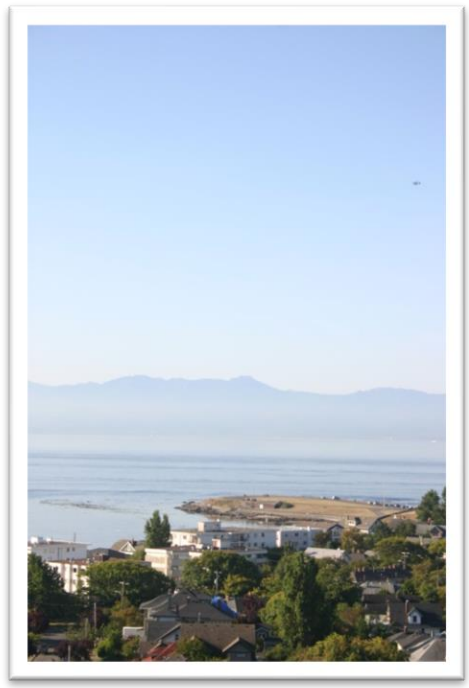
Core Area Wastewater Facilities

Environmental Monitoring Program - 2022 Report

Cycle 3 – Year 2

Capital Regional District | Parks & Environmental Services, Environmental Protection



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CORE AREA WASTEWATER FACILITIES
ENVIRONMENTAL MONITORING PROGRAM
2022 REPORT

EXECUTIVE SUMMARY

In mid-2020, the Capital Regional District (CRD) commissioned a new tertiary treatment plant and outfall at McLoughlin Point (McLoughlin). Prior to this, the CRD discharged fine-screened municipal wastewater for over 100 years through two core area outfalls located at Macaulay Point (Macaulay) and Clover Point (Clover). Full optimization of treatment processes at McLoughlin was ongoing throughout 2022. Therefore, 2020 through 2022 are considered transitional years for both sewage treatment in the Core Area and the associated wastewater and receiving environment monitoring program.

Monitoring of wastewater quality, and the surface water and seafloor environments in the vicinity of the Macaulay and Clover outfalls, has occurred on a regular basis since the late 1980s. The focus of this monitoring shifted to McLoughlin in 2021, but there is significant overlap with historic monitoring locations. The CRD is required to monitor for compliance with the Municipal Wastewater Regulation (MWR) under the provincial *Environmental Management Act* and the Wastewater Systems Effluent Regulations (WSER) under the federal *Fisheries Act*.

Beyond regulatory compliance, to ensure protection of human health and the environment, the CRD undertakes monitoring, as outlined in the Core Area Liquid Waste Management Plan, and to assess the impacts of the outfalls on the marine environment. This monitoring is done on a five-year cycle.

The 2022 Environmental Monitoring Program (EMP) report represents Year 2 of Cycle 3 and includes:

- wastewater monitoring and analysis for a list of substances, including conventional parameters, metals, and other priority substances and toxicity (conducted monthly at McLoughlin).
- biosolids monitoring and analysis (results are presented in separate reports as the Residual Treatment Facility results are reported under a separate authorization).
- surface water and water column monitoring and analysis for bacteriological indicators of potential for human exposure to wastewater in the marine environment. Additionally, a list of substances, including conventional parameters, metals, and other priority substances (conducted quarterly at McLoughlin, and only if they are discharging coincident with routine McLoughlin sampling, around the Macaulay and Clover outfalls).
- wet weather overflow and bypass sampling for bacteriological indicators indicating potential for human exposure to wastewater in the marine environment, and a subset of conventional parameters indicative of wastewater strength (conducted as needed at Macaulay and Clover, and around the various shoreline overflow locations when bypass, overflow or wet weather events occurred).
- seafloor sampling for sediment chemistry (routine and high resolution), sediment toxicity and bioaccumulation, and benthic invertebrate community structure around the McLoughlin outfall.
- continuing additional investigations that address specific questions about water column and seafloor monitoring components and that investigate emerging scientific issues regarding wastewater discharges and environmental effects.

Overall, risks to human health and the environment were low. The installation of tertiary treatment at McLoughlin has substantively reduced the concentrations and loadings of contaminants to the marine receiving environment relative to the historic discharge practices out of the Macaulay and Clover outfalls. As such, potential risks to human health and the environment have also been reduced.

During 2022, McLoughlin achieved a high-quality effluent but was slightly above regulatory limits intermittently from February to December. This was expected as regulatory limits are exceptionally low relative to treatment plant design capabilities. Possible changes to these limits are currently being discussed with the regulator. In addition, there is potential that highly variable centrate return flows from the

Residuals Treatment Facility may be impacting the treatment plant's ability to continuously achieve effluent quality limits.

Wet weather high flows are predicted to occur up to 70 days per year resulting in blended primary and tertiary effluent being discharged out the McLoughlin outfall. In 2022, there were only 21 days when blending occurred. Eighteen (18) of these days occurred when the full tertiary treatment capacity was not achieved. Operators are continuing to refine internal flow balancing to ensure blending only happens when full tertiary treatment capacity is reached.

The McLoughlin reclaimed water system was abandoned early in 2022 due to operational challenges. As such, no reclaimed water samples were collected for analysis.

Surface water and water column sampling confirmed that the new McLoughlin outfall was operating as predicted from plume dispersion and dilution modelling. Bacteriological and other contaminant levels in the receiving environment were well below those observed when Macaulay and Clover were discharging. This further affirms the benefit of installing treatment at McLoughlin.

The conveyance system is designed with numerous shoreline sanitary and combined sewer overflow and relief points that discharge during heavy rains, planned maintenance activities or following unexpected non-routine or emergency events. Shoreline monitoring is required to assess human health risk for people engaged in recreational activities on beaches adjacent to the overflows. There was no shoreline monitoring conducted in 2022, but the historical program (up until 2021) confirmed that wastewater overflow signals typically dissipate within 48 hours, but adjacent municipal stormwater discharge signals persist longer, sometimes continuously.

Seafloor monitoring was conducted in 2022 around the McLoughlin outfall and reference stations. Results were not yet available at the time of publishing this report, but will be included in the 2023 report.

ADDITIONAL INVESTIGATIONS

Additional investigations address specific questions or issues pertaining to the monitoring program, clarify aspects of the program, or provide concurrent data for the assessment of environmental effects. Some additional investigations are also requirements of the Liquid Waste Management Plan approval. Recommended studies have historically been reviewed by the Marine Monitoring Advisory Group (MMAG) and other experts.

The CRD is sampling influent from the McLoughlin Wastewater Treatment Plant several times per week for the BC Centre for Disease Control (BCCDC), who is testing influent from McLoughlin and elsewhere in BC for both COVID-19 and influenza analyses. Results are available on the BCCDC website.

The CRD continued to participate in a related project with the University of British Columbia and Harbour Resource Partners, the consortium that built the McLoughlin Wastewater Treatment Plant. This project involves the development of a simple handheld sensor that could be used by operators to detect various pathogens in wastewater (including viruses like COVID-19), with the hope that the data would be used to inform local health authorities about changes in pathogen levels over time. No results are available currently.

In 2022, the CRD continued to participate in two Ocean Wise Conservation Association initiatives: the Salish Sea Ambient Monitoring Exchange (SSAMEx) and Pollution Tracker.

Discussions are ongoing with research laboratories regarding opportunities to assess the effectiveness of the McLoughlin WWTP to characterize and potentially reduce microplastic loadings to the environment. This work is targeted to implement in 2023 or 2024.

The CRD has also provided benthic invertebrate debris samples from Macaulay Point to a University of Chicago researcher as part of a collaborative project with the CRD's contract benthic taxonomist. The researcher has been comparing the "death assemblages" of molluscs and bivalves contained within the archived debris to the “live” communities that are assessed as part of the routine sediment sampling program. Assessments are ongoing, with results likely to be published in a relevant scientific journal.

Finally, the CRD continued participation in a second collaborative project with the contract benthic taxonomist, UVIC and Metro Vancouver to develop an inexpensive benthos toxicogenomic tool that could be used in years when seafloor sampling does not take place. It could also be used at historical monitoring stations that have been abandoned. The project has a five-year timeline and in 2021 the team optimized field collection methods and successfully isolated environmental DNA (eDNA) from several indicator species. The CRD will continue to provide support, including future sampling vessel and sample access in 2022 and beyond. Results to-date have been presented at three scientific conferences in 2021 and 2022.

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Terms & Abbreviations

ADWF	Average Dry Weather Flow
BAF	Biological Aerated Filters
BOD	Biochemical Oxygen Demand
CALA	Canadian Association For Laboratory Accreditation Inc.
CBOD	Carbonaceous Biochemical Oxygen Demand
CCME	Canadian Council of Ministers of the Environment
CFU	colony-forming unit
Cl	Chloride
COD	Chemical Oxygen Demand
COND	Conductivity
CPS	Clover Pump Station
CRD	Capital Regional District
CSO	combined sewer overflow
CTD	conductivity-temperature-depth
EMP	Environmental Monitoring Program
ENT	Enterococci
ENV	BC Ministry of Environment and Climate Change Strategy
FC	Fecal Coliform
ICES	International Council for the Exploration of the Sea
IDZ	Initial Dilution Zone
LWMP	Liquid Waste Management Program
MBBR	Moving Bed Biofilm Reactors
MPWWTP	McLoughlin Point Wastewater Treatment Plant
MLD	megalitres per day
MMAG	Marine Monitoring Advisory Group
MPS	Macaulay Pump Station
NH_3	Ammonia
NO_2	nitrite
NO_3	nitrate
NP	Nonylphenols
OC	Organochlorine pesticides
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCDD	polychlorinated dibenzo-p-dioxins
PDBE	Polybrominated diphenyl ethers
PFAS	Per- and poly-fluoroalkyl substances
PFOS	perfluorooctane sulfonate
PICES	North Pacific Marine Science Organization
PPCP	Pharmaceuticals and personal care products
Q+	Quarterly Plus
QA/QC	quality assurance/quality control
SCADA	Supervisory Control and Data Acquisition
SETAC	Society of Environmental Toxicology and Chemistry
SQG	sediment quality guidelines
SSAMEx	Salish Sea Ambient Monitoring Exchange
SSO	sanitary sewer overflow
TDP	total dissolved phosphorus
TKN	total Kjeldahl nitrogen
TOC	total organic carbon
TP	total phosphorus
TSS	Total Suspended Solids

Terms & Abbreviations

TWQRP	Technical Water Quality Review Panel
US EPA	US Environmental Protection Agency
UVIC	University of Victoria
WAD	weak acid dissociable (WAD) cyanide
WMEP	Wastewater Marine Environment Program
WQG	Water Quality Guidelines
WSER	Wastewater Systems Effluent Regulations
MWR	Municipal Wastewater Regulation
WWTP	Wastewater Treatment Plant

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1.0 BACKGROUND

The Capital Regional District (CRD) treats Core Area wastewater at the McLoughlin Point Wastewater Treatment Plant (MPWWTP) (Figure 1.1). This facility was commissioned in August 2020 to replace the previous practice of discharging fine-screened (6 mm) wastewater through the Macaulay and Clover Point outfalls. The MPWWTP treats most of the Core Area wastewater to a tertiary standard before discharge through a 1,925 metre (m) long outfall. This outfall includes a 210 m multiport diffuser that terminates at approximately 60 m depth and is located approximately 200 m east of the existing Macaulay Point outfall terminus.

Screening and grit removal occurs at the Macaulay and Clover pump stations (Figure 1.1) prior to pumping flows to MPWWTP. The MPWWTP capacity can handle up to four times Average Dry Weather Flow (ADWF; 1xADWF = 108 megalitres per day [MLD]; 4xADWF = 432 MLD) and treatment processes include:

- Primary:
  - Lamella plate settlers for flows up to 216 MLD (i.e., 2xADWF).
  - High rate Densadegs for flows exceeding 216 MLD and up to 432 MLD (i.e., from 2-4xADWF).
- Secondary: a sequence of Moving Bed Biofilm Reactors (MBBR) and Biological Aerated Filters (BAF) for primary flows up to 216 MLD.
- Tertiary: Cloth Disk Filters for secondary flows up to 216 MLD.

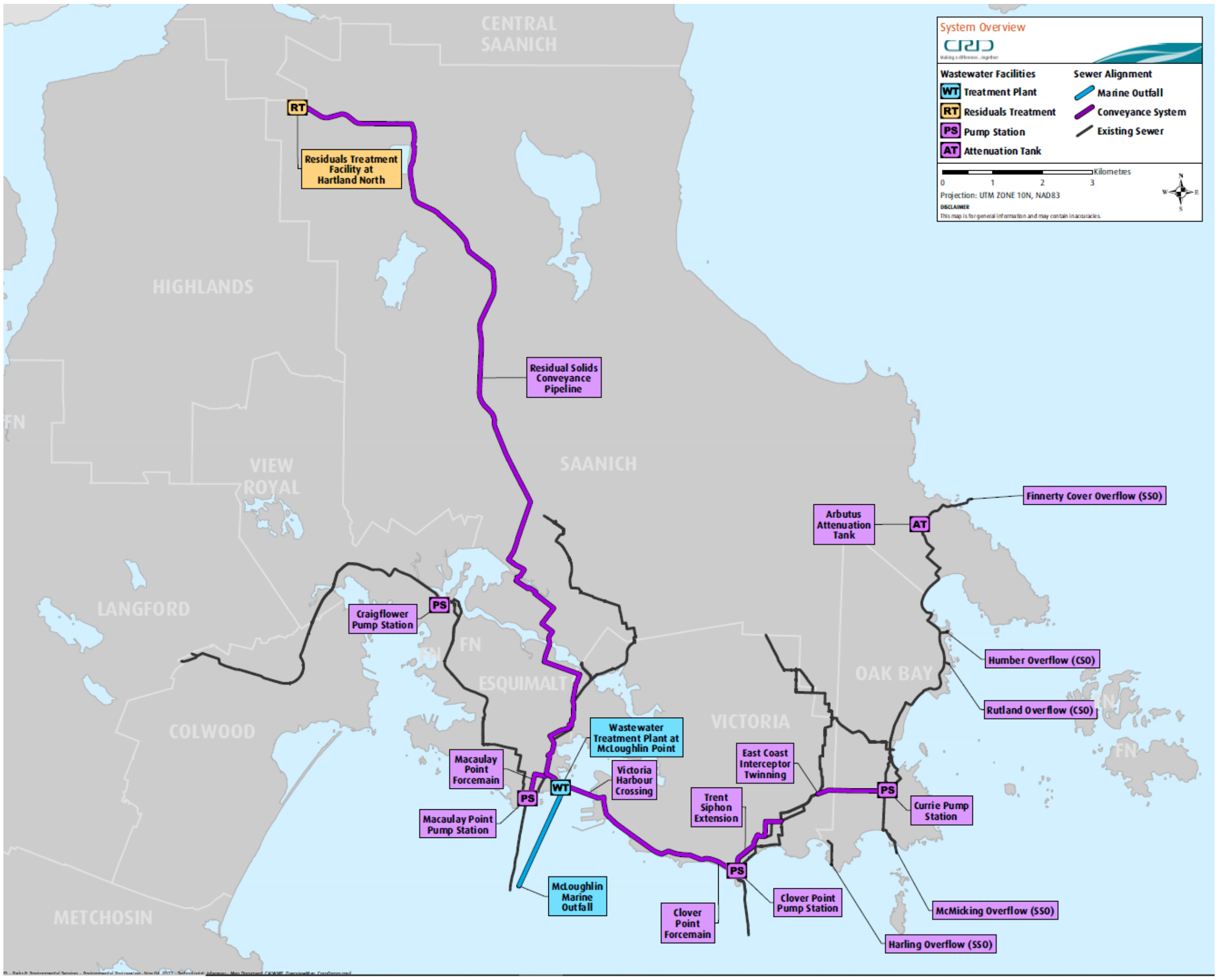
Flows up to 216 MLD (i.e., 2xADWF) receive full tertiary treatment. When flows exceed 216 MLD, typically during wet weather, the flows above 216 MLD receive primary only (high rate Densadeg) treatment, and are then blended with the 216 MLD of tertiary effluent prior to outfall discharge.

Both Clover and Macaulay pump stations now have the capacity to pump 4xADWF to McLoughlin. During heavy rain events, flows may exceed this threshold. In these rain events, flows exceeding 4xADWF are screened to 6 mm and discharged out their respective long outfalls – effectively operating as sanitary sewer overflow points for the upstream conveyance system.

Wastewater has been discharged from the Macaulay Point and Clover Point outfalls for over 100 years. The Macaulay outfall has been in use since 1915, with the initial discharge at low tide level. In 1971, to alleviate shoreline pollution, the location of discharge was moved offshore. The outfall is now approximately 1,800 m long and terminates in a multiport diffuser at a depth of 60 m. The discharge of municipal wastewater at Clover began in 1894. Discharge was to the shoreline until 1981, when construction of an extended outfall was completed. The Clover outfall is now approximately 1,160 m long and discharges through a multiport diffuser at a depth of approximately 65 m.

The treated McLoughlin and screened wet weather Macaulay and Clover wastewaters are discharged to the fast-moving waters of Juan de Fuca Strait. The non-saline wastewaters are then rapidly diluted, as they mix with surrounding marine waters. As the wastewater plumes mix with the marine waters, they rapidly rise and trap at mean depths of 20-50 m (McLoughlin) and 45-60 m (Macaulay and Clover), with some plume surfacing predicted during periods of slack tide, predominantly during the winter months (Hodgins, 2006; Lorax, 2019).

Figure 1.1 Locations of Major Core Area Wastewater Facilities and Discharge Locations



In addition to the three main discharge points, there are several shoreline sanitary sewer overflow (SSO) and two combined sewer overflow (CSO) locations in the upstream conveyance system (Figure 1.1) that serve as wet weather and emergency bypass and overflow locations. A new flow attenuation tank was installed in the upstream conveyance system on Arbutus Road (near Haro Woods) as part of the McLoughlin project. This tank substantively reduces the frequency of most downstream SSO discharge events relative to the old configuration. The two CSO locations are within the District of Oak Bay. Oak Bay is required to separate these systems and is developing a plan to do so. Until separated, the frequency of CSO discharge events will remain unchanged as they are operated independently of the adjacent trunk conveyance system during wet weather events.

In March 2003, the CRD Core Area Liquid Waste Management Plan (LWMP) (CRD, 2000) was approved by the BC Ministry of Environment and Climate Change Strategy (ENV). The plan outlined the CRD's strategy to manage liquid wastes for the next 25 years. Commitments made in this plan were designed to protect public health and the environment from the impacts of liquid waste discharges. On July 21, 2006, the CRD received a letter from the minister of environment requiring an amendment to the plan detailing a schedule for the provision of secondary or better sewage treatment. In the letter, the minister also requested that the CRD continue the current monitoring program. The plan amendment #7 (CRD, 2009) was submitted to ENV in December 2009, with follow up amendments #8 (CRD, 2010), #9 (CRD, 2014), #10 (CRD, 2016), #11 (CRD, 2016), and #12 (CRD, 2017a). These amendments have all been conditionally approved by ENV and included the CRD's commitment to build the new plant at McLoughlin Point, plus a facility at Hartland Landfill to treat the resulting sewage residuals to a Class A biosolids standard, as per the BC

Organic Matter Recycling Regulation. Amendment #12, detailing the District of Oak Bay's plans to eliminate the two CSO locations in the Clover system, was also conditionally approved in June 2018.

The McLoughlin WWTP operates under *BC Municipal Wastewater Regulation* registration RE-108831, which was originally issued in June 2020 and revised in February 2021. The MPWWTP also meets all requirements of the Federal *Wastewater Systems Effluent Regulation* (WSER). The Macaulay and Clover outfalls historically operated under permits issued by ENV under the 2004 *BC Environmental Management Act* [formerly the *BC Waste Management Act* (BCMoE, 2004)]. Following the commissioning of the McLoughlin facility, the permit for Clover was cancelled effective June 20, 2021 and for Macaulay effective January 7, 2022. The transitional authorizations for Macaulay and Clover, to discharge deleterious substances under WSER, were also cancelled effective December 31, 2020. All three outfalls also operate under the long-term direction of the LWMP (see Section 1.1.1 for more detail).

Monitoring year 2022 represents Cycle 3, Year 2 of the Environmental Monitoring Program (EMP; formerly the Wastewater and Marine Environment Program [WMEP]). As the Residuals Treatment Facility at Hartland Landfill is regulated under a separate provincial authorization (ME-109471), biosolids monitoring results are presented in separate reports (CRD, 2023 and HRMG, 2023).

1.1.1 Program History

Monitoring of wastewater discharges, surface waters and the seafloor environment in the vicinity of the Macaulay and Clover outfalls has been conducted as part of the EMP on a regular basis since the late 1980s. The program has undergone several changes over the years. Monitoring of wastewater, marine surface waters close to the outfalls, and benthic communities were conducted in the 1970s and 1980s in collaboration with the University of Victoria (UVIC) and independent consultants. In addition, special additional investigations were undertaken to more clearly define the effects of the outfalls on the receiving environment. In 1992, a detailed investigation of effects related to the outfalls was conducted by EVS Environment Consultants Ltd. (North Vancouver, BC) (1992). This study included the analysis of wastewater and sediment chemistry, sediment toxicity, and the assessment of the health of biological communities near the outfalls. The 1992 study results were used to design a regular monitoring and assessment program, in collaboration with the Marine Monitoring Advisory Group (MMAG) (see Section 1.2 for details).

From 1992 until 1999, the program consisted of monthly wastewater analysis for conventional parameters, quarterly wastewater analysis for priority substances, monthly surface water (<1 m depth) sampling for indicator bacteria, yearly sediment chemistry analysis and seafloor organism monitoring on a three-year cycle. Starting in 2000, the program was again revised in consultation with MMAG, with changes primarily in increased frequency of monitoring. Special additional investigations continued to supplement the routine monitoring as necessary.

Toxicity testing also used to be a component of the monitoring program for both wastewater and sediment. Wastewater toxicity testing invariably failed, primarily due to the high ammonia concentrations in the Macaulay and Clover wastewaters. Because ammonia is not typically a concern in the marine environment, it was agreed in consultation with MMAG and ENV that wastewater toxicity testing be dropped from the program. Sediment toxicity testing was also a component of the program and was dropped following the 1992 EVS study (EVS, 1992) due to confounding total organic carbon concentrations. Both sediment and wastewater toxicity testing, using updated methodologies, were reintroduced to the monitoring program in 2011 as part of a revised monitoring program for which more details are provided below.

The Society of Environmental Toxicology and Chemistry (SETAC) completed a review of the CRD Core Area LWMP in 2006 (SETAC, 2006). This review panel commented that the monitoring program was substantial and well designed, and that continuing it would be appropriate for assessing the CRD wastewater discharge in the future. However, the panel made several recommendations to enhance the monitoring program, including considering more extensive monitoring with better spatial and temporal resolution in the far-field to provide a better understanding of the fate of the surfaced sewage plume. Since the SETAC review, the decision to move to advanced treatment was made.

In 2008, CRD and ENV staff initiated a review of the objectives and design of the monitoring program, considering the SETAC review and plans to install additional treatment for the Macaulay and Clover wastewaters. As a result of this review, a revised monitoring program based on a five-year cycle was implemented in 2011. Both the MMAG and consultants familiar with the monitoring program data reviewed the new program (Golder, 2011) and provided recommendations. There is also a commitment within the five-year monitoring program that CRD and ENV staff will meet on an annual basis to review the results of the previous monitoring year.

The monitoring program design for Cycle 3 and beyond has been revised based on these annual collaborative reviews, comments from the advisory group and other external expert reviews, and the transition to treatment at McLoughlin in 2020. Since 2020, EMP revisions have primarily included shifting most of the wastewater and surface water monitoring effort to McLoughlin and adding new stations to the seafloor monitoring to encompass the predicted impact footprint of the new McLoughlin outfall. Monitoring of the new seafloor locations began in 2019, along with some effluent quality monitoring once the MPWWTP commissioning began in 2020. In addition, the bulk of the wastewater monitoring effort at Macaulay and Clover was dropped effective December 31, 2020, aligning with cancellation of the Federal Transitional Authorizations for the two facilities, and shifted instead to the McLoughlin facility. As such, the overall monitoring shift to McLoughlin effectively started in 2021, which aligns with Cycle 3, Year 1 of the EMP.

With the commissioning of the MPWWTP came the need to manage sludge and produce biosolids, which ae produced at the Residuals Treatment Facility (RTF) at the Hartland Landfill. As noted previously, the RTF is under a separate provincial authorization and monitoring results are presented in other reports (CRD, 2023 and HRMG, 2023).

1.1.2 Approach and Program Components

As noted above, the current monitoring program components were developed in conjunction with ENV and MMAG, as part of the new environmental monitoring program based on a five-year cycle. The first cycle (Cycle 1) took place from 2011-2015, but one component (the fish survey) was delayed until 2018 due to logistical concerns. Cycle 2 began in 2016 and ended in 2020. Cycle 3 began in 2021 and will end in 2025. The objectives of the monitoring program [as presented in the Core Area Liquid Waste Management Plan (CRD, 2000) and updated in amendment #7 (CRD, 2009)] are as follows:

- monitor and assess wastewater quality and quantity.
- monitor and assess the potential effects of the wastewater discharges to the marine environment.
- monitor and assess the potential effects of the wastewater discharges to human health.
- provide information to the CRD's Regional Source Control Program.
- provide information to wastewater managers regarding plant and outfall diffuser performance.
- provide compliance monitoring results to regulatory agencies.
- provide scientific assessment to the general public regarding the use of the marine environment for the disposal of municipal wastewater.

A summary of the monitoring components and sampling frequency of the current five-year EMP Cycle 3 is presented in Table 1.1. The 2022 monitoring program is presented in Table 1.2 and consisted of the following components:

- wastewater monitoring and analysis for a list of substances, including conventional parameters, metals, and other priority substances and toxicity (conducted monthly at McLoughlin).

- surface water and water column monitoring and analysis for bacteriological indicators of potential for human exposure to wastewater in the marine environment. Additionally, a list of substances, including conventional parameters, metals, and other priority substances (conducted quarterly at McLoughlin, and only if they are discharging coincident with routine McLoughlin sampling, around the Macaulay and Clover outfalls).

- wet weather overflow and bypass sampling for bacteriological indicators of potential for human exposure to wastewater in the marine environment, and a subset of conventional parameters indicative of wastewater strength (conducted as needed at Macaulay and Clover, and around the various shoreline overflow locations when bypass, overflow or wet weather events occurred).

- continuing additional investigations that address specific questions about water column and seafloor monitoring components and that investigate emerging scientific issues regarding wastewater discharges and environmental effects.

Reclaimed water monitoring is also a requirement of the EMP, but the reclaimed water system was abandoned early in 2021 due to operational challenges. As such, no reclaimed water data will be presented in this report.

An evidence-based approach is used to assess potential environmental effects. Wastewater is analyzed on a regular basis to monitor the substances present in sewage. The potential effects of these substances on organisms in surface waters and the water column are assessed by comparing the concentrations that are predicted in the marine environment to water quality guidelines. The predicted concentrations are calculated by applying computer model-derived receiving environment dilution factors to the wastewater concentrations. Predicted concentrations are then confirmed by surface and water column monitoring around each outfall. Human health risks are assessed via the surface, water column and shoreline bacteriological monitoring. Concentrations of substances present in the wastewater discharges are also analyzed in sediments around the outfalls and at reference sites. Sediment chemistry results are compared to various sediment quality guidelines as a screening tool to predict potential effects on biological organisms in the marine environment. Finally, organisms that live around the outfalls are monitored to assess direct *in situ* outfall effects.

