L1099-BLK1)				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Reference (B0L1099-SRM1)				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Mercury, dissolved	0.00665	0.000010	mg/L	0.00581		114	70-130			
Non-Chlorinated Phenols, Batch B0L1340										
Blank (B0L1340-BLK1)				Prepared: 2020-12-15, Analyzed: 2020-12-17						
Phenol	< 0.50	0.50	µg/L							
2-Methylphenol	< 0.50	0.50	µg/L							
3 & 4-Methylphenol	< 0.50	0.50	µg/L							
2,4-Dimethylphenol	< 0.50	0.50	µg/L							
2-Nitrophenol	< 0.50	0.50	µg/L							
4-Nitrophenol	< 0.50	0.50	µg/L							
2,4-Dinitrophenol	< 0.50	0.50	µg/L							
2-Methyl-4,6-dinitrophenol	< 0.50	0.50	µg/L							
Surrogate: 2,4-Dibromophenol	*1.32*		*µg/L*	2.02		*66*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*1.42*		*µg/L*	2.00		*71*	*60-130*			
LCS (B0L1340-BS1)				Prepared: 2020-12-15, Analyzed: 2020-12-17						
Phenol	7.55	0.50	µg/L	10.0		75	60-130			
2-Methylphenol	8.69	0.50	µg/L	10.0		87	60-115			
3 & 4-Methylphenol	17.8	0.50	µg/L	20.0		89	60-109			
2,4-Dimethylphenol	10.7	0.50	µg/L	10.0		107	60-130			
2-Nitrophenol	7.97	0.50	µg/L	10.0		80	57-117			
4-Nitrophenol	11.8	0.50	µg/L	10.0		118	63-130			
2,4-Dinitrophenol	11.0	0.50	µg/L	9.95		110	35-130			
2-Methyl-4,6-dinitrophenol	9.61	0.50	µg/L	10.0		96	53-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Non-Chlorinated Phenols, Batch B0L1340, Continued										
LCS (B0L1340-BS1), Continued				Prepared: 2020-12-15, Analyzed: 2020-12-17						
Surrogate: 2,4-Dibromophenol	*1.86*		*µg/L*	2.02		*92*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*1.84*		*µg/L*	2.00		*92*	*60-130*			
LCS Dup (B0L1340-BSD1)				Prepared: 2020-12-15, Analyzed: 2020-12-17						
Phenol	6.32	0.50	µg/L	10.0		63	60-130	18	23	
2-Methylphenol	6.91	0.50	µg/L	10.0		69	60-115	23	20	RPD
3 & 4-Methylphenol	11.9	0.50	µg/L	20.0		60	60-109	40	16	RPD
2,4-Dimethylphenol	4.03	0.50	µg/L	10.0		40	60-130	91	24	RPD, SPK1
2-Nitrophenol	6.57	0.50	µg/L	10.0		66	57-117	19	22	
4-Nitrophenol	11.6	0.50	µg/L	10.0		116	63-130	2	40	
2,4-Dinitrophenol	10.2	0.50	µg/L	9.95		102	35-130	8	27	
2-Methyl-4,6-dinitrophenol	9.77	0.50	µg/L	10.0		97	53-130	2	20	
Surrogate: 2,4-Dibromophenol	*1.67*		*µg/L*	2.02		*83*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*1.62*		*µg/L*	2.00		*81*	*60-130*			
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0L1411										
Blank (B0L1411-BLK1)				Prepared: 2020-12-15, Analyzed: 2020-12-15						
Acenaphthene	< 0.050	0.050	µg/L							
Acenaphthylene	< 0.200	0.200	µg/L							
Acridine	< 0.050	0.050	µg/L							
Anthracene	< 0.010	0.010	µg/L							
Benz(a)anthracene	< 0.010	0.010	µg/L							
Benzo(a)pyrene	< 0.010	0.010	µg/L							
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L							
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L							
Benzo(k)fluoranthene	< 0.050	0.050	µg/L							
2-Chloronaphthalene	< 0.100	0.100	µg/L							
Chrysene	< 0.050	0.050	µg/L							
Dibenz(a,h)anthracene	< 0.010	0.010	µg/L							
Fluoranthene	< 0.030	0.030	µg/L							
Fluorene	< 0.050	0.050	µg/L							
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L							
1-Methylnaphthalene	< 0.100	0.100	µg/L							
2-Methylnaphthalene	< 0.100	0.100	µg/L							
Naphthalene	< 0.200	0.200	µg/L							
Phenanthrene	< 0.100	0.100	µg/L							
Pyrene	< 0.020	0.020	µg/L							
Quinoline	< 0.050	0.050	µg/L							
Surrogate: Acridine-d9	*3.98*		*µg/L*	4.31		*92*	*50-140*			
Surrogate: Naphthalene-d8	*3.74*		*µg/L*	4.47		*84*	*50-140*			
Surrogate: Perylene-d12	*3.95*		*µg/L*	4.47		*88*	*50-140*			
LCS (B0L1411-BS1)				Prepared: 2020-12-15, Analyzed: 2020-12-15						
Acenaphthene	3.81	0.050	µg/L	4.44		86	55-137			
Acenaphthylene	3.96	0.200	µg/L	4.44		89	53-140			
Acridine	3.53	0.050	µg/L	4.44		79	50-120			
Anthracene	4.11	0.010	µg/L	4.44		92	64-130			
Benz(a)anthracene	4.25	0.010	µg/L	4.44		96	57-140			
Benzo(a)pyrene	4.14	0.010	µg/L	4.44		93	63-133			
Benzo(b+j)fluoranthene	7.99	0.050	µg/L	8.89		90	60-129			
Benzo(g,h,i)perylene	4.36	0.050	µg/L	4.44		98	52-139			
Benzo(k)fluoranthene	4.03	0.050	µg/L	4.44		91	50-138			
2-Chloronaphthalene	3.60	0.100	µg/L	4.38		82	50-139			
Chrysene	4.32	0.050	µg/L	4.44		97	59-140			

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0L1411, Continued										
LCS (B0L1411-BS1), Continued				Prepared: 2020-12-15, Analyzed: 2020-12-15						
Dibenz(a,h)anthracene	4.27	0.010	µg/L	4.44		96	53-136			
Fluoranthene	4.84	0.030	µg/L	4.44		109	67-135			
Fluorene	3.94	0.050	µg/L	4.44		89	57-134			
Indeno(1,2,3-cd)pyrene	3.59	0.050	µg/L	4.44		81	52-129			
1-Methylnaphthalene	3.90	0.100	µg/L	4.44		88	50-140			
2-Methylnaphthalene	3.77	0.100	µg/L	4.44		85	50-140			
Naphthalene	3.61	0.200	µg/L	4.44		81	50-140			
Phenanthrene	4.40	0.100	µg/L	4.44		99	61-134			
Pyrene	4.82	0.020	µg/L	4.44		108	66-131			
Quinoline	5.73	0.050	µg/L	4.44		129	50-140			
Surrogate: Acridine-d9	*4.19*		*µg/L*	4.31		*97*	*50-140*			
Surrogate: Naphthalene-d8	*3.75*		*µg/L*	4.47		*84*	*50-140*			
Surrogate: Perylene-d12	*4.16*		*µg/L*	4.47		*93*	*50-140*			
LCS Dup (B0L1411-BSD1)				Prepared: 2020-12-15, Analyzed: 2020-12-15						
Acenaphthene	3.80	0.050	µg/L	4.44		85	55-137	< 1	18	
Acenaphthylene	3.92	0.200	µg/L	4.44		88	53-140	< 1	20	
Acridine	3.36	0.050	µg/L	4.44		76	50-120	5	30	
Anthracene	3.91	0.010	µg/L	4.44		88	64-130	5	15	
Benz(a)anthracene	3.91	0.010	µg/L	4.44		88	57-140	8	25	
Benzo(a)pyrene	3.78	0.010	µg/L	4.44		85	63-133	9	18	
Benzo(b+j)fluoranthene	7.18	0.050	µg/L	8.89		81	60-129	11	17	
Benzo(g,h,i)perylene	3.98	0.050	µg/L	4.44		89	52-139	9	22	
Benzo(k)fluoranthene	3.71	0.050	µg/L	4.44		84	50-138	8	26	
2-Chloronaphthalene	3.67	0.100	µg/L	4.38		84	50-139	2	23	
Chrysene	3.99	0.050	µg/L	4.44		90	59-140	8	23	
Dibenz(a,h)anthracene	3.83	0.010	µg/L	4.44		86	53-136	11	21	
Fluoranthene	4.51	0.030	µg/L	4.44		102	67-135	7	18	
Fluorene	3.84	0.050	µg/L	4.44		86	57-134	2	18	
Indeno(1,2,3-cd)pyrene	3.77	0.050	µg/L	4.44		85	52-129	5	21	
1-Methylnaphthalene	3.99	0.100	µg/L	4.44		90	50-140	2	20	
2-Methylnaphthalene	3.87	0.100	µg/L	4.44		87	50-140	3	21	
Naphthalene	3.79	0.200	µg/L	4.44		85	50-140	5	22	
Phenanthrene	4.22	0.100	µg/L	4.44		95	61-134	4	17	
Pyrene	4.48	0.020	µg/L	4.44		101	66-131	7	19	
Quinoline	5.82	0.050	µg/L	4.44		131	50-140	1	14	
Surrogate: Acridine-d9	*3.88*		*µg/L*	4.31		*90*	*50-140*			
Surrogate: Naphthalene-d8	*3.83*		*µg/L*	4.47		*86*	*50-140*			
Surrogate: Perylene-d12	*3.74*		*µg/L*	4.47		*84*	*50-140*			
Total Metals, Batch B0L1100										
Blank (B0L1100-BLK1)				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B0L1100-BLK2)				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Mercury, total	< 0.000010	0.000010	mg/L							
Reference (B0L1100-SRM1)				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Mercury, total	0.00648	0.000010	mg/L	0.00581		112	70-130			
Reference (B0L1100-SRM2)				Prepared: 2020-12-11, Analyzed: 2020-12-11						
Mercury, total	0.00683	0.000010	mg/L	0.00581		118	70-130			
Total Metals, Batch B0L1423										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0L1423, Continued										
Blank (B0L1423-BLK1)				Prepared: 2020-12-15, Analyzed: 2020-12-16						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Beryllium, total	< 0.00010	0.00010	mg/L							
Bismuth, total	< 0.00010	0.00010	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Phosphorus, total	< 0.050	0.050	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Silicon, total	< 1.0	1.0	mg/L							
Silver, total	< 0.000050	0.000050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Sulfur, total	< 3.0	3.0	mg/L							
Tellurium, total	< 0.00050	0.00050	mg/L							
Thallium, total	< 0.000020	0.000020	mg/L							
Thorium, total	< 0.00010	0.00010	mg/L							
Tin, total	< 0.00020	0.00020	mg/L							
Titanium, total	< 0.0050	0.0050	mg/L							
Tungsten, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Vanadium, total	< 0.0010	0.0010	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B0L1423-BS1)				Prepared: 2020-12-15, Analyzed: 2020-12-16						
Aluminum, total	0.0216	0.0050	mg/L	0.0199		109	80-120			
Antimony, total	0.0211	0.00020	mg/L	0.0200		105	80-120			
Arsenic, total	0.0213	0.00050	mg/L	0.0200		106	80-120			
Barium, total	0.0197	0.0050	mg/L	0.0198		100	80-120			
Beryllium, total	0.0209	0.00010	mg/L	0.0198		105	80-120			
Bismuth, total	0.0202	0.00010	mg/L	0.0200		101	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		105	80-120			
Cadmium, total	0.0198	0.000010	mg/L	0.0199		100	80-120			
Calcium, total	1.96	0.20	mg/L	2.02		97	80-120			
Chromium, total	0.0211	0.00050	mg/L	0.0198		107	80-120			
Cobalt, total	0.0213	0.00010	mg/L	0.0199		107	80-120			
Copper, total	0.0215	0.00040	mg/L	0.0200		107	80-120			
Iron, total	2.01	0.010	mg/L	2.02		99	80-120			
Lead, total	0.0197	0.00020	mg/L	0.0199		99	80-120			
Lithium, total	0.0211	0.00010	mg/L	0.0200		105	80-120			
Magnesium, total	2.18	0.010	mg/L	2.02		108	80-120			
Manganese, total	0.0215	0.00020	mg/L	0.0199		108	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0L1423, Continued										
LCS (B0L1423-BS1), Continued				Prepared: 2020-12-15, Analyzed: 2020-12-16						
Molybdenum, total	0.0202	0.00010	mg/L	0.0200		101	80-120			
Nickel, total	0.0217	0.00040	mg/L	0.0200		108	80-120			
Phosphorus, total	2.04	0.050	mg/L	2.00		102	80-120			
Potassium, total	2.18	0.10	mg/L	2.02		108	80-120			
Selenium, total	0.0187	0.00050	mg/L	0.0200		94	80-120			
Silicon, total	2.3	1.0	mg/L	2.00		113	80-120			
Silver, total	0.0205	0.000050	mg/L	0.0200		103	80-120			
Sodium, total	2.11	0.10	mg/L	2.02		104	80-120			
Strontium, total	0.0200	0.0010	mg/L	0.0200		100	80-120			
Sulfur, total	4.9	3.0	mg/L	5.00		99	80-120			
Tellurium, total	0.0210	0.00050	mg/L	0.0200		105	80-120			
Thallium, total	0.0202	0.000020	mg/L	0.0199		101	80-120			
Thorium, total	0.0192	0.00010	mg/L	0.0200		96	80-120			
Tin, total	0.0208	0.00020	mg/L	0.0200		104	80-120			
Titanium, total	0.0193	0.0050	mg/L	0.0200		97	80-120			
Tungsten, total	0.0188	0.0010	mg/L	0.0200		94	80-120			
Uranium, total	0.0197	0.000020	mg/L	0.0200		98	80-120			
Vanadium, total	0.0238	0.0010	mg/L	0.0200		119	80-120			
Zinc, total	0.0209	0.0040	mg/L	0.0200		105	80-120			
Zirconium, total	0.0205	0.00010	mg/L	0.0200		102	80-120			
Reference (B0L1423-SRM1)				Prepared: 2020-12-15, Analyzed: 2020-12-16						
Aluminum, total	0.306	0.0050	mg/L	0.299		102	70-130			
Antimony, total	0.0546	0.00020	mg/L	0.0517		106	70-130			
Arsenic, total	0.134	0.00050	mg/L	0.119		113	70-130			
Barium, total	0.820	0.0050	mg/L	0.801		102	70-130			
Beryllium, total	0.0521	0.00010	mg/L	0.0501		104	70-130			
Boron, total	3.95	0.0500	mg/L	4.11		96	70-130			
Cadmium, total	0.0511	0.000010	mg/L	0.0503		102	70-130			
Calcium, total	10.2	0.20	mg/L	10.7		95	70-130			
Chromium, total	0.263	0.00050	mg/L	0.250		105	70-130			
Cobalt, total	0.0409	0.00010	mg/L	0.0384		107	70-130			
Copper, total	0.527	0.00040	mg/L	0.487		108	70-130			
Iron, total	0.497	0.010	mg/L	0.504		99	70-130			
Lead, total	0.291	0.00020	mg/L	0.278		105	70-130			
Lithium, total	0.418	0.00010	mg/L	0.398		105	70-130			
Magnesium, total	3.80	0.010	mg/L	3.59		106	70-130			
Manganese, total	0.112	0.00020	mg/L	0.111		101	70-130			
Molybdenum, total	0.204	0.00010	mg/L	0.196		104	70-130			
Nickel, total	0.267	0.00040	mg/L	0.248		108	70-130			
Phosphorus, total	0.274	0.050	mg/L	0.213		129	70-130			
Potassium, total	6.27	0.10	mg/L	5.89		106	70-130			
Selenium, total	0.119	0.00050	mg/L	0.120		99	70-130			
Sodium, total	8.95	0.10	mg/L	8.71		103	70-130			
Strontium, total	0.414	0.0010	mg/L	0.393		105	70-130			
Thallium, total	0.0849	0.000020	mg/L	0.0787		108	70-130			
Uranium, total	0.0342	0.000020	mg/L	0.0344		100	70-130			
Vanadium, total	0.414	0.0010	mg/L	0.391		106	70-130			
Zinc, total	2.67	0.0040	mg/L	2.50		107	70-130			
Volatile Organic Compounds (VOC), Batch B0L1198										
Blank (B0L1198-BLK1)				Prepared: 2020-12-13, Analyzed: 2020-12-13						
Benzene	< 0.5	0.5	µg/L							
Bromodichloromethane	< 1.0	1.0	µg/L							
Bromoform	< 1.0	1.0	µg/L							

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Volatile Organic Compounds (VOC), Batch B0L1198, Continued										
Blank (B0L1198-BLK1), Continued				Prepared: 2020-12-13, Analyzed: 2020-12-13						
Carbon tetrachloride	< 0.5	0.5	µg/L							
Chlorobenzene	< 1.0	1.0	µg/L							
Chloroethane	< 2.0	2.0	µg/L							
Chloroform	< 1.0	1.0	µg/L							
Dibromochloromethane	< 1.0	1.0	µg/L							
1,2-Dibromoethane	< 0.3	0.3	µg/L							
Dibromomethane	< 1.0	1.0	µg/L							
1,2-Dichlorobenzene	< 0.5	0.5	µg/L							
1,3-Dichlorobenzene	< 1.0	1.0	µg/L							
1,4-Dichlorobenzene	< 1.0	1.0	µg/L							
1,1-Dichloroethane	< 1.0	1.0	µg/L							
1,2-Dichloroethane	< 1.0	1.0	µg/L							
1,1-Dichloroethylene	< 1.0	1.0	µg/L							
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L							
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L							
Dichloromethane	< 3.0	3.0	µg/L							
1,2-Dichloropropane	< 1.0	1.0	µg/L							
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L							
Ethylbenzene	< 1.0	1.0	µg/L							
Methyl tert-butyl ether	< 1.0	1.0	µg/L							
Styrene	< 1.0	1.0	µg/L							
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L							
Tetrachloroethylene	< 1.0	1.0	µg/L							
Toluene	< 1.0	1.0	µg/L							
1,1,1-Trichloroethane	< 1.0	1.0	µg/L							
1,1,2-Trichloroethane	< 1.0	1.0	µg/L							
Trichloroethylene	< 1.0	1.0	µg/L							
Trichlorofluoromethane	< 1.0	1.0	µg/L							
Vinyl chloride	< 1.0	1.0	µg/L							
Xylenes (total)	< 2.0	2.0	µg/L							
Surrogate: Toluene-d8	*25.6*		*µg/L*	26.5		*96*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*18.9*		*µg/L*	24.9		*76*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*17.9*		*µg/L*	25.5		*70*	*70-130*			
LCS (B0L1198-BS1)				Prepared: 2020-12-13, Analyzed: 2020-12-13						
Benzene	18.0	0.5	µg/L	20.0		90	70-130			
Bromodichloromethane	18.4	1.0	µg/L	20.0		92	70-130			
Bromoform	18.5	1.0	µg/L	20.1		92	70-130			
Carbon tetrachloride	15.7	0.5	µg/L	20.2		78	70-130			
Chlorobenzene	18.1	1.0	µg/L	20.1		90	70-130			
Chloroethane	19.7	2.0	µg/L	20.0		98	60-140			
Chloroform	18.8	1.0	µg/L	20.1		94	70-130			
Dibromochloromethane	19.1	1.0	µg/L	20.2		94	70-130			
1,2-Dibromoethane	17.9	0.3	µg/L	20.0		89	70-130			
Dibromomethane	18.6	1.0	µg/L	20.0		93	70-130			
1,2-Dichlorobenzene	18.1	0.5	µg/L	20.1		90	70-130			
1,3-Dichlorobenzene	18.5	1.0	µg/L	20.1		92	70-130			
1,4-Dichlorobenzene	19.6	1.0	µg/L	20.1		98	70-130			
1,1-Dichloroethane	19.8	1.0	µg/L	20.1		99	70-130			
1,2-Dichloroethane	19.1	1.0	µg/L	20.1		95	70-130			
1,1-Dichloroethylene	18.0	1.0	µg/L	20.1		90	70-130			
cis-1,2-Dichloroethylene	17.9	1.0	µg/L	20.0		90	70-130			
trans-1,2-Dichloroethylene	18.6	1.0	µg/L	20.0		93	70-130			
Dichloromethane	18.7	3.0	µg/L	20.1		93	70-130			
1,2-Dichloropropane	18.2	1.0	µg/L	20.1		90	70-130			
1,3-Dichloropropene (cis + trans)	36.4	1.0	µg/L	40.0		91	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Volatile Organic Compounds (VOC), Batch B0L1198, Continued										
LCS (B0L1198-BS1), Continued				Prepared: 2020-12-13, Analyzed: 2020-12-13						
Ethylbenzene	16.8	1.0	µg/L	20.0		84	70-130			
Methyl tert-butyl ether	19.1	1.0	µg/L	20.0		95	70-130			
Styrene	16.9	1.0	µg/L	20.0		84	70-130			
1,1,2,2-Tetrachloroethane	21.4	0.5	µg/L	20.1		106	70-130			
Tetrachloroethylene	18.1	1.0	µg/L	20.1		90	70-130			
Toluene	30.0	1.0	µg/L	20.0		150	70-130			SPK
1,1,1-Trichloroethane	17.6	1.0	µg/L	20.0		88	70-130			
1,1,2-Trichloroethane	18.5	1.0	µg/L	20.1		92	70-130			
Trichloroethylene	18.6	1.0	µg/L	20.1		92	70-130			
Trichlorofluoromethane	19.3	1.0	µg/L	20.0		97	60-140			
Vinyl chloride	29.1	1.0	µg/L	20.0		145	60-140			SPK
Xylenes (total)	53.8	2.0	µg/L	60.0		90	70-130			
Surrogate: Toluene-d8	*25.0*		*µg/L*	26.5		*94*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*23.9*		*µg/L*	24.9		*96*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*23.6*		*µg/L*	25.5		*93*	*70-130*			
Duplicate (B0L1198-DUP1)		**Source: 20L1218-01**		Prepared: 2020-12-13, Analyzed: 2020-12-13						
Benzene	< 0.5	0.5	µg/L		< 0.5				22	
Bromodichloromethane	< 1.0	1.0	µg/L		< 1.0				23	
Bromoform	< 1.0	1.0	µg/L		< 1.0				23	
Carbon tetrachloride	< 0.5	0.5	µg/L		< 0.5				30	
Chlorobenzene	< 1.0	1.0	µg/L		< 1.0				26	
Chloroethane	< 2.0	2.0	µg/L		< 2.0				50	
Chloroform	< 1.0	1.0	µg/L		< 1.0				22	
Dibromochloromethane	< 1.0	1.0	µg/L		< 1.0				28	
1,2-Dibromoethane	< 0.3	0.3	µg/L		< 0.3				30	
Dibromomethane	< 1.0	1.0	µg/L		< 1.0				30	
1,2-Dichlorobenzene	< 0.5	0.5	µg/L		< 0.5				27	
1,3-Dichlorobenzene	< 1.0	1.0	µg/L		< 1.0				30	
1,4-Dichlorobenzene	< 1.0	1.0	µg/L		< 1.0				30	
1,1-Dichloroethane	< 1.0	1.0	µg/L		< 1.0				24	
1,2-Dichloroethane	< 1.0	1.0	µg/L		< 1.0				24	
1,1-Dichloroethylene	< 1.0	1.0	µg/L		< 1.0				30	
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L		< 1.0				22	
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L		< 1.0				27	
Dichloromethane	< 3.0	3.0	µg/L		< 3.0				27	
1,2-Dichloropropane	< 1.0	1.0	µg/L		< 1.0				28	
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L		< 1.0				30	
Ethylbenzene	< 1.0	1.0	µg/L		< 1.0				30	
Methyl tert-butyl ether	< 1.0	1.0	µg/L		< 1.0				20	
Styrene	< 1.0	1.0	µg/L		< 1.0				30	
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L		< 0.5				30	
Tetrachloroethylene	< 1.0	1.0	µg/L		< 1.0				30	
Toluene	< 1.0	1.0	µg/L		< 1.0				24	
1,1,1-Trichloroethane	< 1.0	1.0	µg/L		< 1.0				30	
1,1,2-Trichloroethane	< 1.0	1.0	µg/L		< 1.0				30	
Trichloroethylene	< 1.0	1.0	µg/L		< 1.0				27	
Trichlorofluoromethane	< 1.0	1.0	µg/L		< 1.0				50	
Vinyl chloride	< 1.0	1.0	µg/L		< 1.0				40	
Xylenes (total)	< 2.0	2.0	µg/L		< 2.0				29	
Surrogate: Toluene-d8	*25.5*		*µg/L*	26.5		*96*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*18.8*		*µg/L*	24.9		*76*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*17.9*		*µg/L*	25.5		*70*	*70-130*			
Matrix Spike (B0L1198-MS1)		**Source: 20L1218-01**		Prepared: 2020-12-13, Analyzed: 2020-12-13						
Benzene	18.8	0.5	µg/L	20.0	< 0.5	94	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