The organisms that have the potential for the most severe effects in the marine environment close to the outfalls are those that are sessile and/or continuously exposed to the wastewater discharges. These include benthic invertebrate communities off the McLoughlin and Macaulay outfalls and mussel communities off the Clover outfall. Prior to 2011, these organisms were monitored annually. As part of the revised EMP design, their monitoring frequency was reduced to only once (mussel communities) or twice (benthic invertebrate communities) in the five-year cycle. This reduced frequency has allowed for the addition of sediment toxicity and bioaccumulation assessments, along with the finfish health assessment.

In addition to the sediment toxicity and bioaccumulation studies, the health of the seafloor communities is evaluated by assessing what organisms are present, along with their abundance, growth, and reproductive status. These biological indicators provide a direct assessment of *in situ* environmental effects. Potential effects to higher trophic levels (e.g., fish and marine mammals) are also assessed by measuring concentrations of substances present in wastewater, sediments, benthic invertebrate, mussel, and finfish tissues.

The five-year monitoring cycles will continue to be supplemented by additional investigations, as necessary. Additional investigations are important elements of the monitoring program, with some of the investigations part of the requirements under the Core Area LWMP 2003 approval. Current additional investigations are presented in Table 6.1 and are discussed in Section 6.0. Results from these investigations are incorporated in the overall assessment of effects on the marine environment.

1.2 Marine Monitoring Advisory Group

The CRD formed the MMAG in 1987 to advise on and provide an independent assessment of CRD marine monitoring programs. The MMAG consisted of university and government scientists with expertise in the fields of marine science, oceanography, toxicology, chemistry and environmental health. Since 1987, the MMAG has worked with the CRD to develop a comprehensive monitoring program for the Macaulay and Clover outfalls and has historically been required to submit an annual review of the program to ENV. In September 2010, ENV waived all formal advisory group reporting requirements. The CRD, however, retained the MMAG and broadened the group’s mandate to include the review of the CRD’s Integrated Watershed Management Program marine monitoring activities, as well as expanded the group’s membership to include members of the public with relevant expertise. Because of the transition to a new treatment system to replace the Macaulay and Clover outfalls, the monitoring program has largely been kept unchanged in recent years, except for adding new seafloor stations adjacent to the new McLoughlin outfall. Advice of the MMAG has not been solicited since 2015, but there are plans to resurrect the group once the new McLoughlin treatment system is fully commissioned and operation has stabilized.

1.3 Data Presentation and Analysis

Until 2000, the results of the EMP were tabulated in separate reports according to each sampling component (wastewater monitoring results, etc.). Each of these reports presented a snapshot into the effects of the outfalls on the receiving environment. A comprehensive summary of the results was provided by compiling the data from the different components on a regular basis (once every three to five years). As the frequency of the seafloor components was increased from every three years to annually in 2000, and as additional elements were incorporated into the program, it became evident that the program would benefit from the production of an annual report. Annual reporting began with the 2000-2001 report, which was completed in 2002 (CRD, 2002) and continued up to and including the 2010 monitoring year (CRD, 2011).

Following the review and redesign of the EMP, the need for annual comprehensive reporting was reassessed. Summary data reports are now provided following each of the first four years of a five-year cycle, beginning with the 2011 monitoring year. These data reports will include any completed statistical assessments of the data and the results used to confirm the suitability of the upcoming year's monitoring design. A more comprehensive interpretive report (similar to the annual reports prepared for the 2000-2010 monitoring results) will be prepared at the end of each five-year cycle (after year five) and will include detailed statistical and environmental risk assessments of all data collected within the five-year cycle. The comprehensive report for Cycle 1 was expanded to include 2016-2019 Cycle 2 data. The final report was received in the fall of 2020 (Hatfield, 2021) and a summary of the findings was presented in CRD, 2021.

This report presents a summary of the results of the 2022 Core Area EMP (Cycle 3, Year 2), along with any data and analyses of results from previous years that have not yet been presented. Limited statistical analyses have been performed on the 2022 data; a more detailed and comprehensive statistical assessment of the 2022 results will be undertaken as part of a future Cycle 3 (2021-2025) review that will be initiated in 2024/2025.

Table 1.1 Monitoring Components of the Five-Year McLoughlin, Macaulay, and Clover Environmental Monitoring Program (Cycle 3)

Monitoring Component	Sub-component	Year 1 (2021)			Year 2 (2022)			Year 3 (2023)			Year 4 (2024)			Year 5 (2025)		
		McL[1]	Mac[1]	Clo[1]	McL	Mac	Clo	McL	Mac	Clo	McL	Mac	Clo	McL	Mac	Clo
WASTEWATER																
Wastewater	daily, weekly, monthly and quarterly chemistry	√			√			√			√			√		
	quarterly high-resolution chemistry	√			√			√			√			√		
	monthly toxicity testing	√			√			√			√			√		
	ad hoc wet weather, overflow and bypass chemistry		√	√		√	√		√	√		√	√		√	√
Reclaimed Water	weekly chemistry	√			√			√			√			√		
SEAFLOOR																
Sediment	sediment chemistry				√	√	√				√	√				√
	pore-water chemistry				√	√	√				√	√				
	sediment toxicity				√	√	√				√	√				
	sediment/benthic invertebrate bioaccumulation				√	√					√	√				
Benthic Invertebrates	community structure				√	√					√	√				
Mussels	community indices and health															√
	tissue chemistry															√
Fish	health indices														√[2]	√[2]
	whole fish and fillet tissue chemistry														√[2]	√[2]
SURFACE WATER AND WATER COLUMN																
Surface Water	bacteria	√			√			√			√			√		
Water Column	bacteria, conventionals, metals	√			√			√			√			√		
Ad Hoc Wet Weather, Overflow and Bypass Events	surface and water column bacteria		√	√		√	√		√	√		√	√		√	√
	shoreline bacteria	various conveyance system sanitary and combined sewer overflow shoreline locations														
REPORTING AND ADDITIONAL INVESTIGATIONS																
Additional Investigations	dependent upon emerging environmental issues and recommendations by the advisory group and others	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Reporting	annual data summary report	√	√	√	√	√	√	√	√	√	√	√	√			
	five-year comprehensive report													√	√	√

Notes:
[1] McL-McLoughlin, Mac-Macaulay, Clo-Clover.
[2] Timing of this study to be determined as the Cycle 1 fish survey didn't take place until Cycle 2.

Table 1.2 Monitoring Components of the 2022 McLoughlin, Macaulay, and Clover Environmental Monitoring Program

McLoughlin Outfall	Parameter	Monitoring Frequency
Wastewater	Flow	Daily
	Compliance monitoring and process control	Federal – Weekly, Provincial – Various frequencies
	Conventional parameters[1] and priority substances[1]	Monthly
	Enhanced priority substances[1]	Quarterly (January, April, July, October)
	Toxicity – acute	Monthly
	Toxicity – chronic	Annually
Surface Water & Water Column	Indicator bacteria (fecal coliform and Enterococci) and CTD (dissolved oxygen, salinity, temperature) Conventional parameters[1] and metals[1]	Quarterly with 5 sampling events in 30 days during each quarter
Seafloor	Conventional parameters[1] and priority and high resolution substances[1]	Two times in a five-year cycle (2022 and 2024)
Macaulay Outfall	**Parameter**	**Monitoring Frequency**
Wastewater	Flow	Measured during bypasses and overflows
	Indicator bacteria and select conventional parameters	Measured during bypasses and overflows
Surface Water & Water Column	Indicator bacteria (fecal coliform and Enterococci) and CTD (dissolved oxygen, salinity, temperature) Conventional parameters[1] and metals[1]	Measured during bypasses and overflows if coincident with routine McLoughlin surface water sampling
Clover Outfall	**Parameter**	**Monitoring Frequency**
Wastewater	Flow	Measured during bypasses and overflows
	Indicator bacteria and select conventional parameters	Measured during bypasses and overflows
Surface Water & Water Column	Indicator bacteria (fecal coliform and Enterococci) and CTD (dissolved oxygen, salinity, temperature) Conventional parameters[1] and metals[1]	Measured during bypasses and overflows if coincident with routine McLoughlin surface water sampling
Seafloor		One time in a five-year cycle (2025) at Clover
Conveyance Overflows	**Parameter**	**Monitoring Frequency**
Shoreline	Indicator bacteria (fecal coliform and Enterococci)	Measured during bypasses and overflows

Notes:
[1]Analyte lists can be found in Appendices B1 (wastewater); C1 (water column).

2.0 WASTEWATER MONITORING

2.1 Introduction

Influent and final effluent monitoring is conducted regularly to assess compliance with the registration under the Municipal Wastewater Regulation and with the Federal Wastewater Systems Effluent Regulations (WSER). Regulated parameters include carbonaceous biochemical oxygen demand (CBOD), un-ionized ammonia, toxicity, total suspended solids (TSS), and pH. Table 2.2 presents the federal and provincial limits for these regulated parameters.

Monitoring is also conducted to profile the chemical and physical constituents of influent and effluent before they are released to the marine receiving environment. Assessment of influent and effluent provides information on the concentrations and loadings of contaminants released to the marine receiving environment and provides an indication of which substances may be of environmental concern. These results are then used to direct the efforts of the receiving environment monitoring program and the CRD's Regional Source Control Program.

Wastewater monitoring is also required at the Clover and Macaulay pump stations during conveyance system wet weather overflows, or planned and approved maintenance bypass events. The objective of this monitoring is to assess equivalency to primary treatment and provide data to determine potential risk to the receiving environment. If these events happen concurrently with routine MPWWTP surface water sampling, then receiving environment sampling around the Macaulay and Clover outfalls is also required (discussed in Section 3.0).

The MPWWTP provincial registration allows the use of reclaimed water for operations use (i.e., wash down treatment works). The registration designates the use as "moderate exposure-frequent use", which stipulates criteria for reclaimed water quality to protect the environment and human health. The use of reclaimed water was discontinued in 2021 due to difficulty maintaining quality that was compliant with the registration. This challenge was because of frequency of use: the reclaimed system was designed to operate more frequently than it was, resulting in fouling and non-compliance. The reclaimed water system was subsequently shutdown.

2.2 Methods

Federal and Provincial Compliance Sampling

Both federal and provincial compliance monitoring of MPWWTP final effluent were taken as 24-hour flow based composite samples as required by regulations. Flow-based sampling methods lead to samples taken proportional to the flow (recorded by the SCADA system). After collection, samples were immediately dispatched to two CALA certified laboratories to conduct chemical analyses (Bureau Veritas Laboratories [BV Labs, Burnaby, BC] and the in-house MPWWTP Laboratory).

Toxicity testing using rainbow trout and *Daphnia magna* was conducted monthly by Nautilus Environmental (Burnaby, BC) using final effluent grab samples. The rainbow trout test methods approved by regulators (provincial and federal) allow both EPS 1/RM/50 and EPS 1/RM/13. Test method EPS 1/RM/13 does not use CO_2 aeration to adjust for pH drift while EPS 1/RM/50 does. To use test method EPS 1/RM/50, the discharger must demonstrate that any toxicity is caused by ammonia and pH drift in the test conditions. Final effluent was tested initially in 2021 using 1/RM/13 but was switched to pH stabilized 1/RM/50 after ammonia toxicity was demonstrated (discussed further in Section 2.3.4).

Influent and effluent flow volumes were measured continuously (every few minutes) by a SCADA system at the MPWWTP influent and effluent points. Final effluent flow measurements were compared to maximum daily and annual mean flow limits specified in the permits. Flow values were also used for the calculation of loadings of conventional and priority substances by multiplying daily flows against daily concentrations then extrapolating out to annual loadings to the marine receiving environment.

Wastewater Characterization

CRD staff conducted influent and effluent sampling at the MPWWTP for wastewater characterization and treatment plant performance. Samples were analyzed daily, weekly, monthly, or quarterly for over 20 conventional parameters, such as total suspended solids and nutrients. A comprehensive list of up to 500 priority substances were analyzed monthly or quarterly as described in Table 2.1 and Appendix B1. Acute toxicity was tested monthly and chronic toxicity was tested annually in autumn.

MPWWTP influent and effluent samples were taken as 24-hour time-based composites in 2022 (400 mL wastewater collected every 30 minutes for 24 hours and combined into one sample). Time based composites, as opposed to flow based were used for wastewater characterisation analysis as more predictable sample volumes are required to ensure sufficient sample volume for analysis.

The list of priority substances was originally adapted from the US Environmental Protection Agency (US EPA) National Recommended Water Quality Criteria; Priority Toxic Pollutants list (US EPA, 2002). The CRD's list is reviewed periodically to determine the need to remove or add substances depending on new developments in terms of analytical techniques, potential presence in wastewaters, and potential effects on the receiving environment. The list was most recently revised to align with Ocean Wise's Pollution Tracker Program.

After collection, samples were immediately dispatched to Canadian Association for Laboratory Accreditation Inc. (CALA) certified laboratories to conduct chemical analyses. Conventional and priority substance parameters were analyzed by Bureau Veritas Laboratories (BV Labs, Burnaby, BC), and high-resolution analyses were conducted at SGS AXYS Analytical Services (Sidney, BC). Substances were analyzed using methods capable of achieving method detection limits suitable for comparison to applicable water quality guidelines. Acute (Appendix B6) and chronic (Appendix B7) wastewater toxicity testing was conducted by Nautilus Environmental (Burnaby, BC), using standardized and Environment Canada approved protocols.

Overflow and Bypass Sampling

As required by ENV, any overflow or bypass event discharged from either the Clover or Macaulay pump station must be sampled by automated composite samplers. These samplers are programmed to trigger half hourly composite samples if an overflow or bypass event exceeds one hour of discharge out of either respective long outfall. After collection, composite samples are then dispatched to CALA certified laboratories for fecal coliform, Enterococci, TSS and CBOD analysis. This sampling did not occur in 2022 as there was only one overflow event and the composite sampler did not trigger as planned. The program has been reviewed and tested for successful operation in 2023.

Table 2.1 Frequency of Wastewater Sampling by Analytical Group

(Appendix B1 provides a listing of individual analytes within each analytical group)

Parameter Group	Influent and Final Effluent Analytics			
	Daily/ Weekly	Monthly	Quarterly	Annual
Conventionals (nutrients, oxygen demand, pH, TSS)	√	√	√	
Metals, total		√	√	
Metals, speciated (MeHg and TBT)			√	
Metals, dissolved		√	√	
Aldehydes		√	√	
Phenolic compounds		√	√	
Chlorinated phenolics		√	√	
Non-chlorinated phenolics		√	√	
Polycyclic aromatic hydrocarbons		√	√	
Semi-volatile organics		√	√	
Miscellaneous semi-volatile organics		√	√	
Volatile organics		√	√	
Terpenes		√	√	
Acute Toxicity				
Rainbow trout 96-hr LC50 pH stabilized		√*		
Daphnia magna 48-hr LC50		√*		
Chronic Toxicity				
Ceriodaphnia seven-day (survival and reproduction)				√*
Rainbow trout alevin and embryo (EA) 30-day (survival and growth)				√*
Top smelt seven-day (survival and growth)				√*
Echinoderm fertilization (reproduction)				√*
High-Resolution Analyses				
Nonylphenols (NP)			√	
Organochlorine pesticides (OC Pest)			√	
Pharmaceuticals and personal care products (PPCP)			√	
Polychlorinated biphenyls (PCB)			√	
Polycyclic aromatic hydrocarbons (PAH)			√	
Polybrominated diphenyl ethers (PBDE)			√	
Polychlorinated dibenzodioxins (PCDD)				
Per- and poly-fluoroalkyl substances (PFAS)			√	

Notes:
*final effluent only

DATA QUALITY ASSESSMENT

CRD staff followed a rigorous quality assurance/quality control (QA/QC) assessment procedure for both field sampling procedures and laboratory analyses for the routine wastewater monitoring component. From each analytical batch (12 monthly batches in 2022), one sample was randomly chosen for laboratory triplicate analysis every quarter (January, April, July and October) and one sample was randomly chosen for field triplicate analysis annually. In addition, one sample each month was analyzed as a matrix spike, and trip and field blanks were tested once in 2022. The analytical laboratories also conducted internal QA/QC analyses, including method analyte spikes, method blanks and standard reference materials.

Any data that exhibited failures of QA/QC criteria was not included in any statistical analysis.

2.3 Results and Discussion

Table 2.2 presents the Federal and Provincial final effluent compliance limits.

Table 2.2 McLoughlin Point WWTP Provincial and Federal Compliance Limits – Final Effluent

Parameter	Unit	Provincial Limit		Federal Limit
		McLoughlin WWTP ≤216,000 m^3/day	McLoughlin WWTP* >216,000 m^3/day	McLoughlin WWTP ≤432,000 m^3/day
CBOD	mg/L	25 (maximum) 10 (monthly average)	130 (maximum)	25 (monthly average)
Rainbow Trout Toxicity	pass/fail	pass	---	pass
TSS	mg/L	25 (maximum) 10 (monthly average)	130 (maximum)	25 (monthly average)
Unionized NH_3 @ 15°C	mg/L	---	---	1.25 (maximum)
pH	pH	6-9	---	---
Effluent Flow (maximum)	m^3/day	432,000		---

Notes:
*Provincial registration allows only 70 days per year >216,000 m^3/day.

2.3.1 Provincial Compliance Monitoring

Effluent monitoring is undertaken to ensure compliance with the provincial registration issued for MPWWTP; effluent quality limits vary depending on whether the facility is discharging solely tertiary effluent when flows are less than or equal to 216,000 m^3/day (≤2ADWF), or blended (primary + tertiary) effluent when flows are greater than 216,000 m^3/day (>2DWF). Table 2.2 presents these compliance limits. The MPWWTP is authorized to blend primary and tertiary flows for 70 days per year. The provincial registration also requires monitoring and reporting of ammonia, phosphate, total phosphorous, fecal coliforms and Enterococci, but there are no effluent quality limits for these parameters. Results for pH, ortho-phosphate and total phosphorous are presented in Table 2.5.

The average daily effluent flow from MPWWTP was 91,796 m^3/day, and the maximum was 232,000 m^3/day on January 11, 2022, well below the limit of 432,000 m^3/day. Flow information is presented in Figure 2.1 and Appendix B2 (influent) and Appendix B3 (effluent).

Table 2.3 presents the compliance results for non-blended flow days (<216,000 m^3/day). MPWWTP effluent was not compliant with provincial registration requirements on the following occasions:

Monthly Averages

- Monthly average TSS concentrations were out of compliance in 6 of the 12 monthly averages (February, March, April, May, June, and November).

- Monthly average CBOD concentrations were out of compliance for 11 of the 12 monthly averages (February, March, April, May, June, July, August, September, October, November and December).

Maximum Values

- Individual maximum TSS concentrations were out of compliance 5 times in 2022 (February 28, March 17, June 9, October 12, and December 26).

- Individual maximum CBOD were out of compliance 2 times in 2022 (June 9 and October 12).

Maximum CBOD and TSS concentration exceedances did not align with blended days and are most likely a result of continued optimization of plant operations at the MPWWTP. In addition, there is potential that highly variable centrate return flows from the Hartland Residuals Treatment Facility may be impacting the treatment plant's ability to achieve effluent quality limits at all times. Investigations and optimization efforts are ongoing. In 2022, there were 21 days when blending occurred, but of those, only 3 days were when total flows were greater than 216,000 m^3. The remaining 18 days were technically out of compliance because full tertiary treatment capacity was not achieved prior to blending. Operators continue to refine the instantaneous flow control set points that resulted in the premature blending.

Table 2.4 presents flow measurements and compliance results for the 21 days that blending occurred. During the 21 days that blending occurred and flows were <216,000 m^3/day, most compliance results were below the normal non-blended maximum limits of 25 mg/L for TSS and CBOD except for one CBOD measurement on October 12 (78 mg/L) and two measurements for TSS on March 17 (36 mg/L) and December 26 (29 mg/L).

An acute toxicity test conducted on June 14 using method EPS 1/RM/50 (pH stabilized) failed and was likely caused by clogged sample tubing that delivers final effluent to the laboratory. Subsequent tests were run increasing the flushing time. All subsequent toxicity tests in 2022 passed. All Daphnia acute toxicity testing passed without any test modifications.

2.3.2 Federal Compliance Monitoring

Table 2.3 presents results of compliance to WSER. The MPWWTP was compliant with WSER limits for TSS, unionized ammonia and CBOD in 2022.

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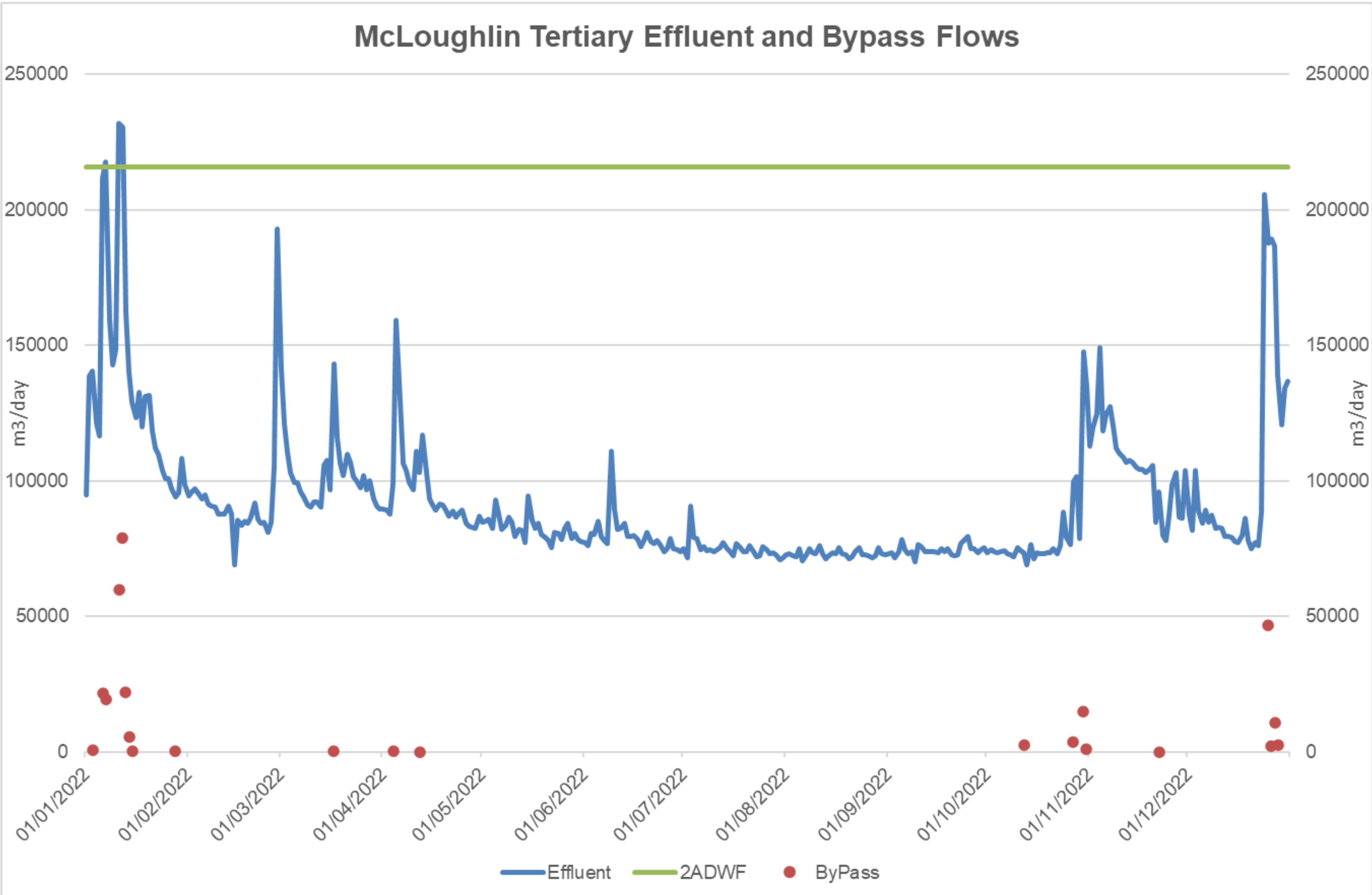


Figure 2.1 McLoughlin Point WWTP Tertiary Effluent Flows in 2022

Table 2.3 McLoughlin Point WWTP Federal and Provincial Wastewater Compliance Results for 2022 (<2x ADWF*)

McLoughlin Point Wastewater Treatment Plant Final Effluent										
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
01-Jan-22	94,800				8.0		28.0		
02-Jan-22	138,800			8.3	12.0	0.2			
03-Jan-22	140,500	520		8.8	8.0		24.0		
04-Jan-22	121,300			6.1	5.0	0.23		44,000	3,800
05-Jan-22	116,500			5.4	9.0		16.0		
06-Jan-22	211,900	21,600		8.7		0.08			
07-Jan-22	217,800	19,200							
08-Jan-22	159,300				6.0		13.0		
09-Jan-22	142,800			6.7	5.0	0.02			
10-Jan-22	148,500			5.4	13.0		17.0	45,000	6,900
11-Jan-22	232,000	59,800		9.9	25.0	0.02			
12-Jan-22	230,600	79,080		11.5	14.0		11.0		
13-Jan-22	162,400	21,930		9		0.01			
14-Jan-22	140,000	5,640							
15-Jan-22	129,100	170			9.0		23.0		
16-Jan-22	123,500				10.0	0.07			
17-Jan-22	132,700				14.0		17.0		
18-Jan-22	120,000			11.1	8.0	0.04		68,000	5,300
19-Jan-22	131,300		Pass	9.3	7.0	0.02	22.0		

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
20-Jan-22	131,600					0.06			
21-Jan-22	118,500								
22-Jan-22	112,100				5.0		28.0		
23-Jan-22	110,000			11	8.0	0.07			
24-Jan-22	103,800			10	6.0		23.0		
25-Jan-22	100,700			12	8.0	0.06		42,000	4,900
26-Jan-22	100,800			9.5	7.0		33.0		
27-Jan-22	97,100			10	5.0	0.15			
28-Jan-22	94,100	70		6.3					
29-Jan-22	95,600				10.0		29.0		
30-Jan-22	108,500			9.8	13.0	0.05			
31-Jan-22	98,700			15	16		37.9		
January Average				**9.3**	**8.1**		**24**		
01-Feb-22	94,600			12.0	10.0	0.05	28.0	280,000	47,000
02-Feb-22	96,000			14.0	11.0				
03-Feb-22	97,200			15.5	10.0	0.05	25.0		
04-Feb-22	95,500								
05-Feb-22	93,500								
06-Feb-22	94,700			14.0	15.0		31.0		
07-Feb-22	91,300			14.8	12.0				

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
08-Feb-22	90,600			16.9	13.0	<0.1	33.1	110,000	10,000
09-Feb-22	90,400			16.5	11.0				
10-Feb-22	87,900			13.0	13.0	<0.1	32.4		
11-Feb-22	87,700								
12-Feb-22	87,900								
13-Feb-22	90,700			12.8	10.0	<0.1	27.6		
14-Feb-22	87,600			12.3	10.0				
15-Feb-22	69,100			12.1	12.0	0.11	32.2	380,000	59,000
16-Feb-22	85,600		Pass	14.7	15.0	0.05	31.0	64,000	11,000
17-Feb-22	83,700			19.4	10.0	0.14	31.3		
18-Feb-22	85,200				7.0				
19-Feb-22	84,300				8.0				
20-Feb-22	86,500			9.6	7.0	0.2	35.4		
21-Feb-22	92,000			8.5	8.0				
22-Feb-22	85,800			9.7	7.0	0.17	32.5	160,000	35,000
23-Feb-22	84,300			13.5	13.0				
24-Feb-22	84,700			14.8	11.0	0.11	25.4		
25-Feb-22	81,000				5.0				
26-Feb-22	84,900				11.0				
27-Feb-22	105,400			16.6	20.0	<0.1	25.7		

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
28-Feb-22	193,100			18.3	28.0				
February Average				**13.6**	**10.4**		**30.4**		
01-Mar-22	141,300			8.2	11	<0.1	14.6	100,000	14,000
02-Mar-22	121,100			7.5	6				
03-Mar-22	110,400			12.9	15	0.13	27.7		
04-Mar-22	103,200								
05-Mar-22	99,500								
06-Mar-22	99,500			15.5	16	0.19	39.4		
07-Mar-22	96,000			20.1	17				
08-Mar-22	94,100			12.6	11	0.15	38.9	220,000	38,000
09-Mar-22	91,000			21.5	16				
10-Mar-22	90,400			19.3	13	0.11	30.8		
11-Mar-22	92,200								
12-Mar-22	92,200								
13-Mar-22	90,300			16.4	14	0.17	36.2		
14-Mar-22	105,800			14.6	15				
15-Mar-22	107,400			14.6	12	0.12	30.9	280,000	48,000
16-Mar-22	96,900			10.1	8				
17-Mar-22	143,000	290		22.2	36	<0.1	29.5		
18-Mar-22	116,200								

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
19-Mar-22	106,400								
20-Mar-22	102,000			10.2	8	<0.1	23.7		
21-Mar-22	110,000			9.2	7				
22-Mar-22	106,900			6.4	9	<0.1		65,000	6,200
23-Mar-22	101,600		Pass	11	10	0.04	28	75,000	6,600
24-Mar-22	100,200			10.6	8	<0.1			
25-Mar-22	97,500								
26-Mar-22	102,100								
27-Mar-22	96,600			11.8	8	0.12			
28-Mar-22	100,100			11.7	8				
29-Mar-22	93,200			13.4	10	0.21		320,000	48,000
30-Mar-22	90,600			12.3	7				
31-Mar-22	89,600			16.9	14	0.17			
March Average				**13**	**11**		**29.3**		
01-Apr-22	89,600								
02-Apr-22	89,200								
03-Apr-22	87,700			17	15	<0.1	29.4		
04-Apr-22	98,900	400		16.6	25				
05-Apr-22	159,200			14.8	10	<0.1	18.2	87,000	9,700
06-Apr-22	129,500		Pass	11.8	12	0.03	19	64,000	11,000

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
07-Apr-22	106,500			12.1	10	0.17	29.4		
08-Apr-22	104,000								
09-Apr-22	99,400			12		0.1	29.3		
10-Apr-22	96,800			13.5	10	0.1	29.1		
11-Apr-22	111,100			10.6	10				
12-Apr-22	103,200	10		16.3	9			530,000	75,000
13-Apr-22	116,900			11.8	8	<0.1	24.4		
14-Apr-22	103,200								
15-Apr-22	93,300								
16-Apr-22	91,000								
17-Apr-22	89,100			9.5	7	0.1	23.1		
18-Apr-22	91,500			13.7	12				
19-Apr-22	91,200			15.7	12	0.16		470,000	33,000
20-Apr-22	89,200			16.1	14				
21-Apr-22	87,000			13	10	0.24	34		
22-Apr-22	88,700								
23-Apr-22	86,600								
24-Apr-22	88,200			12.7	10	0.16			
25-Apr-22	89,400			14.4	12				
26-Apr-22	84,500			14	13	0.1		490,000	91,000

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
27-Apr-22	83,100			13	13				
28-Apr-22	82,700			17.5	14	0.13			
29-Apr-22	82,500								
30-Apr-22	87,000								
April Average				**13.5**	**11.3**		**26.2**		
01-May-22	84,900			14.3	11	0.13	40.1		
02-May-22	85,200			15.9	13				
03-May-22	85,800			14	11	0.15	39.2	610,000	70,000
04-May-22	82,300			11	9				
05-May-22	93,000			13	10	0.13	30.7		
06-May-22	87,700								
07-May-22	82,200								
08-May-22	83,600			7.6	8	0.12	35.7		
09-May-22	86,700			14.4	11				
10-May-22	84,600			12.4	11	0.19	40.1	330,000	60,000
11-May-22	79,300			17.5	13				
12-May-22	82,100			16.7	14	0.21	44.1		
13-May-22	81,700								
14-May-22	77,300								
15-May-22	94,500				19	<0.1	32.3		

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
16-May-22	85,300			12	8				
17-May-22	82,300			14	11	0.1	41.9	390,000	48,000
18-May-22	84,500		Pass	14	11	0.08		130,000	74,000
19-May-22	80,400			16	9	<0.1	31.9		
20-May-22	79,100								
21-May-22	77,900								
22-May-22	75,500			12	7	<0.1	33.3		
23-May-22	81,000			13	10				
24-May-22	80,600				11	<0.1	36.2	52,000	11,300
25-May-22	78,400			10	11				
26-May-22	82,600			22	13	0.24	35.7		
27-May-22	84,200								
28-May-22	78,900			7					
29-May-22	80,500			14	11	0.12	32.2		
30-May-22	78,400			16	13			550,000	65,000
31-May-22	77,700			21	17	0.12	30.9		
May Average				**14**	**11.4**		**36**		
01-Jun-22	77,400			14	19				
02-Jun-22	76,000			15	13	0.18	37		
03-Jun-22	80,700								

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
04-Jun-22	80,100								
05-Jun-22	85,000			11	10	<0.1	25		
06-Jun-22	79,600			18	14				
07-Jun-22	78,100			23	15		49.8	580,000	60,000
08-Jun-22	77,000			19.3	14				
09-Jun-22	111,100			35	41	0.12	35.4		
10-Jun-22	89,700								
11-Jun-22	82,000								
12-Jun-22	82,500			15	12	0.13	32.8		
13-Jun-22	84,200			17.8	12				
14-Jun-22	79,400		Fail	18	16	0.51	50	480,000	66,000
15-Jun-22	79,400			18.1	12				
16-Jun-22	80,000			21.5	15	0.21	36.9		
17-Jun-22	78,200								
18-Jun-22	75,900								
19-Jun-22	77,900			14	6	0.13	35.1		
20-Jun-22	80,800			18.6	9				
21-Jun-22	77,700			12.3	8		34.5	490,000	55,000
22-Jun-22	76,700			19.9	14				
23-Jun-22	78,000			18	11	0.24	40.8		

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
24-Jun-22	76,600								
25-Jun-22	73,900								
26-Jun-22	74,900				8	0.13	34.8		
27-Jun-22	78,700				7				
28-Jun-22	74,800			10.9	9	0.12	30.3	360,000	44,000
29-Jun-22	74,500			8.8	7				
30-Jun-22	74,000								
June Average				**17.3**	**13**		**36.9**		
01-Jul-22	75,000								
02-Jul-22	71,500			8.5	7	0.24	29.9		
03-Jul-22	90,700			19	21	<0.1	24.5		
04-Jul-22	79,000		Pass	12.6	9				
05-Jul-22	78,900			17	12	0.15	31.4	1,100,000	24,000
06-Jul-22	74,600			17.6	10				
07-Jul-22	75,800			18.5	13	0.13	28.9		
08-Jul-22	74,100								
09-Jul-22	74,700								
10-Jul-22	73,700			7.9	8	0.14	31.7		
11-Jul-22	74,700		Pass	9.2	12				
12-Jul-22	75,300			15.8	14	0.2	37	630,000	21,000

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
13-Jul-22	77,200		Pass	16.7	9	0.06			
14-Jul-22	74,900			15	10	0.32	41.3		
15-Jul-22	73,900		Pass						
16-Jul-22	72,300								
17-Jul-22	76,900			11.2	7	0.37	52.5		
18-Jul-22	75,500			12.7	9				
19-Jul-22	73,900			12.1	9	0.15	37.9	920,000	65,000
20-Jul-22	73,900			13.3	8				
21-Jul-22	76,000			17.6	13	0.32	50.5		
22-Jul-22	73,700								
23-Jul-22	71,800								
24-Jul-22	72,200			7	6	0.19	35.8		
25-Jul-22	75,700			8.3	9				
26-Jul-22	74,500			11.6	7	0.2	28.8	450,000	26,000
27-Jul-22	73,100			6.7	7				
28-Jul-22	73,500			11.6	9	0.14	24.5		
29-Jul-22	72,700								
30-Jul-22	71,000								
31-Jul-22	71,700			7.6	5	0.15	30.8		
July Average				**12.6**	**9.7**		**34.7**		

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
01-Aug-22	72,800			8.5	6				
02-Aug-22	73,100			12	9	0.17	36.2	430,000	45,000
03-Aug-22	72,400			11.6	7				
04-Aug-22	71,900			13.7	9	0.12	26.1		
05-Aug-22	75,000								
06-Aug-22	70,300								
07-Aug-22	72,600			8	7	0.15	34.1		
08-Aug-22	75,000			12.5	9				
09-Aug-22	73,300			12.3	9	0.26	39.4	610,000	34,000
10-Aug-22	73,100			12.4	8				
11-Aug-22	76,000			13.2	7	0.34	45.6		
12-Aug-22	73,000								
13-Aug-22	71,200								
14-Aug-22	72,400			9.7	6	0.1	30.1		
15-Aug-22	73,500			9.9	8			420,000	29,000
16-Aug-22	73,200			11.8	10	0.14	30.8		
17-Aug-22	75,400		Pass	10.3	10	0.13			
18-Aug-22	73,200			8.8	6	0.25	27.1		
19-Aug-22	72,800								
20-Aug-22	71,400								

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
21-Aug-22	72,100			7.2	8	<0.1	25.1		
22-Aug-22	73,700			10.9	9				
23-Aug-22	75,500			9.1	7	0.35	51.8	940,000	69,000
24-Aug-22	72,700			8.8	7				
25-Aug-22	72,900			15.9	10	0.21	42.9		
26-Aug-22	72,400								
27-Aug-22	71,700								
28-Aug-22	72,400			6.9	4	0.13	40		
29-Aug-22	75,300			8.2	7			580,000	51,000
30-Aug-22	73,100			10.8	7	0.11	33.5		
31-Aug-22	72,600			11.2	6				
August Average				**10.6**	**7.7**		**35.6**		
01-Sep-22	73,000			8.3	6	<0.1	29.3		
02-Sep-22	73,400								
03-Sep-22	71,600								
04-Sep-22	73,700			7.5	7	0.14	36.6		
05-Sep-22	78,400			9.8	11				
06-Sep-22	74,600			12.3	8	0.1	29	440,000	14,000
07-Sep-22	73,000			8.9	7				
08-Sep-22	73,700			11.6	7	0.12	27.1		

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
09-Sep-22	70,200								
10-Sep-22	76,500								
11-Sep-22	75,800			11.4	8	0.18	47.9		
12-Sep-22	74,000			10.6	8				
13-Sep-22	73,800			10	9	<0.1	27.4	320,000	27,000
14-Sep-22	73,800		Pass	12	6.8	0.11	29	110,000	9,100
15-Sep-22	73,800			12	8	0.19	45.4		
16-Sep-22	73,300								
17-Sep-22	74,800								
18-Sep-22	73,800			8.3	6	0.16	40.2		
19-Sep-22	74,900			11.6	10				
20-Sep-22	72,800			19.8	12	0.13	33.2	3,900,000	150,000
21-Sep-22	72,500			11.4	6				
22-Sep-22	72,700			19.8	11	0.15	36.1		
23-Sep-22	76,900								
24-Sep-22	78,400								
25-Sep-22	79,300			6	8	0.33	55.1		
26-Sep-22	74,900			11.4	12				
27-Sep-22	75,100			12.4	10	0.17	42.3	840,000	45,000
28-Sep-22	73,500			16.5	12	0.1	30.9		

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
29-Sep-22	74,500								
30-Sep-22	75,400								
September Average				**11.6**	**8.6**		**36.4**		
01-Oct-22	73,600								
02-Oct-22	74,600			6.8	6	0.16	34.7		
03-Oct-22	73,900			11.2	9				
04-Oct-22	73,400			12.4	10	0.1	31.1	1,000,000	55,000
05-Oct-22	73,800			12.5	10				
06-Oct-22	74,100			19.9	14	0.16	36.8		
07-Oct-22	73,200								
08-Oct-22	72,600								
09-Oct-22	72,100			7.5	6	0.15	39.9		
10-Oct-22	75,400			11	5				
11-Oct-22	74,200			15.5	10	<0.1	31.4	98,000	7,100
12-Oct-22	73,400	2,650		78	158				
13-Oct-22	68,900			8.8	9	0.12	36.3		
14-Oct-22	76,400								
15-Oct-22	71,400								
16-Oct-22	73,500			6.8	6	0.13	29.2		
17-Oct-22	73,200			24.3	8				

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
18-Oct-22	73,000			19.2	20	0.17		2,100,000	76,000
19-Oct-22	73,600			9.9	8				
20-Oct-22	73,600			9.8	7	0.29			
21-Oct-22	74,800								
22-Oct-22	73,000								
23-Oct-22	76,000			7.7	7	<0.1			
24-Oct-22	88,400			11	8				
25-Oct-22	79,000			8.8	8	<0.1		380,000	14,000
26-Oct-22	76,600		Pass	9.5	7				
27-Oct-22	99,800	3,600		16.5	21	0.11			
28-Oct-22	101,600								
29-Oct-22	78,900								
30-Oct-22	147,500	15,030		14.5	25	<0.1			
31-Oct-22	135,000	820		6.4	8				
October Average				**11.8**	**8.8**		**34.2**		
01-Nov-22	112,800			8.3	5	<0.1	23.8	450,000	37,000
02-Nov-22	119,700			11.6	11				
03-Nov-22	125,000			14.1	17	0.1	33.5		
04-Nov-22	149,000								
05-Nov-22	118,400			7.5	7	<0.1	21.8		

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
06-Nov-22	124,400			9	13	0.11	35.2		
07-Nov-22	127,500			10.9	13				
08-Nov-22	120,400			11.8	13			330,000	36,000
09-Nov-22	112,000			10.9	9	<0.1	25.5		
10-Nov-22	110,100								
11-Nov-22	108,800								
12-Nov-22	106,800								
13-Nov-22	107,700			14.2	14	0.1	37.3		
14-Nov-22	107,000			17	15				
15-Nov-22	104,900			15.4	9	0.12	35.2	800,000	62,000
16-Nov-22	104,200			13.3	9				
17-Nov-22	104,300		Pass	17.2	14	0.11	35.7	530,000	92,000
18-Nov-22	103,000								
19-Nov-22	104,200								
20-Nov-22	105,700			12.9	8	<0.1	33		
21-Nov-22	84,600			14.4	9				
22-Nov-22	95,900	20		20.2	24	<0.1	27.3	760,000	120,000
23-Nov-22	80,000			13.5	7				
24-Nov-22	78,100			14.6	10	0.13	42.7		
25-Nov-22	87,100								

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
26-Nov-22	98,700			15	11				
27-Nov-22	103,000			8.1	11	0.12	31.6		
28-Nov-22	86,700			9	10				
29-Nov-22	86,300			14.9	16	0.1	25.6	280,000	55,000
30-Nov-22	103,800			13	10				
November Average				**12.6**	**11**		**31.7**		
01-Dec-22	87,400			14.8	12	0.14	29.2		
02-Dec-22	81,900								
03-Dec-22	103,800								
04-Dec-22	89,000			7.8	8	0.13	33.2		
05-Dec-22	84,300			9.3	8			230,000	27,000
06-Dec-22	89,100			8.3	10	0.1	27.2		
07-Dec-22	84,900			12.7	12				
08-Dec-22	87,500			13.7	11	0.18	34.4		
09-Dec-22	82,300								
10-Dec-22	83,000								
11-Dec-22	82,400			9.6	6	0.14	27.6		
12-Dec-22	79,600			10.6	11				
13-Dec-22	79,600			9.7	10	0.13	27.7	290,000	26,000
14-Dec-22	79,100			13.9	7				

Table 2.3, cont'd

McLoughlin Point Wastewater Treatment Plant Final Effluent									
	Total Daily Flow (<2ADWF)	Secondary Bypass Flow	Rainbow Trout Toxicity	CBOD	TSS	Unionized NH_3 @ 15°C	NH_3-N	Fecal Coliforms	Enterococci
	m^3/day	m^3/day	96-hour LC50	mg/L	mg/L	mg/L	mg/L	CFU/100 mL	CFU/100 mL
Provincial Registration 108831	<216,000	≤70 days per year	Pass/Fail	25 (maximum) 10 (monthly average)	25 (maximum) 10 (monthly average)	---			
Wastewater Systems Effluent Regulations			Pass (100% v/v%)	25 (monthly average)	25 (monthly average)	1.25 (maximum)	---	---	---
Water Quality Criteria							**BC WQG 58 mg/L (max), 8.7 mg/L monthly average		***Environment Canada 35 CFU / 100 mL (geomean) and 70 CFU/100 mL (maximum)
15-Dec-22	77,600		Pass	14	9.2	0.48	46	130,000	81,000
16-Dec-22	77,400								
17-Dec-22	79,800								
18-Dec-22	86,100				8	0.11	35.6		
19-Dec-22	77,800				8				
20-Dec-22	74,900			11.3	8	0.65	42		
21-Dec-22	77,200			10.9	8				
22-Dec-22	76,100			11.8	10		35.1	230,000	36,000
23-Dec-22	88,400								
24-Dec-22	205,900			10.9					
25-Dec-22	187,700	46,850			22	<0.1	18.3		
26-Dec-22	189,400	2,040		14.9	29				
27-Dec-22	186,600	10,720		10.4	20	<0.1	12.8		
28-Dec-22	138,900	2,670						220,000	17,000
29-Dec-22	120,800			6.1	5	<0.1	21.6		
30-Dec-22	134,100								
31-Dec-22	136,900								
December Average		**21 (total days)**		**11**	**8.9**		**32.7**		
Annual Average	91,796	n/a	n/a	13	11	0	32	464,136	41,812

Notes:
2ADWF = 2 times the average dry weather flow.

Table 2.3, cont’d

Orange shading indicates that single values exceed the maximum limit.
Purple shading indicates that average values exceed the monthly average limit.
*ADWF – Average Dry Weather Flow.
LC50 – The concentration at which 50% of test organisms experience mortality after an acute exposure time.
** BC WQG receiving environment – marine for ammonia is not part of compliance but inserted into table for informational purposes
*** Environment Canada receiving environment – Enterococci ammonia is not part of compliance but inserted into table for informational purposes

Table 2.4 McLoughlin Point WWTP Provincial Wastewater Compliance Results for 2022 Blended Effluent Days (>216,000 m^3/day)

McLoughlin Point Wastewater Treatment Plant Final Effluent					
	Blended Days	Flow (<2ADWF)	Flow (>2ADWF*)	CBOD	TSS
		m^3/day	m^3/day	mg/L	mg/L
Provincial Limit Registration	70	<216,000	>216,000**	130 (maximum)	130 (maximum)
03/01/2022	1	140,500	520	8.5	8.0
06/01/2022	2	211,900	21,600	3.3	3.0
07/01/2022	3	217,800	19,200	5.8	7.1
11/01/2022	4	232,000	59,800	6.5	10.3
12/01/2022	5	230,600	79,080	6.5 (Jan 11)	10.3 (Jan 11)
13/01/2022	6	162,400	21,930	9.9	5.6
14/01/2022	7	140,000	5,640	12.0	6.4
15/01/2022	8	129,100	170	12.0 (Jan 14)	6.4 (Jan 14)
28/01/2022	9	94,100	70	5.4	5.5
17/03/2022	10	143,000	290	22.1	36.0
04/04/2022	11	98,900	400	16.6	25.0
12/04/2022	12	103,200	10	16.3	9.0
12/10/2022	13	73,400	2,650	78.0	158.0
27/10/2022	14	101,600	3,600	16.5	21.0
30/10/2022	15	147,500	15,030	14.5	25.0
31/10/2022	16	135,000	820	6.4	8.0
22/11/2022	17	95,900	20	20.2	24.0
25/12/2022	18	187,700	46,850	10.9 (Dec 24)	22.0
26/12/2022	19	189,400	2,040	14.9	29.0
27/12/2022	20	186,600	10,720	10.4	20.0
28/12/2022	21	138,900	2,670	6.1 (Dec 29)	5.0 (Dec 29)

Notes:
*ADWF – Average Dry Weather Flow.
**Represents the amount of flow over and above the tertiary capacity of 216,000 m^3/day.
--- no sample
Grey shading indicates non-compliant blending occurred.
Red shading indicates exceedance to provincial limit.
*** Technically out of compliance as the 130 mg/L TSS and 130 mg/L CBOD maximum value not applicable when flows <216,000 m^3/day.

2.3.3 Priority Substances

McLoughlin final effluent was analyzed for priority substances as listed in Table 2.1 and Appendix B1. There were more than 170 routine resolution substances analyzed and more than half of these were not detected in 2022 (at routine detection limits chosen for comparison to the applicable water quality guidelines). The high-resolution analyses resulted in higher frequency of detection relative to the routine resolution analysis for the same parameters due to the lower detection limits of the high-resolution methods. Frequency of detections were slightly less in effluent from McLoughlin WWTP than historical Clover and Macaulay screened discharges because of the higher levels of treatment. The frequencies of detection of all substances analyzed in wastewater are included in Appendix B5 (McLoughlin).

McLoughlin Point WWTP effluent had lower loadings than the combined historic Clover and Macaulay loadings. Concentrations of substances that were frequently detected (greater than 50% of sampling events) in final effluent are presented in Table 2.5. Annual loadings to the marine environment are presented in Appendix B4 alongside influent loadings.

To determine the potential for effects of the wastewater discharges on the receiving environment, average and maximum wastewater concentrations of frequently detected substances (Table 2.5) were compared to the BC Approved and Working Water Quality Guidelines (https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality guidelines) (BCMoE&CCS 2021a; 2021b) and CCME Environmental Quality Guidelines (CCME, 2003) developed to protect aquatic life. Conservative estimates of the minimum initial dilution of the wastewaters in receiving waters off the outfalls (113:1 for McLoughlin; Lorax, 2019) were applied to maximum wastewater substance concentrations to predict maximum potential concentrations in the marine environment. These minimum initial dilution factors are predicted to occur at the edge of the initial dilution zone (IDZ) of each outfall. The use of estimated minimum initial dilution factors allows for a conservative (i.e., highly protective) estimation of potential effects, because the predicted average (mean) initial dilution factors are much higher in the marine receiving environments around the outfall (711:1 [median] for McLoughlin).

Before application of minimum initial dilution factors, there were a few substances that exceeded applicable guidelines in undiluted final effluent prior to discharge (Table 2.5), including ammonia and Enterococci (Table 2.3), weak acid dissociable cyanide, copper, zinc, total PCBs, Bisphenol A and PCB 123.

After application of the minimum initial dilution factor, there were no substances exceeding applicable guidelines in final effluent, indicating that receiving environment concentrations were unlikely to exceed guidelines beyond the initial dilution zone (i.e., the area that extends 100 m around the outfall diffusers), and the potential for effects on aquatic life were likely limited to within the initial dilution zone.

In final effluent, the bacterial indicator Enterococci (Table 2.3) routinely exceeded WQG protective of the public engaging in recreational activities such as swimming and shellfish collection (Health Canada, 2012). The Enterococci average concentration was 28,740 CFU/100 mL. The modelled dilution of 113:1 (Lorax, 2019) indicated that environmental concentrations could be approximately 254 CFU/100 mL (Table 2.5). The MPWWTP does not use disinfection as part of tertiary treatment and as such, bacterial indicators will continue to exceed water quality criteria.

Table 2.6 presents removal efficiency of the treatment process in 2022. These values are based on 12 samples of influent and effluent over a year. Of the hundreds of parameters measured, 16% of them were undetectable after treatment including pharmaceuticals, dioxins, PCBs, pesticides and oil and grease. Twenty four percent (24%) of parameters had a >90% removal efficiency and 33% had a removal efficiency >80%.