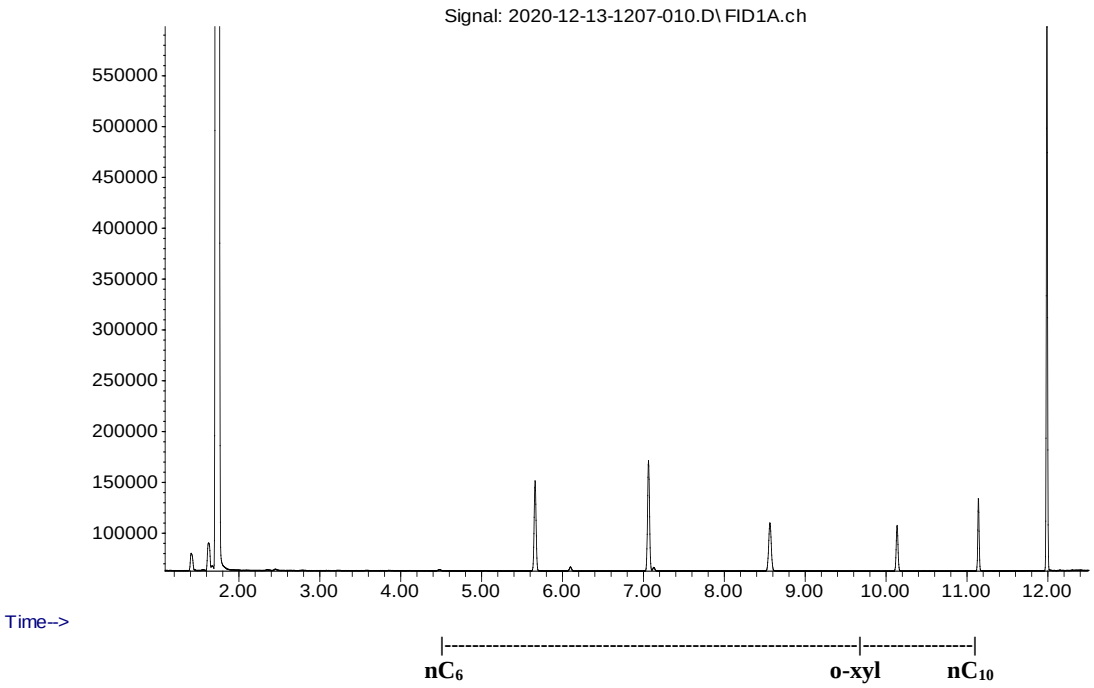
REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L1218
PROJECT	WWTP	**REPORTED**	2020-12-17 15:04

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Volatile Organic Compounds (VOC), Batch B0L1198, Continued										
Matrix Spike (B0L1198-MS1), Continued	**Source: 20L1218-01**			Prepared: 2020-12-13, Analyzed: 2020-12-13						
Bromodichloromethane	19.8	1.0	µg/L	20.0	< 1.0	99	70-130			
Bromoform	19.6	1.0	µg/L	20.1	< 1.0	98	70-130			
Carbon tetrachloride	16.3	0.5	µg/L	20.2	< 0.5	81	70-130			
Chlorobenzene	18.9	1.0	µg/L	20.1	< 1.0	94	70-130			
Chloroethane	21.1	2.0	µg/L	20.0	< 2.0	106	60-140			
Chloroform	19.9	1.0	µg/L	20.1	< 1.0	97	70-130			
Dibromochloromethane	20.5	1.0	µg/L	20.2	< 1.0	102	70-130			
1,2-Dibromoethane	19.5	0.3	µg/L	20.0	< 0.3	98	70-130			
Dibromomethane	19.4	1.0	µg/L	20.0	< 1.0	97	70-130			
1,2-Dichlorobenzene	19.3	0.5	µg/L	20.1	< 0.5	96	70-130			
1,3-Dichlorobenzene	19.5	1.0	µg/L	20.1	< 1.0	97	70-130			
1,4-Dichlorobenzene	20.9	1.0	µg/L	20.1	< 1.0	104	70-130			
1,1-Dichloroethane	21.0	1.0	µg/L	20.1	< 1.0	104	70-130			
1,2-Dichloroethane	20.4	1.0	µg/L	20.1	< 1.0	101	70-130			
1,1-Dichloroethylene	18.7	1.0	µg/L	20.1	< 1.0	93	70-130			
cis-1,2-Dichloroethylene	18.8	1.0	µg/L	20.0	< 1.0	94	70-130			
trans-1,2-Dichloroethylene	19.8	1.0	µg/L	20.0	< 1.0	99	70-130			
Dichloromethane	19.9	3.0	µg/L	20.1	< 3.0	99	70-130			
1,2-Dichloropropane	19.2	1.0	µg/L	20.1	< 1.0	95	70-130			
1,3-Dichloropropene (cis + trans)	41.5	1.0	µg/L	40.0	< 1.0	104	70-130			
Ethylbenzene	17.2	1.0	µg/L	20.0	< 1.0	86	70-130			
Methyl tert-butyl ether	17.9	1.0	µg/L	20.0	< 1.0	90	70-130			
Styrene	16.7	1.0	µg/L	20.0	< 1.0	83	70-130			
1,1,2,2-Tetrachloroethane	20.0	0.5	µg/L	20.1	< 0.5	100	70-130			
Tetrachloroethylene	10.2	1.0	µg/L	20.1	< 1.0	51	70-130			SPK1
Toluene	31.2	1.0	µg/L	20.0	< 1.0	153	70-130			SPK
1,1,1-Trichloroethane	18.4	1.0	µg/L	20.0	< 1.0	92	70-130			
1,1,2-Trichloroethane	20.6	1.0	µg/L	20.1	< 1.0	102	70-130			
Trichloroethylene	12.6	1.0	µg/L	20.1	< 1.0	63	70-130			SPK1
Trichlorofluoromethane	20.3	1.0	µg/L	20.0	< 1.0	102	60-140			
Vinyl chloride	31.2	1.0	µg/L	20.0	< 1.0	156	60-140			SPK
Xylenes (total)	55.0	2.0	µg/L	60.0	< 2.0	92	70-130			
Surrogate: Toluene-d8	*25.4*		*µg/L*	26.5		*96*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*24.4*		*µg/L*	24.9		*98*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*24.8*		*µg/L*	25.5		*97*	*70-130*			

QC Qualifiers:

RPD	Relative percent difference (RPD) of duplicate analysis are outside of control limits for unknown reason(s).
SPK	The recovery of this analyte was outside of established control limits.
SPK1	The recovery of this analyte was outside of established control limits. The data was accepted based on performance of other batch QC.

Sample ID: Final Effluent 2:00pm
Caro ID: 20L1218-01



CERTIFICATE OF ANALYSIS

REPORTED TO	Whistler, Resort Municipality of 4325 Blackcomb Way Whistler, BC V8E 0X5		
ATTENTION	Neil Kearns	**WORK ORDER**	20L2032
PO NUMBER	6310.6663	**RECEIVED / TEMP**	2020-12-17 13:30 / 5°C
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00
PROJECT INFO			

Introduction:

CARO Analytical Services is a testing laboratory full of smart, engaged scientists driven to make the world a safer and healthier place. Through our clients' projects we become an essential element for a better world. We employ methods conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts. CARO is accredited by the Canadian Association for Laboratories Accreditation (CALA) to ISO/IEC 17025:2017 for specific tests listed in the scope of accreditation approved by CALA.

Big Picture Sidekicks

You know that the sample you collected after snowshoeing to site, digging 5 meters, and racing to get it on a plane so you can submit it to the lab for time sensitive results needed to make important and expensive decisions (whew) is VERY important. We know that too.

We've Got Chemistry

It's simple. We figure the more you enjoy working with our fun and engaged team members; the more likely you are to give us continued opportunities to support you.

Ahead of the Curve

Through research, regulation knowledge, and instrumentation, we are your analytical centre for the technical knowledge you need, BEFORE you need it, so you can stay up to date and in the know.

If you have any questions or concerns, please contact me at rsundar@caro.ca

Authorized By:

Rochita Sundar
Junior Account Manager

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L2032-01) | Matrix: Water | Sampled: 2020-12-16 14:00					
BCMOE Aggregate Hydrocarbons					CT8
VHw (6-10)	< 100	100	µg/L	2020-12-19	
VPHw	< 100	100	µg/L wet	N/A	
Calculated Parameters					
Hardness, Total (as CaCO3)	**73.2**	0.500	mg/L	N/A	
Dissolved Metals					
Lithium, dissolved	**0.00241**	0.00010	mg/L	2020-12-23	
Aluminum, dissolved	**0.0328**	0.0050	mg/L	2020-12-23	
Antimony, dissolved	< 0.00020	0.00020	mg/L	2020-12-24	
Arsenic, dissolved	< 0.00050	0.00050	mg/L	2020-12-24	
Barium, dissolved	**0.0120**	0.0050	mg/L	2020-12-23	
Beryllium, dissolved	< 0.00010	0.00010	mg/L	2020-12-23	
Bismuth, dissolved	< 0.00010	0.00010	mg/L	2020-12-23	
Boron, dissolved	**0.0883**	0.0500	mg/L	2020-12-23	
Cadmium, dissolved	**0.000056**	0.000010	mg/L	2020-12-23	
Calcium, dissolved	**25.8**	0.20	mg/L	2020-12-23	
Chromium, dissolved	< 0.00050	0.00050	mg/L	2020-12-23	
Cobalt, dissolved	**0.00050**	0.00010	mg/L	2020-12-23	
Copper, dissolved	**0.0125**	0.00040	mg/L	2020-12-23	
Iron, dissolved	**0.060**	0.010	mg/L	2020-12-23	
Lead, dissolved	< 0.00020	0.00020	mg/L	2020-12-23	
Magnesium, dissolved	**2.12**	0.010	mg/L	2020-12-23	
Manganese, dissolved	**0.120**	0.00020	mg/L	2020-12-23	
Mercury, dissolved	< 0.000010	0.000010	mg/L	2020-12-22	
Molybdenum, dissolved	**0.00054**	0.00010	mg/L	2020-12-23	
Nickel, dissolved	**0.00144**	0.00040	mg/L	2020-12-23	
Phosphorus, dissolved	**0.088**	0.050	mg/L	2020-12-23	
Potassium, dissolved	**9.23**	0.10	mg/L	2020-12-23	
Selenium, dissolved	< 0.00050	0.00050	mg/L	2020-12-24	
Silicon, dissolved	**5.0**	1.0	mg/L	2020-12-23	
Silver, dissolved	< 0.000050	0.000050	mg/L	2020-12-23	
Sodium, dissolved	**36.5**	0.10	mg/L	2020-12-23	
Strontium, dissolved	**0.178**	0.0010	mg/L	2020-12-23	
Sulfur, dissolved	**27.1**	3.0	mg/L	2020-12-23	
Tellurium, dissolved	< 0.00050	0.00050	mg/L	2020-12-23	
Thallium, dissolved	< 0.000020	0.000020	mg/L	2020-12-23	
Thorium, dissolved	< 0.00010	0.00010	mg/L	2020-12-23	
Tin, dissolved	< 0.00020	0.00020	mg/L	2020-12-23	
Titanium, dissolved	< 0.0050	0.0050	mg/L	2020-12-23	
Tungsten, dissolved	< 0.0010	0.0010	mg/L	2020-12-23	
Uranium, dissolved	< 0.000020	0.000020	mg/L	2020-12-23	
Vanadium, dissolved	**0.0014**	0.0010	mg/L	2020-12-23	
Zinc, dissolved	**0.0472**	0.0040	mg/L	2020-12-23	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L2032-01) | Matrix: Water | Sampled: 2020-12-16 14:00, Continued					
Dissolved Metals, Continued					
Zirconium, dissolved	< 0.00010	0.00010	mg/L	2020-12-23	
Non-Chlorinated Phenols					
Phenol	< 0.50	0.50	µg/L	2020-12-23	
2-Methylphenol	< 0.50	0.50	µg/L	2020-12-23	
3 & 4-Methylphenol	< 0.50	0.50	µg/L	2020-12-23	
2,4-Dimethylphenol	< 0.50	0.50	µg/L	2020-12-23	
2-Nitrophenol	< 0.50	0.50	µg/L	2020-12-23	
4-Nitrophenol	< 0.50	0.50	µg/L	2020-12-23	
2,4-Dinitrophenol	< 0.50	0.50	µg/L	2020-12-23	
2-Methyl-4,6-dinitrophenol	< 0.50	0.50	µg/L	2020-12-23	
Surrogate: 2,4-Dibromophenol	*77*	*60-130*	%	*2020-12-23*	
Surrogate: 2,4,6-Tribromophenol	*77*	*60-130*	%	*2020-12-23*	
Polycyclic Aromatic Hydrocarbons (PAH)					
Acenaphthene	< 0.050	0.050	µg/L	2020-12-20	
Acenaphthylene	< 0.200	0.200	µg/L	2020-12-20	
Acridine	< 0.050	0.050	µg/L	2020-12-20	
Anthracene	< 0.010	0.010	µg/L	2020-12-20	
Benz(a)anthracene	< 0.010	0.010	µg/L	2020-12-20	
Benzo(a)pyrene	< 0.010	0.010	µg/L	2020-12-20	
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L	2020-12-20	
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L	2020-12-20	
Benzo(k)fluoranthene	< 0.050	0.050	µg/L	2020-12-20	
2-Chloronaphthalene	< 0.100	0.100	µg/L	2020-12-20	
Chrysene	< 0.050	0.050	µg/L	2020-12-20	
Dibenz(a,h)anthracene	< 0.010	0.010	µg/L	2020-12-20	
Fluoranthene	< 0.030	0.030	µg/L	2020-12-20	
Fluorene	< 0.050	0.050	µg/L	2020-12-20	
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L	2020-12-20	
1-Methylnaphthalene	< 0.100	0.100	µg/L	2020-12-20	
2-Methylnaphthalene	< 0.100	0.100	µg/L	2020-12-20	
Naphthalene	< 0.200	0.200	µg/L	2020-12-20	
Phenanthrene	< 0.100	0.100	µg/L	2020-12-20	
Pyrene	< 0.020	0.020	µg/L	2020-12-20	
Quinoline	< 0.050	0.050	µg/L	2020-12-20	
Surrogate: Acridine-d9	*68*	*50-140*	%	*2020-12-20*	
Surrogate: Naphthalene-d8	*107*	*50-140*	%	*2020-12-20*	
Surrogate: Perylene-d12	*94*	*50-140*	%	*2020-12-20*	
Total Metals					
Aluminum, total	**0.0490**	0.0050	mg/L	2020-12-21	
Antimony, total	< 0.00020	0.00020	mg/L	2020-12-21	
Arsenic, total	< 0.00050	0.00050	mg/L	2020-12-21	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L2032-01) | Matrix: Water | Sampled: 2020-12-16 14:00, Continued					
Total Metals, Continued					
Barium, total	**0.0133**	0.0050	mg/L	2020-12-21	
Beryllium, total	< 0.00010	0.00010	mg/L	2020-12-21	
Bismuth, total	< 0.00010	0.00010	mg/L	2020-12-21	
Boron, total	**0.0832**	0.0500	mg/L	2020-12-21	
Cadmium, total	**0.000045**	0.000010	mg/L	2020-12-21	
Calcium, total	**28.3**	0.20	mg/L	2020-12-21	
Chromium, total	< 0.00050	0.00050	mg/L	2020-12-21	
Cobalt, total	**0.00057**	0.00010	mg/L	2020-12-21	
Copper, total	**0.0160**	0.00040	mg/L	2020-12-21	
Iron, total	**0.099**	0.010	mg/L	2020-12-21	
Lead, total	< 0.00020	0.00020	mg/L	2020-12-21	
Lithium, total	**0.00303**	0.00010	mg/L	2020-12-21	
Magnesium, total	**2.68**	0.010	mg/L	2020-12-21	
Manganese, total	**0.126**	0.00020	mg/L	2020-12-21	
Mercury, total	< 0.000010	0.000010	mg/L	2020-12-22	
Molybdenum, total	**0.00052**	0.00010	mg/L	2020-12-21	
Nickel, total	**0.00199**	0.00040	mg/L	2020-12-21	
Phosphorus, total	**0.150**	0.050	mg/L	2020-12-21	
Potassium, total	**10.1**	0.10	mg/L	2020-12-21	
Selenium, total	< 0.00050	0.00050	mg/L	2020-12-21	
Silicon, total	**4.6**	1.0	mg/L	2020-12-21	
Silver, total	< 0.000050	0.000050	mg/L	2020-12-21	
Sodium, total	**42.5**	0.10	mg/L	2020-12-21	
Strontium, total	**0.176**	0.0010	mg/L	2020-12-21	
Sulfur, total	**13.7**	3.0	mg/L	2020-12-21	
Tellurium, total	< 0.00050	0.00050	mg/L	2020-12-21	
Thallium, total	< 0.000020	0.000020	mg/L	2020-12-21	
Thorium, total	< 0.00010	0.00010	mg/L	2020-12-21	
Tin, total	< 0.00020	0.00020	mg/L	2020-12-21	
Titanium, total	< 0.0050	0.0050	mg/L	2020-12-21	
Tungsten, total	< 0.0010	0.0010	mg/L	2020-12-21	
Uranium, total	< 0.000020	0.000020	mg/L	2020-12-21	
Vanadium, total	< 0.0010	0.0010	mg/L	2020-12-21	
Zinc, total	**0.0510**	0.0040	mg/L	2020-12-21	
Zirconium, total	< 0.00010	0.00010	mg/L	2020-12-21	
Volatile Organic Compounds (VOC)					CT8
Benzene	< 0.5	0.5	µg/L	2020-12-19	
Bromodichloromethane	< 1.0	1.0	µg/L	2020-12-19	
Bromoform	< 1.0	1.0	µg/L	2020-12-19	
Carbon tetrachloride	< 0.5	0.5	µg/L	2020-12-19	
Chlorobenzene	< 1.0	1.0	µg/L	2020-12-19	
Chloroethane	< 2.0	2.0	µg/L	2020-12-19	