Table 2.5 Concentrations of Frequently Detected Substances (>50% of the time) in McLoughlin Point WWTP Final Effluent – 2022

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
BIO -Microbiology	Enterococci	CFU/ 100 mL	100%	28,740	12	85,000	800	254	35 (mean) / 70 (max)c	
BIO - Microbiology	Fecal Coliforms	CFU/ 100 mL	100%	175,600	12	620,000	5,800	1,554	200 d	
Conventionals - Major Ions	Alkalinity - Total - pH 4.5	mg/L	100%	154	12	240	80	1		
Conventionals - Cyanide	Total/SAD Cyanide	mg/L	92%	0.00238	12	0.01010	0.00050	0.00002		
Conventionals - Cyanide	WAD Cyanide	mg/L	83%	0.00115	12	0.00250	0.00050	0.00001	0.001b	
Conventionals - Major Ions	Alkalinity - Bicarbonate	mg/L	100%	188	12	290	97	2		
Conventionals - Major Ions	Alkalinity - Carbonate	mg/L	0%	---	12	---	---	---		
Conventionals - Major Ions	Alkalinity - Hydroxide	mg/L	0%	---	12	---	---	---		
Conventionals - Major Ions	Alkalinity - Phenolphthalein - pH 8.3	mg/L	0%	---	12	---	---	---		
Conventionals - Major Ions	Hardness (as CaCO3)	mg/L	100%	71	12	92	55	1		
Conventionals - Nutrients	N - NH3 (As N)	mg/L	100%	31	12	49	2	0.27		
Conventionals - Nutrients	N - NH3 (As N)- Unionized	mg/L	100%	0.124	12	0.510	0.004	0.001		
Conventionals - Nutrients	N - TKN (As N)	mg/L	100%	28.9	12	47.0	12.3	0.3		
Conventionals - Nutrients	N - Total (As N)	mg/L	100%	36.3	12	51.8	20.8	0.3		
Conventionals - Nutrients	Organic Carbon	mg/L	100%	212	12	1100	13	2		
Conventionals - Nutrients	P - PO4 - Total (As P)	µg/L	100%	4,141	12	5,710	1,832	37		
Conventionals - Oil and Grease	Oil & Grease, Mineral	mg/L	0%	---	12	---	---	---		
Conventionals - Oil and Grease	Oil & Grease, total	mg/L	33%	---	12	---	---	---		
Conventionals - Oxygen Demand	BOD	mg/L	100%	38	12	86	15	0.33		
Conventionals - Oxygen Demand	CBOD	mg/L	100%	15.1	12	28.0	10.0	0.1		
Conventionals - Oxygen Demand	COD	mg/L	100%	117	9	401	70	1.0		
Conventionals - Physical	pH	No Units	100%	7.7	12	8.02	7.44	0.07		
Conventionals - Physical	TSS	mg/L	100%	10.7	12	17	6.8	0.09		
Conventionals - Sulphide	H2S	mg/L	0%	---	1	---	---	---		
Conventionals - Sulphide	Sulfide	mg/L	58%	0.039	12	0.12	0.018	0.00035		
HALCO	Tetrabromomethane	µg/L	0%	---	12	---	---	---		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
Metals - Alkali	Potassium	mg/L	100%	14.9	12	18.0	11.3	0.1		
Metals - Alkali	Sodium	mg/L	100%	47	8	58	42	0.42		
Metals - Alkaline earth	Barium	µg/L	100%	5.3	12	9.4	4.2	0.05		
Metals - Alkaline earth	Beryllium	µg/L	0%	---	12	---	---	---	100b	
Metals - Alkaline earth	Calcium	mg/L	100%	17.6	12	23.3	13.7	0.156		
Metals - Alkaline earth	Magnesium	mg/L	100%	6.6	12	8.3	4.8	0.1		
Metals - Lanthanoids	Thallium	µg/L	42%	---	12	---	---	---		
Metals - Metalloid	Arsenic	µg/L	100%	0.448	12	0.620	0.344	0.004	12.5a	12.5
Metals - Metalloid	Antimony	µg/L	100%	0.256	12	0.303	0.215	0.002		
Metals - Post transition metals	Lead	µg/L	100%	0.753	12	1.01	0.49	0.00666	2 (mean)/ 140 (max)a	
Metals - Post transition metals	Aluminum	µg/L	100%	33.4	12	53.3	23.6	0.3		
Metals - Post transition metals	Tin	µg/L	100%	0.584	12	0.77	0.43	0.005		
Metals - Reactive nonmetal	Selenium	µg/L	100%	0.170	12	0.226	0.130	0.002	2a	
Metals - Reactive nonmetal	Sulfur	mg/L	100%	8.05	8	9.6	6.6	0.07		
Ketones	4-Methyl-2-Pentanone	µg/L	0%	---	12	---	---	---		
Ketones	4-Methyl-2-Pentanone	µg/L	0%	---	12	---	---	---		
Ketones	Dimethyl Ketone	µg/L	67%	34.5	12	110	15	0.3		
Ketones	Endrin Ketone	ng/L	0%	---	4	---	---	---		
Ketones	Isophorone	µg/L	0%	---	12	---	---	---		
Metals - Transition	Cadmium	µg/L	100%	0.033	12	0.05	0.02	0.0003	0.12b	0.12
Metals - Transition	Chromium	µg/L	100%	1.08	12	1.72	0.51	0.01		
Metals - Speciated	Chromium III	mg/L	58%	0.0012	12	0.0017	0.001	0.00001	0.056a	0.056
Metals - Speciated	Chromium VI	mg/L	8%	---	12	---	---	---		1.5b
Metals - Transition	Cobalt	µg/L	100%	0.561	12	0.88	0.345	0.005		
Metals - Transition	Copper	µg/L	100%	23.8	12	31.6	14.7	0.2	2 (mean)/3 (max)a	
Metals - Speciated	Dibutyltin	µg/L	25%	---	4	---	---	---		
Metals - Speciated	Dibutyltin Dichloride	µg/L	25%	---	4	---	---	---		
Metals - Transition	Iron	µg/L	100%	609	12	1140	375	5		
Metals - Transition	Manganese	µg/L	100%	45	12	55.7	35.6	0.4	100b	
Metals - Transition	Mercury	µg/L	67%	0.013	12	0.038	0.002	0.00012		
Metals - Speciated	Methyl Mercury	ng/L	75%	0.151	4	0.22	0.05	0.001		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
Metals - Transition	Molybdenum	µg/L	100%	2.08	12	5.92	0.97	0.02		
Metals - Speciated	Monobutyltin	µg/L	75%	0.01	4	0.023	0.001	0.00009		
Metals - Speciated	Monobutyltin Trichloride	µg/L	75%	0.016	4	0.036	0.001	0.00014		
Metals - Transition	Nickel	µg/L	100%	3.17	12	3.86	2.25	0.03	8.3b	
Metals - Transition	Silver	µg/L	100%	0.086	12	0.198	0.03	0.001	1.5(mean)/ 3(max)a	7.5
Metals - Speciated	Tributyltin	µg/L	25%	---	4	---	---	---		0.001
Metals - Speciated	Tributyltin Chloride	µg/L	25%	---	4	---	---	---		
Metals - Transition	Zinc	µg/L	100%	47	12	65.1	27.7	0.4	10a	
Organics - Aromatic hydrocarbons	1,1,1,2-Tetrachloroethane	µg/L	0%	---	12	---	---	---		
Organics - Aromatic hydrocarbons	Dichlorodifluoromethane	µg/L	0%	---	12	---	---	---		
Organics - Aromatic hydrocarbons	Nitrobenzene	µg/L	0%	---	12	---	---	---		
Organics - Base Neutrals	N-Nitrosodimethylamine	µg/L	0%	---	12	---	---	---		
Organics - Base Neutrals	N-Nitrosodi-N-Propylamine	µg/L	0%	---	12	---	---	---		
Organics - BTEX	Benzene	µg/L	0%	---	12	---	---	---	110a	110
Organics - BTEX	Ethylbenzene	µg/L	0%	---	12	---	---	---		25
Organics - BTEX	Toluene	µg/L	0%	---	12	---	---	---		215
Organics - BTEX	Xylenes	µg/L	0%	---	12	---	---	---		
Organics - Misc	1,2,3,4-Tetrachlorobenzene	ng/L	0%	---	4	---	---	---		
Organics - Misc	1,3,5-Trichlorobenzene	ng/L	0%	---	3	---	---	---		
Organics - Misc	1,4-Dioxane	µg/L	75%	0.705	4	1.3	0.42	0.006		
Organics - Misc	1,7-Dimethylxanthine	ng/L	100%	5,617	3	8,580	3,390	50		
Organics - Misc	Acrolein	µg/L	0%	---	12	---	---	---		
Organics - Misc	Acrylonitrile	µg/L	0%	---	12	---	---	---		
Organics - Misc	Delta-Hch Or Delta-Bhc	ng/L	0%	---	4	---	---	---		
Organics - Misc	Dibromomethane	µg/L	0%	---	12	---	---	---		
Organics - Misc	Pentachlorobenzene	ng/L	75%	0.066	4	0.136	0.035	0.001		
Organics - Misc	Perfluorobutanoic acid	ng/L	100%	21	4	23	19	0.19		
Organics - Misc	Tetrachloromethane	µg/L	0%	---	12	---	---	---		
Organics - Misc	Trans-Chlordane	ng/L	75%	0.155	4	0.272	0.077	0.001		
Organics - Misc	Trans-Nonachlor	ng/L	75%	0.118	4	0.272	0.054	0.001		
Organics - Misc	Tribromomethane	µg/L	0%	---	12	---	---	---		
Organics - Misc	Trichloromethane	µg/L	50%	---	12	---	---	---		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
Organics - Semi-Volatile	1,2-diphenylhydrazine	µg/L	0%	---	12	---	---	---		
Organics - Semi-Volatile	2,4-dinitrotoluene	µg/L	0%	---	12	---	---	---		
Organics - Semi-Volatile	2,6-dinitrotoluene	µg/L	0%	---	12	---	---	---		
Organics - Semi-Volatile	3,3-dichlorobenzidine	µg/L	0%	---	12	---	---	---		
Organics - Semi-Volatile	4-Bromophenyl Phenyl Ether	µg/L	0%	---	12	---	---	---		
Organics - Semi-Volatile	4-Chlorophenyl Phenyl Ether	µg/L	0%	---	12	---	---	---		
Organics - Semi-Volatile	Hexachlorocyclopentadiene	µg/L	0%	---	12	---	---	---		
Organics - Semi-Volatile	Hexachloroethane	µg/L	0%	---	12	---	---	---		
Organics - Terpenes	Alpha-Terpineol	µg/L	0%	---	12	---	---	---		
Organics - VOCs	1,1,1-trichloroethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	1,1,2,2-tetrachloroethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	1,1,2-trichloroethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	1,1-dichloroethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	1,1-dichloroethene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	1,2,3-Trichlorobenzene	ng/L	0%	---	3	---	---	---		
Organics - VOCs	1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ng/L	0%	---	4	---	---	---		
Organics - VOCs	1,2,4-trichlorobenzene	ng/L	33%	---	3	---	---	---		5.4
Organics - VOCs	1,2-dibromoethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	1,2-dichlorobenzene	ng/L	100%	0.845	3	1.12	0.672	0.007	42a	42
Organics - VOCs	1,2-dichloroethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	1,2-dichloropropane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	1,3-dichlorobenzene	ng/L	33%	---	3	---	---	---		
Organics - VOCs	1,4-dichlorobenzene	ng/L	100%	57	3	77	34	1		
Organics - VOCs	Bromodichloromethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Bromomethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Chlorobenzene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Chlorodibromomethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Chloroethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Chloroethene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Chloromethane	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Cis-1,2-Dichloroethene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Cis-1,3-dichloropropene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Hexachlorobutadiene	ng/L	100%	0.153	3	0.224	0.089	0.001		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
Organics - VOCs	M & P Xylenes	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Methyl Ethyl Ketone	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Methyl Tertiary Butyl Ether	µg/L	0%	---	12	---	---	---		5000
Organics - VOCs	O-Xylene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Styrene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Tetrachloroethene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Trans-1,2-Dichloroethene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Trans-1,3-dichloropropene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Trichloroethene	µg/L	0%	---	12	---	---	---		
Organics - VOCs	Trichlorofluoromethane	µg/L	0%	---	12	---	---	---		
Phenols	Total Phenols	mg/L	50%	---	12	---	---	---		
Phenols - Chlorinated	2,4 + 2,5 Dichlorophenol	µg/L	0%	---	12	---	---	---		
Phenols - Chlorinated	2-Chlorophenol	µg/L	0%	---	12	---	---	---		
Phenols - Chlorinated	4-Chloro-3-Methylphenol	µg/L	0%	---	12	---	---	---		
Phenols - Chlorinated	Pentachlorophenol	µg/L	0%	---	12	---	---	---		
Phenols - Non-chlorinated	2,4-dimethylphenol	µg/L	0%	---	12	---	---	---		
Phenols - Non-chlorinated	2,4-dinitrophenol	µg/L	0%	---	12	---	---	---		
Phenols - Non-chlorinated	2-Methyl-4,6-Dinitrophenol	µg/L	0%	---	12	---	---	---		
Phenols - Non-chlorinated	2-Nitrophenol	µg/L	0%	---	12	---	---	---		
Phenols - Non-chlorinated	Phenol	µg/L	0%	---	12	---	---	---		
Phenols - Chlorinated	2,4,6-trichlorophenol	µg/L	0%	---	12	---	---	---		
Physical	Conductivity	µS/cm	100%	696	12	890	610	6		
POPS-Pharmaceuticals	17 beta-Estradiol 3-benzoate	ng/L	0%	---	4	---	---	---		
POPS-Pharmaceuticals	Allyl Trenbolone	ng/L	0%	---	4	---	---	---		
POPS-Pharmaceuticals	Androstenedione	ng/L	75%	5.1	4	9.1	2.9	0.05		
POPS-Pharmaceuticals	Androsterone	ng/L	0%	---	3	---	---	---		
POPS-Pharmaceuticals	Desogestrel	ng/L	0%	---	4	---	---	---		
POPS-Pharmaceuticals	Mestranol	ng/L	0%	---	4	---	---	---		
POPS-Pharmaceuticals	Norethindrone	ng/L	0%	---	4	---	---	---		
POPS-Pharmaceuticals	Norgestrel	ng/L	0%	---	4	---	---	---		
POPS-Pharmaceuticals	Progesterone	ng/L	25%	---	4	---	---	---		
POPS-Pharmaceuticals	Testosterone	ng/L	0%	---	4	---	---	---		
POPs - Hormones and Sterols	17 alpha-Dihydroequilin	ng/L	0%	---	4	---	---	---		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - Hormones and Sterols	17 alpha-Estradiol	ng/L	0%	---	4	---	---	---		
POPs - Hormones and Sterols	17 alpha-Ethinyl-Estradiol	ng/L	0%	---	4	---	---	---	0.5 (mean) / 0.75 (max)a	
POPs - Hormones and Sterols	17 beta-Estradiol	ng/L	0%	---	4	---	---	---		
POPs - Hormones and Sterols	Equilenin	ng/L	25%	---	4	---	---	---		
POPs - Hormones and Sterols	Equilin	ng/L	0%	---	4	---	---	---		
POPs - Hormones and Sterols	Estriol	ng/L	25%	---	4	---	---	---		
POPs - Hormones and Sterols	Estrone	ng/L	100%	7.5	4	16.3	3.7	0.1		
POPs - Nonylphenols	4-Nitrophenol	µg/L	0%	---	12	---	---	---		
POPs - Nonylphenols	4-n-Octylphenol	ng/L	50%	---	4	---	---	---		
POPs - Nonylphenols	4-Nonylphenol Diethoxylates	ng/L	100%	424	4	547	284	4		
POPs - Nonylphenols	4-Nonylphenol Monoethoxylates	ng/L	100%	913	4	1400	583	8.08		
POPs - Nonylphenols	Np	ng/L	100%	363	4	476	250	3	700b	700
POPs - PAH	1-Methylphenanthrene	ng/L	100%	2.11	4	3.72	1.42	0.019		
POPs - PAH	2,3,5-trimethylnaphthalene	ng/L	100%	2.72	4	5.18	1.79	0.02		
POPs - PAH	2,6-dimethylnaphthalene	ng/L	100%	2.27	4	4.72	1.33	0.02		
POPs - PAH	2-Chloronaphthalene	µg/L	0%	---	12	---	---	---		
POPs - PAH	2-Methylnaphthalene	ng/L	100%	5.24	4	10.30	3.26	0.05		
POPs - PAH	Acenaphthene	ng/L	100%	33	4	95	8	0.29	6,000c	
POPs - PAH	Acenaphthylene	ng/L	100%	0.86	4	2.06	0.27	0.01		
POPs - PAH	Anthracene	ng/L	100%	1.53	4	3.27	0.87	0.01		
POPs - PAH	Benzo[a]anthracene	ng/L	100%	3.48	4	6.16	1.93	0.03		
POPs - PAH	Benzo[a]pyrene	ng/L	100%	2.17	4	3.73	1.15	0.02	10c	
POPs - PAH	Benzo[b]fluoranthene	ng/L	100%	2.23	4	4.27	1.16	0.02		
POPs - PAH	Benzo[e]pyrene	ng/L	100%	2.04	4	2.89	1.34	0.02		
POPs - PAH	Benzo[ghi]perylene	ng/L	100%	1.75	4	2.74	1.03	0.015		
POPs - PAH	Benzo[J,K]Fluoranthenes	ng/L	100%	1.87	4	3.06	1.19	0.017		
POPs - PAH	Chrysene	ng/L	100%	4.21	4	6.38	2.49	0.04	100c	