TEST RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Analyzed	Qualifier
Final Effluent 2:00pm (20L2032-01) | Matrix: Water | Sampled: 2020-12-16 14:00, Continued					
Volatile Organic Compounds (VOC), Continued					CT8
Chloroform	< 1.0	1.0	µg/L	2020-12-19	
Dibromochloromethane	< 1.0	1.0	µg/L	2020-12-19	
1,2-Dibromoethane	< 0.3	0.3	µg/L	2020-12-19	
Dibromomethane	< 1.0	1.0	µg/L	2020-12-19	
1,2-Dichlorobenzene	< 0.5	0.5	µg/L	2020-12-19	
1,3-Dichlorobenzene	< 1.0	1.0	µg/L	2020-12-19	
1,4-Dichlorobenzene	< 1.0	1.0	µg/L	2020-12-19	
1,1-Dichloroethane	< 1.0	1.0	µg/L	2020-12-19	
1,2-Dichloroethane	< 1.0	1.0	µg/L	2020-12-19	
1,1-Dichloroethylene	< 1.0	1.0	µg/L	2020-12-19	
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-12-19	
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L	2020-12-19	
Dichloromethane	< 3.0	3.0	µg/L	2020-12-19	
1,2-Dichloropropane	< 1.0	1.0	µg/L	2020-12-19	
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L	2020-12-19	
Ethylbenzene	< 1.0	1.0	µg/L	2020-12-19	
Methyl tert-butyl ether	< 1.0	1.0	µg/L	2020-12-19	
Styrene	< 1.0	1.0	µg/L	2020-12-19	
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L	2020-12-19	
Tetrachloroethylene	< 1.0	1.0	µg/L	2020-12-19	
Toluene	< 1.0	1.0	µg/L	2020-12-19	
1,1,1-Trichloroethane	< 1.0	1.0	µg/L	2020-12-19	
1,1,2-Trichloroethane	< 1.0	1.0	µg/L	2020-12-19	
Trichloroethylene	< 1.0	1.0	µg/L	2020-12-19	
Trichlorofluoromethane	< 1.0	1.0	µg/L	2020-12-19	
Vinyl chloride	< 1.0	1.0	µg/L	2020-12-19	
Xylenes (total)	< 2.0	2.0	µg/L	2020-12-19	
Surrogate: Toluene-d8	*100*	*70-130*	%	*2020-12-19*	
Surrogate: 4-Bromofluorobenzene	*77*	*70-130*	%	*2020-12-19*	
Surrogate: 1,4-Dichlorobenzene-d4	*69*	*70-130*	%	*2020-12-19*	S02

Sample Qualifiers:

CT8	Headspace in sample container is greater than 5% volume - VOC results may be compromised
S02	Surrogate recovery outside of control limits. Data accepted based on acceptable recovery of other surrogates.

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analysis Description	Method Ref.	Technique	Accredited	Location
Dissolved Metals in Water	EPA 200.8 / EPA 6020B	0.45 µm Filtration / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
Hardness in Water	SM 2340 B (2017)	Calculation: 2.497 [diss Ca] + 4.118 [diss Mg]	✓	N/A
Mercury, dissolved in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Mercury, total in Water	EPA 245.7*	BrCl2 Oxidation / Cold Vapor Atomic Fluorescence Spectrometry (CVAFS)	✓	Richmond
Phenols, Non-Chlorinated in Water	EPA 3510C* / EPA 8270D	Liquid-Liquid DCM Extraction (Acidic) / GC-MSD (SIM)	✓	Richmond
Polycyclic Aromatic Hydrocarbons in Water	EPA 3511* / EPA 8270D	Hexane MicroExtraction (Base/Neutral) / GC-MSD (SIM)	✓	Richmond
Total Metals in Water	EPA 200.2 / EPA 6020B	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	✓	Richmond
VH in Water	EPA 5030B / BCMOE VHw	Purge&Trap / Gas Chromatography (GC-FID)	✓	Richmond
Volatile Organic Compounds in Water	EPA 5030B / EPA 8260D	Purge&Trap / GC-MSD (SIM)	✓	Richmond
VPHw in Water	BCMOE VPH	Calculation: VH - (Benzene + Toluene + Ethylbenzene + Xylenes + Styrene)		N/A

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Glossary of Terms:

RL	Reporting Limit (default)
<	Less than the specified Reporting Limit (RL) - the actual RL may be higher than the default RL due to various factors
mg/L	Milligrams per litre
µg/L	Micrograms per litre
BCMOE	British Columbia Environmental Laboratory Manual, British Columbia Ministry of Environment
EPA	United States Environmental Protection Agency Test Methods
SM	Standard Methods for the Examination of Water and Wastewater, American Public Health Association

APPENDIX 1: SUPPORTING INFORMATION

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

General Comments:

The results in this report apply to the samples analyzed in accordance with the Chain of Custody document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued or once samples expire, whichever comes first. Longer hold is possible if agreed to in writing.

Please note any regulatory guidelines applied to this report are added as a convenience to the client, at their request, to help provide some initial context to analytical results obtained. Although CARO makes every effort to ensure accuracy of the associated regulatory guideline(s) applied, the guidelines applied cannot be assumed to be correct due to a variety of factors and as such CARO Analytical Services assumes no liability or responsibility for the use of those guidelines to make any decisions. The original source of the regulation should be verified and a review of the guideline (s) should be validated as correct in order to make any decisions arising from the comparison of the analytical data obtained to the relevant regulatory guideline for one's particular circumstances. Further, CARO Analytical Services assumes no liability or responsibility for any loss attributed from the use of these guidelines in any way.

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in “batches” and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: A blank sample that undergoes sample processing identical to that carried out for the test samples. Method blank results are used to assess contamination from the laboratory environment and reagents.
- **Duplicate (Dup)**: An additional or second portion of a randomly selected sample in the analytical run carried through the entire analytical process. Duplicates provide a measure of the analytical method's precision (reproducibility).
- **Blank Spike (BS)**: A sample of known concentration which undergoes processing identical to that carried out for test samples, also referred to as a laboratory control sample (LCS). Blank spikes provide a measure of the analytical method's accuracy.
- **Matrix Spike (MS)**: A second aliquot of sample is fortified with with a known concentration of target analytes and carried through the entire analytical process. Matrix spikes evaluate potential matrix effects that may affect the analyte recovery.
- **Reference Material (SRM)**: A homogenous material of similar matrix to the samples, certified for the parameter(s) listed. Reference Materials ensure that the analytical process is adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10-20 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
BCMOE Aggregate Hydrocarbons, Batch B0L1789										
Blank (B0L1789-BLK1)				Prepared: 2020-12-19, Analyzed: 2020-12-19						
VHw (6-10)	< 100	100	µg/L							
LCS (B0L1789-BS2)				Prepared: 2020-12-19, Analyzed: 2020-12-19						
VHw (6-10)	2710	100	µg/L	2690		101	70-130			
Dissolved Metals, Batch B0L2080										
Blank (B0L2080-BLK1)				Prepared: 2020-12-22, Analyzed: 2020-12-22						
Mercury, dissolved	< 0.000010	0.000010	mg/L							
Matrix Spike (B0L2080-MS1)			**Source: 20L2032-01**	Prepared: 2020-12-22, Analyzed: 2020-12-22						
Mercury, dissolved	0.000319	0.000010	mg/L	0.000250	< 0.000010	127	70-130			
Reference (B0L2080-SRM1)				Prepared: 2020-12-22, Analyzed: 2020-12-22						
Mercury, dissolved	0.00714	0.000010	mg/L	0.00581		123	70-130			
Dissolved Metals, Batch B0L2094										
Blank (B0L2094-BLK1)				Prepared: 2020-12-24, Analyzed: 2020-12-23						
Lithium, dissolved	< 0.00010	0.00010	mg/L							
Aluminum, dissolved	< 0.0050	0.0050	mg/L							
Antimony, dissolved	< 0.00020	0.00020	mg/L							
Arsenic, dissolved	< 0.00050	0.00050	mg/L							
Barium, dissolved	< 0.0050	0.0050	mg/L							
Beryllium, dissolved	< 0.00010	0.00010	mg/L							
Bismuth, dissolved	< 0.00010	0.00010	mg/L							
Boron, dissolved	< 0.0500	0.0500	mg/L							
Cadmium, dissolved	< 0.000010	0.000010	mg/L							
Calcium, dissolved	< 0.20	0.20	mg/L							
Chromium, dissolved	< 0.00050	0.00050	mg/L							
Cobalt, dissolved	< 0.00010	0.00010	mg/L							
Copper, dissolved	< 0.00040	0.00040	mg/L							
Iron, dissolved	< 0.010	0.010	mg/L							
Lead, dissolved	< 0.00020	0.00020	mg/L							
Magnesium, dissolved	< 0.010	0.010	mg/L							
Manganese, dissolved	< 0.00020	0.00020	mg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0L2094, Continued										
Blank (B0L2094-BLK1), Continued				Prepared: 2020-12-24, Analyzed: 2020-12-23						
Molybdenum, dissolved	< 0.00010	0.00010	mg/L							
Nickel, dissolved	< 0.00040	0.00040	mg/L							
Phosphorus, dissolved	< 0.050	0.050	mg/L							
Potassium, dissolved	< 0.10	0.10	mg/L							
Selenium, dissolved	< 0.00050	0.00050	mg/L							
Silicon, dissolved	< 1.0	1.0	mg/L							
Silver, dissolved	< 0.000050	0.000050	mg/L							
Sodium, dissolved	< 0.10	0.10	mg/L							
Strontium, dissolved	< 0.0010	0.0010	mg/L							
Sulfur, dissolved	< 3.0	3.0	mg/L							
Tellurium, dissolved	< 0.00050	0.00050	mg/L							
Thallium, dissolved	< 0.000020	0.000020	mg/L							
Thorium, dissolved	< 0.00010	0.00010	mg/L							
Tin, dissolved	< 0.00020	0.00020	mg/L							
Titanium, dissolved	< 0.0050	0.0050	mg/L							
Tungsten, dissolved	< 0.0010	0.0010	mg/L							
Uranium, dissolved	< 0.000020	0.000020	mg/L							
Vanadium, dissolved	< 0.0010	0.0010	mg/L							
Zinc, dissolved	< 0.0040	0.0040	mg/L							
Zirconium, dissolved	< 0.00010	0.00010	mg/L							
LCS (B0L2094-BS1)				Prepared: 2020-12-24, Analyzed: 2020-12-23						
Lithium, dissolved	0.0182	0.00010	mg/L	0.0200		91	80-120			
Aluminum, dissolved	0.0226	0.0050	mg/L	0.0199		113	80-120			
Antimony, dissolved	0.0188	0.00020	mg/L	0.0200		94	80-120			
Arsenic, dissolved	0.0211	0.00050	mg/L	0.0200		105	80-120			
Barium, dissolved	0.0206	0.0050	mg/L	0.0198		104	80-120			
Beryllium, dissolved	0.0186	0.00010	mg/L	0.0198		94	80-120			
Bismuth, dissolved	0.0193	0.00010	mg/L	0.0200		96	80-120			
Boron, dissolved	< 0.0500	0.0500	mg/L	0.0200		97	80-120			
Cadmium, dissolved	0.0201	0.000010	mg/L	0.0199		101	80-120			
Calcium, dissolved	2.12	0.20	mg/L	2.02		105	80-120			
Chromium, dissolved	0.0199	0.00050	mg/L	0.0198		100	80-120			
Cobalt, dissolved	0.0193	0.00010	mg/L	0.0199		97	80-120			
Copper, dissolved	0.0200	0.00040	mg/L	0.0200		100	80-120			
Iron, dissolved	1.88	0.010	mg/L	2.02		93	80-120			
Lead, dissolved	0.0194	0.00020	mg/L	0.0199		98	80-120			
Magnesium, dissolved	1.93	0.010	mg/L	2.02		96	80-120			
Manganese, dissolved	0.0194	0.00020	mg/L	0.0199		97	80-120			
Molybdenum, dissolved	0.0199	0.00010	mg/L	0.0200		100	80-120			
Nickel, dissolved	0.0196	0.00040	mg/L	0.0200		98	80-120			
Phosphorus, dissolved	2.00	0.050	mg/L	2.00		100	80-120			
Potassium, dissolved	1.89	0.10	mg/L	2.02		93	80-120			
Selenium, dissolved	0.0196	0.00050	mg/L	0.0200		98	80-120			
Silicon, dissolved	2.0	1.0	mg/L	2.00		102	80-120			
Silver, dissolved	0.0197	0.000050	mg/L	0.0200		98	80-120			
Sodium, dissolved	2.01	0.10	mg/L	2.02		99	80-120			
Strontium, dissolved	0.0205	0.0010	mg/L	0.0200		103	80-120			
Sulfur, dissolved	5.3	3.0	mg/L	5.00		107	80-120			
Tellurium, dissolved	0.0210	0.00050	mg/L	0.0200		105	80-120			
Thallium, dissolved	0.0194	0.000020	mg/L	0.0199		97	80-120			
Thorium, dissolved	0.0193	0.00010	mg/L	0.0200		97	80-120			
Tin, dissolved	0.0214	0.00020	mg/L	0.0200		107	80-120			
Titanium, dissolved	0.0208	0.0050	mg/L	0.0200		104	80-120			
Tungsten, dissolved	0.0211	0.0010	mg/L	0.0200		106	80-120			
Uranium, dissolved	0.0193	0.000020	mg/L	0.0200		97	80-120			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0L2094, Continued										
LCS (B0L2094-BS1), Continued				Prepared: 2020-12-24, Analyzed: 2020-12-23						
Vanadium, dissolved	0.0212	0.0010	mg/L	0.0200		106	80-120			
Zinc, dissolved	0.0219	0.0040	mg/L	0.0200		110	80-120			
Zirconium, dissolved	0.0204	0.00010	mg/L	0.0200		102	80-120			
Duplicate (B0L2094-DUP1)				**Source: 20L2032-01**	Prepared: 2020-12-24, Analyzed: 2020-12-23					
Lithium, dissolved	0.00234	0.00010	mg/L		0.00241			3	20	
Aluminum, dissolved	0.0312	0.0050	mg/L		0.0328			5	20	
Antimony, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Arsenic, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Barium, dissolved	0.0124	0.0050	mg/L		0.0120				20	
Beryllium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Bismuth, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Boron, dissolved	0.118	0.0500	mg/L		0.0883				20	
Cadmium, dissolved	0.000024	0.000010	mg/L		0.000056			82	20	
Calcium, dissolved	24.9	0.20	mg/L		25.8			3	20	
Chromium, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Cobalt, dissolved	0.00047	0.00010	mg/L		0.00050			5	20	
Copper, dissolved	0.0122	0.00040	mg/L		0.0125			3	20	
Iron, dissolved	0.059	0.010	mg/L		0.060			1	20	
Lead, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Magnesium, dissolved	2.07	0.010	mg/L		2.12			3	20	
Manganese, dissolved	0.116	0.00020	mg/L		0.120			3	20	
Molybdenum, dissolved	0.00055	0.00010	mg/L		0.00054			1	20	
Nickel, dissolved	0.00151	0.00040	mg/L		0.00144				20	
Phosphorus, dissolved	0.089	0.050	mg/L		0.088				20	
Potassium, dissolved	8.89	0.10	mg/L		9.23			4	20	
Selenium, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Silicon, dissolved	4.6	1.0	mg/L		5.0			8	20	
Silver, dissolved	< 0.000050	0.000050	mg/L		< 0.000050				20	
Sodium, dissolved	35.6	0.10	mg/L		36.5			2	20	
Strontium, dissolved	0.173	0.0010	mg/L		0.178			3	20	
Sulfur, dissolved	40.9	3.0	mg/L		27.1			41	20	RPD
Tellurium, dissolved	< 0.00050	0.00050	mg/L		< 0.00050				20	
Thallium, dissolved	< 0.000020	0.000020	mg/L		< 0.000020				20	
Thorium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Tin, dissolved	< 0.00020	0.00020	mg/L		< 0.00020				20	
Titanium, dissolved	< 0.0050	0.0050	mg/L		< 0.0050				20	
Tungsten, dissolved	< 0.0010	0.0010	mg/L		< 0.0010				20	
Uranium, dissolved	< 0.000020	0.000020	mg/L		< 0.000020				20	
Vanadium, dissolved	0.0013	0.0010	mg/L		0.0014				20	
Zinc, dissolved	0.0453	0.0040	mg/L		0.0472			4	20	
Zirconium, dissolved	< 0.00010	0.00010	mg/L		< 0.00010				20	
Reference (B0L2094-SRM1)				Prepared: 2020-12-24, Analyzed: 2020-12-23						
Lithium, dissolved	0.0947	0.00010	mg/L	0.100		95	70-130			
Aluminum, dissolved	0.230	0.0050	mg/L	0.235		98	70-130			
Antimony, dissolved	0.0474	0.00020	mg/L	0.0431		110	70-130			
Arsenic, dissolved	0.456	0.00050	mg/L	0.423		108	70-130			
Barium, dissolved	3.19	0.0050	mg/L	3.30		97	70-130			
Beryllium, dissolved	0.208	0.00010	mg/L	0.209		99	70-130			
Boron, dissolved	1.57	0.0500	mg/L	1.65		95	70-130			
Cadmium, dissolved	0.229	0.000010	mg/L	0.221		104	70-130			
Calcium, dissolved	7.33	0.20	mg/L	7.72		95	70-130			
Chromium, dissolved	0.439	0.00050	mg/L	0.434		101	70-130			
Cobalt, dissolved	0.126	0.00010	mg/L	0.124		101	70-130			
Copper, dissolved	0.826	0.00040	mg/L	0.815		101	70-130			
Iron, dissolved	1.23	0.010	mg/L	1.27		97	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Dissolved Metals, Batch B0L2094, Continued										
Reference (B0L2094-SRM1), Continued				Prepared: 2020-12-24, Analyzed: 2020-12-23						
Lead, dissolved	0.109	0.00020	mg/L	0.110		99	70-130			
Magnesium, dissolved	6.55	0.010	mg/L	6.59		99	70-130			
Manganese, dissolved	0.329	0.00020	mg/L	0.342		96	70-130			
Molybdenum, dissolved	0.417	0.00010	mg/L	0.404		103	70-130			
Nickel, dissolved	0.855	0.00040	mg/L	0.835		102	70-130			
Phosphorus, dissolved	0.553	0.050	mg/L	0.499		111	70-130			
Potassium, dissolved	2.92	0.10	mg/L	2.88		101	70-130			
Selenium, dissolved	0.0333	0.00050	mg/L	0.0324		103	70-130			
Sodium, dissolved	17.9	0.10	mg/L	18.0		99	70-130			
Strontium, dissolved	0.952	0.0010	mg/L	0.935		102	70-130			
Thallium, dissolved	0.0382	0.000020	mg/L	0.0385		99	70-130			
Uranium, dissolved	0.240	0.000020	mg/L	0.258		93	70-130			
Vanadium, dissolved	0.881	0.0010	mg/L	0.873		101	70-130			
Zinc, dissolved	0.855	0.0040	mg/L	0.848		101	70-130			
Non-Chlorinated Phenols, Batch B0L1891										
Blank (B0L1891-BLK1)				Prepared: 2020-12-20, Analyzed: 2020-12-23						
Phenol	< 0.50	0.50	µg/L							
2-Methylphenol	< 0.50	0.50	µg/L							
3 & 4-Methylphenol	< 0.50	0.50	µg/L							
2,4-Dimethylphenol	< 0.50	0.50	µg/L							
2-Nitrophenol	< 0.50	0.50	µg/L							
4-Nitrophenol	< 0.50	0.50	µg/L							
2,4-Dinitrophenol	< 0.50	0.50	µg/L							
2-Methyl-4,6-dinitrophenol	< 0.50	0.50	µg/L							
Surrogate: 2,4-Dibromophenol	*1.36*		*µg/L*	2.02		*67*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*1.25*		*µg/L*	2.00		*62*	*60-130*			
LCS (B0L1891-BS1)				Prepared: 2020-12-20, Analyzed: 2020-12-23						
Phenol	8.62	0.50	µg/L	10.0		86	60-130			
2-Methylphenol	10.1	0.50	µg/L	10.0		101	60-115			
3 & 4-Methylphenol	19.5	0.50	µg/L	20.0		97	60-109			
2,4-Dimethylphenol	11.3	0.50	µg/L	10.0		113	60-130			
2-Nitrophenol	9.04	0.50	µg/L	10.0		90	57-117			
4-Nitrophenol	11.8	0.50	µg/L	10.0		118	63-130			
2,4-Dinitrophenol	10.7	0.50	µg/L	9.95		107	35-130			
2-Methyl-4,6-dinitrophenol	9.84	0.50	µg/L	10.0		98	53-130			
Surrogate: 2,4-Dibromophenol	*1.78*		*µg/L*	2.02		*88*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*1.47*		*µg/L*	2.00		*74*	*60-130*			
LCS Dup (B0L1891-BSD1)				Prepared: 2020-12-20, Analyzed: 2020-12-23						
Phenol	9.61	0.50	µg/L	10.0		96	60-130	11	23	
2-Methylphenol	11.1	0.50	µg/L	10.0		111	60-115	10	20	
3 & 4-Methylphenol	20.9	0.50	µg/L	20.0		104	60-109	7	16	
2,4-Dimethylphenol	10.6	0.50	µg/L	10.0		106	60-130	7	24	
2-Nitrophenol	9.48	0.50	µg/L	10.0		95	57-117	5	22	
4-Nitrophenol	10.6	0.50	µg/L	10.0		106	63-130	11	40	
2,4-Dinitrophenol	10.3	0.50	µg/L	9.95		104	35-130	4	27	
2-Methyl-4,6-dinitrophenol	8.41	0.50	µg/L	10.0		84	53-130	16	20	
Surrogate: 2,4-Dibromophenol	*1.96*		*µg/L*	2.02		*97*	*60-130*			
Surrogate: 2,4,6-Tribromophenol	*1.60*		*µg/L*	2.00		*80*	*60-130*			
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0L1816										

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0L1816, Continued										
Blank (B0L1816-BLK1)				Prepared: 2020-12-19, Analyzed: 2020-12-19						
Acenaphthene	< 0.050	0.050	µg/L							
Acenaphthylene	< 0.200	0.200	µg/L							
Acridine	< 0.050	0.050	µg/L							
Anthracene	< 0.010	0.010	µg/L							
Benz(a)anthracene	< 0.010	0.010	µg/L							
Benzo(a)pyrene	< 0.010	0.010	µg/L							
Benzo(b+j)fluoranthene	< 0.050	0.050	µg/L							
Benzo(g,h,i)perylene	< 0.050	0.050	µg/L							
Benzo(k)fluoranthene	< 0.050	0.050	µg/L							
2-Chloronaphthalene	< 0.100	0.100	µg/L							
Chrysene	< 0.050	0.050	µg/L							
Dibenz(a,h)anthracene	< 0.010	0.010	µg/L							
Fluoranthene	< 0.030	0.030	µg/L							
Fluorene	< 0.050	0.050	µg/L							
Indeno(1,2,3-cd)pyrene	< 0.050	0.050	µg/L							
1-Methylnaphthalene	< 0.100	0.100	µg/L							
2-Methylnaphthalene	< 0.100	0.100	µg/L							
Naphthalene	< 0.200	0.200	µg/L							
Phenanthrene	< 0.100	0.100	µg/L							
Pyrene	< 0.020	0.020	µg/L							
Quinoline	< 0.050	0.050	µg/L							
Surrogate: Acridine-d9	*2.71*		*µg/L*	4.31		*63*	*50-140*			
Surrogate: Naphthalene-d8	*5.25*		*µg/L*	4.47		*117*	*50-140*			
Surrogate: Perylene-d12	*4.18*		*µg/L*	4.47		*94*	*50-140*			
LCS (B0L1816-BS1)				Prepared: 2020-12-19, Analyzed: 2020-12-19						
Acenaphthene	3.74	0.050	µg/L	4.44		84	55-137			
Acenaphthylene	3.81	0.200	µg/L	4.44		86	53-140			
Acridine	3.23	0.050	µg/L	4.44		73	50-120			
Anthracene	4.08	0.010	µg/L	4.44		92	64-130			
Benz(a)anthracene	4.10	0.010	µg/L	4.44		92	57-140			
Benzo(a)pyrene	3.44	0.010	µg/L	4.44		77	63-133			
Benzo(b+j)fluoranthene	7.65	0.050	µg/L	8.89		86	60-129			
Benzo(g,h,i)perylene	3.86	0.050	µg/L	4.44		87	52-139			
Benzo(k)fluoranthene	3.27	0.050	µg/L	4.44		73	50-138			
2-Chloronaphthalene	4.03	0.100	µg/L	4.38		92	50-139			
Chrysene	4.53	0.050	µg/L	4.44		102	59-140			
Dibenz(a,h)anthracene	3.65	0.010	µg/L	4.44		82	53-136			
Fluoranthene	4.29	0.030	µg/L	4.44		97	67-135			
Fluorene	3.67	0.050	µg/L	4.44		83	57-134			
Indeno(1,2,3-cd)pyrene	3.08	0.050	µg/L	4.44		69	52-129			
1-Methylnaphthalene	4.12	0.100	µg/L	4.44		93	50-140			
2-Methylnaphthalene	4.36	0.100	µg/L	4.44		98	50-140			
Naphthalene	4.80	0.200	µg/L	4.44		108	50-140			
Phenanthrene	3.70	0.100	µg/L	4.44		83	61-134			
Pyrene	4.28	0.020	µg/L	4.44		96	66-131			
Quinoline	4.90	0.050	µg/L	4.44		110	50-140			
Surrogate: Acridine-d9	*2.87*		*µg/L*	4.31		*67*	*50-140*			
Surrogate: Naphthalene-d8	*5.64*		*µg/L*	4.47		*126*	*50-140*			
Surrogate: Perylene-d12	*4.16*		*µg/L*	4.47		*93*	*50-140*			
LCS Dup (B0L1816-BSD1)				Prepared: 2020-12-19, Analyzed: 2020-12-19						
Acenaphthene	3.53	0.050	µg/L	4.44		79	55-137	6	18	
Acenaphthylene	3.60	0.200	µg/L	4.44		81	53-140	5	20	
Acridine	3.15	0.050	µg/L	4.44		71	50-120	3	30	
Anthracene	4.00	0.010	µg/L	4.44		90	64-130	2	15	

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Polycyclic Aromatic Hydrocarbons (PAH), Batch B0L1816, Continued										
LCS Dup (B0L1816-BSD1), Continued				Prepared: 2020-12-19, Analyzed: 2020-12-19						
Benz(a)anthracene	4.17	0.010	µg/L	4.44		94	57-140	2	25	
Benzo(a)pyrene	3.46	0.010	µg/L	4.44		78	63-133	< 1	18	
Benzo(b+j)fluoranthene	7.70	0.050	µg/L	8.89		87	60-129	< 1	17	
Benzo(g,h,i)perylene	3.63	0.050	µg/L	4.44		82	52-139	6	22	
Benzo(k)fluoranthene	3.26	0.050	µg/L	4.44		73	50-138	< 1	26	
2-Chloronaphthalene	3.94	0.100	µg/L	4.38		90	50-139	2	23	
Chrysene	4.55	0.050	µg/L	4.44		102	59-140	< 1	23	
Dibenz(a,h)anthracene	3.66	0.010	µg/L	4.44		82	53-136	< 1	21	
Fluoranthene	4.27	0.030	µg/L	4.44		96	67-135	< 1	18	
Fluorene	3.61	0.050	µg/L	4.44		81	57-134	2	18	
Indeno(1,2,3-cd)pyrene	3.09	0.050	µg/L	4.44		70	52-129	< 1	21	
1-Methylnaphthalene	3.99	0.100	µg/L	4.44		90	50-140	3	20	
2-Methylnaphthalene	4.26	0.100	µg/L	4.44		96	50-140	2	21	
Naphthalene	4.58	0.200	µg/L	4.44		103	50-140	5	22	
Phenanthrene	3.63	0.100	µg/L	4.44		82	61-134	2	17	
Pyrene	4.24	0.020	µg/L	4.44		95	66-131	1	19	
Quinoline	4.92	0.050	µg/L	4.44		111	50-140	< 1	14	
Surrogate: Acridine-d9	*2.74*		*µg/L*	4.31		*64*	*50-140*			
Surrogate: Naphthalene-d8	*5.35*		*µg/L*	4.47		*120*	*50-140*			
Surrogate: Perylene-d12	*4.35*		*µg/L*	4.47		*97*	*50-140*			
Total Metals, Batch B0L1903										
Blank (B0L1903-BLK1)				Prepared: 2020-12-20, Analyzed: 2020-12-21						
Aluminum, total	< 0.0050	0.0050	mg/L							
Antimony, total	< 0.00020	0.00020	mg/L							
Arsenic, total	< 0.00050	0.00050	mg/L							
Barium, total	< 0.0050	0.0050	mg/L							
Beryllium, total	< 0.00010	0.00010	mg/L							
Bismuth, total	< 0.00010	0.00010	mg/L							
Boron, total	< 0.0500	0.0500	mg/L							
Cadmium, total	< 0.000010	0.000010	mg/L							
Calcium, total	< 0.20	0.20	mg/L							
Chromium, total	< 0.00050	0.00050	mg/L							
Cobalt, total	< 0.00010	0.00010	mg/L							
Copper, total	< 0.00040	0.00040	mg/L							
Iron, total	< 0.010	0.010	mg/L							
Lead, total	< 0.00020	0.00020	mg/L							
Lithium, total	< 0.00010	0.00010	mg/L							
Magnesium, total	< 0.010	0.010	mg/L							
Manganese, total	< 0.00020	0.00020	mg/L							
Molybdenum, total	< 0.00010	0.00010	mg/L							
Nickel, total	< 0.00040	0.00040	mg/L							
Phosphorus, total	< 0.050	0.050	mg/L							
Potassium, total	< 0.10	0.10	mg/L							
Selenium, total	< 0.00050	0.00050	mg/L							
Silicon, total	< 1.0	1.0	mg/L							
Silver, total	< 0.000050	0.000050	mg/L							
Sodium, total	< 0.10	0.10	mg/L							
Strontium, total	< 0.0010	0.0010	mg/L							
Sulfur, total	< 3.0	3.0	mg/L							
Tellurium, total	< 0.00050	0.00050	mg/L							
Thallium, total	< 0.000020	0.000020	mg/L							
Thorium, total	< 0.00010	0.00010	mg/L							
Tin, total	< 0.00020	0.00020	mg/L							
Titanium, total	< 0.0050	0.0050	mg/L							

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0L1903, Continued										
Blank (B0L1903-BLK1), Continued				Prepared: 2020-12-20, Analyzed: 2020-12-21						
Tungsten, total	< 0.0010	0.0010	mg/L							
Uranium, total	< 0.000020	0.000020	mg/L							
Vanadium, total	< 0.0010	0.0010	mg/L							
Zinc, total	< 0.0040	0.0040	mg/L							
Zirconium, total	< 0.00010	0.00010	mg/L							
LCS (B0L1903-BS1)				Prepared: 2020-12-20, Analyzed: 2020-12-21						
Aluminum, total	0.0220	0.0050	mg/L	0.0199		111	80-120			
Antimony, total	0.0227	0.00020	mg/L	0.0200		114	80-120			
Arsenic, total	0.0219	0.00050	mg/L	0.0200		109	80-120			
Barium, total	0.0214	0.0050	mg/L	0.0198		108	80-120			
Beryllium, total	0.0208	0.00010	mg/L	0.0198		105	80-120			
Bismuth, total	0.0221	0.00010	mg/L	0.0200		111	80-120			
Boron, total	< 0.0500	0.0500	mg/L	0.0200		120	80-120			
Cadmium, total	0.0211	0.000010	mg/L	0.0199		106	80-120			
Calcium, total	2.26	0.20	mg/L	2.02		112	80-120			
Chromium, total	0.0197	0.00050	mg/L	0.0198		100	80-120			
Cobalt, total	0.0203	0.00010	mg/L	0.0199		102	80-120			
Copper, total	0.0204	0.00040	mg/L	0.0200		102	80-120			
Iron, total	2.03	0.010	mg/L	2.02		100	80-120			
Lead, total	0.0237	0.00020	mg/L	0.0199		119	80-120			
Lithium, total	0.0213	0.00010	mg/L	0.0200		107	80-120			
Magnesium, total	2.20	0.010	mg/L	2.02		109	80-120			
Manganese, total	0.0191	0.00020	mg/L	0.0199		96	80-120			
Molybdenum, total	0.0206	0.00010	mg/L	0.0200		103	80-120			
Nickel, total	0.0203	0.00040	mg/L	0.0200		102	80-120			
Phosphorus, total	2.01	0.050	mg/L	2.00		100	80-120			
Potassium, total	2.03	0.10	mg/L	2.02		100	80-120			
Selenium, total	0.0202	0.00050	mg/L	0.0200		101	80-120			
Silicon, total	2.1	1.0	mg/L	2.00		107	80-120			
Silver, total	0.0211	0.000050	mg/L	0.0200		106	80-120			
Sodium, total	2.20	0.10	mg/L	2.02		109	80-120			
Strontium, total	0.0204	0.0010	mg/L	0.0200		102	80-120			
Sulfur, total	4.3	3.0	mg/L	5.00		86	80-120			
Tellurium, total	0.0240	0.00050	mg/L	0.0200		120	80-120			
Thallium, total	0.0216	0.000020	mg/L	0.0199		108	80-120			
Thorium, total	0.0214	0.00010	mg/L	0.0200		107	80-120			
Tin, total	0.0215	0.00020	mg/L	0.0200		108	80-120			
Titanium, total	0.0160	0.0050	mg/L	0.0200		80	80-120			
Tungsten, total	0.0213	0.0010	mg/L	0.0200		106	80-120			
Uranium, total	0.0216	0.000020	mg/L	0.0200		108	80-120			
Vanadium, total	0.0215	0.0010	mg/L	0.0200		108	80-120			
Zinc, total	0.0223	0.0040	mg/L	0.0200		112	80-120			
Zirconium, total	0.0208	0.00010	mg/L	0.0200		104	80-120			
Reference (B0L1903-SRM1)				Prepared: 2020-12-20, Analyzed: 2020-12-21						
Aluminum, total	0.298	0.0050	mg/L	0.299		100	70-130			
Antimony, total	0.0556	0.00020	mg/L	0.0517		108	70-130			
Arsenic, total	0.133	0.00050	mg/L	0.119		111	70-130			
Barium, total	0.839	0.0050	mg/L	0.801		105	70-130			
Beryllium, total	0.0501	0.00010	mg/L	0.0501		100	70-130			
Boron, total	3.91	0.0500	mg/L	4.11		95	70-130			
Cadmium, total	0.0531	0.000010	mg/L	0.0503		106	70-130			
Calcium, total	10.9	0.20	mg/L	10.7		102	70-130			
Chromium, total	0.252	0.00050	mg/L	0.250		101	70-130			
Cobalt, total	0.0393	0.00010	mg/L	0.0384		102	70-130			
Copper, total	0.505	0.00040	mg/L	0.487		104	70-130			

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Total Metals, Batch B0L1903, Continued										
Reference (B0L1903-SRM1), Continued				Prepared: 2020-12-20, Analyzed: 2020-12-21						
Iron, total	0.523	0.010	mg/L	0.504		104	70-130			
Lead, total	0.321	0.00020	mg/L	0.278		116	70-130			
Lithium, total	0.412	0.00010	mg/L	0.398		104	70-130			
Magnesium, total	4.03	0.010	mg/L	3.59		112	70-130			
Manganese, total	0.103	0.00020	mg/L	0.111		93	70-130			
Molybdenum, total	0.205	0.00010	mg/L	0.196		104	70-130			
Nickel, total	0.252	0.00040	mg/L	0.248		102	70-130			
Phosphorus, total	0.218	0.050	mg/L	0.213		102	70-130			
Potassium, total	6.18	0.10	mg/L	5.89		105	70-130			
Selenium, total	0.126	0.00050	mg/L	0.120		105	70-130			
Sodium, total	9.63	0.10	mg/L	8.71		111	70-130			
Strontium, total	0.406	0.0010	mg/L	0.393		103	70-130			
Thallium, total	0.0826	0.000020	mg/L	0.0787		105	70-130			
Uranium, total	0.0356	0.000020	mg/L	0.0344		103	70-130			
Vanadium, total	0.391	0.0010	mg/L	0.391		100	70-130			
Zinc, total	2.58	0.0040	mg/L	2.50		103	70-130			
Total Metals, Batch B0L2083										
Blank (B0L2083-BLK1)				Prepared: 2020-12-22, Analyzed: 2020-12-22						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B0L2083-BLK2)				Prepared: 2020-12-22, Analyzed: 2020-12-22						
Mercury, total	< 0.000010	0.000010	mg/L							
Blank (B0L2083-BLK3)				Prepared: 2020-12-22, Analyzed: 2020-12-22						
Mercury, total	< 0.000010	0.000010	mg/L							
Reference (B0L2083-SRM1)				Prepared: 2020-12-22, Analyzed: 2020-12-22						
Mercury, total	0.00694	0.000010	mg/L	0.00581		119	70-130			
Reference (B0L2083-SRM2)				Prepared: 2020-12-22, Analyzed: 2020-12-22						
Mercury, total	0.00682	0.000010	mg/L	0.00581		117	70-130			
Reference (B0L2083-SRM3)				Prepared: 2020-12-22, Analyzed: 2020-12-22						
Mercury, total	0.00700	0.000010	mg/L	0.00581		120	70-130			
Volatile Organic Compounds (VOC), Batch B0L1789										
Blank (B0L1789-BLK1)				Prepared: 2020-12-19, Analyzed: 2020-12-19						
Benzene	< 0.5	0.5	µg/L							
Bromodichloromethane	< 1.0	1.0	µg/L							
Bromoform	< 1.0	1.0	µg/L							
Carbon tetrachloride	< 0.5	0.5	µg/L							
Chlorobenzene	< 1.0	1.0	µg/L							
Chloroethane	< 2.0	2.0	µg/L							
Chloroform	< 1.0	1.0	µg/L							
Dibromochloromethane	< 1.0	1.0	µg/L							
1,2-Dibromoethane	< 0.3	0.3	µg/L							
Dibromomethane	< 1.0	1.0	µg/L							
1,2-Dichlorobenzene	< 0.5	0.5	µg/L							
1,3-Dichlorobenzene	< 1.0	1.0	µg/L							
1,4-Dichlorobenzene	< 1.0	1.0	µg/L							
1,1-Dichloroethane	< 1.0	1.0	µg/L							
1,2-Dichloroethane	< 1.0	1.0	µg/L							
1,1-Dichloroethylene	< 1.0	1.0	µg/L							