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PAH	Dibenzo(a,h)anthracene	ng/L	50%	---	4	---	---	---		
POPs - PAH	Dibenzothiophene	ng/L	100%	2.95	4	5.57	1.68	0.03		
POPs - PAH	Fluoranthene	ng/L	100%	18.4	4	34.4	10.9	0.2		
POPs - PAH	Fluorene	ng/L	100%	15.6	4	39.4	6.5	0.1	12,000c	
POPs - PAH	High Molecular Weight PAH`s	µg/L	75%	0.040	12	0.100	0.020	0.0004		
POPs - PAH	Indeno(1,2,3-C,D)Pyrene	ng/L	100%	1.62	4	2.40	1.14	0.01		
POPs - PAH	Low Molecular Weight PAH`s	µg/L	92%	0.063	12	0.190	0.010	0.001		
POPs - PAH	Naphthalene	ng/L	100%	22.0	4	56.2	8.6	0.2	1,000c	1400
POPs - PAH	Perylene	ng/L	75%	0.53	4	0.68	0.38	0.01		
POPs - PAH	Phenanthrene	ng/L	100%	19.7	4	34.7	12.7	0.2		
POPs - PAH	Pyrene	ng/L	100%	17.8	4	29.4	10.1	0.2		
POPs - PAH	Total PAH	µg/L	83%	0.098	12	0.220	0.020	0.001		
POPs - PBDE	Pbde 10	pg/L	0%	---	4	---	---	---		
POPs - PBDE	Pbde 100	pg/L	100%	775	4	996	643	6.86		
POPs - PBDE	Pbde 105	pg/L	0%	---	4	---	---	---		
POPs - PBDE	Pbde 116	pg/L	25%	---	4	---	---	---		
POPs - PBDE	Pbde 119/120	pg/L	100%	9.8	4	10.6	8.7	0.1		
POPs - PBDE	Pbde 12/13	pg/L	100%	3.0	4	4.3	1.4	0.03		
POPs - PBDE	Pbde 126	pg/L	0%	---	4	---	---	---		
POPs - PBDE	Pbde 128	pg/L	0%	---	4	---	---	---		
POPs - PBDE	Pbde 138/166	pg/L	100%	48.9	4	65.6	33.2	0.4		
POPs - PBDE	Pbde 140	pg/L	100%	12.6	4	16.7	9.8	0.1		
POPs - PBDE	Pbde 15	pg/L	100%	7.8	4	13.1	3.97	0.07		
POPs - PBDE	Pbde 153	pg/L	100%	345	4	436	272	3.05		
POPs - PBDE	Pbde 154	pg/L	100%	274	4	341	218	2		
POPs - PBDE	Pbde 155	pg/L	100%	21	4	26	19	0.19		
POPs - PBDE	Pbde 17/25	pg/L	100%	43.1	4	63.8	26.8	0.4		
POPs - PBDE	Pbde 181	pg/L	0%	---	4	---	---	---		
POPs - PBDE	Pbde 183	pg/L	100%	54.7	4	71.8	42.9	0.5		
POPs - PBDE	Pbde 190	pg/L	75%	3.9	4	5.9	2.9	0.03		
POPs - PBDE	Pbde 203	pg/L	100%	36.8	4	43.6	27.5	0.3		
POPs - PBDE	Pbde 206	pg/L	100%	211	4	288	95	2		
POPs - PBDE	Pbde 207	pg/L	100%	244	4	392	121	2		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PBDE	Pbde 208	pg/L	100%	135	4	180	98	1		
POPs - PBDE	Pbde 209	pg/L	100%	3,520	4	5,190	2,530	31		
POPs - PBDE	Pbde 28/33	pg/L	100%	80	4	103	58	1		
POPs - PBDE	Pbde 30	pg/L	0%	---	4	---	---	---		
POPs - PBDE	Pbde 32	pg/L	0%	---	4	---	---	---		
POPs - PBDE	Pbde 35	pg/L	75%	1.9	4	2.95	1.44	0.02		
POPs - PBDE	Pbde 37	pg/L	100%	8.4	4	10.7	4.4	0.1		
POPs - PBDE	Pbde 47	pg/L	100%	3,660	4	4,870	2,820	32		
POPs - PBDE	Pbde 49	pg/L	100%	113	4	154	77	1		
POPs - PBDE	Pbde 51	pg/L	100%	12.0	4	17.5	9.5	0.1		
POPs - PBDE	Pbde 66	pg/L	100%	78.9	4	105.0	66.8	0.7		
POPs - PBDE	Pbde 7	pg/L	75%	3.1	4	4.5	1.8	0.03		
POPs - PBDE	Pbde 71	pg/L	100%	13.4	4	17.3	9.8	0.1		
POPs - PBDE	Pbde 75	pg/L	100%	6.1	4	8.1	5.3	0.1		
POPs - PBDE	Pbde 77	pg/L	0%	---	4	---	---	---		
POPs - PBDE	Pbde 79	pg/L	75%	15.1	4	38.6	1.7	0.1		
POPs - PBDE	Pbde 8/11	pg/L	75%	2.2	4	3.0	1.4	0.019		
POPs - PBDE	Pbde 85	pg/L	100%	161	4	224	126	1		
POPs - PBDE	Pbde 99	pg/L	100%	3,735	4	4,940	3,050	33		
POPs - PCB - Congener	Decachloro Biphenyl	pg/L	100%	5.8	3	7.4	4.4	0.1		
POPs - PCB - Congener	Pcb 1	pg/L	100%	16.5	4	30.9	5.8	0.2		
POPs - PCB - Congener	Pcb 10	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 103	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 104	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 105	pg/L	100%	18.2	4	21.8	14.6	0.2	90a	
POPs - PCB - Congener	Pcb 106	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 107/124	pg/L	100%	2.46	4	3.27	2.05	0.02		
POPs - PCB - Congener	Pcb 109	pg/L	100%	3.64	4	4.17	2.89	0.03		
POPs - PCB - Congener	Pcb 11	pg/L	100%	90.9	4	97.4	81.1	0.8		
POPs - PCB - Congener	Pcb 110/115	pg/L	100%	67.8	4	82.3	47.8	0.6		
POPs - PCB - Congener	Pcb 111	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 112	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 114	pg/L	75%	2.27	4	2.73	1.76	0.02		
POPs - PCB - Congener	Pcb 118	pg/L	100%	47.3	4	57.8	37.8	0.4		
POPs - PCB - Congener	Pcb 12/13	pg/L	75%	4.24	4	4.99	3.69	0.04		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PCB - Congener	Pcb 120	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 121	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 122	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 123	pg/L	75%	2.24	4	2.63	1.96	0.02	0.25a	
POPs - PCB - Congener	Pcb 126	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 127	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 128/166	pg/L	100%	7.84	4	10.2	6.15	0.07		
POPs - PCB - Congener	Pcb 129/138/160/163	pg/L	100%	55.7	4	59.9	51.5	0.5		
POPs - PCB - Congener	Pcb 130	pg/L	100%	3.68	4	4.2	3.07	0.03		
POPs - PCB - Congener	Pcb 131	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 132	pg/L	100%	18.2	4	22.6	13.2	0.2		
POPs - PCB - Congener	Pcb 133	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 134/143	pg/L	100%	2.95	4	3.36	2.77	0.03		
POPs - PCB - Congener	Pcb 135/151/154	pg/L	100%	19.8	4	21.9	17.4	0.18		
POPs - PCB - Congener	Pcb 136	pg/L	100%	7.54	4	8.9	5.84	0.07		
POPs - PCB - Congener	Pcb 137	pg/L	100%	3.25	4	3.9	2.69	0.03		
POPs - PCB - Congener	Pcb 139/140	pg/L	75%	1.94	4	2.26	1.58	0.02		
POPs - PCB - Congener	Pcb 14	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 141	pg/L	100%	9.02	4	10.3	7.81	0.08		
POPs - PCB - Congener	Pcb 142	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 144	pg/L	100%	2.97	4	4.17	1.79	0.03		
POPs - PCB - Congener	Pcb 145	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 146	pg/L	100%	7.49	4	8.56	6.6	0.07		
POPs - PCB - Congener	Pcb 147/149	pg/L	100%	41.8	4	45.0	36.7	0.4		
POPs - PCB - Congener	Pcb 148	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 15	pg/L	100%	16.6	4	19.4	15.4	0.2		
POPs - PCB - Congener	Pcb 150	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 152	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 153/168	pg/L	100%	51.3	4	58.5	43.6	0.5		
POPs - PCB - Congener	Pcb 155	pg/L	100%	6.16	4	7.71	5.31	0.05		
POPs - PCB - Congener	Pcb 156157	pg/L	100%	8.14	4	8.99	7.42	0.07		
POPs - PCB - Congener	Pcb 158	pg/L	100%	5.06	4	5.51	4.7	0.04		
POPs - PCB - Congener	Pcb 159	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 16	pg/L	100%	19.8	4	29.5	12.6	0.18		
POPs - PCB - Congener	Pcb 161	pg/L	0%	---	4	---	---	---		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PCB - Congener	Pcb 162	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 164	pg/L	100%	3.41	4	4.18	2.19	0.03		
POPs - PCB - Congener	Pcb 165	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 167	pg/L	100%	2.79	4	3.15	2.58	0.02		
POPs - PCB - Congener	Pcb 169	pg/L	0%	---	4	---	---	---	60a	
POPs - PCB - Congener	Pcb 17	pg/L	100%	19.6	4	26.5	10.7	0.2		
POPs - PCB - Congener	Pcb 170	pg/L	100%	10.2	4	12.2	8.1	0.1		
POPs - PCB - Congener	Pcb 171/173	pg/L	100%	3.26	4	4.17	2.64	0.03		
POPs - PCB - Congener	Pcb 172	pg/L	75%	1.74	4	2.44	1.14	0.02		
POPs - PCB - Congener	Pcb 174	pg/L	100%	10.5	4	11.9	8.5	0.1		
POPs - PCB - Congener	Pcb 175	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 176	pg/L	100%	1.55	4	1.7	1.37	0.01		
POPs - PCB - Congener	Pcb 177	pg/L	100%	5.87	4	6.99	4.94	0.05		
POPs - PCB - Congener	Pcb 178	pg/L	100%	3.18	4	3.41	3	0.03		
POPs - PCB - Congener	Pcb 179	pg/L	100%	5.86	4	7.07	4.58	0.05		
POPs - PCB - Congener	Pcb 18/30	pg/L	100%	38.5	4	55.6	20.8	0.3		
POPs - PCB - Congener	Pcb 180/193	pg/L	100%	28.3	4	31.4	24.5	0.3		
POPs - PCB - Congener	Pcb 181	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 182	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 183/185	pg/L	100%	7.61	4	8.66	6.05	0.07		
POPs - PCB - Congener	Pcb 184	pg/L	100%	8.88	4	11	6.03	0.08		
POPs - PCB - Congener	Pcb 186	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 187	pg/L	100%	15.3	4	16.9	13.0	0.1		
POPs - PCB - Congener	Pcb 188	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 189	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 19	pg/L	100%	12.35	4	19.1	4.08	0.11		
POPs - PCB - Congener	Pcb 190	pg/L	100%	1.95	4	2.17	1.73	0.02		
POPs - PCB - Congener	Pcb 191	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 192	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 194	pg/L	100%	4.69	4	5.84	3.73	0.04		
POPs - PCB - Congener	Pcb 195	pg/L	100%	1.33	4	1.85	0.94	0.01		
POPs - PCB - Congener	Pcb 196	pg/L	100%	2.47	4	3.19	1.59	0.02		
POPs - PCB - Congener	Pcb 197/200	pg/L	100%	1.66	4	2.11	1.06	0.01		
POPs - PCB - Congener	Pcb 198/199	pg/L	100%	6.25	4	7.88	4.6	0.06		
POPs - PCB - Congener	Pcb 2	pg/L	100%	4.49	4	6.92	2.2	0.04		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PCB - Congener	Pcb 20/28	pg/L	100%	55.5	4	76.1	39.0	0.5		
POPs - PCB - Congener	Pcb 201	pg/L	100%	1.2	4	1.4	1.0	0.011		
POPs - PCB - Congener	Pcb 202	pg/L	100%	2.67	4	3.51	1.79	0.02		
POPs - PCB - Congener	Pcb 203	pg/L	100%	3.78	4	4.22	3.25	0.03		
POPs - PCB - Congener	Pcb 204	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 205	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 206	pg/L	100%	5.18	4	6.27	4.06	0.05		
POPs - PCB - Congener	Pcb 207	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 208	pg/L	75%	2.21	4	3.07	1.47	0.02		
POPs - PCB - Congener	Pcb 209	pg/L	100%	5.96	4	7.44	4.39	0.05		
POPs - PCB - Congener	Pcb 21/33	pg/L	100%	27.2	4	33.9	19.5	0.24		
POPs - PCB - Congener	Pcb 22	pg/L	100%	21.9	4	29.6	16.4	0.19		
POPs - PCB - Congener	Pcb 23	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 24	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 25	pg/L	100%	7.27	4	12.2	3.78	0.06		
POPs - PCB - Congener	Pcb 26/29	pg/L	100%	13.0	4	17.7	7.0	0.1		
POPs - PCB - Congener	Pcb 27	pg/L	100%	7.0	4	12.9	2.5	0.1		
POPs - PCB - Congener	Pcb 3	pg/L	100%	6.59	4	7.44	5.9	0.06		
POPs - PCB - Congener	Pcb 31	pg/L	100%	47.3	4	62.8	32.9	0.4		
POPs - PCB - Congener	Pcb 32	pg/L	100%	13.9	4	18.1	7.9	0.1		
POPs - PCB - Congener	Pcb 34	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 35	pg/L	100%	3.65	4	5	1.68	0.03		
POPs - PCB - Congener	Pcb 36	pg/L	50%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 37	pg/L	100%	13.15	4	18.1	8.5	0.12		
POPs - PCB - Congener	Pcb 38	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 39	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 4	pg/L	100%	51.3	4	93.1	13.9	0.5		
POPs - PCB - Congener	Pcb 40/41/71	pg/L	100%	23.7	4	28.7	18.7	0.2		
POPs - PCB - Congener	Pcb 42	pg/L	100%	11.7	4	15.2	8.87	0.1		
POPs - PCB - Congener	Pcb 43	pg/L	75%	1.98	4	2.52	1.42	0.02		
POPs - PCB - Congener	Pcb 44/47/65	pg/L	100%	80.8	4	83.8	77.2	0.72		
POPs - PCB - Congener	Pcb 45/51	pg/L	100%	15.6	4	16.9	14.8	0.1		
POPs - PCB - Congener	Pcb 46	pg/L	100%	4.21	4	5.84	2.41	0.04		
POPs - PCB - Congener	Pcb 48	pg/L	100%	8.73	4	11.9	6.84	0.08		
POPs - PCB - Congener	Pcb 49/69	pg/L	100%	31.2	4	47.5	22.5	0.3		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PCB - Congener	Pcb 5	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 50/53	pg/L	100%	10.7	4	18.4	5.7	0.1		
POPs - PCB - Congener	Pcb 52	pg/L	100%	72	4	95.7	53.4	0.64		
POPs - PCB - Congener	Pcb 54	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 55	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 56	pg/L	100%	15.3	4	20.2	12.8	0.1		
POPs - PCB - Congener	Pcb 57	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 58	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 59/62/75	pg/L	100%	3.9	4	4.9	3.1	0.035		
POPs - PCB - Congener	Pcb 6	pg/L	75%	6.8	4	11.9	2.98	0.06		
POPs - PCB - Congener	Pcb 60	pg/L	100%	8.4	4	12.1	7.0	0.1		
POPs - PCB - Congener	Pcb 61/70/74/76	pg/L	100%	67.1	4	79.8	56.1	0.6		
POPs - PCB - Congener	Pcb 63	pg/L	50%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 64	pg/L	100%	18.1	4	21.3	14.4	0.2		
POPs - PCB - Congener	Pcb 66	pg/L	100%	26.5	4	35.0	23.1	0.2		
POPs - PCB - Congener	Pcb 67	pg/L	25%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 68	pg/L	100%	5.27	4	5.85	4.68	0.05		
POPs - PCB - Congener	Pcb 7	pg/L	75%	3.16	4	3.93	1.5	0.03		
POPs - PCB - Congener	Pcb 72	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 73	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 77	pg/L	100%	3.08	4	3.93	1.93	0.03	40a	
POPs - PCB - Congener	Pcb 78	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 79	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 8	pg/L	100%	24.8	4	37.0	11.3	0.2		
POPs - PCB - Congener	Pcb 80	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 81	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 82	pg/L	100%	7.32	4	8.37	5.33	0.06		
POPs - PCB - Congener	Pcb 83/99	pg/L	100%	36.1	4	42.4	26.3	0.32		
POPs - PCB - Congener	Pcb 84	pg/L	100%	18	4	22.1	11.9	0.16		
POPs - PCB - Congener	Pcb 85/116/117	pg/L	100%	10.5	4	12.6	7.4	0.1		
POPs - PCB - Congener	Pcb 86/87/97/108/119/125	pg/L	100%	47.3	4	57.9	33.3	0.4		
POPs - PCB - Congener	Pcb 88/91	pg/L	100%	9.68	4	11.5	7.38	0.09		
POPs - PCB - Congener	Pcb 89	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 9	pg/L	75%	2.65	4	3.69	1.71	0.02		
POPs - PCB - Congener	Pcb 90/101/113	pg/L	100%	66.5	4	79.1	46.9	0.6		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PCB - Congener	Pcb 92	pg/L	100%	11.9	4	14.2	9.0	0.1		
POPs - PCB - Congener	Pcb 93/95/98/100/102	pg/L	100%	57.8	4	69.5	41.4	0.5		
POPs - PCB - Congener	Pcb 94	pg/L	0%	---	4	---	---	---		
POPs - PCB - Congener	Pcb 96	pg/L	25%	---	4	---	---	---		
POPs - PCB - Homologue	Total Dichloro Biphenyls	pg/L	100%	184	4	221	135	2		
POPs - PCB - Homologue	Total Heptachloro Biphenyls	pg/L	100%	70.3	4	96.3	28.1	0.6		
POPs - PCB - Homologue	Total Hexachloro Biphenyls	pg/L	100%	229	4	262	200	2.03		
POPs - PCB - Homologue	Total Monochloro Biphenyls	pg/L	100%	25.8	4	35.2	16.4	0.2		
POPs - PCB - Homologue	Total Nonachloro Biphenyls	pg/L	100%	5.17	2	7.9	2.43	0.05		
POPs - PCB - Homologue	Total Octachloro Biphenyls	pg/L	100%	14.5	4	23.8	8.91	0.13		
POPs - PCB - Homologue	Total Pentachloro Biphenyls	pg/L	100%	377	4	486	241	3.34		
POPs - PCB - Homologue	Total Tetrachloro Biphenyls	pg/L	100%	390	4	444	334	3.45		
POPs - PCB - Homologue	Total Trichloro Biphenyls	pg/L	100%	281	4	393	194	2		
POPs - PCB TEQ	Pcb Teq 3	pg/L	100%	0.02	4	0.03	0.01	0.0002		
POPs - PCB TEQ	Pcb Teq 4	pg/L	100%	0.83	4	1.14	0.12	0.01		
POPs - PCB Total	PCBs Total	pg/L	100%	1,580	4	1,880	1,350	14	100a	
POPs - PCDD	1,2,3,4,6,7,8-HPCDD	pg/L	100%	1.8	3	1.9	1.7	0.016		
POPs - PCDD	1,2,3,4,6,7,8-HPCDF	pg/L	33%	---	3	---	---	---		
POPs - PCDD	1,2,3,4,7,8,9-HPCDF	pg/L	0%	---	3	---	---	---		
POPs - PCDD	1,2,3,4,7,8-HXCDD	pg/L	0%	---	3	---	---	---		
POPs - PCDD	1,2,3,4,7,8-HXCDF	pg/L	0%	---	3	---	---	---		
POPs - PCDD	1,2,3,6,7,8-HXCDD	pg/L	0%	---	3	---	---	---		
POPs - PCDD	1,2,3,6,7,8-HXCDF	pg/L	0%	---	3	---	---	---		
POPs - PCDD	1,2,3,7,8,9-HXCDD	pg/L	0%	---	3	---	---	---		
POPs - PCDD	1,2,3,7,8,9-HXCDF	pg/L	33%	---	3	---	---	---		
POPs - PCDD	1,2,3,7,8-PECDD	pg/L	0%	---	3	---	---	---		
POPs - PCDD	1,2,3,7,8-PECDF	pg/L	33%	---	3	---	---	---		
POPs - PCDD	2,3,4,6,7,8-HXCDF	pg/L	0%	---	3	---	---	---		
POPs - PCDD	2,3,4,7,8-PECDF	pg/L	0%	---	3	---	---	---		
POPs - PCDD	2,3,7,8-TCDD	pg/L	0%	---	3	---	---	---		
POPs - PCDD	2,3,7,8-TCDF	pg/L	0%	---	3	---	---	---		
POPs - PCDD	OCDD	pg/L	100%	10.2	3	11.3	8.5	0.1		
POPs - PCDD	OCDF	pg/L	33%	---	3	---	---	---		
POPs - PCDD	TOTAL HEPTA-DIOXINS	pg/L	100%	2.1	3	3.2	1.2	0.019		
POPs - PCDD	TOTAL HEPTA-FURANS	pg/L	0%	---	3	---	---	---		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PCDD	TOTAL HEXA-DIOXINS	pg/L	0%	---	3	---	---	---		
POPs - PCDD	TOTAL HEXA-FURANS	pg/L	0%	---	3	---	---	---		
POPs - PCDD	TOTAL PENTA-DIOXINS	pg/L	0%	---	3	---	---	---		
POPs - PCDD	TOTAL PENTA-FURANS	pg/L	0%	---	3	---	---	---		
POPs - PCDD	TOTAL TETRA-DIOXINS	pg/L	0%	---	3	---	---	---		
POPs - PCDD	TOTAL TETRA-FURANS	pg/L	0%	---	3	---	---	---		
POPs - Pesticides	2,4-DDD	ng/L	100%	1.3	4	3.0	0.4	0.011		
POPs - Pesticides	2,4-DDE	ng/L	0%	---	4	---	---	---		
POPs - Pesticides	2,4-DDT	ng/L	0%	---	4	---	---	---		
POPs - Pesticides	4,4-DDD	ng/L	0%	---	4	---	---	---		
POPs - Pesticides	4,4-DDE	ng/L	75%	0.2	4	0.3	0.2	0.0018		
POPs - Pesticides	4,4-DDT	ng/L	25%	---	4	---	---	---		
POPs - Pesticides	ABHC	ng/L	25%	---	4	---	---	---		
POPs - Pesticides	Aldrin	ng/L	25%	---	4	---	---	---		
POPs - Pesticides	Alpha Chlordane	ng/L	50%	---	4	---	---	---		
POPs - Pesticides	Alpha-Endosulfan	ng/L	75%	0.4	4	0.679	0.267	0.004		
POPs - Pesticides	Beta-Endosulfan	ng/L	75%	0.5	4	0.7	0.4	0.004		
POPs - Pesticides	Beta-Hch Or Beta-Bhc	ng/L	75%	0.1	4	0.3	0.1	0.0009		
POPs - Pesticides	Bis(2-Chloroethoxy)Methane	µg/L	0%	---	12	---	---	---		
POPs - Pesticides	Bis(2-Chloroethyl)Ether	µg/L	0%	---	12	---	---	---		
POPs - Pesticides	Bis(2-Chloroisopropyl)Ether	µg/L	0%	---	12	---	---	---		
POPs - Pesticides	Cis-Nonachlor	ng/L	25%	---	4	---	---	---		
POPs - Pesticides	Dieldrin	ng/L	75%	0.3	4	0.7	0.2	0.004		
POPs - Pesticides	Endosulfan Sulfate	ng/L	25%	---	4	---	---	---	0.16b	
POPs - Pesticides	Endrin	ng/L	0%	---	4	---	---	---		
POPs - Pesticides	Endrin Aldehyde	ng/L	0%	---	4	---	---	---		
POPs - Pesticides	Hch, Gamma	ng/L	75%	0.2	4	0.3	0.1	0.0009		
POPs - Pesticides	Heptachlor	ng/L	25%	---	4	---	---	---		
POPs - Pesticides	Heptachlor Epoxide	ng/L	0%	---	4	---	---	---		
POPs - Pesticides	Hexachlorobenzene	ng/L	75%	0.1	4	0.1	0.0	0.0009		
POPs - Pesticides	Methoxyclor	ng/L	25%	---	4	---	---	---		
POPs - Pesticides	Mirex	ng/L	25%	---	4	---	---	---		
POPs - Pesticides	Octachlorostyrene	ng/L	25%	---	4	---	---	---		
POPs - Pesticides	Oxychlordane	ng/L	0%	---	4	---	---	---		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PFOS	3:3 FTCA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	4:2 FTS	ng/L	0%	---	2	---	---	---		
POPs - PFOS	5:3 FTCA	ng/L	50%	---	2	---	---	---		
POPs - PFOS	6:2 FTS	ng/L	0%	---	2	---	---	---		
POPs - PFOS	7:3 FTCA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	8:2 FTS	ng/L	0%	---	2	---	---	---		
POPs - PFOS	ADONA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	EtFOSAA	ng/L	50%	---	2	---	---	---		
POPs - PFOS	HFPO-DA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	MeFOSAA	ng/L	50%	---	2	---	---	---		
POPs - PFOS	N-EtFOSA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	N-EtFOSE	ng/L	0%	---	2	---	---	---		
POPs - PFOS	NFDHA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	N-MeFOSA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	N-MeFOSE	ng/L	0%	---	2	---	---	---		
POPs - PFOS	Perfluorodecanoic acid (PFDA)	ng/L	100%	1.58	4	1.90	1.12	0.01		
POPs - PFOS	Perfluoroheptanoic Acid (PFHpA)	ng/L	100%	5.16	4	8.67	2.38	0.05		
POPs - PFOS	Perfluorohexanoic Acid (PFHxA)	ng/L	100%	26.88	4	45.20	12.40	0.24		
POPs - PFOS	Perfluorononanoic Acid (PFNA)	ng/L	75%	1.21	4	1.76	0.65	0.01		
POPs - PFOS	Perfluorooctane sulfonamide (PFOSA)	ng/L	0%	---	4	---	---	---		
POPs - PFOS	Perfluorooctanesulfonic acid (PFOS)	ng/L	100%	5.36	4	8.25	2.84	0.05		
POPs - PFOS	Perfluorooctanoic acid (PFOA)	ng/L	100%	11.82	4	21.70	3.65	0.11		
POPs - PFOS	Perfluoropentanoic Acid (PFPeA)	ng/L	100%	18.93	4	24.50	15.10	0.17		
POPs - PFOS	PFBS	ng/L	100%	8.94	4	16.30	1.75	0.08		
POPs - PFOS	PFDoA	ng/L	0%	---	4	---	---	---		
POPs - PFOS	PFDoS	ng/L	0%	---	2	---	---	---		
POPs - PFOS	PFDS	ng/L	0%	---	2	---	---	---		
POPs - PFOS	PFEESA	ng/L	0%	---	2	---	---	---		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PFOS	PFHpS	ng/L	0%	---	2	---	---	---		
POPs - PFOS	PFHxS	ng/L	100%	8.51	4	17.70	1.83	0.08		
POPs - PFOS	PFMBA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	PFMPA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	PFNS	ng/L	0%	---	2	---	---	---		
POPs - PFOS	PFPeS	ng/L	0%	---	2	---	---	---		
POPs - PFOS	PFTeDA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	PFTrDA	ng/L	0%	---	2	---	---	---		
POPs - PFOS	PFUnA	ng/L	0%	---	4	---	---	---		
POPs - Phthalates	Bis(2-Ethylhexyl)Phthalate	µg/L	0%	---	12	---	---	---		
POPs - Phthalates	Butylbenzyl Phthalate	µg/L	0%	---	12	---	---	---		
POPs - Phthalates	Diethyl Phthalate	µg/L	0%	---	12	---	---	---		
POPs - Phthalates	Dimethyl Phthalate	µg/L	0%	---	12	---	---	---		
POPs - Phthalates	Di-N-Butyl Phthalate	µg/L	8%	---	12	---	---	---		
POPs - Phthalates	Di-N-Octyl Phthalate	µg/L	0%	---	12	---	---	---		
POPs - PPCPs	2-Hydroxy-Ibuprofen	ng/L	100%	5,283	4	7,560	2,130	47		
POPs - PPCPs	Acetaminophen	ng/L	100%	402	3	740	120	4		
POPs - PPCPs	Azithromycin	ng/L	100%	351	3	619	210	3		
POPs - PPCPs	Bisphenol A	ng/L	100%	1,058	4	2,870	83	9	900b	
POPs - PPCPs	Caffeine	ng/L	100%	6,560	3	8,760	4,920	58		
POPs - PPCPs	Carbadox	ng/L	67%	9.1	3	16.5	4.5	0.1		
POPs - PPCPs	Carbamazepine	ng/L	100%	548	3	661	408	5		
POPs - PPCPs	Cefotaxime	ng/L	0%	---	2	---	---	---		
POPs - PPCPs	Ciprofloxacin	ng/L	67%	120	3	141	94	1		
POPs - PPCPs	Clarithromycin	ng/L	100%	137	3	157	107	1.21		
POPs - PPCPs	Clinafloxacin	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Cloxacillin	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Dehydronifedipine	ng/L	100%	4.5	3	7.7	2.6	0.04		
POPs - PPCPs	Digoxigenin	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Digoxin	ng/L	33%	---	3	---	---	---		
POPs - PPCPs	Diltiazem	ng/L	100%	288	3	414	219	2.55		
POPs - PPCPs	Diphenhydramine	ng/L	100%	898	3	994	791	8		
POPs - PPCPs	Enrofloxacin	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Erythromycin-H2O	ng/L	100%	36.6	3	50.2	25.7	0.3		
POPs - PPCPs	Flumequine	ng/L	0%	---	3	---	---	---		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PPCPs	Fluoxetine	ng/L	100%	29.4	3	35.9	18	0.26		
POPs - PPCPs	Furosemide	ng/L	100%	601.3	4	847	502	5.3		
POPs - PPCPs	Gemfibrozil	ng/L	100%	53.03	4	63.7	40.7	0.47		
POPs - PPCPs	Glipizide	ng/L	0%	---	4	---	---	---		
POPs - PPCPs	Glyburide	ng/L	100%	3.5	4	4.3	2.4	0.03		
POPs - PPCPs	Hydrochlorothiazide	ng/L	100%	1,206	4	1,520	893	11		
POPs - PPCPs	Ibuprofen	ng/L	100%	1,490	4	2,440	1,120	13		
POPs - PPCPs	Lincomycin	ng/L	100%	6.64	3	16.1	1.46	0.06		
POPs - PPCPs	Lomefloxacin	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Miconazole	ng/L	100%	3.28	3	6.23	1.65	0.03		
POPs - PPCPs	Naproxen	ng/L	100%	2,465	4	3,000	1,580	22		
POPs - PPCPs	Norfloxacin	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Norgestimate	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Ofloxacin	ng/L	100%	16.1	3	19.4	13.1	0.1		
POPs - PPCPs	Ormetoprim	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Oxacillin	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Oxolinic Acid	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Penicillin G	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Penicillin V	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Roxithromycin	ng/L	100%	1.19	3	1.63	0.62	0.01		
POPs - PPCPs	Sarafloxacin	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Sulfachloropyridazine	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Sulfadiazine	ng/L	33%	---	3	---	---	---		
POPs - PPCPs	Sulfadimethoxine	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Sulfamerazine	ng/L	33%	---	3	---	---	---		
POPs - PPCPs	Sulfamethazine	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Sulfamethizole	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Sulfamethoxazole	ng/L	100%	553	3	660	427	4.89		
POPs - PPCPs	Sulfanilamide	ng/L	100%	108	1	108	108	0.96		
POPs - PPCPs	Sulfathiazole	ng/L	0%	---	3	---	---	---		
POPs - PPCPs	Thiabendazole	ng/L	100%	25.4	3	30.4	21.7	0.22		
POPs - PPCPs	Triclocarban	ng/L	100%	1.41	4	1.91	1.11	0.01		
POPs - PPCPs	Triclosan	ng/L	100%	22.3	4	24.9	17.8	0.2		
POPs - PPCPs	Trimethoprim	ng/L	100%	222	3	270	172	1.96		
POPs - PPCPs	Tylosin	ng/L	67%	3	3	5.8	1.4	0.03		

Table 2.5, cont'd

Parameter Grouping	Parameter	Unit	Frequency Of Detection	Average Concentration	*n*	Maximum Concentration	Minimum Concentration	113:1 Dilution	BC WQG	CCME WQG
POPs - PPCPs	Virginiamycin	ng/L	0%	---	2	---	---	---		
POPs - PPCPs	Warfarin	ng/L	100%	2.96	4	3.98	2.09	0.026		
Ketones	4-Methyl-2-Pentanone	µg/L	0%	---	12	---	---	---		
Ketones	Dimethyl Ketone	µg/L	67%	34.5	12	110	15	0.3		
Ketones	Endrin Ketone	ng/L	0%	---	4	---	---	---		
Ketones	Isophorone	µg/L	0%	---	12	---	---	---		
Metals - Speciated	Chromium III	mg/L	58%	0.0012	12	0.0017	0.0010	0.00001	0.056a	0.056
Metals - Speciated	Chromium VI	mg/L	8%	---	12	---	---	---		1.5b
Metals - Speciated	Dibutyltin	µg/L	25%	---	4	---	---	---		
Metals - Speciated	Dibutyltin Dichloride	µg/L	25%	---	4	---	---	---		
Metals - Speciated	Methyl Mercury	ng/L	75%	0.151	4	0.220	0.050	0.001		
Metals - Speciated	Monobutyltin	µg/L	75%	0.01	4	0.023	0.001	0.00009		
Metals - Speciated	Monobutyltin Trichloride	µg/L	75%	0.016	4	0.036	0.001	0.00014		
Metals - Speciated	Tributyltin	µg/L	25%	---	4	---	---	---		0.001
Metals - Speciated	Tributyltin Chloride	µg/L	25%	---	4	---	---	---		
Metals - Transition	Cadmium	µg/L	100%	0.033	12	0.050	0.020	0.0003	0.12b	0.12
Metals - Transition	Chromium	µg/L	100%	1.08	12	1.72	0.51	0.01		
Metals - Transition	Cobalt	µg/L	100%	0.561	12	0.880	0.345	0.005		
Metals - Transition	Copper	µg/L	100%	23.8	12	31.6	14.7	0.2	2 (mean)/3 (max)a	
Metals - Transition	Mercury	µg/L	67%	0.013	12	0.038	0.002	0.0001		
Metals - Transition	Molybdenum	µg/L	100%	2.08	12	5.92	0.97	0.02		
Metals - Transition	Nickel	µg/L	100%	3.17	12	3.86	2.25	0.03	8.3b	
Metals - Transition	Zinc	µg/L	100%	47.0	12	65.1	27.7	0.4	10a	
Metals - Transition	Iron	µg/L	100%	609	12	1140	375	5		
Metals - Transition	Manganese	µg/L	100%	45.0	12	55.7	35.6	0.4	100b	
Metals - Transition	Silver	µg/L	100%	0.086	12	0.198	0.030	0.001	1.5(mean)/ 3 (max)a	7.5

Notes:
*Dilution calculated from maximum concentration, BC WQG = British Columbia water quality guidelines, CCME WQG = Canadian Council of Ministers of the Environment water quality guidelines, a. approved guideline, b. working guideline, c. Environment Canada (2012), d. rescinded guideline.
*guidelines are maximum concentrations unless otherwise stated.
Red shading indicates exceedance to BC WQG or CCME WQG.

Table 2.6 Removal Efficiencies – 2022 Samples (*n*=12)

Chemical Category	Parameter	Percent Removal
Metals	Thallium	100%
POPs - PCDD	1,2,3,4,6,7,8-HPCDF	100%
POPs - PCDD	1,2,3,6,7,8-HXCDD	100%
Organics - VOCs	1,2,4-trichlorobenzene	100%
Organics - VOCs	1,3-dichlorobenzene	100%
POPs - Pesticides	4,4-DDD	100%
POPs - Pesticides	Alpha Chlordane	100%
Organics - Terpenes	Alpha-Terpineol	100%
PHARMA	Androsterone	100%
POPs - Pesticides	Cis-Nonachlor	100%
POPs - PAH	dibenzo(a,h)anthracene	100%
POPs - Phthalates	Diethyl Phthalate	100%
POPs - Hormones and Sterols	Estriol	100%
Conventionals - Sulphide	H2S	100%
POPs - PCDD	OCDF	100%
Conventionals - Oil and Grease	Oil & grease, total	100%
POPs - PCB - Conjener	Pcb 10	100%
POPs - PCB - Conjener	Pcb 103	100%
POPs - PCB - Conjener	Pcb 104	100%
POPs - PCB - Conjener	Pcb 131	100%
POPs - PCB - Conjener	Pcb 133	100%
POPs - PCB - Conjener	Pcb 150	100%
POPs - PCB - Conjener	Pcb 189	100%
POPs - PCB - Conjener	Pcb 191	100%
POPs - PCB - Conjener	Pcb 204	100%
POPs - PCB - Conjener	Pcb 205	100%
POPs - PCB - Conjener	Pcb 207	100%
POPs - PCB - Conjener	Pcb 24	100%
POPs - PCB - Conjener	Pcb 34	100%
POPs - PCB - Conjener	Pcb 36	100%
POPs - PCB - Conjener	Pcb 39	100%
POPs - PCB - Conjener	Pcb 5	100%
POPs - PCB - Conjener	Pcb 54	100%
POPs - PCB - Conjener	Pcb 63	100%
POPs - PCB - Conjener	Pcb 67	100%
POPs - PCB - Conjener	Pcb 79	100%
POPs - PCB - Conjener	Pcb 89	100%
POPs - PCB - Conjener	Pcb 94	100%

Table 2.6, cont'd

Chemical Category	Parameter	Percent Removal
POPs - PCB - Conjener	Pcb 96	100%
Phenols - Non-chlorinated phenols	Phenol	100%
PHARMA	Progesterone	100%
Organics - BTEX	Toluene	100%
POPs - PCDD	TOTAL HEPTA-FURANS	100%
POPs - PCDD	TOTAL HEXA-DIOXINS	100%
POPs - PCDD	TOTAL HEXA-FURANS	100%
Phenols - Non-chlorinated phenols	Total Phenols	100%
Organics - Misc	Trichloromethane	100%
POPs - PPCPs	Acetaminophen	100%
POPs - PCDD	TOTAL HEPTA-DIOXINS	97%
PHARMA	Androstenedione	97%
POPs - PCDD	OCDD	97%
POPs - PAH	2-Methylnaphthalene	95%
Conventionals - Sulphide	Sulfide	95%
POPs - PCDD	1,2,3,4,6,7,8-HPCDD	95%
POPs - PBDE	Pbde 209	95%
Conventionals - Oxygen Demand	CBOD	95%
Conventionals - Physical	TSS	94%
POPs - PAH	Anthracene	93%
POPs - PAH	2,6-dimethylnaphthalene	93%
POPs - PCB TEQ	Pcb Teq 3	93%
POPs - PAH	Perylene	93%
POPs - PPCPs	Caffeine	93%
POPs - PBDE	Pbde 208	92%
POPs - PAH	Benzo[J,K]Fluoranthenes	91%
POPs - PBDE	Pbde 206	91%
POPs - PAH	Benzo[a]pyrene	91%
POPs - PBDE	Pbde 207	91%
POPs - PAH	Naphthalene	91%
POPs - PAH	Benzo[ghi]perylene	90%
POPs - PPCPs	Ibuprofen	90%
POPs - PAH	Indeno(1,2,3-C,D)Pyrene	90%
POPs - PAH	Benzo[e]pyrene	90%
POPs - PAH	Phenanthrene	89%
POPs - PAH	Benzo[b]fluoranthene	89%
POPs - PAH	Low Molecular Weight PAH`s	88%
Conventionals - Oxygen Demand	BOD	88%
POPs - PAH	Total PAH	88%
POPs - PPCPs	Bisphenol A	88%