APPENDIX 2: QUALITY CONTROL RESULTS

REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Volatile Organic Compounds (VOC), Batch B0L1789, Continued										
Blank (B0L1789-BLK1), Continued				Prepared: 2020-12-19, Analyzed: 2020-12-19						
cis-1,2-Dichloroethylene	< 1.0	1.0	µg/L							
trans-1,2-Dichloroethylene	< 1.0	1.0	µg/L							
Dichloromethane	< 3.0	3.0	µg/L							
1,2-Dichloropropane	< 1.0	1.0	µg/L							
1,3-Dichloropropene (cis + trans)	< 1.0	1.0	µg/L							
Ethylbenzene	< 1.0	1.0	µg/L							
Methyl tert-butyl ether	< 1.0	1.0	µg/L							
Styrene	< 1.0	1.0	µg/L							
1,1,2,2-Tetrachloroethane	< 0.5	0.5	µg/L							
Tetrachloroethylene	< 1.0	1.0	µg/L							
Toluene	< 1.0	1.0	µg/L							
1,1,1-Trichloroethane	< 1.0	1.0	µg/L							
1,1,2-Trichloroethane	< 1.0	1.0	µg/L							
Trichloroethylene	< 1.0	1.0	µg/L							
Trichlorofluoromethane	< 1.0	1.0	µg/L							
Vinyl chloride	< 1.0	1.0	µg/L							
Xylenes (total)	< 2.0	2.0	µg/L							
Surrogate: Toluene-d8	*26.6*		*µg/L*	26.5		*100*	*70-130*			
Surrogate: 4-Bromofluorobenzene	*19.2*		*µg/L*	24.9		*77*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*17.5*		*µg/L*	25.5		*69*	*70-130*			*S02*
LCS (B0L1789-BS1)				Prepared: 2020-12-19, Analyzed: 2020-12-19						
Benzene	20.9	0.5	µg/L	20.0		104	70-130			
Bromodichloromethane	21.1	1.0	µg/L	20.0		105	70-130			
Bromoform	18.0	1.0	µg/L	20.1		90	70-130			
Carbon tetrachloride	20.6	0.5	µg/L	20.2		102	70-130			
Chlorobenzene	20.5	1.0	µg/L	20.1		102	70-130			
Chloroethane	25.4	2.0	µg/L	20.0		127	60-140			
Chloroform	23.5	1.0	µg/L	20.1		117	70-130			
Dibromochloromethane	21.2	1.0	µg/L	20.2		105	70-130			
1,2-Dibromoethane	19.9	0.3	µg/L	20.0		99	70-130			
Dibromomethane	21.8	1.0	µg/L	20.0		109	70-130			
1,2-Dichlorobenzene	22.5	0.5	µg/L	20.1		112	70-130			
1,3-Dichlorobenzene	23.2	1.0	µg/L	20.1		116	70-130			
1,4-Dichlorobenzene	24.3	1.0	µg/L	20.1		121	70-130			
1,1-Dichloroethane	23.6	1.0	µg/L	20.1		118	70-130			
1,2-Dichloroethane	24.4	1.0	µg/L	20.1		121	70-130			
1,1-Dichloroethylene	23.5	1.0	µg/L	20.1		117	70-130			
cis-1,2-Dichloroethylene	21.5	1.0	µg/L	20.0		108	70-130			
trans-1,2-Dichloroethylene	23.2	1.0	µg/L	20.0		116	70-130			
Dichloromethane	23.4	3.0	µg/L	20.1		116	70-130			
1,2-Dichloropropane	20.2	1.0	µg/L	20.1		100	70-130			
1,3-Dichloropropene (cis + trans)	31.7	1.0	µg/L	40.0		79	70-130			
Ethylbenzene	18.3	1.0	µg/L	20.0		92	70-130			
Methyl tert-butyl ether	22.0	1.0	µg/L	20.0		110	70-130			
Styrene	18.4	1.0	µg/L	20.0		92	70-130			
1,1,2,2-Tetrachloroethane	22.4	0.5	µg/L	20.1		112	70-130			
Tetrachloroethylene	22.8	1.0	µg/L	20.1		113	70-130			
Toluene	20.4	1.0	µg/L	20.0		102	70-130			
1,1,1-Trichloroethane	21.0	1.0	µg/L	20.0		105	70-130			
1,1,2-Trichloroethane	21.2	1.0	µg/L	20.1		105	70-130			
Trichloroethylene	23.8	1.0	µg/L	20.1		118	70-130			
Trichlorofluoromethane	27.7	1.0	µg/L	20.0		138	60-140			
Vinyl chloride	21.1	1.0	µg/L	20.0		105	60-140			
Xylenes (total)	61.6	2.0	µg/L	60.0		103	70-130			
Surrogate: Toluene-d8	*25.7*		*µg/L*	26.5		*97*	*70-130*			

APPENDIX 2: QUALITY CONTROL RESULTS

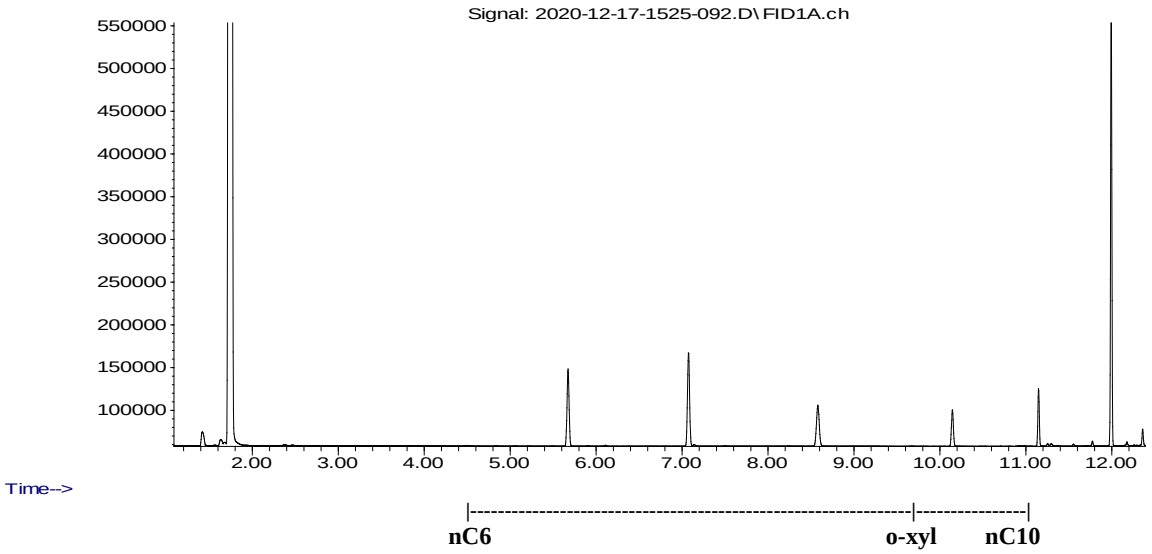
REPORTED TO	Whistler, Resort Municipality of	**WORK ORDER**	20L2032
PROJECT	WWTP	**REPORTED**	2020-12-24 15:00

Analyte	Result	RL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Qualifier
Volatile Organic Compounds (VOC), Batch B0L1789, Continued										
LCS (B0L1789-BS1), Continued				Prepared: 2020-12-19, Analyzed: 2020-12-19						
Surrogate: 4-Bromofluorobenzene	*26.2*		*µg/L*	24.9		*105*	*70-130*			
Surrogate: 1,4-Dichlorobenzene-d4	*25.6*		*µg/L*	25.5		*100*	*70-130*			

QC Qualifiers:

RPD	Relative percent difference (RPD) of duplicate analysis are outside of control limits for unknown reason(s).
S02	Surrogate recovery outside of control limits. Data accepted based on acceptable recovery of other surrogates.

Sample ID: Final Effluent 2:00pm
Caro ID: 20L2032-01



APPENDIX D: WASTEWATER TREATMENT PLANT DATA

Date	Effluent (m3/day)	Total Suspended Solids (mg/L)	CBOD5 (mg/L)	Soluble PO4 as P (mg/L)	PO4 as P (kg/day)	Total Phosphorous (mg/L)	Fecal Coliform (cfu/100mL)
01/01/2020	15803	7	6	0.03	0.47	0.22	
01/02/2020	14905	6		0.01	0.15		
01/03/2020	16118	12		0.01	0.16		
01/04/2020	16663	17		0.02	0.33		
01/05/2020	14442	12		0.02	0.29		
01/06/2020	12408	7		0.01	0.12		
01/07/2020	11731	11		0.04	0.47		
01/08/2020	12965	9	7	0.02	0.26	0.25	2.00
01/09/2020	12684	6		0.01	0.13		2.00
01/10/2020	11889	4		0.01	0.12		
01/11/2020	12626	9		0.02	0.25		
01/12/2020	11785	11		0.03	0.35		
01/13/2020	10284	10		0.04	0.41		
01/14/2020	9998	9		0.05	0.50		
01/15/2020	9860	4	7	0.05	0.49	0.21	4.00
01/16/2020	9944	14		0.01	0.10		2.00
01/17/2020	10737	5		0.03	0.32		
01/18/2020	12408	4		0.03	0.37		
01/19/2020	12514	6		0.05	0.63		
01/20/2020	12526	4		0.04	0.50		
01/21/2020	11838	7		0.05	0.59		
01/22/2020	11433	7	13	0.03	0.34	0.03	2.00
01/23/2020	13819	7		0.08	1.11		2.00
01/24/2020	15169	9		0.03	0.46		
01/25/2020	15704	12		0.07	1.10		
01/26/2020	15352	11		0.03	0.46		
01/27/2020	13475	6		0.04	0.54		
01/28/2020	13075	8		0.05	0.65		
01/29/2020	13260	6	7	0.05	0.66	0.30	2.00
01/30/2020	12485	6		0.02	0.25		2.00
01/31/2020	20854	32		0.07	1.46		
02/01/2020	26793	13		0.02	0.54		
02/02/2020	19990	8		0.02	0.40		
02/03/2020	16487	6		0.02	0.33		
02/04/2020	14943	6		0.05	0.75		
02/05/2020	13726	8	6	0.04	0.55	0.31	23.00

02/06/2020	13067	8		0.07	0.91		2.00
02/07/2020	13101	13		0.03	0.39		
02/08/2020	13527	2		0.05	0.68		
02/09/2020	12739	8		0.07	0.89		
02/10/2020	11610	11		0.07	0.81		
02/11/2020	11304	11		0.03	0.34		
02/12/2020	10882	6	5	0.03	0.33	0.29	13.00
02/13/2020	10071	16		0.02	0.20		2.00
02/14/2020	12201	7		0.02	0.24		
02/15/2020	13569	9		0.04	0.54		
02/16/2020	13619	15		0.08	1.09		
02/17/2020	13291	13		0.05	0.66		
02/18/2020	12034	8		0.07	0.84		
02/19/2020	11681	9	6	0.05	0.58	0.42	2.00
02/20/2020	12012	8		0.07	0.84		2.00
02/21/2020	12264	13		0.04	0.49		
02/22/2020	12921	12		0.08	1.03		
02/23/2020	11593	13		0.04	0.46		
02/24/2020	11303	12		0.03	0.34		
02/25/2020	10754	10		0.04	0.43		
02/26/2020	10640	7	24	0.04	0.43	0.32	2.00
02/27/2020	10862	9		0.09	0.98		2.00
02/28/2020	12039	12		0.07	0.84		
02/29/2020	12530	8		0.12	1.50		
03/01/2020	11751	6		0.03	0.35		
03/02/2020	11153	5		0.03	0.33		
03/03/2020	10921	6		0.03	0.33		
03/04/2020	10790	11	2	0.03	0.32	0.28	2.00
03/05/2020	11010	11		0.05	0.55		2.00
03/06/2020	11213	5		0.03	0.34		
03/07/2020	11937	8		0.14	1.67		
03/08/2020	11962	11		0.02	0.24		
03/09/2020	10565	11		0.03	0.32		
03/10/2020	10280	5		0.04	0.41		
03/11/2020	10201	6	7	0.03	0.31	0.29	1.80
03/12/2020	10208	11		0.02	0.20		1.80
03/13/2020	11166	6		0.34	3.80		
03/14/2020	11591	10		0.11	1.28		
03/15/2020	10522	10		0.21	2.21		
03/16/2020	9830	2		0.03	0.29		
03/17/2020	9358	13		0.02	0.19		
03/18/2020	8696	5	8	0.02	0.17	0.28	1.80
03/19/2020	8052	5		0.02	0.16		1.80
03/20/2020	7934	8		0.02	0.16		

03/21/2020	7840	4		0.05	0.39		
03/22/2020	7885	13		0.18	1.42		
03/23/2020	7899	14		0.15	1.18		
03/24/2020	8240	5		0.15	1.24		
03/25/2020	7517	10	5	0.24	1.80	0.45	1.80
03/26/2020	7160	23		0.10	0.72		1.80
03/27/2020	7321	15		0.02	0.15		
03/28/2020	8329	7		0.06	0.50		
03/29/2020	8988	8		0.15	1.35		
03/30/2020	8559	15		0.18	1.54		
03/31/2020	8958	10		0.30	2.69		
04/01/2020	8056	12	7	0.32	2.58	0.68	2.00
04/02/2020	7726	8		0.38	2.94		1.80
04/03/2020	7580	12		0.28	2.12		
04/04/2020	7358	6		0.29	2.13		
04/05/2020	7266	5		0.33	2.40		
04/06/2020	6978	5		0.35	2.44		
04/07/2020	7059	4		0.33	2.33		
04/08/2020	7302	7	5	0.33	2.41	0.63	1.80
04/09/2020	7536	4		0.32	2.41		1.80
04/10/2020	7910	12		0.25	1.98		
04/11/2020	7933	7		0.41	3.25		
04/12/2020	7699	7		0.34	2.62		
04/13/2020	7464	5		0.33	2.46		
04/14/2020	7571	8		0.34	2.57		
04/15/2020	7514	5	7	0.36	2.71	0.57	2.00
04/16/2020	7585	4		0.35	2.65		1.80
04/17/2020	7830	7		0.36	2.82		
04/18/2020	7911	6		0.50	3.96		
04/19/2020	7909	3		0.47	3.72		
04/20/2020	7880	5		0.49	3.86		
04/21/2020	7604	5		0.42	3.19		
04/22/2020	7825	10	4	0.38	2.97	0.61	1.80
04/23/2020	7877	4		0.40	3.15		2.00
04/24/2020	7718	2		0.41	3.16		
04/25/2020	8138	8		0.57	4.64		
04/26/2020	7700	7		0.61	4.70		
04/27/2020	7614	8		0.57	4.34		
04/28/2020	5973	10		0.54	3.23		
04/29/2020	8783	7	4	0.54	4.74	0.93	13.00
04/30/2020	8471	7		0.51	4.32		2.00
05/01/2020	7900	9		0.47	3.96		
05/02/2020	7698	9		0.62	4.77		
05/03/2020	8673	10		0.56	4.86		

05/04/2020	7753	9		0.52	4.03		
05/05/2020	7919	6		0.71	5.62		
05/06/2020	7860	10	6	0.52	4.09	0.87	11.00
05/07/2020	7491	7		0.52	3.90		33.00
05/08/2020	7314	9		0.52	3.80		
05/09/2020	7488	10		0.51	3.82		
05/10/2020	7391	9		0.53	3.92	0.74	
05/11/2020	7251	9		0.51	3.70		
05/12/2020	7269	10		1.03	7.49	0.81	
05/13/2020	7182	6	6	1.21	8.69	1.62	33.00
05/14/2020	7174	8		1.14	8.18	1.09	23.00
05/15/2020	6969	8		1.17	8.15		
05/16/2020	7270	8		1.28	9.31		
05/17/2020	7462	12		1.33	9.92		
05/18/2020	7018	9		1.40	9.83		
05/19/2020	6782	10		1.55	10.51		
05/20/2020	6940	11	8	1.59	11.03	1.38	49.00
05/21/2020	6823	8		2.28	15.56		3500.00
05/22/2020	6715	6		2.19	14.71		
05/23/2020	6786	10		2.21	15.00		
05/24/2020	6801	10		0.85	5.78		
05/25/2020	6838	5		0.29	1.98		
05/26/2020	6605	5		0.21	1.39		
05/27/2020	6503	11	8	0.07	0.46	0.25	1.80
05/28/2020	6722	8		0.08	0.54		1.80
05/29/2020	6727	9		0.04	0.27		
05/30/2020	7111	7		0.14	1.00		
05/31/2020	6916	9		0.14	0.97		
06/01/2020	6569	7		0.05	0.33		
06/02/2020	6707	8		0.09	0.60		
06/03/2020	6378	5	6	0.10	0.64	0.39	1.80
06/04/2020	6657	3		0.23	1.53		4.00
06/05/2020	6669	2		0.27	1.80		
06/06/2020	6151	5		0.44	2.71		
06/07/2020	6696	7		0.46	3.08		
06/08/2020	6473	8		0.48	3.11		
06/09/2020	6604	6		0.45	2.97		
06/10/2020	6488	10	5	0.45	2.92	1.08	2.00
06/11/2020	7077	12		0.46	3.26		6.80
06/12/2020	7647	13		0.24	1.84		
06/13/2020	7682	10		0.30	2.30		
06/14/2020	7403	15		0.21	1.55		
06/15/2020	7051	12		0.12	0.85		
06/16/2020	6811	12		0.25	1.70		

06/17/2020	6830	11		0.06	0.41		13.00
06/18/2020	7008	12	7	0.06	0.42	0.76	4.50
06/19/2020	7350	10		0.06	0.44		
06/20/2020	8037	13		0.05	0.40		
06/21/2020	7515	12		0.04	0.30		
06/22/2020	7037	10		0.06	0.42		
06/23/2020	6642	8		0.06	0.40		
06/24/2020	7712	10	10	0.08	0.62	0.75	17.00
06/25/2020	8309	11		0.09	0.75		4.50
06/26/2020	8272	5		0.07	0.58		
06/27/2020	8654	9		0.10	0.87		
06/28/2020	9049	9		0.11	1.00		
06/29/2020	8595	9		0.13	1.12		
06/30/2020	8580	7		0.14	1.20		
07/01/2020	9150	7	3	0.07	0.64	0.51	13.00
07/02/2020	8785	9		0.04	0.35		11.00
07/03/2020	8905	4		0.55	4.90		
07/04/2020	9839	8		0.72	7.08		
07/05/2020	7748	7		1.03	7.98		
07/06/2020	7926	7		0.06	0.48		
07/07/2020	7778	6		0.05	0.39		
07/08/2020	7754	8	6	0.04	0.31	0.28	7.80
07/09/2020	7810	8		0.09	0.70		1.80
07/10/2020	8128	9		0.28	2.28		
07/11/2020	8977	7		0.05	0.45		
07/12/2020	8316	8		0.12	1.00		
07/13/2020	7826	4		0.06	0.47		
07/14/2020	7848	6		0.10	0.78		
07/15/2020	7853	5	5	0.10	0.79	0.28	2.00
07/16/2020	7900	13		0.06	0.47		2.00
07/17/2020	8621	6		0.25	2.16		
07/18/2020	9315	5		0.08	0.75		
07/19/2020	8994	7		0.08	0.72		
07/20/2020	8196	6		0.05	0.41		
07/21/2020	8228	9		0.07	0.58		
07/22/2020	9217	9	6	0.13	1.20	0.26	2.00
07/23/2020	8289	9		0.26	2.16		1.80
07/24/2020	8710	5		0.30	2.61		
07/25/2020	9265	5		0.18	1.67		
07/26/2020	8897	5		0.07	0.62		
07/27/2020	8467	6		0.08	0.68		
07/28/2020	8255	10		0.12	0.99		
07/29/2020	8233	21	8	0.43	3.54	0.72	1.70
07/30/2020	8224	6		0.29	2.38		1.70

07/31/2020	8924	6		0.47	4.19		
08/01/2020	9886	7		0.35	3.46		
08/02/2020	10780	7		0.25	2.70		
08/03/2020	9577	4		0.20	1.92		
08/04/2020	8766	3		0.08	0.70		
08/05/2020	8807	6	5	0.17	1.50	0.49	1.00
08/06/2020	9184	7		0.33	3.03		1.00
08/07/2020	8844	6		0.16	1.42		
08/08/2020	9319	9		0.25	2.33		
08/09/2020	8909	8		0.16	1.43		
08/10/2020	8503	6		0.18	1.53		
08/11/2020	8231	9		0.28	2.30		
08/12/2020	8094	7	5	0.39	3.16	0.83	17.00
08/13/2020	8017	7		0.29	2.32		49.00
08/14/2020	8472	7		0.60	5.08		
08/15/2020	9189	7		0.39	3.58		
08/16/2020	8948	6		0.13	1.16		
08/17/2020	8501	7		0.12	1.02		
08/18/2020	8461	7		0.11	0.93		
08/19/2020	8355	7	5	0.18	1.50	0.43	44.00
08/20/2020	8859	7		0.21	1.86		16.00
08/21/2020	9770	5		0.39	3.81		
08/22/2020	10112	7		0.12	1.21		
08/23/2020	9734	4		0.09	0.88		
08/24/2020	8571	4		0.16	1.37		
08/25/2020	8670	5		0.27	2.34		
08/26/2020	8529	7	4	0.38	3.24	0.46	20.00
08/27/2020	8531	6		0.03	0.26		2.00
08/28/2020	8728	5		0.16	1.40		
08/29/2020	9346	8		0.10	0.93		
08/30/2020	8762	9		0.06	0.53		
08/31/2020	8125	9		0.03	0.24		
09/01/2020	8024	6		0.12	0.96		
09/02/2020	8193	7	7	0.07	0.57	0.62	6.00
09/03/2020	8280	7		0.22	1.82		8.00
09/04/2020	8667	5		0.16	1.39		
09/05/2020	9483	10		0.06	0.57		
09/06/2020	9975	11		0.14	1.40		
09/07/2020	9177	10		0.04	0.37		
09/08/2020	7555	7		0.05	0.38		
09/09/2020	7429	7	7	0.12	0.89	0.67	3.00
09/10/2020	7321	9		0.06	0.44		5.00
09/11/2020	7687	7		0.48	3.69		
09/12/2020	8321	9		0.46	3.83		

09/13/2020	7673	9		0.07	0.54		
09/14/2020	6890	8		0.07	0.48		
09/15/2020	6531	9		0.09	0.59		
09/16/2020	6499	9	8	0.11	0.71	0.74	22.00
09/17/2020	6739	12		0.38	2.56		7.00
09/18/2020	7153	9		0.10	0.72		
09/19/2020	7639	12		0.05	0.38		
09/20/2020	7663	12		0.07	0.54		
09/21/2020	7812	12		0.05	0.39		
09/22/2020	6541	10		0.10	0.65		
09/23/2020	8010	10	9	0.11	0.88	0.60	5.00
09/24/2020	8379	8		0.10	0.84		8.00
09/25/2020	10237	8		0.03	0.31		
09/26/2020	10888	14		0.07	0.76		
09/27/2020	8580	12		0.11	0.94		
09/28/2020	7792	13		0.10	0.78		
09/29/2020	7386	11		0.11	0.81		
09/30/2020	7211	12	6	0.10	0.72	0.50	12.00
10/01/2020	7000	11		0.09	0.63		3.00
10/02/2020	7483	12		0.29	2.17		
10/03/2020	7883	12		0.06	0.47		
10/04/2020	8732	11		0.09	0.79		
10/05/2020	7879	9		0.05	0.39		
10/06/2020	7092	10		0.05	0.35		
10/07/2020	6751	10	13	0.06	0.41	1.05	1.00
10/08/2020	6889	14		0.06	0.41		5.00
10/09/2020	7995	20		1.14	9.11		
10/10/2020	10581	16		0.07	0.74		
10/11/2020	10808	17		0.33	3.57		
10/12/2020	9755	11		0.08	0.78		
10/13/2020	8169	20		0.08	0.65		
10/14/2020	8772	14	12	0.29	2.54	1.10	23.00
10/15/2020	8503	12		0.31	2.64		79.00
10/16/2020	9173	17		0.81	7.43		
10/17/2020	9563	19		0.32	3.06		
10/18/2020	8950	16		0.36	3.22		
10/19/2020	8249	11		0.34	2.80		
10/20/2020	7689	11		0.47	3.61		
10/21/2020	7815	15	7	0.76	5.94	1.41	1.80
10/22/2020	7553	18		0.68	5.14		2.00
10/23/2020	8268	13		1.04	8.60		
10/24/2020	8246	16		0.14	1.15		
10/25/2020	7975	13		0.10	0.80		
10/26/2020	6936	13		0.07	0.49		

10/27/2020	7365	12		0.09	0.66		
10/28/2020	7695	11	6	0.09	0.69	0.42	7.80
10/29/2020	8098	11		0.10	0.81		14.00
10/30/2020	8680	9		0.10	0.87		
10/31/2020	9530	9		0.23	2.19		
11/01/2020	8555	9		0.14	1.20		
11/02/2020	7926	9		0.44	3.49		
11/03/2020	9466	10		0.41	3.88		
11/04/2020	12248	18	6	1.61	19.72	1.85	13.00
11/05/2020	12278	9		0.13	1.60		2.00
11/06/2020	10986	8		0.49	5.38		
11/07/2020	10480	8		0.94	9.85		
11/08/2020	9670	9		0.96	9.28		
11/09/2020	8508	10		0.98	8.34		
11/10/2020	8072	10		1.04	8.39		
11/11/2020	7810	11	8	1.09	8.51	1.40	3.00
11/12/2020	7799	12		0.93	7.25		1.00
11/13/2020	7889	10		0.65	5.13		
11/14/2020	8289	11		0.76	6.30		
11/15/2020	8113	8		0.68	5.52		
11/16/2020	7725	9		0.89	6.88		
11/17/2020	9463	9		0.54	5.11		
11/18/2020	11125	5	7	0.49	5.45	0.81	7.80
11/19/2020	11218	8		0.55	6.17		7.80
11/20/2020	11089	8		0.49	5.43		
11/21/2020	10570	7		0.41	4.33		
11/22/2020	9770	8		0.42	4.10		
11/23/2020	8946	7		0.53	4.74		
11/24/2020	9689	8		0.63	6.10		
11/25/2020	9531	5	5	0.38	3.62	0.60	37.00
11/26/2020	9484	8		0.21	1.99		26.00
11/27/2020	10335	6		0.23	2.38		
11/28/2020	10668	5		0.37	3.95		
11/29/2020	10436	7		0.21	2.19		
11/30/2020	10166	7		0.25	2.54		
12/01/2020	9347	6		0.26	2.43		
12/02/2020	9008	6	6	0.11	0.99	0.28	
12/03/2020	8789	8		0.20	1.76		4.00
12/04/2020	8936	6		0.10	0.89		8.00
12/05/2020	9356	6		0.12	1.12		
12/06/2020	9115	8		0.10	0.91		
12/07/2020	10835	8		0.28	3.03		
12/08/2020	12902	8		0.78	10.06		
12/09/2020	12309	8	5	0.07	0.86	0.28	1.00

12/10/2020	11387	9		0.26	2.96		1.00
12/11/2020	10608	5		0.03	0.32		
12/12/2020	10567	8		0.04	0.42		
12/13/2020	10437	6		0.04	0.42		
12/14/2020	8986	5		0.04	0.36		
12/15/2020	9066	6		0.04	0.36		
12/16/2020	9107	4	4	0.07	0.64	0.21	
12/17/2020	9150	6		0.07	0.64		
12/18/2020	10253	4		0.03	0.31		
12/19/2020	10818	2		0.22	2.38		
12/20/2020	11662	5		0.10	1.17	0.39	
12/21/2020	11511	5		0.04	0.46		
12/22/2020	10497	5		0.04	0.42		
12/23/2020	10234	8		0.05	0.51		
12/24/2020	10143	5		0.07	0.71		
12/25/2020	10102	5		0.12	1.21		
12/26/2020	10039	6		0.08	0.80		
12/27/2020	10625	6		0.13	1.38		
12/28/2020	10602	6	3	0.05	0.53	0.25	
12/29/2020	10977	5		0.05	0.55		
12/30/2020	10929	6		0.04	0.44		
12/31/2020	11239	6.0		0.05	0.56		

APPENDIX E: RECEIVING ENVIRONMENT MONITORING

CASCADE ENVIRONMENTAL
RESOURCE GROUP LTD

DATE: June 7, 2021

TO: Brett Jenaway, Resort Municipality of Whistler

FROM: Margot Webster, B.I.T., Cascade Environmental Resource Group Ltd.
Candace Rose-Taylor, R.P.Bio., E.P., Cascade Environmental Resource Group Ltd.

RE: 2020 Whistler Wastewater Treatment Plant Report: Receiving Environment Data Analysis

FILE #: 013-34-09

Introduction

The Resort Municipality of Whistler (RMOW) retained Cascade Environmental Resource Group Ltd. (Cascade) to assist in the data analysis of the Receiving Environment Monitoring section of the 2020 Annual Wastewater Treatment Plant Report. The Whistler Wastewater Treatment Plant (WWTP) is operated by the RMOW under the operational certificate ME-01452 under the provisions of the *Environmental Management Act*, which requires the RMOW to sample the WWTP discharge effluent and the receiving environment in the Cheakamus River and summarize the sample data in an annual report.

Receiving Environment Monitoring

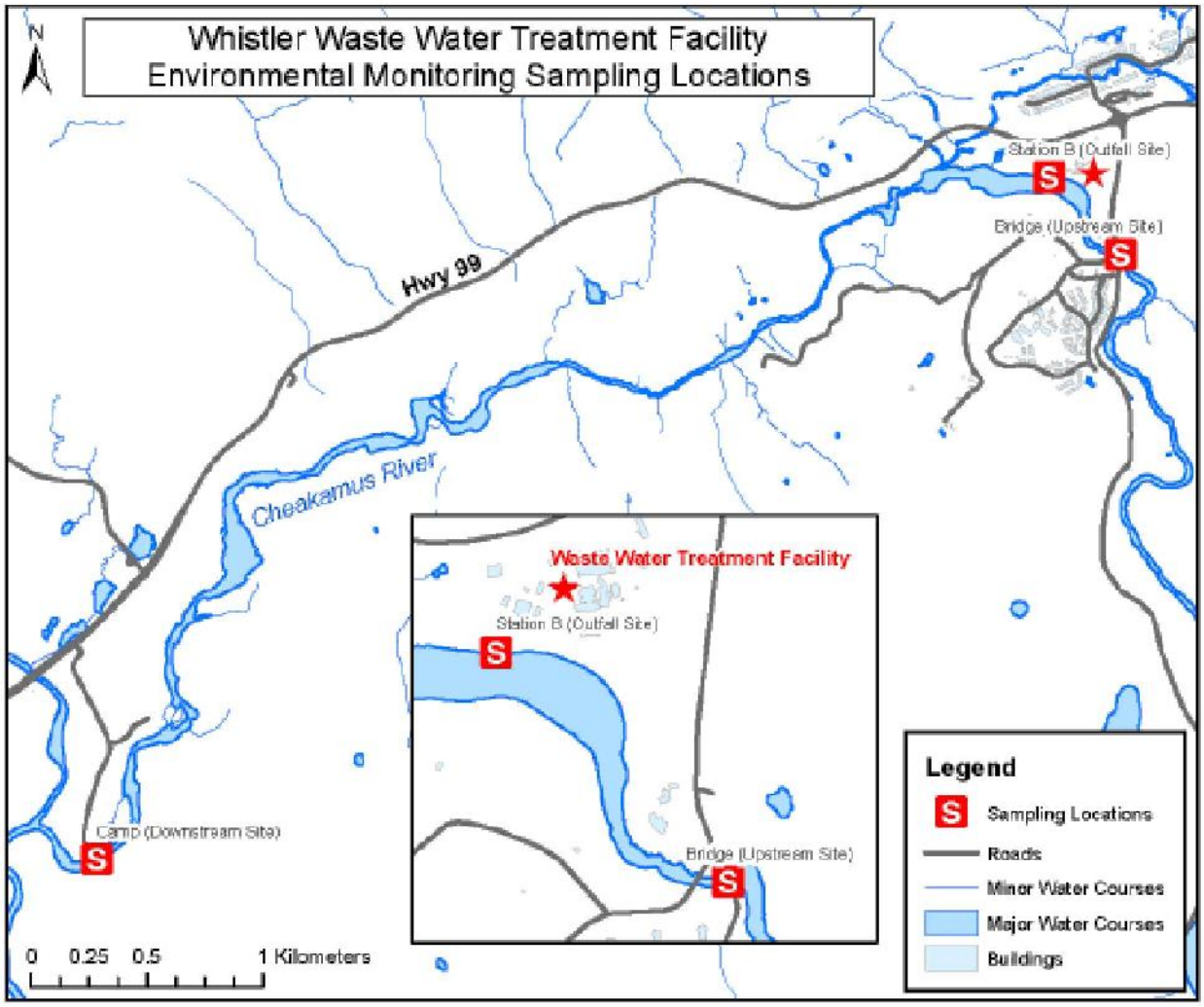
The receiving environment (the Cheakamus River) is sampled once per month by WWTP staff, and the samples are submitted to a certified laboratory. The operational certificate requires the RMOW to monitor two sampling stations, with a grab sample taken three times per year. The RMOW exceeds this requirement by sampling at three locations, every month of the year.

The monitored parameters are compared at three sampling locations: Upstream, Outfall and Downstream (see Map 1). The sample locations are as follows: the upstream sampling location is at the 'bridge', approximately 100 metres upstream of the outfall; the outfall location is also referred to as 'Station B'; and the downstream sampling location is also known as 'camp', which is approximately 4 kilometres downstream of the outfall.

Parameters required for sample analysis in the receiving environment by the operational certificate are pH, conductivity, turbidity, orthophosphate (as phosphorous), nitrate nitrogen, nitrite nitrogen, and ammonia nitrogen. Results that fall below the laboratory detection limit are represented graphically in this report as equal to the laboratory detection limit.

This report is intended to meet the operational certificate reporting requirements to be provided by a qualified professional that includes a compendium of both discharge and receiving environment data, a trend analysis review and interpretation of analytical data for results of the 2020 sample year and comparisons with past years in terms of potential impact to the receiving environment.

Map 1: Whistler Wastewater Treatment Plant Environmental Monitoring Sampling Locations



Water Quality Guidelines

Receiving environment sample results were compared to several water quality guidelines to determine compliance. Several guidelines exist for many of the sample parameters: the operational certificate (ME-01452), British Columbia approved water quality guidelines (BC WQG), and the Province of BC *Environmental Management Act* Contaminated Sites Regulation (CSR) - Schedule 3.2 – Generic Numerical Water Standards. The BC WQGs provide policy direction and are used as the basis for determining the allowable limits in waste discharge authorizations, however they do not have direct legal standing. The CSR standards are legally upheld in BC. The operational certificate requirements must be met to maintain legal authorization to operate the WWTP. All water quality standards used in this report are for the protection of freshwater aquatic life. Legally binding guidelines will be used (operational certificate and CSR) where possible and the most conservative guideline will be prioritized.

Table 1: Guidelines for Water Samples in the Receiving Environment

Parameter	Unit	Operational Certificate	CSR	BC WQG
Ammonia-N	mg/L		1.3 (pH ≥ 8.5) 3.7 (pH 8.0 – 8.5) 11.3 (pH 7.5 – 8.0) 18.5 (pH 7.0 – 7.5) 18.4 (pH < 7.0)	Varies with temperature and pH
Conductivity		No guideline or standard for conductivity - typical range in Western Canadian surface waters is 4.8 to 84,600 µS/cm (NAQUADAT, 1985)		
Nitrate-N	mg/L		400	3.0
Nitrite-N	mg/L		0.2 (Cl < 2 mg/L) 0.4 (Cl 2 – 4 mg/L) 0.6 (Cl 4 – 6 mg/L) 0.8 (Cl 6 – 8 mg/L) 1.0 (Cl 8 – 10 mg/L) 2.0 (Cl >10 mg/L)	0.02 (when Cl^- ≤ 2 mg/L) 30 day average 0.06 (Cl^- ≤ 2 mg/L) short-term
Nitrate + Nitrite	mg/L		400	3.0
Orthophosphate (as phosphorus)	mg/L	1.75 mg/L		0.01* (for recreational use)
pH				6.5-9.0
Turbidity	NTU			±8 (clear water/ 24 hours) ±2 (clear water/ 30 days) ±5 (background is 8-50) ±10% (background is >50)

pH in the Receiving Environment

The BC water quality guidelines for the protection of freshwater aquatic life for pH are between 6.5 and 9.0. Sample results from 2020 are displayed in Figure 1 which shows that no sample event is outside of the guidelines (marked in red) and that the pH trend between sample locations is similar. The average annual pH measurements for 2020 are 7.16 upstream, 7.17 at the outfall and 7.20 downstream.

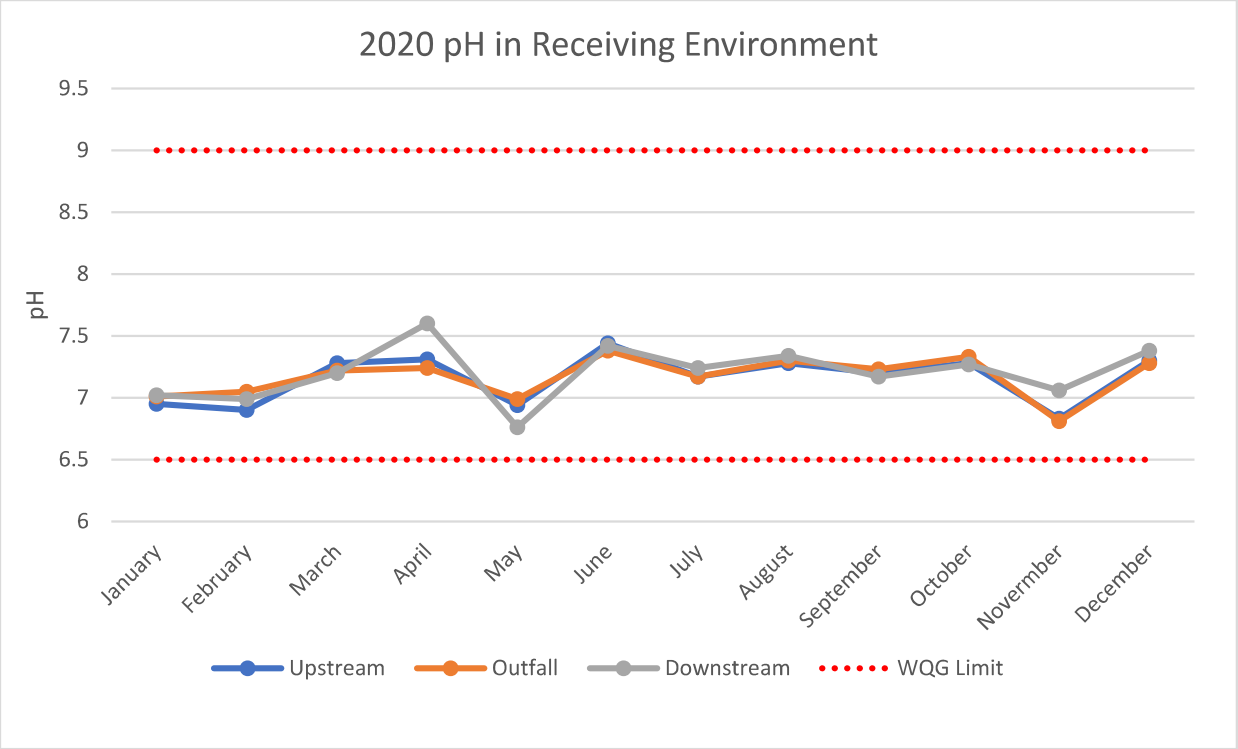


Figure 1: Whistler Wastewater Treatment Plant pH Monitoring in the Receiving Environment for 2020

Figure 2 compares the pH sample results from the years 2016 to 2020 at the outfall location to the BC water quality guidelines in red. It appears that the pH has remained within the WQG for all sample years at the outfall. One recorded pH measurement from all sample locations over all sample years has been marginally outside of the WQG: in October, 2017, the downstream sample was 6.1, however the recorded pH at the outfall during this sample event was 6.68 which is within guidelines.

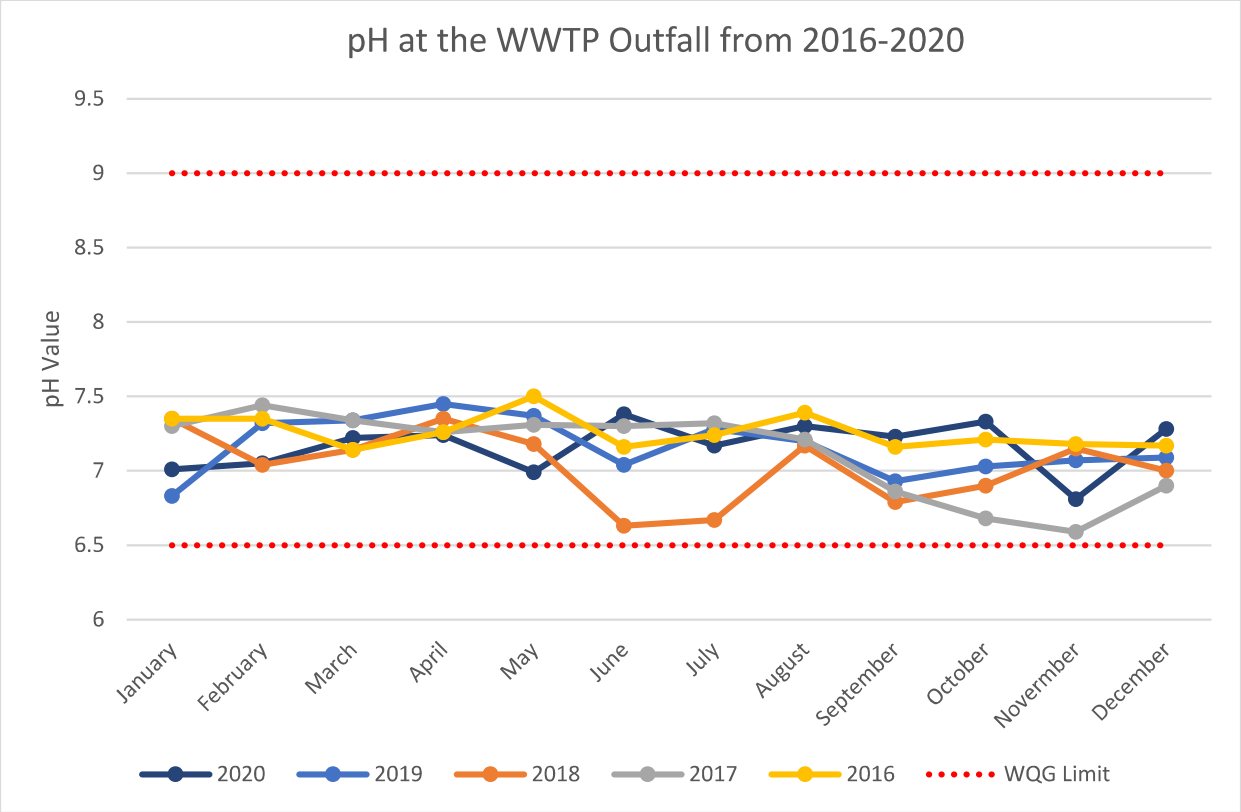


Figure 2: pH at the Whistler WWTP Outfall on the Cheakamus River from 2016-2020

Conductivity in the Receiving Environment

The water quality samples from the Cheakamus River receiving environment demonstrated an electrical conductivity range of 31.2 to 85.3 µS/cm for the year 2020 at all sample locations. This is in alignment with the years 2016 to 2019 which resulted in conductivity measurements with an overall range of 28.7 to 121 µS/cm at all sample locations (Figure 3). Conductivity typically ranges from 4.8 to 84,600 µS/cm in Western Canada surface waters (NAQUADAT, 1985), therefore all conductivity results are within range.