Table 2.6, cont'd

Chemical Category	Parameter	Percent Removal
POPs - PAH	2,3,5-trimethylnaphthalene	87%
POPs - PAH	Benzo[a]anthracene	87%
POPs - PAH	Dibenzothiophene	87%
POPs - Hormones and Sterols	Estrone	87%
Organics - Misc	1,7-Dimethylxanthine	86%
POPs - PCB - Homol	Total Nonachloro Biphenyls	86%
POPs - PCB - Homol	Total Octachloro Biphenyls	86%
Ketones	Dimethyl Ketone	86%
POPs - PBDE	Pbde 119/120	86%
POPs - PBDE	Pbde 203	84%
POPs - PAH	High Molecular Weight PAH`s	84%
POPs - PAH	1-Methylphenanthrene	83%
POPs - PCB - Conjener	Pcb 195	83%
Metals	Aluminum	83%
POPs - PCB - Homol	Total Heptachloro Biphenyls	83%
POPs - PCB - Conjener	Pcb 203	82%
POPs - PAH	Chrysene	82%
POPs - PCB - Conjener	Pcb 198/199	82%
POPs - PAH	Fluoranthene	81%
Conventionals - Oxygen Demand	COD	81%
POPs - PPCPs	2-Hydroxy-Ibuprofen	80%
POPs - PAH	Fluorene	80%
POPs - PCB - Conjener	Pcb 6	79%
POPs - PBDE	Pbde 183	79%
POPs - PCB - Conjener	Pcb 8	79%
POPs - PCB - Conjener	Pcb 196	79%
POPs - PCB - Conjener	Pcb 194	79%
POPs - PCB - Conjener	Pcb 184	79%
POPs - PCB - Conjener	Pcb 35	78%
POPs - PCB - Conjener	Pcb 183/185	78%
POPs - PCB - Conjener	Pcb 17	78%
Organics - Misc	Pentachlorobenzene	78%
POPs - PBDE	Pbde 49	78%
POPs - PCB - Conjener	Pcb 21/33	78%
POPs - PCB - Conjener	Pcb 172	77%
POPs - PCB - Conjener	Pcb 176	77%
POPs - PAH	Pyrene	77%
POPs - PBDE	Pbde 85	77%
POPs - PCB - Homol	Total Trichloro Biphenyls	77%
POPs - PCB - Conjener	Pcb 141	77%

Table 2.6, cont'd

Chemical Category	Parameter	Percent Removal
POPs - PCB - Conjener	Pcb 206	77%
POPs - PCB - Conjener	Pcb 170	77%
POPs - PBDE	Pbde 51	77%
POPs - PCB - Conjener	Pcb 27	77%
POPs - PCB - Conjener	Pcb 144	77%
POPs - PBDE	Pbde 153	77%
POPs - PAH	Acenaphthene	77%
POPs - PCB - Conjener	Pcb 180/193	76%
POPs - PAH	Acenaphthylene	76%
POPs - PCB - Conjener	Pcb 164	76%
POPs - PCB - Conjener	Pcb 16	76%
POPs - PCB - Homol	Total hexachloro biphenyls	76%
POPs - PCB - Conjener	Pcb 132	76%
POPs - PCB - Conjener	Pcb 18/30	76%
POPs - PBDE	Pbde 99	76%
POPs - PCB - Conjener	Pcb 174	76%
POPs - PBDE	Pbde 47	76%
POPs - PCB - Conjener	Pcb 52	76%
POPs - PCB - Conjener	Pcb 146	76%
POPs - PCB - Conjener	Pcb 158	76%
POPs - PCB Total	PCBs Total	76%
POPs - PBDE	Pbde 100	76%
Metals	Cadmium	76%
POPs - PCB - Conjener	Pcb 12/13	75%
POPs - PCB - Conjener	Pcb 208	75%
POPs - PCB - Conjener	Pcb 202	75%
POPs - PCB - Conjener	Pcb 190	75%
POPs - PCB - Conjener	Pcb 179	75%
POPs - PCB - Conjener	Pcb 147/149	75%
POPs - PCB - Conjener	Pcb 153/168	75%
POPs - PBDE	Pbde 140	75%
POPs - PBDE	Pbde 154	75%
POPs - Pesticides	2,4-DDD	75%
POPs - PCB - Conjener	Pcb 22	75%
POPs - PCB - Conjener	Pcb 25	74%
POPs - PCB - Conjener	Pcb 31	74%
POPs - PCB - Conjener	Pcb 49/69	74%
Metals	Lead	74%
POPs - PCB - Conjener	Pcb 1	74%
POPs - PCB - Conjener	Pcb 37	74%

Table 2.6, cont'd

Chemical Category	Parameter	Percent Removal
POPs - PCB - Conjener	Pcb 26/29	74%
POPs - PCB - Homol	Total Dichloro Biphenyls	74%
POPs - PCB - Conjener	Pcb 129/138/160/163	74%
POPs - PCB - Conjener	Pcb 20/28	74%
POPs - PCB - Conjener	Pcb 177	74%
POPs - PBDE	Pbde 12/13	74%
POPs - PCB - Homol	Total Tetrachloro Biphenyls	74%
POPs - PCB - Conjener	Pcb 134/143	74%
POPs - PCB - Conjener	Pcb 171/173	74%
POPs - PBDE	Pbde 28/33	74%
POPs - PCB - Conjener	Pcb 66	74%
POPs - PCB - Homol	Total Pentachloro Biphenyls	74%
POPs - PCB - Conjener	Pcb 93/95/98/100/102	74%
POPs - PCB - Conjener	Pcb 178	74%
POPs - PCB - Conjener	Pcb 135/151/154	74%
POPs - PCB - Conjener	Pcb 85/116/117	74%
POPs - PCB - Conjener	Pcb 59/62/75	74%
POPs - PCB - Conjener	Pcb 137	74%
POPs - PCB - Conjener	Pcb 45/51	74%
POPs - PCB - Conjener	Pcb 48	74%
POPs - PCB - Conjener	Pcb 50/53	74%
POPs - PCB - Conjener	Pcb 15	74%
POPs - PCB - Conjener	Pcb 105	73%
POPs - PCB - Conjener	Pcb 118	73%
POPs - PCB - Conjener	Pcb 84	73%
POPs - PCB - Conjener	Pcb 40/41/71	73%
POPs - PCB - Conjener	Pcb 110/115	73%
POPs - PCB - Homol	Total Monochloro Biphenyls	73%
POPs - PCB - Conjener	Pcb 156157	73%
POPs - PCB - Conjener	Pcb 88/91	73%
POPs - PCB - Conjener	Pcb 61/70/74/76	73%
POPs - PBDE	Pbde 75	73%
POPs - PCB - Conjener	Pcb 42	73%
Organics - VOCs	1,2-dichlorobenzene	72%
POPs - PCB - Conjener	Pcb 64	72%
POPs - PCB - Conjener	Pcb 128/166	72%
POPs - PBDE	Pbde 155	72%
POPs - PBDE	Pbde 15	72%
POPs - PBDE	Pbde 66	72%
Organics - VOCs	Hexachlorobutadiene	72%

Table 2.6, cont'd

Chemical Category	Parameter	Percent Removal
POPs - PCB - Conjener	Pcb 82	72%
POPs - Pesticides	4,4-DDE	72%
POPs - PCB - Conjener	Pcb 86/87/97/108/119/125	72%
POPs - PCB - Conjener	Pcb 56	72%
POPs - PCB - Conjener	Pcb 83/99	72%
POPs - PCB - Conjener	Pcb 43	72%
POPs - PCB - Conjener	Pcb 44/47/65	71%
Metals	Barium	71%
POPs - PCB - Conjener	Pcb 32	71%
POPs - PCB - Conjener	Pcb 109	71%
POPs - PCB - Conjener	Pcb 130	71%
POPs - PCB - Conjener	Decachloro Biphenyl	71%
POPs - PCB - Conjener	Pcb 11	71%
POPs - PCB - Conjener	Pcb 167	70%
POPs - PCB - Conjener	Pcb 46	70%
POPs - PCB - Conjener	Pcb 155	70%
POPs - PBDE	Pbde 71	70%
POPs - PCB - Conjener	Pcb 187	70%
POPs - PCB - Conjener	Pcb 77	70%
POPs - PCB - Conjener	Pcb 209	70%
POPs - PCB - Conjener	Pcb 197/200	70%
POPs - PCB - Conjener	Pcb 19	70%
POPs - PBDE	Pbde 8/11	69%
POPs - PCB - Conjener	Pcb 68	69%
POPs - Pesticides	Hexachlorobenzene	69%
POPs - PCB - Conjener	Pcb 3	69%
POPs - PCB - Conjener	Pcb 201	69%
POPs - PCB - Conjener	Pcb 136	69%
POPs - PCB - Conjener	Pcb 107/124	68%
POPs - PCB - Conjener	Pcb 139/140	68%
POPs - PCB - Conjener	Pcb 4	67%
POPs - PCB - Conjener	Pcb 92	67%
POPs - PCB - Conjener	Pcb 90/101/113	67%
POPs - PCB - Conjener	Pcb 9	66%
POPs - PBDE	Pbde 17/25	66%
POPs - PPCPs	Naproxen	65%
Conventionals - Nutrients	Organic Carbon	63%
POPs - Nonylphenols	Np	63%
POPs - PBDE	Pbde 7	63%
POPs - PCB - Conjener	Pcb 60	62%

Table 2.6, cont'd

Chemical Category	Parameter	Percent Removal
Metals	Iron	62%
Metals	Chromium III	61%
POPs - PCB - Conjener	Pcb 2	60%
POPs - PBDE	Pbde 138/166	59%
POPs - PCB - Conjener	Pcb 123	58%
POPs - PBDE	Pbde 79	58%
POPs - PCB - Conjener	Pcb 114	55%
Metals	Zinc	54%
POPs - PPCPs	Miconazole	54%
POPs - PPCPs	Ofloxacin	53%
POPs - PPCPs	Triclosan	52%
POPs - PPCPs	Ciprofloxacin	52%
Metals - Transition	Copper	52%
POPs - PBDE	Pbde 35	50%
Conventionals - Nutrients	N - Tkn (As N)	50%
POPs - PCB - Conjener	Pcb 7	48%
Organics - Misc	Trans-Nonachlor	46%
POPs - PPCPs	Sulfamethoxazole	46%
POPs - Pesticides	Dieldrin	44%
POPs - PFOS	Perfluorooctanesulfonic acid (PFOS)	43%
Metals	Selenium	43%
POPs - PPCPs	Carbadox	41%
Conventionals - Cyanide	WAD Cyanide	40%
Conventionals - Nutrients	P - Po4 - Total (As P)	39%
Conventionals - Nutrients	N - Total (As N)	36%
Conventionals - Major Ions	Alkalinity - Bicarbonate	35%
Metals	Chromium	34%
CONV	Alkalinity - Total - Ph 4.5	34%
Metals	Silver	33%
POPs - Pesticides	Beta-Hch Or Beta-Bhc	32%
POPs - PPCPs	Gemfibrozil	32%
Organics - Misc	Trans-Chlordane	31%
POPs - Nonylphenols	4-Nonylphenol Monoethoxylates	30%
Conventionals - Nutrients	N - Nh3 (As N)	27%
Conventionals - Cyanide	Total/SAD Cyanide	26%
Metals	Arsenic	25%
Metals	Cobalt	25%
Organics - VOCs	1,4-dichlorobenzene	25%
POPs - PPCPs	Furosemide	24%

Table 2.6, cont'd

Chemical Category	Parameter	Percent Removal
POPs - PPCPs	Trimethoprim	24%
Metals	Tin	22%
Metals	Manganese	22%
Metals	Antimony	20%
POPs - PFOS	Perfluoroheptanoic Acid (PFHpA)	19%
POPs - PPCPs	Thiabendazole	19%
Organics - Misc	Perfluorobutanoic acid	15%
POPs - PFOS	Perfluorooctanoic acid (PFOA)	15%
POPs - PCB TEQ	Pcb Teq 4	14%
Metals	Calcium	14%
POPs - PFOS	PFBS	12%
Conventionals - Major Ions	Hardness (as CaCO3)	11%
POPs - PPCPs	Hydrochlorothiazide	11%
POPs - PPCPs	Glyburide	10%
POPs - PPCPs	Diltiazem	9%
POPs - PPCPs	Warfarin	9%
Metals	Molybdenum	8%
POPs - Pesticides	Hch, Gamma	8%
POPs - PFOS	PFHxS	8%
Metals	Magnesium	8%
POPs - PPCPs	Carbamazepine	7%
Metals - Transition	Nickel	6%
Metals	Potassium	6%
POPs - PBDE	Pbde 37	4%
POPs - PPCPs	Fluoxetine	2%
Metals	Sodium	2%
Metals	Sulfur	2%
POPs - PFOS	Perfluorohexanoic Acid (PFHxA)	1%
POPs - PPCPs	Diphenhydramine	1%

2.3.4 Acute Toxicity Testing

Acute toxicity describes the adverse effects of a substance that results either from a single exposure or from multiple exposures in a short period of time (usually less than 24 hours). To be described as acutely toxic, the adverse effects should occur within 14 days of the administration of the test substance. Acute toxicity results for the McLoughlin final effluent are reported as the LC50, which is the effluent concentration that will cause mortality in 50% of the organisms within the specified test period. An LC50 result that is less than 100% effluent is a failed test. Refer to Appendix B6 for acute toxicity reports.

Table 2.7 presents the results from acute toxicity testing. Results indicated MPWWTP final effluent was acutely toxic (i.e., kills 50% in 96 hours) to trout once in 2022. A toxicity test conducted in June failed. This was followed by non-toxic results for subsequent follow up testing on July 4, 11, 13 and 25. Toxicity on June 14 was attributed to elevated ammonia concentrations.

Daphnia magna toxicity testing is not required by regulations but is conducted as part of expanded EMP commitments. There was no toxicity in any sample tested in 2022.

Table 2.7 McLoughlin Point WWTP Acute Toxicity Test Results – 2022

	Rainbow Trout LC50 (96-hour) (%) pH Stabilized	Daphnia magna 48-hour % Survival in 100% Effluent
January 19	>100	>100
February 16	>100	>100
March 23	>100	>100
March 18	>100	>100
April 6	>100	>100
May 18	>100	>100
June 14	>73.5	>100
July 4	>100	---
July 11	>100	>100
July 13	>100	>100
July 25	>100	---
August 17	>100	>100
September 14	>100	>100
October 26	>100	>100
November 17	>100	>100
December 15	>100	>100

Notes: Test pass = >100%.
Results are presented as v/v%.
Shaded cells indicated test failure.
--- Test not conducted.

2.3.5 Chronic Toxicity Testing

Chronic toxicity is described as adverse health effects from repeated or continuous exposures to a substance, often at lower levels over a longer time (weeks or years). Chronic toxicity results are reported as the LC50, which is the concentration that will result in mortality of 50% of the organisms in the specified test period, or as EC50, EC25 (effective concentration), IC50 or IC25 (inhibition concentration) which are the concentrations that will have a sub-lethal negative effect upon 50% or 25%, respectively, of the organisms in the specified test period (e.g., decreased fertilization or growth). Refer to Appendix B7 for chronic toxicity reports.

Chronic toxicity testing was conducted using McLoughlin Point WWTP final effluent from mid-November to mid-December 2022. Several species were tested, including Topsmelt (*Atherinops affinis*), C*eriodaphnia,* Echinoids (*Strongylocentrotus purpuratus*) and a 30-day Rainbow Trout (*Oncorhynchus mykiss*) embryo/alevin viability test.

The Rainbow Trout embryo/alevin viability test is based on assessing non-viable alevins or the failure to reach the alevin stage with timely and expected development, due to deterioration at any previous stage, including failure of egg fertilization, mortality of embryo or alevin, failure to hatch by test end, or abnormal development. One or both of the following two endpoints are obtained for the same effect: (1) effective concentration for failure of 25% of individuals to develop normally to the alevin stage (EC25); and (2) median effective concentration for failure of 50% of individuals to develop normally to the alevin stage (EC50).

Table 2.8 presents the results from chronic toxicity testing of McLoughlin Point WWTP effluent. Final effluent was not toxic to Ceriodaphnia survival and reproduction and echinoderm fertilization in 100% effluent.

Topsmelt chronic toxicity (survival) occurred at a wastewater concentration of 83.6% (LC50), with sub-lethal effects) (dry biomass and weight) (IC50) at wastewater concentrations of 71.6 and >100% respectively. Rainbow trout embryo-alevin chronic toxicity survival and viability (LC50) occurred at wastewater concentrations of 93.2% and 88% respectively. Like the acute toxicity test results, the effluent concentrations at which most chronic effects were observed were 93.2% and 88% respectively.

Chronic toxicity concentrations were substantially higher than the predicted wastewater concentrations in the marine receiving environment at the edge of the initial dilution zone (i.e., 0.9% at McLoughlin based on a minimum initial dilution of 113:1) (Lorax, 2019). Marine life is unlikely to be exposed to the chronically toxic wastewater concentrations unless exposure occurs close to the outfall diffusers within the initial dilution zone and the organisms spend a prolonged time exposed to the sewage plume.

Table 2.8 McLoughlin Point WWTP Chronic Toxicity Test Results – 2022

Chronic Toxicity Test	%v/v (CI)
Six-day Topsmelt	
Survival - LC25	64.7 (60.9-72.4)
Survival - LC50	83.6 (74.0->100)
Dry Biomass - IC25	53.9 (33.3-61.3)
Dry Biomass - IC50	71.6 (62.3-80.5)
Dry Weight - IC25	56.9 (28.9-93.8)
Dry Weight - IC50	>100
Seven-day Ceriodaphnia	
Survival - LC50	>100
Reproduction - IC25	>100
Reproduction - IC50	>100
Echinoid Fertilization	
IC25	>100
IC50	>100
Rainbow Trout Embryo-Alevin	
Embryo Survival - LC25	77.2 (67.1-89.9)
Embryo Survival - LC50	93.2 (80.5->100)
Embryo Viability - EC25	64.8 (10.2-83.3)
Embryo Viability - EC50	88.0 (53.9->100)

Notes: CI = 95% confidence limits.

2.3.6 Overall Assessment

The 2022 McLoughlin Point WWTP wastewater monitoring results are qualitatively an improvement from historical Macaulay and Clover results, indicating that from an operational and regulatory compliance perspective, wastewater quality has improved substantively since the installation of treatment. Tertiary effluent quality was achieved for the bulk of the year, but there were a few non-compliant effluent days and months as treatment process optimization was ongoing throughout 2022. Effluent quality was less variable than the first and second years of operation (2020-2021), but ongoing process optimization work is needed to be fully compliant with provincial and federal wastewater regulations in the future. It is anticipated that the McLoughlin treatment processes could take up to two years to fully optimize (estimated the end of 2022), with occasional non-compliance events expected throughout this time. In addition, there is potential that highly variable centrate return flows from the Hartland Residuals Treatment Facility may be impacting the treatment plant's ability to achieve effluent quality limits at all times. This issue is being investigated.

All effluent quality parameters were predicted to be below applicable water quality guidelines in the marine receiving environment at the edge of the initial dilution zone, except for bacteriological indicators. The use of estimated minimum initial dilution factors allows for a conservative (i.e., highly protective) estimation of potential effects in the marine receiving environment. However, predicted average initial dilution factors are much higher around the outfall (711:1 median for McLoughlin Point), so overall risk to human health and the environment is lower than predictions indicate. These bacteriological indicator guideline exceedances will continue as disinfection has not been installed as part of the new McLoughlin treatment process, and disinfection is also not feasible at Macaulay or Clover during rain events. However, with tertiary treatment at McLoughlin, even without disinfection, the magnitude of the bacteriological exceedances has been greatly reduced.

As designed, the treatment plant is removing substances effectively from final effluent. Effluent quality has improved significantly with high removal efficiencies for most substances measured.

3.0 SURFACE WATER MONITORING

3.1 Introduction

CRD staff have been monitoring receiving waters around the Macaulay and Clover outfalls for fecal indicator bacteria concentrations since the early 1980s. This indicator is used as a surrogate to assess the potential for human health impacts from exposure to wastewaters in the marine receiving environment during recreational activities such as kite surfing, diving, and swimming. Observed impacts at the shoreline have been attributed to stormwater discharges, which are currently monitored by the CRD's Stormwater Quality Program.

The McLoughlin Point Wastewater Treatment Plant commenced operation in August 2020. Since the beginning of 2021, surface water and initial dilution zone (IDZ) sampling shifted from Clover and Macaulay receiving environments to the McLoughlin receiving environment. The IDZ is defined by BC ENV as a 100-meter area around the end of the outfall and the area most impacted by wastewater discharge.

The Clover and Macaulay Point outfalls have been converted to screening and pump stations that now only discharge sewage out their respective long outfalls during very heavy rain events or planned overflow and bypass events during maintenance. In the event of an overflow out either Clover Point or Macaulay Point outfalls, surface water sampling is attempted, conditional on vessel availability and weather conditions. However, overflow events often occur during storms which makes sampling dangerous to staff and vessel crew.

3.2 Methods

Staff collected 5 samples in 30 days ("5-in-30") in each quarter (i.e., January, April, July, and October) at the IDZ and at the surface of the receiving environment at stations around the McLoughlin outfall (Figure 3.1). Sampling was conducted using the University of Victoria's 16-metre science vessel, the MSV John Strickland.

Surface water and IDZ sampling parameters are presented in Appendix C1. For surface water sampling, CRD staff collected samples at a depth of 1 m using a sampling pole. For IDZ sampling, staff collected samples using a Seabird ECO55 rosette sampler along with a SBE19PlusV2 conductivity-temperature-depth (CTD) instrument. The CTD instrument was also equipped with a SBE43 dissolved oxygen sensor. Water column instrument profiles were taken at each IDZ station and water column samples were taken at the top (at a depth of 5 m), middle (middle of predicted plume trapping depth) at 40 m, and bottom (5 m above the seafloor, approximately 55 m) of the water column. CTD casts were captured at each IDZ sample station, and measured depth, conductivity, salinity, temperature and dissolved oxygen.

Surface water sampling stations are presented in Figure 3.1 and Appendix C2. The surface sampling grid, consisting of a total of 13 stations, was used to ensure good spatial coverage of the receiving environment where plume surfacing is most likely to occur. In addition, samples were collected at the location at which a drift drogue was retrieved each day (see Appendix C2, sample D1). Surface samples were collected in sterile, wide-mouth bottles by rapidly submerging open, upright bottles to a depth of 1 m using a sampling pole. Reference stations were also sampled at Parry Bay, Metchosin and at Constance Bank (see Figure 3.1).

IDZ stations are also presented in Figure 3.1. For each cruise, the predicted current direction and plume trapping depth were determined using the CRD's hydrodynamic C3 model. The model incorporates local conditions (historic instrument data and current and tide tables) to estimate current direction and effluent trapping depth (Hodgins, 2006). The model is also updated on an annual basis to incorporate the previous year's data. Four stations and the "middle" sampling depth were then selected to ensure that they fell within the plume's model-predicted direction of travel and trapping depth for that specific day and time. Samples were collected with a Seabird ECO55 rosette sampler, decanted into sample bottles and preserved for analysis of metals, various conventional parameters and nutrients (Appendix C1). Bacteriological indicators, ammonia, hardness, metals, total suspended solids and pH samples were analyzed for each of the “5-in-30” cruise days, with additional analysis of oil and grease, phosphorus, sulfide and total organic carbon on samples collected from only one day per quarter (usually the first of the “5-in-30” cruise days).

The surface and IDZ water column samples were analyzed for two bacteriological indicators (fecal coliforms and Enterococci) by BV Labs (Victoria, BC).

Bacteriological results were evaluated against the historical human health guidelines developed by the BC ENV (BCMoE&CCS 2021a; 2021b) for recreational primary contact (for informational purposes only) and to Health Canada (2012) guidelines for recreational water quality. The Health Canada guidelines for Enterococci are:

- The geometric mean of 5 samples taken 5 times in 30 days, should not exceed 35 CFU/100 mL.
- Single Enterococci values should not exceed 70 CFU/100 mL.

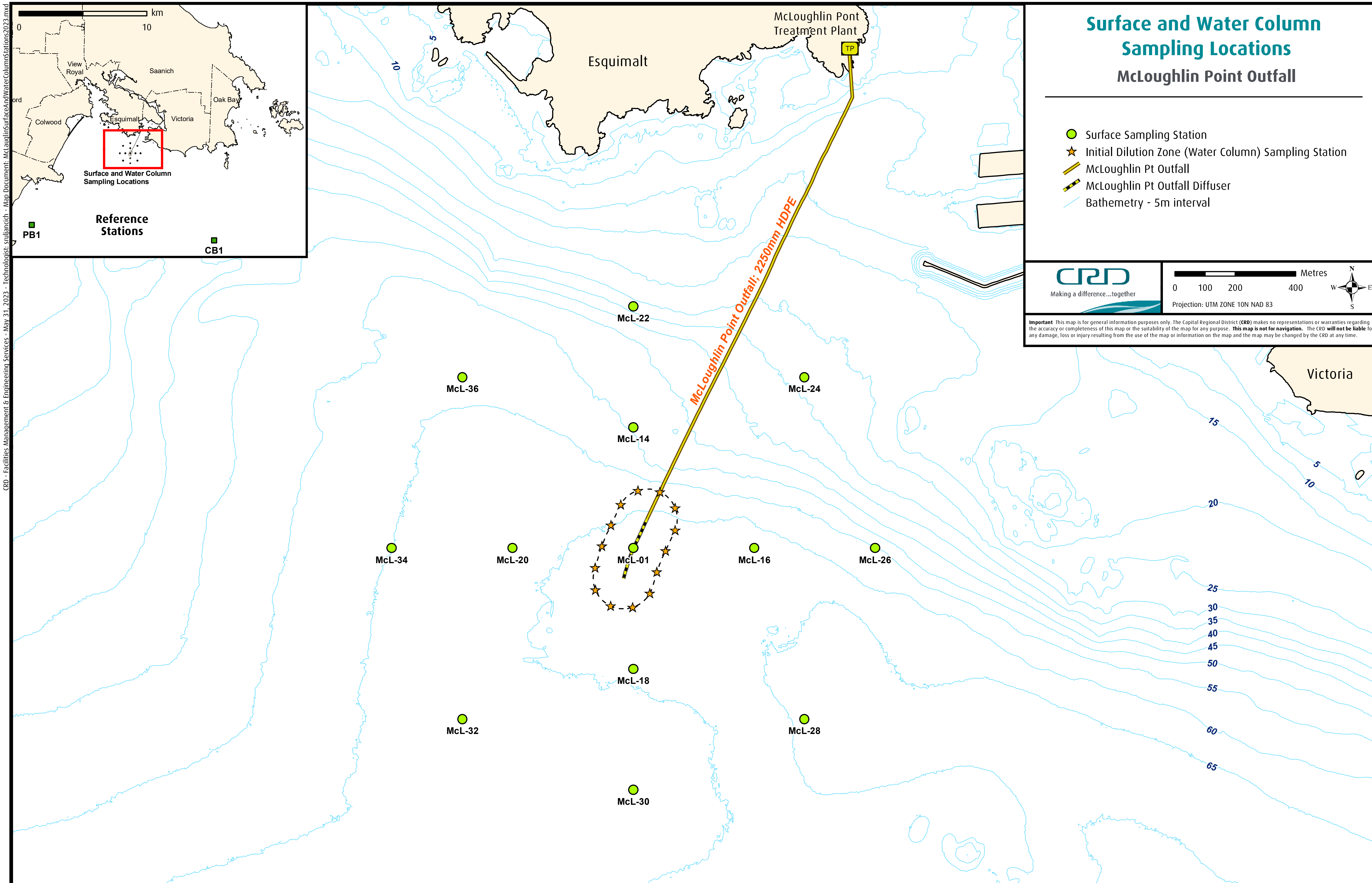
All other IDZ water column results were evaluated against Approved BC Water Quality Guidelines for the Protection of Aquatic Life (BCMoE&CCS 2021a; 2021b).

The registration under the Municipal Wastewater Regulation (MWR), Authorization #RE108831, requires plume dispersion and dilution modelling using concurrent effluent and receiving environment water quality samples at the edge of the IDZ at McLoughlin Point outfall, far-field sites (Haystock Islets, Ogden Point, Cook Street, Chatham and Discovery Islands, Trial Island) and at Clover (CPS) and Macaulay pump stations (MPS) during potential overflow events, for modelled scenarios 1, 2 and 3 (Lorax, 2019).