Figure 3 displays the trend of conductivity throughout the year showing that values are higher in winter months (December to April) and lower in summer months (May to November). The average conductivity at the outfall in 2020 of winter months is 71.9 µS/cm and in summer months is 48.7 µS/cm. This trend is consistent with the previous years sample results.

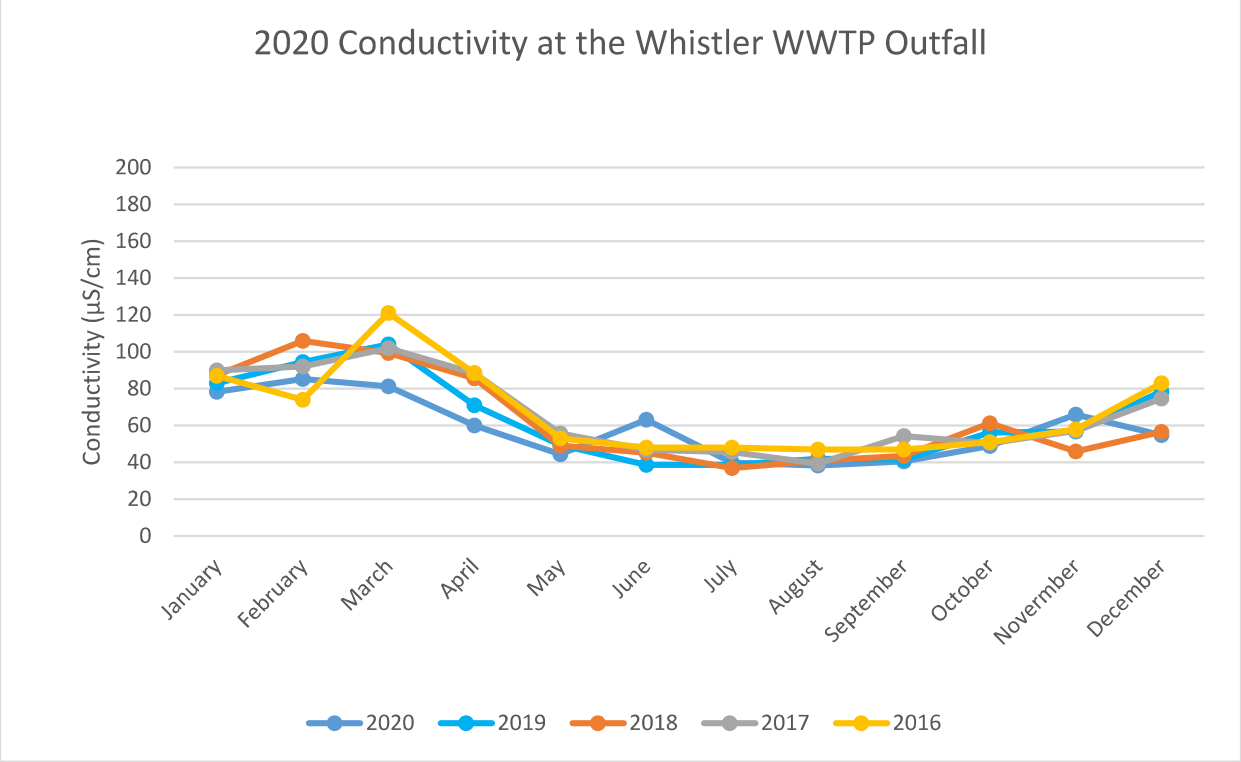


Figure 3: Conductivity Sample Results from the Whistler WWTP Outfall on the Cheakamus River from 2016-2020

Turbidity in the Receiving Environment

There are no operational certificate or CSR guidelines for turbidity of water. The BC WQG states that in clear waters (less than 8 NTU) the allowable turbidity is a short-term change of 8 NTU from background. When background is between 8 to 50 NTU, the allowable change is 5 NTU, and when background is over 50 NTU the allowable change is 10% from background. The upstream sample location will provide the background turbidity measurement.

Figure 4 displays the results for turbidity samples in the receiving environment for the year 2020 with the BC WQG displayed in red. The BC WQG is 8 NTU above the upstream sample values (background), except for June of 2020, which is 5 NTU above the upstream sample as the background value is between 8 to 50 NTU. There is no sample event for the year 2020 that exceeds the BC WQG for turbidity. However, during high turbidity levels in June of 2020, the downstream turbidity (18.1 NTU) has increased close to the allowable limit (18.8 NTU) but does not exceed it. The increase in June of 2020 is likely due to natural cases as the background levels and downstream locations all have high turbidity measurements.

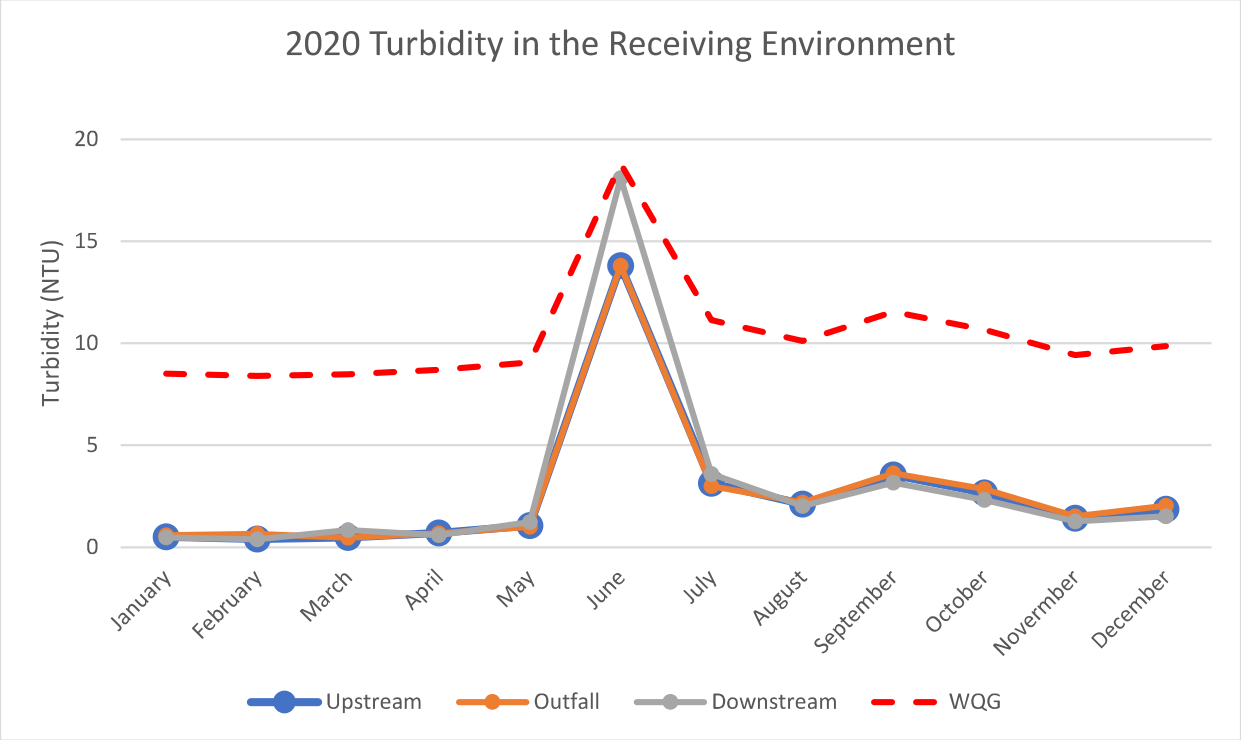


Figure 4: 2020 Turbidity Sample Results of the Whistler WWTP Receiving Environment

Figure 5 depicts the results of turbidity samples from the years 2016 to 2020 at the Whistler WWTP Outfall sample location. There is no sample event that has exceeds the BC WQG, although increases in turbidity exist at varying sample events. This is likely due to natural causes, such as high rain events, as the background (upstream) turbidity increases with the downstream measurements.

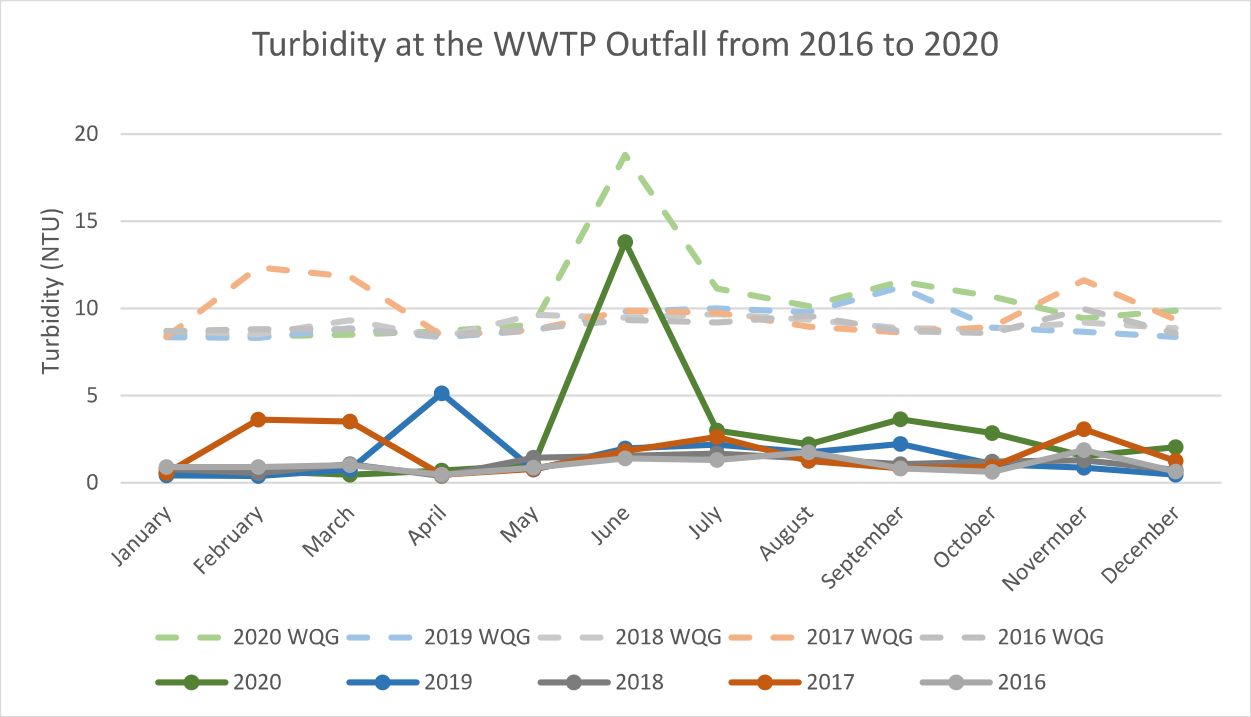


Figure 5: Turbidity Results at the Whistler WWTP Outfall from 2016 to 2020 and Guidelines

Phosphorous in the Receiving Environment

There are no water quality guidelines for phosphate, orthophosphate or total phosphorous by the BC WQG or CSR for the protection of freshwater aquatic life, as this is non-toxic to aquatic organisms at levels and forms present in the environment. Most phosphorous in freshwater occurs as organic phosphates (95%), whereas orthophosphate is inorganic. The operational certificate specifies a maximum limit of 1.75 mg/L of ortho-phosphate (as phosphorous) for WWTP discharge. As the total phosphorous does not exceed the limit of 1.75 mg/L, orthophosphate also does not exceed the limit for any sample event within the receiving environment.

The CCME guideline displayed in Figure 6 is the Canadian Council of Ministers of the Environment recommended framework for total phosphorous in the freshwater aquatic environment (CCME, 2004). Phosphorous loading in the environment can cause eutrophication and oxygen depletion. To evaluate this, baseline conditions have been established based on phosphorous concentrations from 2016 to 2020. Based on phosphorous annual average and median concentrations, the environment is typically Oligotrophic (0.004 to 0.01 mg/L) but is often in the range of Mesotrophic (0.01 to 0.02 mg/L) with the range limits outlined in red for Figure 6.

Figure 6 displays the total phosphorous results of 2020. No guidelines have been exceeded however it appears there are spikes in the concentration of phosphorous at the outfall and downstream samples compared to the upstream (background) throughout the year, suggesting these increases may not be due to natural causes. The downstream sample spikes are correlated with rain events, which can temporarily increase the phosphorous concentration in watercourses, however the outfall increase in March and April of 2020 is not correlated with a rain event, suggesting possible non-natural causes that may be associated with the Wastewater Treatment Plant.

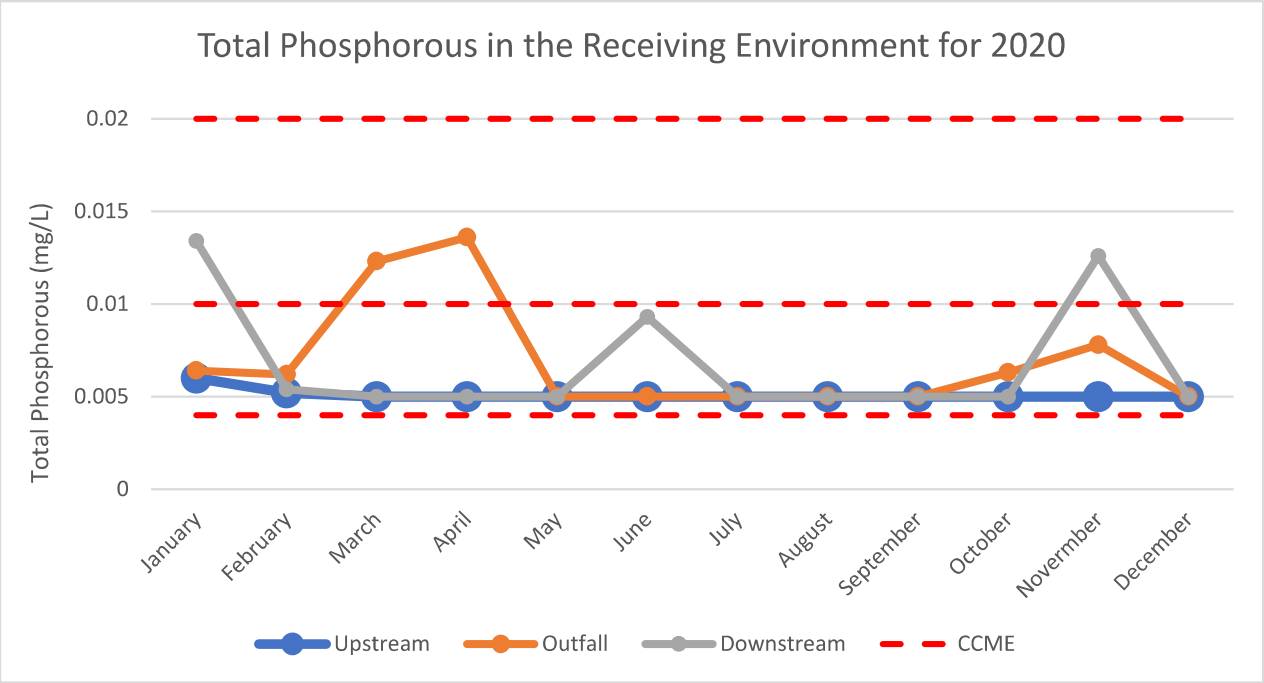


Figure 6: Orthophosphate Sample Results for the year 2020 in the Receiving Environment

Figure 7 displays the orthophosphate sample results from the outfall location in the receiving environment for the years 2016 to 2019. The operational certificate has a limit of 1.75 mg/L of orthophosphate which is not exceeded at any sample event.

The graph displays several spikes at various times. The increases of orthophosphate concentrations at the outfall in December 2017, October 2018, and October 2019, are reflected in the upstream and downstream samples. These increases suggest natural causes and are likely due to rain events that can temporarily increase the nutrient load in watercourses. The sample events from March 2018 and July 2016 contain orthophosphate increases at the outfall that are not reflected in the upstream or downstream samples. These may be due to non-natural causes associated with the Wastewater Treatment Plant.

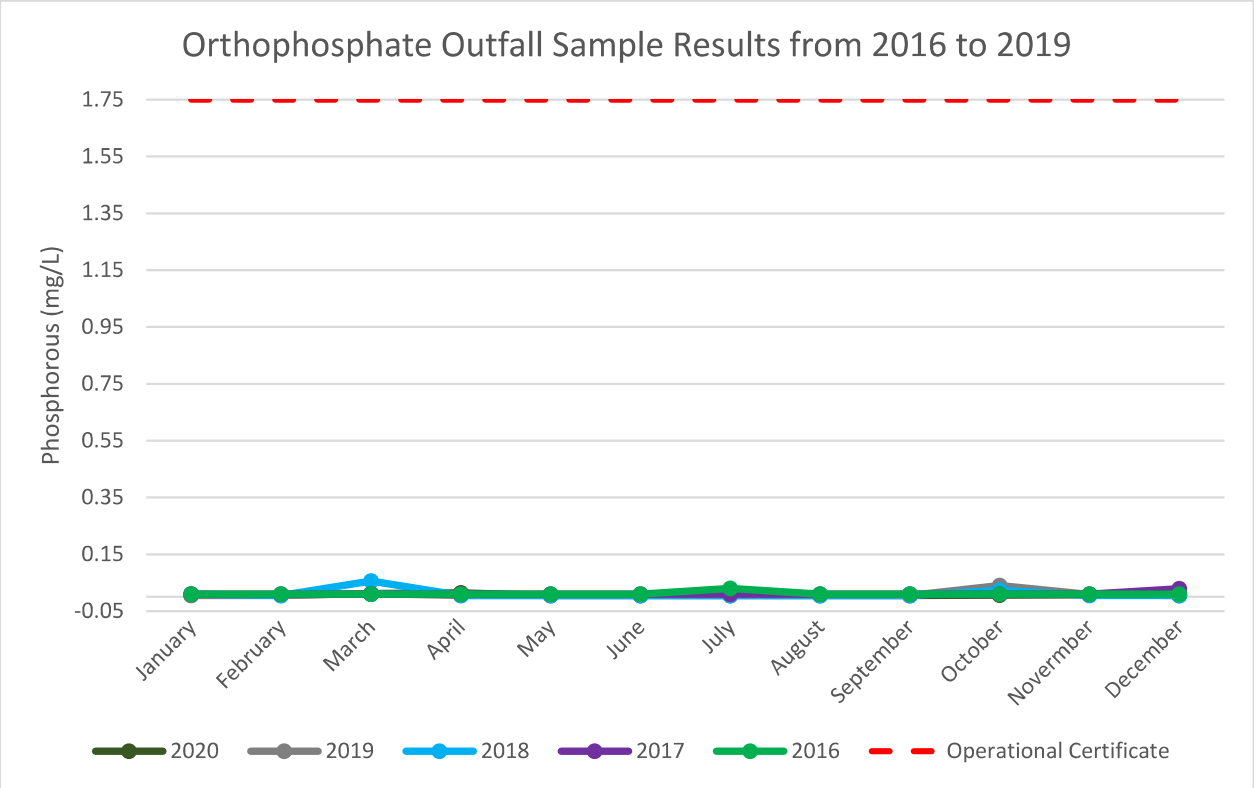


Figure 7: Orthophosphate Sample Results from the Outfall Location between 2016 to 2019.

Nitrogen in the Receiving Environment

Nitrate Nitrogen

The CSR guideline for nitrate nitrogen is 400 mg/L and this is not exceeded for any sample event between 2016 to 2020. Figure 8 and Figure 9 display the BC WQG of 3.0 mg/L which is also not exceeded for any sample event between 2016 to 2020 in the receiving environment.