The three modelled scenarios are based on the influent flow hydrographs prepared by Lorax (2019) representing typical conditions expected up to the year 2030.

- Scenario 1 is summer conditions with flows of about 80% of the average dry weather flow (ADWF) for MPWWTP (ADWF of 108,000 m3/day) of tertiary effluent.
- Scenario 2 is wet weather conditions providing discharge through only the MPWWTP outfall (flows 0.5 x to 2.9 x ADWF when MPWWTP is discharging primary + tertiary blended effluent).
- Scenario 3 is wet weather storm conditions providing discharge through both the MPWWTP (primary + tertiary blended effluent) and CPS (screened effluent) deep outfalls.

Appendix D2 presents results from two validation sampling events that occurred in July 2022 and October 2022. The first round of model validation sampling was conducted on July 7, 2022 and represents Scenario 1, with typical summer conditions. On this day, MPWWTP discharged 75,300m^3 of wastewater. Samples were collected from the five far-field stations. October model validation sampling was conducted on October 12 and was timed to coincide with a bypass of the MPWWTP treatment works that was required to conduct maintenance activities. This represents Scenario 2, with discharge through the McLoughlin outfall of primary + tertiary blended effluent. On this day, 73,400m^3 of treated effluent was discharged from the MPWWTP plus 2,650m^3 of primary/bypass flow. During the bypass, surface water samples were collected from around the MPWWTP IDZ and from the five far-field stations. For both sampling events, samples were analyzed for indicator bacteria fecal coliforms and enterococci as well as for DNA-based bacterial source tracking.


Surface and Water Column Sampling Locations
McLoughlin Point Outfall
Surface Sampling Station
Initial Dilution Zone (Water Column) Sampling Station
McLoughlin Pt Outfall
McLoughlin Pt Outfall Diffuser
Bathemetry - 5m interval
Making a difference...together
Metres
0 100 200 400
Projection: UTM ZONE 10N NAD 83
N
W
E
S
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km
0 5 10
View Royal
Saanich
Oak Bay
Colwood
Esquimalt
Victoria
Surface and Water Column Sampling Locations
Reference Stations
PB1
CB1
McLoughlin Pont Treatment Plant
TP
Esquimalt
Victoria
McLoughlin Point Outfall; 2250mm HDPE
McL-22
McL-36
McL-24
McL-14
McL-34
McL-20
McL-01
McL-16
McL-26
McL-18
McL-32
McL-28
McL-30
5
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3.3 Results and Discussion

3.3.1 Surface Water Sampling

CRD staff collected 320 surface water samples at McLoughlin's WWTP marine receiving environment in 2022.

Fecal coliform results for each sampling event (including seasonal geometric means) are presented in Appendix C3. Station seasonal geometric means were one or two orders of magnitude below the historical provincial guideline of 200 CFU/100 mL (Table 3.1). From the 320 samples, no individual fecal coliform measurements were above the guideline value of 200 CFU/100 mL (Appendix C3). The maximum fecal coliform concentration measured in 2022 was 93 CFU/100 mL which occurred on week two in the autumn at the drogue station.

Enterococci results for each sampling event (including seasonal station geometric means) are presented in Appendix C4. All seasonal geometric means were below the federal guideline of a geomean of 35 CFU/100 mL (Table 3.2). From the 320 samples, one individual Enterococci measurement was above the federal single value guideline of 70 CFU/100 mL (Appendix C4), which occurred on week four in the autumn.

There were no recreational (historical guideline) exceedances for fecal coliforms in any quarter and no exceedances for Enterococci except for the one autumn measurement above the maximum WQG at 170 CFU/100 mL. The frequency and location of exceedances are much less than results from historical Clover and Macaulay receiving environment monitoring. 2022 surface water sampling results indicate that treatment has substantively reduced bacteria concentrations in effluent and the receiving environment by up to two orders of magnitude.

Overall, the data also indicate that the McLoughlin effluent plume was predominantly trapped below the surface, as predicted by the CRD's hydrodynamic C3 model, and that the outfall diffuser was achieving adequate dilution. Had the effluent plume not been predominantly trapped, more frequent high fecal coliform and Enterococci concentrations would have been observed, particularly at stations approximately 100 m from the outfall, where the model predicts the plume is most likely to surface (Hodgins, 2006). If regular plume surfacing was occurring, we would expect to see more fecal coliform concentrations of approximately 4,107 CFU/100 mL, based on applying the average dilution factor of 113:1 to the 2022 mean wastewater fecal coliform concentration of 464,136 CFU/100 mL (Table 2.3). As mentioned above, the maximum single fecal coliform concentration found at 1 m depth was 93 CFU/100 mL, with most results below 10 CFU/100 mL.

Table 3.1 McLoughlin Point WWTP Surface Water (1 m depth) Fecal Coliform Seasonal Geometric Means

Fecal Coliforms	Winter						Spring						Summer						Autumn					
	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean
McL-01	2	5	4	1	<1	2	<1	<1	17	85	<1	4	<1	2	<1	<1	3	1	<1	<1	<1	3	12	2
McL-14	7	15	2	7	<1	4	<1	<1	1	1	2	1	<1	<1	<1	<1	4	1	<1	<1	<1	2	2	1
McL-16	4	3	12	9	<1	4	<1	1	<1	4	<1	1	<1	3	2	<1	2	2	<1	<1	<1	1	23	2
McL-18	3	<1	5	11	<1	3	1	3	<1	9	<1	2	<1	1	<1	<1	<1	1	<1	2	<1	1	1	1
McL-20	5	7	1	6	<1	3	<1	1	1	81	<1	2	<1	4	<1	<1	3	2	<1	<1	<1	1	<1	1
McL-22	18	19	4	6	<1	6	3	6	2	1	2	2	2	2	<1	<1	4	2	<1	1	<1	1	16	2
McL-24	7	3	7	3	<1	3	<1	1	<1	1	3	1	<1	2	<1	<1	2	1	<1	1	<1	1	7	1
McL-26	1	2	2	1	<1	1	1	2	<1	1	<1	1	<1	1	3	<1	2	1	<1	<1	<1	1	12	2
McL-28	1	3	6	14	1	3	<1	1	<1	1	<1	1	<1	2	4	<1	5	2	<1	2	<1	<1	3	1
McL-30	2	1	3	8	<1	2	<1	3	<1	<1	<1	1	<1	<1	<1	<1	4	1	<1	<1	<1	<1	1	1
McL-32	<1	3	1	9	<1	2	<1	<1	<1	<1	<1	1	<1	<1	2	<1	1	1	<1	<1	<1	<1	2	1
McL-34	<1	8	6	12	1	4	1	4	<1	3	1	2	1	<1	<1	<1	<1	1	1	<1	<1	<1	2	1
McL-36	5	11	1	4	2	3	2	1	<1	4	<1	2	<1	2	<1	<1	2	1	1	<1	<1	5	5	2
McL-D1	---	1	1	9	<1	2	<1	1	<1	9	1	2	<1	---	1	<1	---	1	<1	<1	1	3	93	3
Ref-CB	<1	<1	1	<1	<1	1	<1	2	2	<1	<1	1	<1	---	1	<1	---	1	<1	<1	<1	5	<1	1
Ref-PB	2	25	5	<1	2	3	<1	<1	4	8	<1	2	<1	<1	2	<1	3	1	<1	<1	<1	1	1	1

Notes: Red shaded cells indicate exceedance to historical BC WQG Geomean of 200 CFU/100 mL, Geomean = Geometric Mean --- denotes sample not taken due to weather issues

Table 3.2 McLoughlin Point WWTP Surface Water (1 m depth) Enterococci Seasonal Geometric Means

Enterococci	Winter						Spring						Summer						Autumn					
	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean
McL-01	1	1	<1	2	<1	1	<1	<1	2	20	<1	2	<1	<1	<1	<1	<1	1	<1	<1	<1	5	56	3
McL-14	3	3	<1	<1	<1	2	<1	<1	<1	1	<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	28	<1	2
McL-16	<1	1	4	<1	<1	1	<1	<1	<1	<1	1	1	<1	<1	<1	<1	1	1	<1	<1	<1	170	4	4
McL-18	1	1	1	4	<1	1	<1	<1	<1	3	<1	1	<1	<1	<1	<1	1	1	<1	1	<1	<1	<1	1
McL-20	2	7	1	5	<1	2	<1	2	<1	16	<1	2	<1	<1	<1	<1	<1	1	<1	<1	<1	1	<1	1
McL-22	4	9	14	4	<1	5	<1	1	<1	<1	1	1	<1	<1	1	<1	<1	1	<1	<1	<1	21	12	3
McL-24	5	1	6	2	<1	2	<1	2	<1	<1	1	1	<1	<1	<1	2	<1	1	<1	<1	<1	8	3	2
McL-26	4	1	1	<1	1	1	<1	<1	<1	<1	1	1	<1	<1	<1	<1	1	1	<1	<1	<1	2	1	1
McL-28	<1	<1	<1	9	<1	2	<1	1	<1	<1	<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	4	<1	1
McL-30	<1	<1	<1	3	<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	1	1	<1	<1	<1	15	<1	2
McL-32	<1	5	1	5	<1	2	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	5	<1	1
McL-34	1	3	1	4	<1	2	<1	<1	<1	<1	<1	1	<1	1	<1	<1	<1	1	<1	<1	<1	2	<1	1
McL-36	3	5	1	<1	<1	2	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	1	1	<1	1	<1	3	13	2
McL-D1	---	5	<1	2	<1	2	<1	<1	<1	24	<1	2	<1	---	<1	<1	---	1	<1	<1	<1	11	37	3
Ref-CB	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	1	<1	---	<1	<1	---	1	<1	<1	<1	1	<1	1
Ref-PB	1	12	<1	<1	1	2	<1	<1	<1	1	<1	1	<1	<1	<1	<1	1	1	<1	<1	<1	<1	<1	1

Notes: Shaded cells indicate exceedance to Environment Canada maximum guideline of 70 CFU/100 mL (blue) and geomean of 35 CFU/100 mL (red)
--- denotes sample not taken due to weather issues

3.3.2 Initial Dilution Zone Water Column Sampling

Analytical results for each round of IDZ water column sampling are presented in Appendices C3-C16. CTD and dissolved oxygen plots for each cruise day are presented in Appendix C17.

Only samples for which results were above detection limits, and have BC approved recreational water quality guidelines are presented (Appendices C5-C16) (arsenic, boron, cadmium, copper, Enterococci, lead, manganese, nickel, silver and zinc).

The geometric means of the “5-in-30” fecal coliform water column results did not exceed guidelines during any season (historical guideline) (Appendix C5).

The geometric means of the “5-in-30” Enterococci water column results exceed guidelines one time in the spring at a bottom depth. Three single values exceeded federal maximum single Enterococci guidelines of 70 CFU/100 mL in the spring at the top depth (5 m) and twice in the autumn at middle depths (Appendix C6).

There were no exceedances of provincial or federal guidelines for any of the metals that were analyzed in the IDZ samples, except for boron and cadmium. Concentrations of total boron exceeded the provincial guideline of 1.2 mg/L in all samples, with values ranging from 3.89 to 8.15 mg/L including the reference station (Appendix C10). However, ambient boron concentrations, as demonstrated at the reference station, are approximately 4.0 mg/L in southern Vancouver Island marine waters (BCMoE, 2006). Therefore, it is inevitable that guidelines are exceeded. Cadmium had several exceedances in the spring, summer and autumn, which is inconsistent with previous years (Appendix C11). The CRD recently changed methodology for seawater metals analysis. Cadmium will be closely monitored in the marine environment to determine if these exceedances trend over time or are a result of the revised analytical method.

These results indicate an improvement of surface and IDZ water quality since sewage treatment has been installed. The treatment process reduced the concentration of bacterial indicators, heavy metals, and nutrients in the water column as well as on the water surface by up to an order of magnitude or more. More years of sampling are needed to determine any long-term reductions.

Water column profiles of temperature, salinity, dissolved oxygen and transmissivity (Appendix C17) generally followed expected seasonal patterns for the Strait of Georgia (well mixed in winter and stratified in summer). It appears that the plume was only occasionally detected by the sensors, based on decreases in oxygen and increases in bacteriological indicators (fecal coliforms and Enterococci). A master’s thesis (Krogh *et al*., 2018) examining vertical profiles of dissolved oxygen between 2011 and 2016 confirmed that of the approximately 850 CTD casts conducted, only six profiles showed any evidence of a sewage plume layer, using decreases in dissolved oxygen as a primary indicator.

CTD profiling will continue as part of the routine environmental monitoring program and the data will be fed into the oceanographic plume dispersion and dilution modelling on a regular basis to maintain an up-to-date background condition database.

3.3.3 Model Validation Sampling

Results of the model validation sampling are presented in Appendix D2 and include surface bacteria, bacterial source tracking results, and tidal information.

Sampling confirmed that the effluent flows from the McLoughlin WWTP were non-detectable at far-field stations.

3.3.4 Overall Assessment

Overall, the 2022 surface fecal coliform and Enterococci results indicate that the newly commissioned McLoughlin Wastewater Treatment Plant is operating as designed. The treated effluent plume was trapped well below the ocean surface and the diffusers were working as expected. There were no exceedances on the surface at any time of the year for Enterococci, except one measurement that exceeded guidelines in the fourth week in autumn. Three single Enterococci values exceeded federal maximum single Enterococci guidelines at the top depth and times in the autumn at middle depths.

There were no detectable heavy metals, oil and grease or elevated nutrients in any of the 360 samples taken in 2022 except boron and cadmium which exceeded guidelines in many or all samples. Boron is naturally elevated in the Salish Sea at levels of approximately 4.0 mg/L in southern Vancouver Island marine waters (BCMoE, 2006). Therefore, it is inevitable that guidelines are exceeded around the McLoughlin outfall. Cadmium exceedances are a new occurrence and will be closely monitored for any emerging trend.

In summary, the new McLoughlin WWTP treatment processes have substantively reduced potential impacts to human health and the marine receiving environment, particularly from a bacteriological perspective, relative to the historical Macaulay and Clover discharges.

4.0 OVERFLOW AND BYPASS MONITORING

4.1 Introduction

During high volume storm events, the input to the Core Area conveyance system (Figure 1.1) may exceed system capacity, resulting in overflows at designated combined sewer overflow (CSO) and sanitary sewer overflow (SSO) relief points. There are also periodic bypass events to allow for planned maintenance to the treatment works or following unexpected non-routine or emergency events.

There are multiple relief points in the system (Table 4.2), but most are never used and are only in place for emergencies. The relief points that are expected to overflow in rain events, and their historical and predicted future overflow frequencies, are presented in Table 4.1. The new McLoughlin Wastewater Treatment Plant, and the conveyance system upgrades and additions, have reduced the frequency of overflows from most of the SSO points. These additions include the 5,000 m^3 underground Arbutus Attenuation Tank, that temporarily stores wastewater flows during high volume storm events, and moderates release into the downstream system. The frequency of overflows at the Humber and Rutland CSO locations, however, will remain unchanged until the District of Oak Bay separates the wastewater and stormwater systems in the Uplands neighbourhood.

In the event of an overflow or bypass, sampling may be required as part of the Environmental Monitoring Program (EMP) at the adjacent beaches and/or stormwater outputs (Table 4.2, Appendix D1), following protocols developed in consultation with Island Health, and approved by ENV. The purpose of this shoreline monitoring is to assess human health risk for people engaged in recreational activities on beaches adjacent to the overflows by comparing bacterial results to recreational guidelines (Health Canada (2012).

This sampling program has evolved over the years, and currently indicates that from May 1 to September 14 of each year, when beach use is highest, all overflow events are immediately monitored during (if prolonged duration and as safety protocols allow), and after the overflow event. Temporary beach closure signs are posted, Emergency Management BC (EMBC) is notified, and Island Health is consulted.

For the remainder of the year (September 15 to April 30), the response varies. For the Humber and Rutland CSO locations, permanent signage has been posted at all potentially affected beaches advising beach users to stay out of the water for 48 hours after any weather event, and no sampling is undertaken for routine wet weather overflows. For the remaining SSO locations, and any unexpected non-routine or emergency CSO discharges, shoreline monitoring is still required during these winter months.

In the event of a planned or unplanned bypass at the McLoughlin WWTP, the non-compliance inbox at ENV is notified, and the effluent composite sample is analyzed.

Table 4.1 Overflow Frequency Pre- and Post-Treatment Plant Upgrade

Location	Pre-Upgrade	Post-Upgrade
Finnerty	3-4 times/year	>25-year return period storm
Humber	7-10 times/year	7-10 times/year
Rutland	7-10 times/year	7-10 times/year
McMicking	3-4 times/year	>25-year return period storm
Clover Long Outfall	continuous	61 hours/year
Clover Short Outfall	3-4 times/year	>100-year return period storm
Macaulay	continuous	>10-year return period storm
McLoughlin	n/a	Period planned or unplanned bypass due to maintenance, equipment malfunctions, or high flow.

4.2 Methods

A network of shoreline and stormwater sampling stations cover the beach area around the CSO/SSO locations. Shoreline stations are named based on their proximity to the overflow/relief point in the conveyance system, (e.g., HUM-H for Humber H). Storm drains are numbered, with stormwater stations named using that number in combination with “SW” (e.g., 0503/SW0503).

When sampling is required, shoreline sampling stations are selected based on the location of the overflow/bypass event(s) (Table 4.1, Appendix D1), and sampled approximately 48 hours after the event occurred. Samples are collected concurrently at adjacent stormwater discharges.

All samples are collected by submerging a sterile 500 mL plastic bottle into the marine shoreline waters as far as the sampling technician could reach, or by holding the bottle in the stormwater discharge flow, and then sent to Bureau Veritas (Burnaby, BC) for analysis for Enterococci. Results were compared to Health Canada (2012) limit of 70 CFU/100 mL for a single sample.

4.3 Results and Discussion

There were multiple overflow and unplanned bypass events in 2022, as listed in Table 4.3. Based on time of year and overflow location, no shoreline sampling was required for any of these events. There were two occasions where surface water sampling was conducted to coincide with planned bypasses as part of the requirement for dilution model validation. Planned bypass events took place in July and October 2022, with surface water samples collected from around the McLoughlin IDZ and/or as well as at five far-field monitoring locations. This sampling is discussed in greater detail in Section 3.2 and 3.3.3, with results presented in Appendix D2. The sampling confirmed that the effluent flows from the McLoughlin WWTP were non-detectable at far-field stations. The full report on the model validation sampling conducted in 2022 is attached in Appendix D2.

4.4 Overall Assessment

Previous overflow and bypass sampling conducted in the Core Area has reaffirmed that the wastewater signal in the vicinity of the overflow or bypass has generally dissipated by 48 hours following the events. The risk to humans recreating on area beaches is highest in the 48 hours after rain events. Effluent flows from the MPWWTP were non-detectable at far-field monitoring stations. Overflow and bypass sampling will continue to be conducted as required in 2023.

Table 4.2 Sanitary Sewer Overflow and Combined Sewer Overflow Locations

Outfall	Discharge Site	Location*		Treatment Equipment	Diffusers	Discharge Type
		Latitude	Longitude			
Clover Point Pump Station Long Outfall	Marine Outfall	48.394	-123.346	Travelling Panel Screen	Yes	Screened overflows
Humber Pump Station	Marine Outfall	48.449	-123.291	Bar Screen	N/A	Screened overflows
Rutland Pump Station	Marine Outfall	48.441	-123.291	Bar Screen	N/A	Screened overflows
Arbutus Trunk at Finnerty Cove	Marine Outfall	48.473	-123.286	N/A	N/A	Unscreened
Currie Major Pump Station (through McMicking Outfall)	Marine Outfall	48.409	-123.306	Travelling Bar Screen	N/A	Screened overflows From Currie
Currie Minor Pump Station (through McMicking Outfall)	Marine Outfall	48.409	-123.306	N/A	N/A	Unscreened from Currie
Penrhyn Minor Pump Station	Local Storm Sewer	48.459	-123.292	N/A	N/A	Unscreened
Hood Pump Station (through McMicking Outfall)	Marine Outfall	48.409	-123.306	N/A	N/A	Unscreened
East Coast Interceptor at Broom	Local Storm Sewer (Marine Discharge)	48.428	-123.307	N/A	N/A	Unscreened
Bowker Trunk to Bowker Creek at Monterey Avenue	Creek/River	48.429	-123.314	N/A	N/A	Unscreened
Northeast Trunk-B at Broom	Local Storm Sewer (Marine Discharge)	48.428	-123.308	N/A	N/A	Unscreened
Harling Pump Station	Local Storm Sewer (Marine Discharge)	48.407	-123.324	N/A	N/A	Unscreened
Clover Point Pump Station Emergency Bypass Outfall	Marine Outfall	48.404	-123.348	Travelling Panel Screen	N/A	Can be screened and unscreened
Clover Point Pump Station Short Outfall	Marine Outfall	48.402	-123.347	Travelling Panel Screen	N/A	Can be screened and unscreened
Macaulay Point Pump Station Long Outfall	Marine Outfall	48.403	-123.410	Travelling Panel Screen	Yes	Screened overflows
Macaulay Point Pump Station Short Outfall	Marine Outfall	48.416	-123.407	Travelling Panel Screen	N/A	Can be screened and unscreened
Head Street Northwest	Local Storm Sewer	48.427	-123.399	N/A	N/A	Unscreened
Sea Terrace Northwest Trunk	Local Storm Sewer	48.431	-123.394	N/A	N/A	Unscreened
Harriet Siphon Northwest Trunk to Gorge	Marine Outfall	48.443	-123.392	N/A	N/A	Unscreened
Gorge Siphon to Gorge	Marine Outfall	48.440	-123.388	N/A	N/A	Unscreened
Craigflower Pump Station at manhole S0560 on Shoreline Trunk	Marine Outfall	48.453	-123.425	N/A	N/A	Unscreened
Langcove Pump Station	Local Storm Sewer	48.433	-123.419	N/A	N/A	Unscreened
Marigold Pump Station to local storm sewer and into Colquitz Creek	Creek/River	48.468	-123.399	N/A	N/A	Unscreened

Table 4.3 2022 Core Area Overflow and Bypass Events

Date	Location	DGIR Number (Dangerous Good Incident Report)	Type of Event	Monitoring Conducted
Jan 06-07	Humber, Rutland, Clover PS	214096, 214095, 214094	Heavy rain overflow	none
Jan 11	Humber, Rutland	214166, 214165	Heavy rain overflow	none
Jan 11-12	Humber, Rutland, Clover PS	214187, 214188, 214189	Heavy rain overflow	none
Jan 13	Clover PS	214277	Pumped overflow	none
Jan 28	McLoughlin	214454	Unplanned bypass	none
Feb 01	Clover PS	214489	Unplanned bypass	none
Feb 03	Clover PS	214527	Unplanned bypass	none
Feb 13	McLoughlin	214703	Unplanned bypass	none
Feb 28	Humber, Rutland, Clover PS	214856, 214857, 214858	Heavy rain overflow	none
Mar 05	McLoughlin	214942	Unplanned bypass	none
Apr 04	Humber, Rutland	220031, 220032	Heavy rain overflow	none
Jun 15	McLoughlin	221019	Unplanned bypass	none
Jul 03	McLoughlin	221232	Unplanned bypass	none
Jul 07	McLoughlin		Planned bypass	Far-field model validation sampling
Oct 12	McLoughlin		Planned bypass	McLoughlin surface water IDZ and far-field model validation sampling
Oct 27	Rutland	222874	Heavy rain overflow	none
Oct 30-31	Humber, Rutland, Clover PS	222913, 222914, 222916	Heavy rain overflow	none
Nov 26	McLoughlin	223292	Unplanned bypass	none
Dec 24-26	Humber, Rutland, Clover PS	225409, 225408, 225391/225407	Heavy rain overflow	none
Dec 24	McLoughlin	225365	Unplanned bypass	none

5.0 SEAFLOOR MONITORING

The effects of the wastewater discharges on the seafloor adjacent to the Macaulay and Clover outfalls have been measured in a variety of ways, since the monitoring program began. The most recent changes to the seafloor monitoring component were made based on the program review by CRD and ministry staff, and the implementation of a revised five-year monitoring cycle that began in 2011. These changes included a reduction in both the number of seafloor stations, as well as the sampling frequency for sediment chemistry and biological communities (mussels at Clover and benthic invertebrates at Macaulay). These reductions were made to allow for the addition of comprehensive sediment toxicity and bioaccumulation testing, and a finfish survey. 2022 represents the first year of seafloor sampling around the McLoughlin Wastewater Treatment Plant outfall since commissioning. Five new stations were established nearfield to the end of the outfall and several historical Macaulay stations were retained as they were in the predicted zone of influent of the new outfall and to monitor improvements of the seafloor around the Macaulay outfall.

2022 represents Year 2 of Cycle 3 and the seafloor monitoring component consisted of measurements associated with the McLoughlin/Macaulay outfall for:

- sediment chemistry
- pore-water chemistry
- sediment toxicity
- sediment/benthic invertebrate bioaccumulation
- benthic invertebrate community structure

5.1 Methods

Seafloor sampling in 2022 followed established protocols and guidelines that have been developed to standardize marine sampling techniques and help to reduce variability between sampling events (PSAMP, 2002). In addition, sampling methodologies were harmonized in 2014 with protocols, methodologies, and target analytes of the Vancouver Aquarium's Pollution Tracker and SSAMEx programs (www.ssamex.org). Sediment and benthic sampling was conducted off the research vessel MV Strickland, using a 0.1 m^2 Van Veen grab sampler (Picture 5.1).

5.2 Sediment Sampling

Sediment samples were collected from 24 stations (Figure 5.1):

- 14 near-/mid-/far-field stations around Macaulay
- 5 new McLoughlin stations
- 2 reference stations at Parry Bay
- 2 stations at Albert Head
- 1 station at Finnerty Cove

The area 100 m around the diffuser section of the outfall is defined as the initial dilution zone, with station designations as follows:

- M (Macaulay), MC (McLoughlin), AH (Albert Head), FC (Finnerty Cove) and PB (Parry Bay).
- Zero (for the outfall terminus), one (for stations at or just outside the initial dilution zone) or two, four and eight, respectively (for the stations situated approximately 200 m, 400 m and 800 m from the outfall terminus).
- E, N, etc. (for the compass direction from the outfall terminus).

Picture 5.1 Seafloor Sampling Van Veen Grab

SEDIMENT CHEMISTRY

Three replicate grabs were collected at each station and composited into one sample representing each station using methods consistent with previous monitoring years (collecting sediments only from the top 2 cm of each grab). Additional sediment was collected at stations for use in the toxicity and bioaccumulation tests, as the volume requirements for these tests were significant.

The sediment composite samples were analyzed for routine parameters and pore-water by BV Laboratories (Burnaby, BC) and for high resolution parameters by SGS AXYS Analytical Services Ltd. (Sidney, BC). Target analytes included the enhanced Vancouver Aquarium Pollution Tracker and SSAMEx programs (Section 6.1.1). Ten percent of the sediment samples were randomly chosen for additional laboratory and field triplicate analyses. The analytical laboratories also conducted internal QA/QC analyses, including method analyte spikes, method blanks and standard reference materials.