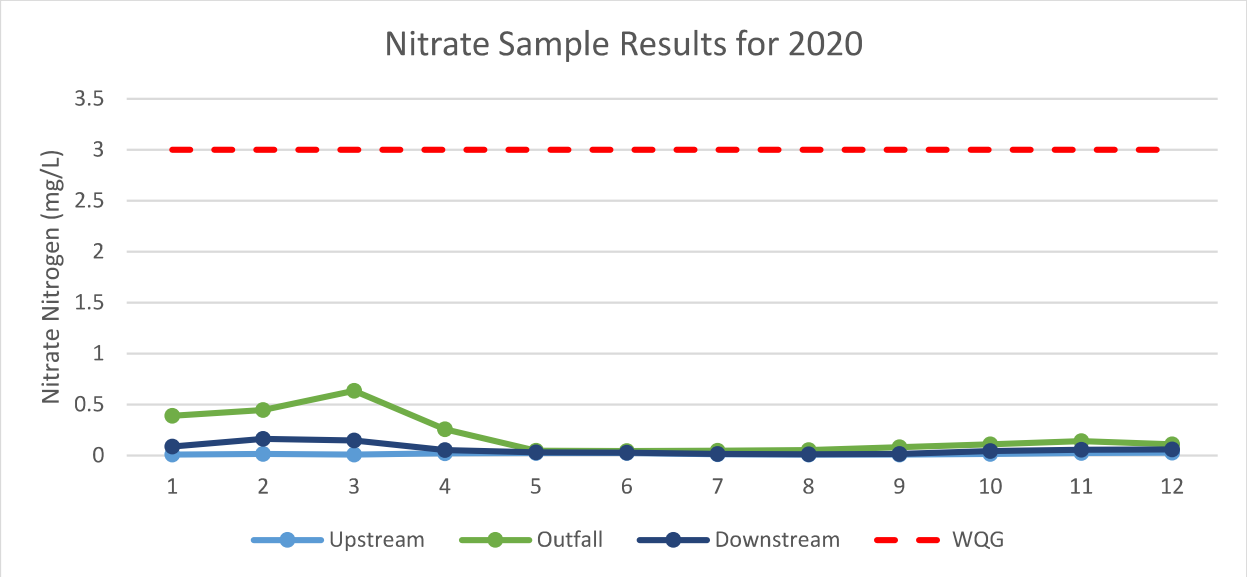


Figure 8: Nitrate Nitrogen Sample Results in the Receiving Environment for 2020

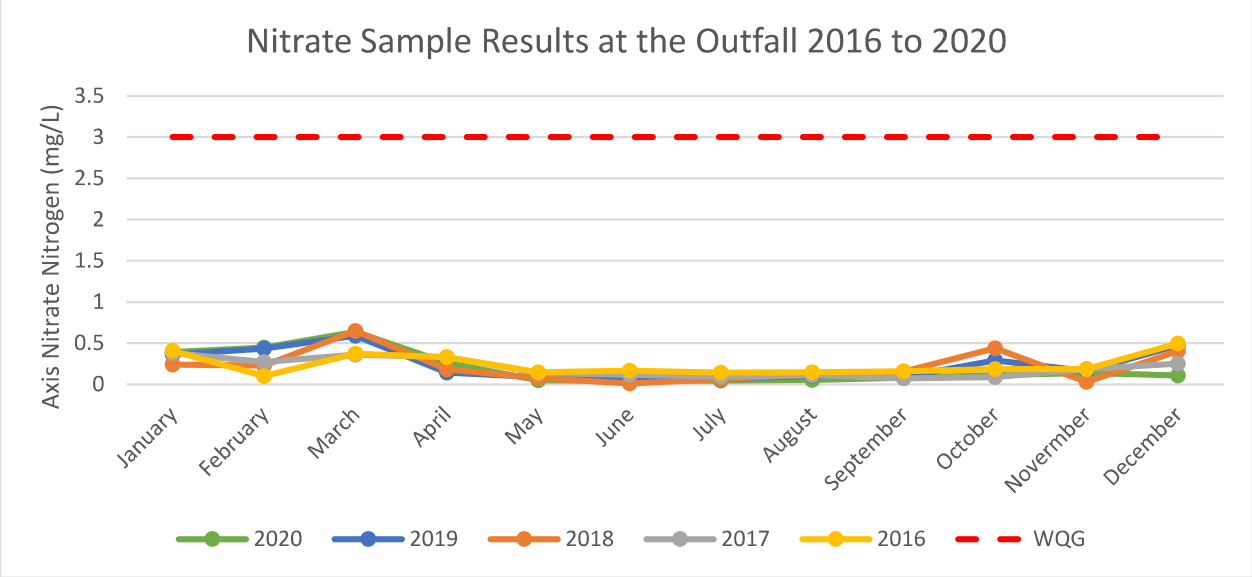


Figure 9: Nitrate Nitrogen Sample Results at the Outfall Sample Location between 2016 and 2020

Nitrite Nitrogen

The CSR guideline when chlorine is less than 2 mg/L is 0.2 mg/L of nitrite nitrogen. No sample event from 2016 to 2020 in the receiving environment exceeds the CSR guideline. The BC WQG when chlorine is less than 2 mg/L is 0.02 mg/L of nitrite nitrogen for a 30 day period (long-term) and 0.06 mg/L for a short-term maximum concentration of nitrite nitrogen. Chlorine sampling was initiated in June of 2020 following the recommendations from the 2019 Wastewater Treatment Plant Report. As the chlorine results for 2020 range from <0.02 mg/L to 0.07 mg/L, the guidelines provided in Figure 10 assume that the chlorine concentrations are below 2 mg/L for the entire year. Chlorine sampling should continue to be conducted for all sample events when nitrite nitrogen is sampled.

Figure 10 displays the nitrite nitrogen sample results for the year 2020. No sample event exceeds the short-term maximum BC WQG of 0.06 mg/L. One sample event in January of 2020 exceeds the 30 day WQG at the outfall with a concentration of 0.022 mg/L. This does not exceed guidelines as the nitrite concentration returns below the threshold in less than 30 days.

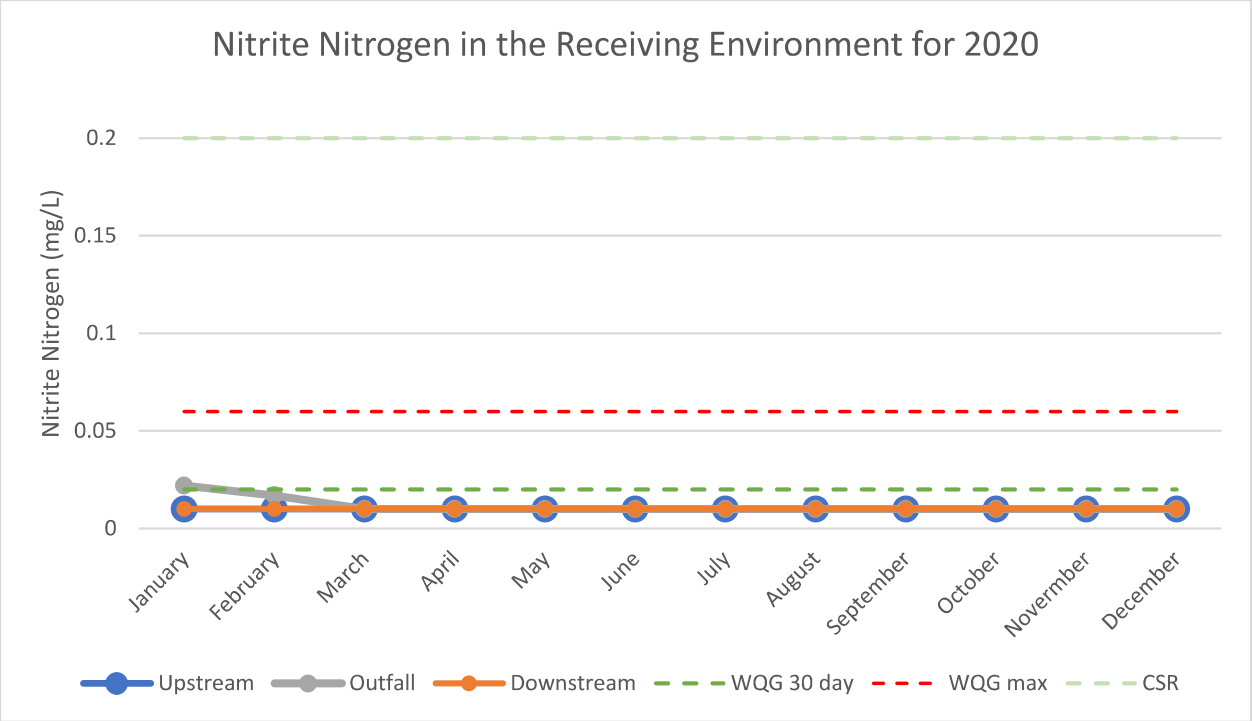


Figure 10: Nitrite Nitrogen Sample Results of the Receiving Environment for 2020

Figure 11 displays the nitrite nitrogen sample results at the outfall location from the years 2016 to 2020. The CSR guidelines of 0.2 mg/L nitrite nitrogen have not been exceeded at any sample event. The BC 30 day WQG of 0.02 mg/L is exceeded in 2016 to 2019 typically in winter months (December to March). The BC WQG maximum limit of 0.06 mg/L is exceeded in February of 2017 and February of 2018. Winter increases in nitrite nitrogen are not reflected in background (upstream) sample results, which suggests nitrite concentration increases may not be due to natural causes. Low flows of the Cheakamus River are common in winter months that likely contribute to elevated nitrite concentrations that may be associated with the Wastewater Treatment Plant.

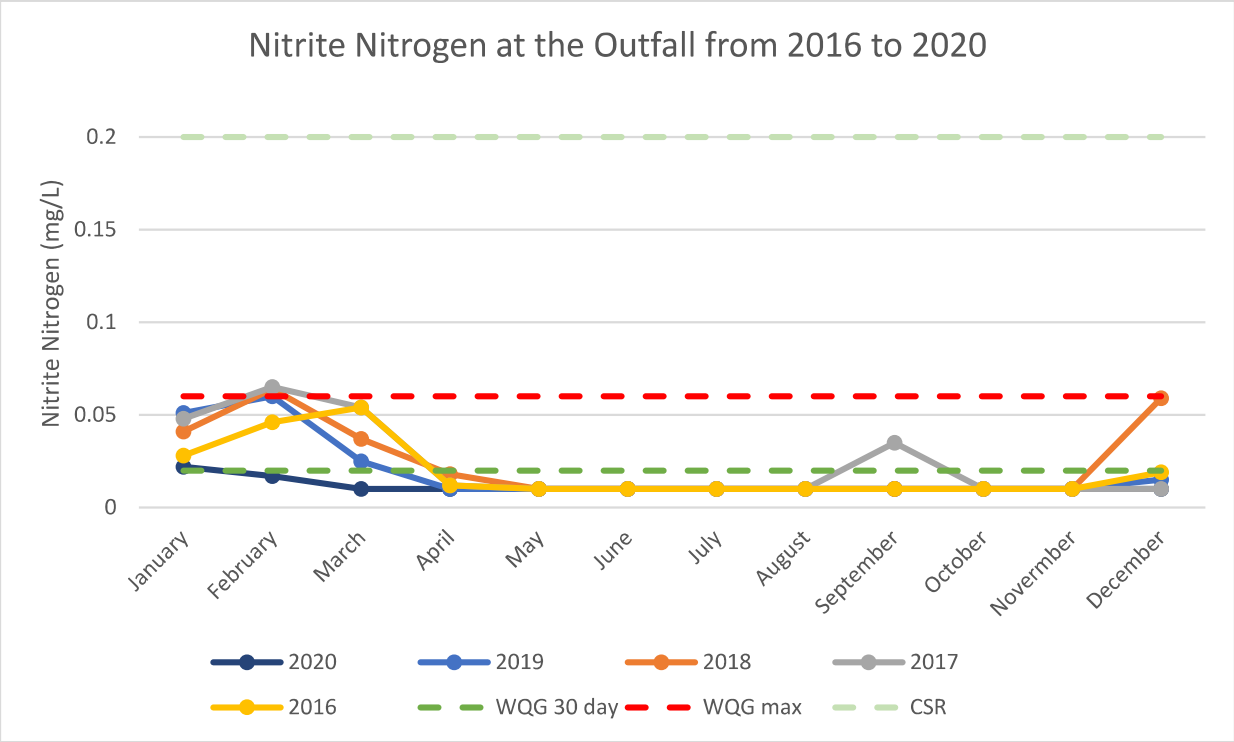


Figure 11: Nitrite Nitrogen Sample Results at the Outfall between 2016 to 2020

Ammonia Nitrogen

The CSR guidelines for ammonia nitrogen varies based on pH. The most conservative CSR guideline value for the 2020 sampling year was 11.3 mg/L which was not exceeded for any sample event. The BC WQG for ammonia nitrogen varies based on temperature and pH. Temperature was provided for June to December of 2020 following the recommendations from the 2019 Wastewater Treatment Plant Report. The BC WQG provided is based on the most conservative WQG value for the known values from June to December, being 1.94 mg/L, which was not exceeded at any sample event. Figure 12 displays the BC WQG in red as opposed to the CSR guideline as it is a more conservative value. Temperature and pH should be recorded whenever ammonia is sampled.

Figure 13 displays the results for ammonia nitrogen in the receiving environment for the sample years 2019 to 2020. The WQG differs based on the pH and temperature. The WQG of 2020, as in Figure 12, assumes the most conservative WQG value due to a lack of temperature data. No sample event exceeds the WQG.

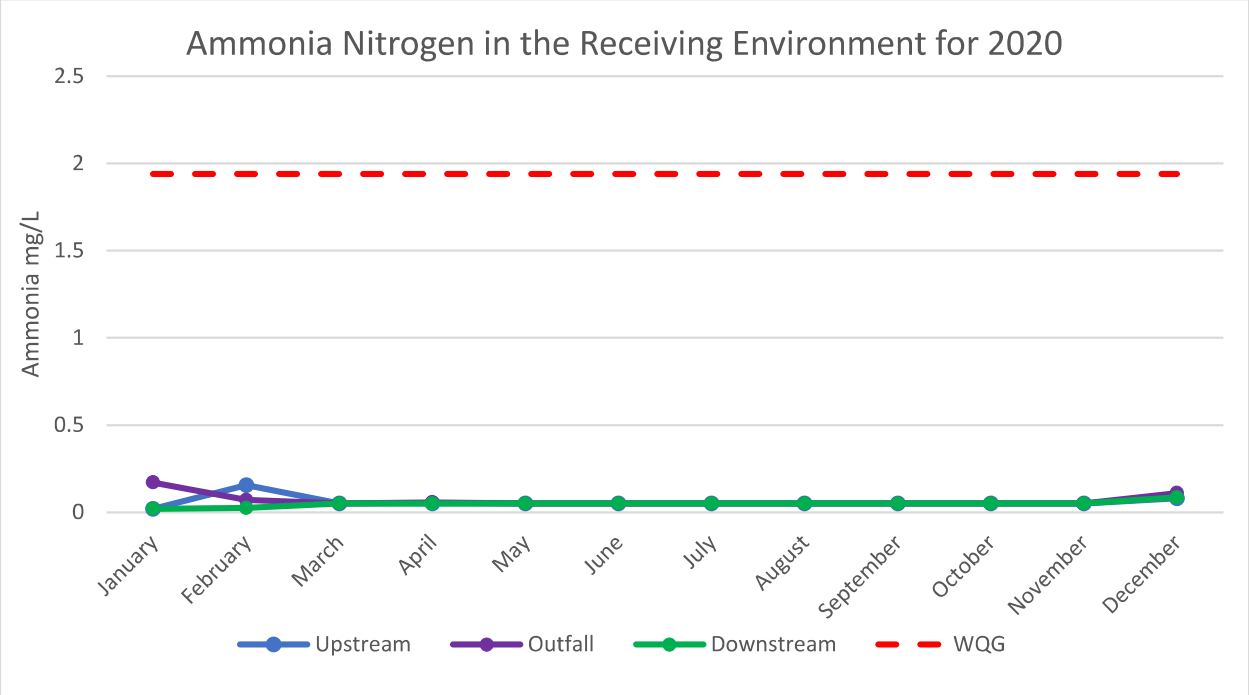


Figure 12: Ammonia Nitrogen in the Receiving Environment for 2020

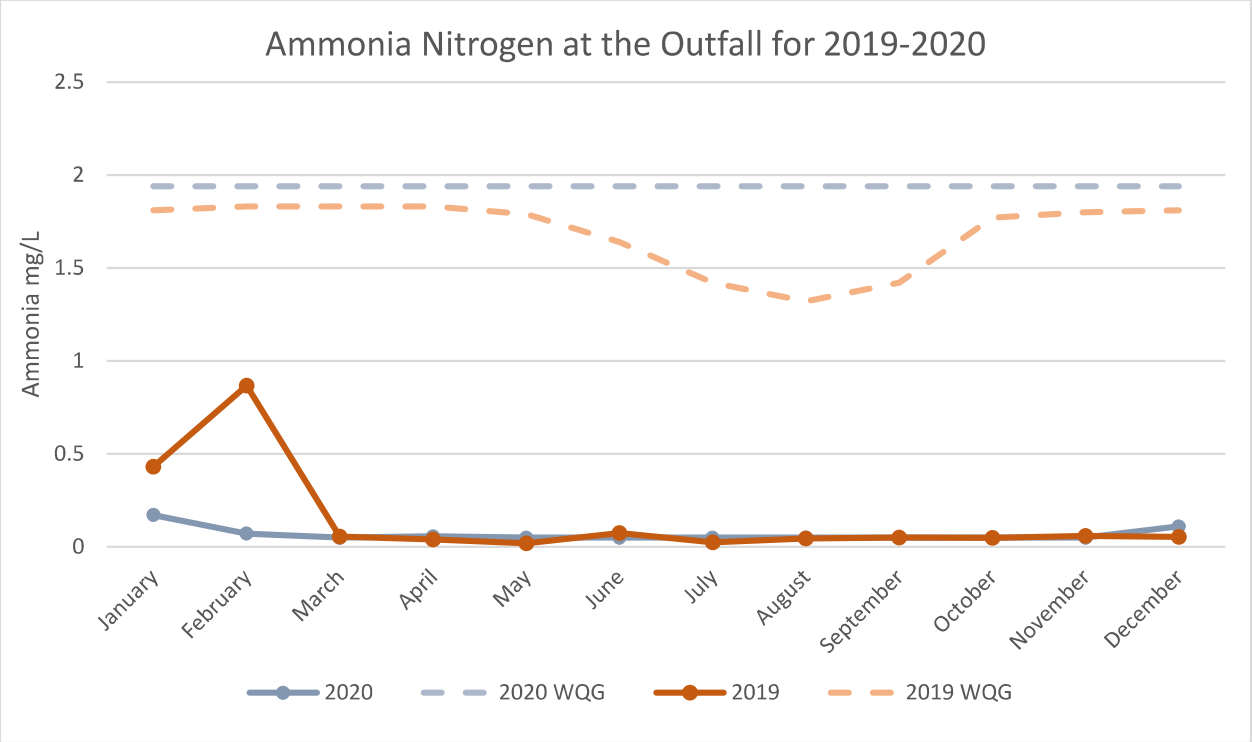


Figure 13: Ammonia Nitrogen Sample Results at the Outfall for 2019-2020

Conclusions and Recommendations

The monthly samples taken by the RMOW from the Cheakamus River receiving environment in the year 2020 all comply with the CSR Standards and the operational certificate sampling standards for orthophosphate (as phosphorous), nitrate nitrogen, nitrite nitrogen and ammonia nitrogen. All sample events for the year 2020 comply with the BC water quality guidelines (WQG) for turbidity and pH. No guidelines or standards are available for conductivity, however conductivity measurements throughout 2020 are all within the natural range of western Canadian surface waters (NAQUADAT, 1985) and align with annual trends from the years 2016 to 2019.

The BC WQG was exceeded for the maximum allowable nitrite nitrogen in February 2017 and February 2018, and the 30 day average was exceeded for winter months in 2016 to 2019. Increases in nitrite nitrogen were not reflected in background (upstream) measurements, which suggests the wastewater treatment plant may be associated with the increased concentrations in winter months. Low flows of the Cheakamus River in winter months may result in higher effluent concentrations. Downstream nitrite concentrations for 2016 to 2019 were not outside of the BC guidelines. There were no WQG exceedances for the year 2020.

Orthophosphate concentrations do not exceed the standards for discharge in the operational certificate for any sample event from 2016 to 2020. Total phosphorous was sampled in 2020 instead of orthophosphate. Orthophosphate is included in the total phosphorous measurement, therefore as the total phosphorous does not exceed the orthophosphate operational limit, it meets the standard.

The CCME guideline provides a framework to observe the total phosphorous concentrations that may be outside of the natural range of the Cheakamus River. Increases in phosphorous concentrations are seen throughout the year 2020. The downstream increases are likely due to high rain events, however the outfall increases of phosphorous in March and April of 2020 are not due to rain, nor are they reflected in upstream or downstream measurements. It is possible the spring phosphorous increases are associated with the Whistler Wastewater Treatment Plant. Orthophosphate was measured from 2016 to 2019. Several spikes in orthophosphate concentration are reflected by upstream and downstream sample measurements, likely due to natural causes. The increases in March of 2018 and July of 2016 are not reflected in the upstream or downstream, suggesting non-natural causes.

It is recommended that the RMOW continue to conduct field pH measurements, chlorine measurements and field temperature measurements whenever samples are taken in the receiving environment for nitrite nitrogen and ammonia nitrogen due to the guideline requirements. It is also recommended that the RMOW continue to measure orthophosphate to continue with sampling from 2016-2019.

Should you have any questions regarding this report or would like further information, please do not hesitate to contact the Cascade Whistler office.

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