BENTHIC INVERTEBRATE TAXONOMY

Field methods were confirmed to align with the Vancouver Aquarium's SSAMEx program (www.ssamex.org). Samples were collected using the Van Veen grab and then processed by staff from Anadara Biological Services (Duncan, BC). Once each sample was within SSAMEx criteria for acceptable volume, the sample was rinsed out in its entirety into a tote for screening. The screening system consisted of an aluminum stand with stacked trays and a seawater pump with intake and outflow hoses. The uppermost screen had 1.0 mm spaces for specimen collection. Samples were washed in portions to minimize the opportunity for animals to become fragmented on the screen, with most of the washing occurring within the sample tote. Large, heavy debris, such as rocks, were removed immediately to prevent damage to organisms, followed by fragile organisms (e.g., brittle stars, nemertean worms, etc.) and then all remaining visible organisms. Organisms were stored in jars and preserved with formalin until identified and enumerated by Biologica Environmental Services Ltd. (Victoria, BC).

TOXICITY AND BIOACCUMULATION

Toxicity and bioaccumulation testing included 56-day bivalve survival and bioaccumulation, 10-day Mysid survival and growth, 48-hour bivalve larval development and survival, 20-day polychaeta survival and growth, and 10-day amphipod survival (Table 5.1). Testing was conducted at Nautilus Environmental (Burnaby, BC).

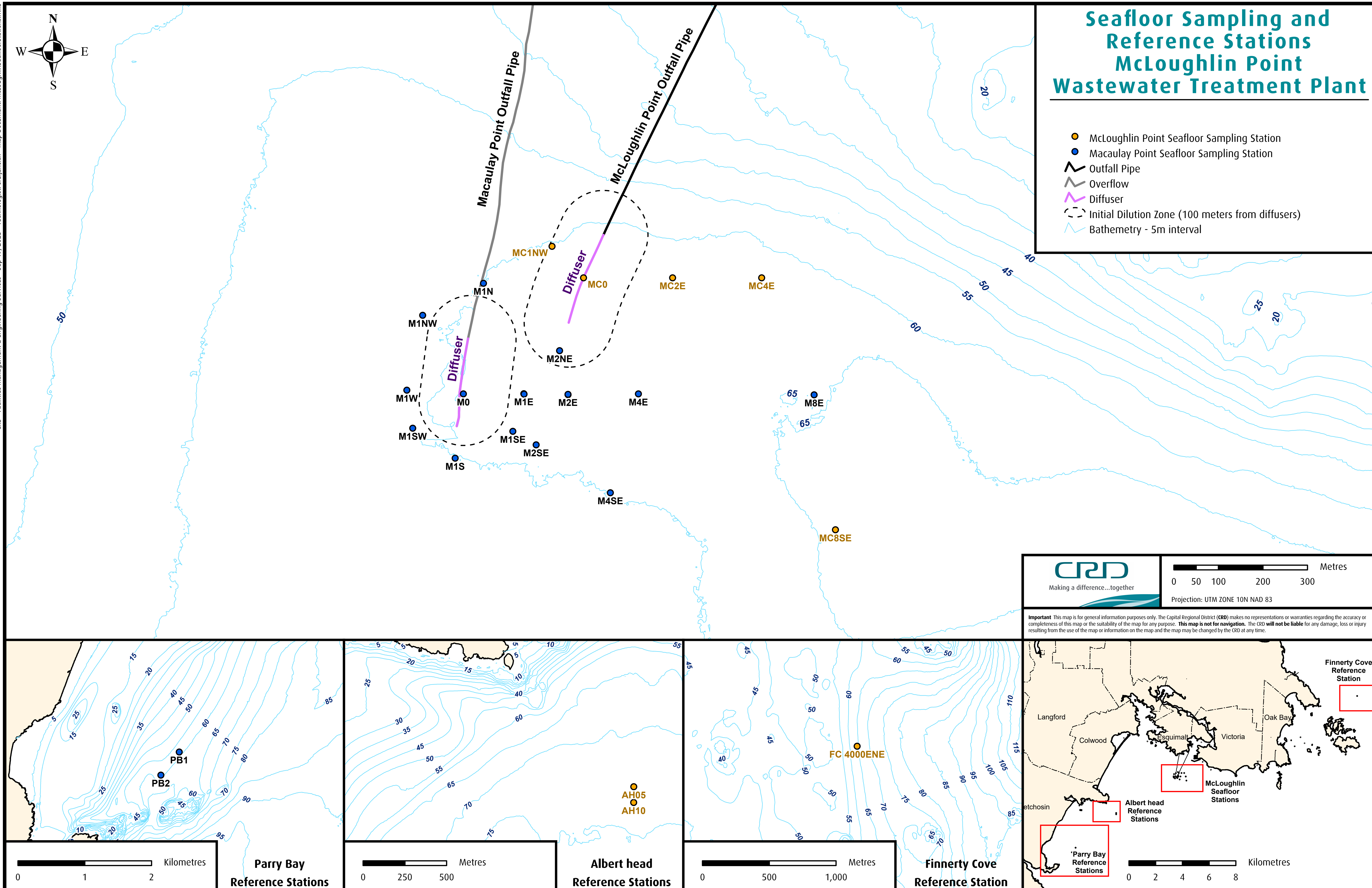
For bioaccumulation assessment of bivalve tissue, samples were analyzed for routine parameters by BV Laboratories (Burnaby, BC) and for high resolution parameters by SGS AXYS Analytical Services Ltd. (Sidney, BC). Target analytes included an enhanced list to follow the Oceanwise and SSAMEx programs.

Table 5.1 2022 Toxicity and Bioaccumulation Test Selection and Endpoints

Test	Measure	Endpoint
10-day mysid shrimp (*Americamysis bahia*)	toxicity	Survival and growth
20-day polychaete (*Neanthes arenaceondentata*)	toxicity	Survival and growth
10-day amphipod (*Eohaustorius estuarius*)	toxicity	Survival
48-hour bivalve (*Mytilus galloprovincealis*)	toxicity	Larval development and survival
56-day bivalve (*Macoma nasuta*)	bioaccumulation	Survival and tissue chemistry

5.3 Results

At the time of writing, seafloor data was not available for presenting due to laboratory delays. These data will be presented in the 2023 Core Area Annual Report.



CRD - Facilities Management & Engineering Services - Sep 19, 2023 - Technologist: sruljancich - Map Document: McLoughlinSeafloorStations.mxd

6.0 ADDITIONAL INVESTIGATIONS

Additional investigations are important elements of the monitoring program and are conducted to address focused or emerging issues, clarify aspects of the program, and provide concurrent data for the assessment of environmental effects. The Society of Ecotoxicology and Chemistry (SETAC) review of the program agreed that one-time investigations are appropriate to fill in information gaps, as needed (SETAC, 2006).

In 2005, the MMAG initiated a comprehensive review of the list of additional investigations. This review was completed in 2006 and Table 6.1 presents the studies that were recommended based on a risk assessment framework: contaminant source, pathways (ways in which contaminants can reach receptors), and receptors (e.g., fish, invertebrates and human health, etc.). For each of these categories, studies were ranked as high, medium or low priority.

Subsequently, in 2006, the CRD received a letter from the BC Minister of Environment requesting that an amendment to the Core Area Liquid Waste Management Plan detailing a schedule for the provision of wastewater treatment be provided by June 30, 2007. The additional investigations presented were evaluated by the MMAG before this decision to move to advanced treatment was made. As such, all additional investigations that had already been implemented by the receipt date of this letter were continued. Implementation of other investigations was put on hold because priority rankings were likely to change once higher levels of treatment were put in place. Following a meeting in early 2013, the advisory group was tasked with reviewing and reprioritizing the list, as well as adding any additional potential new studies. This review was put on hold in 2015 at the last meeting of the MMAG.

Investigations that deal with new emerging scientific issues are best undertaken under collaborative research programs. For example, the potential for environmental effects of pharmaceuticals and personal care products (PPCP) has been identified as a potential environmental concern in the scientific community and was identified as high priority by the MMAG. There was also a requirement under the Core Area Liquid Waste Management Plan approval letter of March 26, 2003, to undertake some collaborative studies on PPCPs. However, when this emerging issue was identified, routine laboratory analytical techniques for quantifying these substances had only recently been developed and there were no commercial laboratories in Canada that could analyze for these compounds. As such, these substances were best assessed in research programs where collaborative resources from academia and government could be used. Since then, commercial laboratories have developed standardized methods and PPCP analyses are now a routine part of the EMP.

Studies that were underway in 2006 have since been completed or are continuing, but new investigations from Table 6.1 have not been initiated. However, several opportunistic collaborative opportunities have come up in recent years. Section 6.1 summarizes additional investigations that were ongoing, completed or initiated in 2022.

Table 6.1 Core Area Additional Investigations Prioritization by MMAG (2006)

Category	Investigation	Description and Characteristics	2006 Rating	Status/ Anticipated Initiation Date	Anticipated Completion Date
Contaminant Source	Study to address the presence of endocrine disrupting compounds and PPCP in wastewater and the potential effects on the receiving environment.	The first part of an overall phased-approach to study these substances will be to measure the concentrations of a group of substances in wastewater. This is an area of emerging concern related to human health and potential environmental effects (from the chemical, biological and toxicological aspects).	High	Initiated in 2004.	Completed in 2010.
	Assessment of contaminants associated with oil and grease.	Determination of contaminants associated with oil and grease originating from the outfalls. Relates to the potential human health and environmental effects issues (e.g., windsurfers, seagulls, etc.). The first phase of this investigation will be to undertake a literature review.	Medium	No dates (study will be re-evaluated in the advisory group additional investigation review).	
	Identification of pathogens in wastewater and the presence of these in surface waters around the outfalls.	Analysis of wastewater for different types of pathogens that have the potential to affect human health and determine if these pathogens are present in the receiving environment around the outfalls (related to die-offs, etc., in marine waters).	Low	Enterococci was added to the bacteriological target analyte list in 2011. Consideration of additional pathogens will be re-evaluated in the advisory group additional investigation review.	
	Bacteria source identification.	Determine the different sources of fecal coliform to differentiate between various mammals, such as cows, dogs and humans.	Low	Conducted at near and far-field sites.	Completed in 2021.
Pathways	Sediment transport/deposition/ re-suspension.	The first step in this investigation would include a determination of the different particle size fractions in wastewater (this could be conducted through a literature review and/or through laboratory experiments). The second phase would include the determination of the settling of particles from the discharge onto sediments. Results from these analyses would be used in the overall assessment of sediment particle deposition and the subsequent movement of sediments around the outfalls.	High	Initiated in 2005 (study is on hold – will be re-evaluated as part of the advisory group additional investigation review).	

Table 6.1, cont'd

Category	Investigation	Description and Characteristics	2006 Rating	Status/ Anticipated Initiation Date	Anticipated Completion Date
Pathways, *cont'd*	Conduct a sediment core sampling program.	Determination of sedimentation and mixing rates and the fluxes of contaminants near the outfalls and at reference sites. A mass balance approach could be used where rates of contaminant accumulation in sediments are compared with the rate of contaminant discharge from the outfalls in an attempt to determine the proportion of each contaminant captured by and stored in the sediments. A sediment trap study could be added to study contaminant transport in the near bottom nepheloid layer.	Medium	Initiated in 2006 in conjunction with the Institute of Ocean Sciences.	Completed in 2011.
Receptors and Potential Effects	Effects of endocrine disrupting compounds and PPCP on the receiving environment.	As part of a phased-approach to study effects of endocrine disrupting compounds, laboratory exposures, bioassay and/or caged studies (or an organism found around the outfall) could be conducted to assess the potential effects of these substances on the receiving environment around the outfalls.	High	Collaborative study with UVic on toxicogenomic effects to benthic invertebrates was initiated in 2007.	Funding not secured and project was shelved.
	Assessment of chemical concentrations in tissue of different trophic level organisms (including higher trophic levels).	Measurement of contaminants in crab, finfish or other organisms near the outfalls would provide a basis for a food-ingestion human health risk assessment. This information could also be used to model bioconcentration and biomagnification of contaminants to higher trophic levels near the outfalls.	High	A finfish sampling program was added to the five-year monitoring cycle.	Delayed Cycle 1 survey completed in 2018, with final report received in 2019 Results were presented in the 2019 annual report.
	Identification of biological resources.	Identification of the harvestable organisms around the outfalls.	Low	No dates (study will be re-evaluated in the advisory group additional investigation review).	
	Clover mussel population biology.	Conduct some additional studies on the mussel population around the Clover outfall (e.g., reproductive cycle, health, etc.). Additional data relates to the current monitoring and to potential studies on emerging chemicals.	Low	No dates (study will be re-evaluated in the advisory group additional investigation review).	
	Levels of pathogens in biota. (e.g., epibenthic, etc.)	Assess the presence and concentration of pathogens in biota near the outfalls.	Low	No dates (study will be re-evaluated in the advisory group additional investigation review).	
	Assess potential risks associated with pathogens/antibacterial resistance.	A literature review, risk assessment or a pilot study could be conducted to study antibiotic bacteria and the relevance as a potential emerging concern to human health, wildlife and domestic animals.	Low	No dates (study will be re-evaluated in the advisory group additional investigation review).	
	Investigate the structure of algal plankton communities.	Assess the potential effects of the wastewater discharges on algal communities (planktonic and benthic).	Low	No dates (study will be re-evaluated in the advisory group additional investigation review).	

6.1 Investigations Completed or Underway from 2021 - 2022

The EMP completed or participated in the following additional investigations:

- continued participation in the Ocean Wise Conservation Association's SSAMEx and Pollution Tracker programs.
- continuation of a collaborative project with the Ocean Wise Conservation Association to develop methods for microplastic analyses in wastewater and environmental samples.
- continuation of a collaborative project with Biologica Environmental Services Ltd. (Victoria, BC) and the University of Chicago to assess live versus dead benthos assemblages around the Macaulay outfall.
- continuation of a collaborative project with Biologica Environmental Services Ltd., UVIC, and Metro Vancouver to develop benthic invertebrate toxicogenomic monitoring tools.
- initiation of a BC Centre for Disease Control project to assess COVID-19 and influenza presence in BC wastewaters.
- participation in a University of British Columbia and industry collaborative project to develop a handheld device to monitor and detect microorganisms in wastewater.

6.1.1 Ocean Wise Conservation Association's SSAMEx and Pollution Tracker Programs

The Ocean Wise Conservation Association's SSAMEx program is a trans-boundary initiative with the aim to build on current monitoring initiatives, enable data sharing to fill gaps in existing coverage for the Salish Sea, and provide a platform for discussion and dialogue among partners. The primary objective of SSAMEx is to facilitate the generation of a cross-jurisdictional trans-boundary dataset that focuses on ambient background conditions in the Salish Sea, such that other monitoring activities (e.g., municipal wastewater outfall monitoring) have a greater ability to determine whether observed shifts in results are associated with natural factors (e.g., climate related) or anthropogenic influences (e.g., wastewater outfalls). One of the main ways that SSAMEx achieves its objective is by developing harmonized sampling methodologies that can be adapted by the various organizations undertaking monitoring throughout the Salish Sea.

The objective of the Ocean Wise Conservation Association's Pollution Tracker program is to assess contaminant levels and profiles along the BC coast, via the collection of surface sediments and shellfish, both near and far from pollution sources. The program meets its objective by supporting new and existing sampling efforts and through coordinating laboratory analyses. The data generated is used to produce "state of the coastal environment" reports for partners and the general public, produce scientific publications, and populate the SSAMEx with data from background sample locations. Results can be found at https://pollutiontracker.org/.

In 2022, the CRD continued to analyze an expanded contaminant list in Core Area wastewaters that aligns with the Pollution Tracker target analyte list. Staff also partially funded and assisted with the collection of Pollution Tracker samples in Victoria Harbour and other areas in the region during the spring of 2022.

6.1.2 Microplastic Analytical Methodology Development

The Ocean Wise Conservation Association is working to assess microplastics in the ocean waters and sea life of the Salish Sea. The Vancouver Island University was also undertaking similar work, though their program has since stopped. The CRD provided 2015 Clover mussel samples to Vancouver Island University to help them develop methods that will be used to determine if plastics are accumulating in sea life tissues. It is doubtful that any results will be received due to the program shutting down. In addition, the CRD provided the Ocean Wise Conservation Association with 2016 wastewater and 2017 sediment samples from Clover and Macaulay and, in conjunction with the Regional Source Control Program, samples from a residential wastewater catchment area upstream in the sewage system. The Ocean Wise Conservation Association has been using these samples to develop analytical methodologies that determine both quantity and type of plastics in wastewater and environmental samples.

In 2021, the CRD reached out to the Ocean Wise Conservation Association to determine whether their lab has capacity to receive more CRD samples, specifically from MPWWTP to determine the plant's efficiency at reducing microplastic loadings to the environment. It is hoped that the lab will be able to start receiving samples in 2023 once McLoughlin treatment processes have stabilized.

6.1.3 Benthos Death Assemblages

In early 2016, the monitoring program was approached by the CRD contract taxonomist (Biologica Environmental Services Ltd.) and a University of Chicago researcher to gauge willingness to provide archived Macaulay benthic sample debris for further assessment. The researcher was interested in comparing the "death assemblages" of molluscs and bivalves contained within the archived debris to the "live" communities that are assessed by Biologica in routine environmental monitoring program sediment samples. Such live-dead comparisons have been used elsewhere to assess anthropogenic stressors over time.

The monitoring program provided 2010, 2014 and 2017 debris to the University of Chicago. The 2005-2017 "live" Macaulay community data were pooled to establish average bivalve species composition per site and the 2014 and 2017 debris samples were picked for "dead" individuals.

The live-dead comparisons generally matched the spatial patterns observed in the other monitoring program seafloor monitoring components (sediment chemistry, etc.) and were indicative of the already known outfall nutrification impacts. Pollution and organic enrichment-tolerant bivalves were found in higher abundance in the debris samples collected close to the outfall, and decreased with distance from the outfall. There were also differences in live-dead taxa abundances that varied with proximity to the outfall. Overall, the results suggest a nutrient footprint that extends greater than one kilometre away from the Macaulay diffuser, slightly farther than what the routine environmental monitoring program stations would capture. The results are being further assessed.

The preliminary findings were presented at the Geological Society of America Annual Meeting in Seattle in October 2017, and more complete findings were presented at the 2020 Salish Sea Ecosystem Conference. Findings are currently being compiled for publication.

6.1.4 Benthos Toxicogenomic Tool Development

Benthic taxonomy is a useful tool for the assessment of anthropogenic stressors and has proven invaluable in determining the impacts of the Macaulay outfall. Taxonomic assessments, however, are labour- and time-intensive, and can be costly. In addition, the revised monitoring program five-year monitoring cycle has a reduced frequency of benthos assessments in comparison to the annual programs that took place pre-2011. This has resulted in a loss of temporal and spatial resolution for the program.

In 2016, the EMP program was approached by our contract taxonomist (Biologica Environmental Services Ltd.) and a UVIC researcher regarding interest in supporting the development of a benthos toxicogenomic tool that would be inexpensive relative to a full taxonomic assessment. This tool could be used in years when seafloor sampling does not take place and at historic monitoring stations that have been abandoned. The CRD collaborated on developing similar toxicogenomic tools for the Clover Point horse mussels (Veldhoen et al., 2009; Veldhoen et al., 2011; CRD, 2011); development of these tools was put on hold following the provincial order to install further treatment, which resulted in the long-term fate of the Clover outfall becoming unknown.

Biologica is the financial driver of this industrial research and development project, with the same UVIC researcher that historically developed some Clover mussel eDNA tools providing the scientific and technical lead. To date, the monitoring program has provided benthos samples collected during seafloor sampling in 2017, 2019 and 2022, as well as access to the archived Macaulay taxonomic reference collection. These were used to identify taxa to prioritize for further toxicogenomic work-up and by various UVIC co-op students for preliminary method development.

In 2018, Biologica and UVIC submitted a grant application to fully implement the project. The application was a success and a five-year project was initiated in April 2019. The CRD and Metro Vancouver were both financial supporters of the project and will continue to provide sampling vessel and sample access throughout the project's duration.

The team has confirmed the best field sample collection methods to optimize eDNA signals and has since developed assays for a number of positive, negative and control benthic species to assess wastewater effects around marine outfalls in the Salish Sea. Work is progressing on isolating eDNA from additional indicator species using sediment samples collected during the September 2022 seafloor sampling program around the McLoughlin and Macaulay outfalls.

Results have so far been presented at the SETAC North America 42nd Annual Meeting (Acharya-Patel, 2021a), the 47th Canadian Ecotoxicity Workshop (Acharya-Patel, 2021b), and the 4th International Council for the Exploration of the Sea (ICES)/North Pacific Marine Science Organization (PICES) Early Career Conference (Acharya-Patel, 2022). Journal articles will be prepared as the project wraps up.

6.1.5 COVID-19 in Wastewater

Throughout the world, researchers have been investigating ways to predict timing of COVID-19 outbreaks to inform health care planning. One promising technique is wastewater epidemiology, which has been used elsewhere in the world to detect COVID-19 in wastewater systems, sometimes as much as a week or two before patients started presenting with widespread symptoms in health care facilities.

The COVID-19 pandemic arrived in British Columbia early in 2020. In April 2020, the CRD was asked to provide weekly wastewater samples from Macaulay, Clover and the Saanich Peninsula wastewater treatment plants by a consortium of researchers from UVIC and Pani Energy Inc. (Victoria, BC). McLoughlin samples were provided once the new plant was commissioned in early 2021. Results from this study can be found in Masri *et. al*., (2022)

In 2022, the CRD was approached by the BC Centre for Disease control to provide McLoughlin wastewater samples for COVID-19 and influenza analyses, along with other treatment plants throughout Vancouver Island and the rest of the province. Results, can be found via an online data dashboard at https://bccdc.shinyapps.io/respiratory_wastewater/.

6.1.6 Handheld Microorganism Detection Device

A researcher at the University of British Columbia and Harbour Resource Partners, the consortium that built the McLoughlin Point WWTP, began a project to develop a novel handheld DNA sequencing device to monitor and detect microorganisms in wastewater. The aim is to provide utility operators with an easy-to-use screening tool that can provide a qualitative assessment of pathogen presence in wastewaters. Results could then be used to inform health agencies of any changes in pathogen presence over time. The contractor began providing McLoughlin wastewater and sludge samples during commissioning and the CRD continued to provide samples after taking over plant operation in January 2021. Results are not yet available.

6.1.7 Investigations Planned for 2023

No new additional investigations or studies are planned for 2022/2023, unless novel opportunities arise.

7.0 CONCLUSIONS

2022 continued to be a transitional year for sewage treatment in the Core Area and the Environmental Monitoring Program (EMP). The McLoughlin Point WWTP began commissioning in August 2020, with flows gradually being diverted from Macaulay and Clover pump stations to the new facility. In 2021, most flows received treatment at McLoughlin and monitoring efforts were therefore shifted to focus on the new facility and outfall. Finally, in 2022, all core area flows were treated at McLoughlin. EMP monitoring requirements still exist for Macaulay and Clover but the focus on these two pump stations is wet weather or other bypass/overflow events. Regardless of discharge location, the different routine monitoring components of the program, and the additional investigations were effective tools to assess the effects of the McLoughlin, Macaulay, and Clover discharges on the marine receiving environment.

McLoughlin influent and effluent sampling was undertaken throughout 2022 to assess regulatory compliance and to determine contaminant removal efficiency of the tertiary treatment processes. Additional sampling was conducted at different sampling points at the MPWWTP, mainly for process optimization and special projects targeting odour removal and H2S reduction, but these are not discussed in this report.

Routine receiving environment surface and water column monitoring was conducted at McLoughlin in 2022. There were no Macaulay or Clover overflow events coincident with the routine McLoughlin sampling in 2022. Far-field monitoring was conducted in July and October assessing bacteria concentrations at far-field locations under two scenarios to validate plume dispersion and dilution modeling: normal summer discharge, and a planned bypass with discharge through the McLoughlin outfall of primary plus tertiary blended effluent.

Macaulay/McLoughlin seafloor sampling is only required twice per monitoring cycle and was conducted in 2022. Sediment result delays occurred, and results were not available to present in this report but will be reported in a future report alongside 2023 data. Clover seafloor sampling took place in 2020 and will next occur in 2025.

Various additional investigations were ongoing in 2022/2023. These investigations continue to address gaps in the routine monitoring program or emerging environmental and human health concerns related to the discharge of wastewater to the marine environment.

Details about individual monitoring program components can be found in preceding sections of this report; the overall results of the assessments are provided below.

It is expected that the MPWWTP processes will be stable at the end of 2022, with a further two to three years (i.e., 2024-2025) before enough influent and effluent data will have been collected to make definitive statements about the efficacy of treatment and resulting reductions of effects to the marine environment. The installation of tertiary treatment is expected to substantively reduce overall contaminant loading to the environment and reduce the footprint of impact. The CRD is committed to continuing the EMP to assess these improvements both spatially and temporally.

7.1 Wastewater

Wastewater regulatory compliance results indicated that the quality of the wastewater from McLoughlin achieved tertiary standards for most of the year. Federal compliance limits were met the entire year. Provincial regulatory limits were intermittently exceeded from February to December when compared to low compliance limits of 10 mg/L monthly average for TSS and CBOD. Monthly averages were only slightly over permit limits with the highest exceedance (17 mg/L) for CBOD in June. The CRD is in discussions with ENV to allow a monthly average of 25 mg/L for TSS and CBOD for McLoughlin effluent, which is consistent with the federal limit.

There is also potential that highly variable centrate return flows from the Hartland Residuals Treatment Facility may be impacting the treatment plant's ability to consistently achieve such conservative effluent quality limits. This issue is being investigated.

Wastewater priority substance monitoring results confirmed the efficacy of the tertiary treatment plant to substantively reduce concentrations and loadings of contaminants to the marine receiving environment relative to historical untreated discharges out of Macaulay and Clover. Except for bacteriological indicators, the estimated receiving environment concentrations (based on applying predicted minimum initial dilution factors to wastewater concentrations) did not exceed applicable provincial and federal water quality guidelines for the protection of human health and aquatic life. Most were below guidelines in wastewater even before discharge. More detailed concentration and loading assessments will be undertaken in 2023.

Tertiary treatment at McLoughlin has also improved acute toxicity. Except for the June rainbow trout test, all McLoughlin acute rainbow trout and invertebrate toxicity tests passed. This represents a substantive improvement over historical Macaulay and Clover discharge practices, when effluent was regularly acutely lethal to fish and sometimes to invertebrates. June’s failure was likely caused by clogged sample tubing that delivers final effluent to the laboratory resulting in the collection of stagnant effluent. Subsequent samples were collected with an increase to line flushing time prior to sample collection. McLoughlin effluent was also much less chronically toxic than historic Macaulay and Clover effluents, further affirming the value of advanced treatment to reduce potential for adverse effects to organisms around the outfall.

Chronic toxicity results indicated that the predicted wastewater concentrations at the edge of the McLoughlin IDZ would have little to no effect on organism health.

The bacteriological guideline exceedances will continue at McLoughlin, as disinfection was not included as part of the treatment processes. However, the magnitude and duration of the exceedances has decreased substantially relative to historical Macaulay and Clover flows, as bacterial levels in McLoughlin final effluent are an order of magnitude lower. In addition, overflows out of the Clover long outfall will now only occur during significant rain events. Future consideration of the need to disinfect effluent will be subject to ongoing monitoring of the impact of the treated McLoughlin effluent and wet weather overflows. Wet weather discharges will be further reduced through the ongoing implementation of CRD and municipal inflow and infiltration reduction programs.

There are many newer and emerging substances that the CRD may not yet monitor and for which guidelines have yet to be developed. The potential influence of these chemicals on the environment is therefore relatively unknown. The CRD attempts to assess the risk of these newer chemicals through additional investigations as described in Section 6.0.

7.2 Reclaimed Water

The reclaimed water system was disconnected and decommissioned in 2021 due to operational challenges. As such, no reclaimed water samples were collected for analysis in 2022.

7.3 Surface Water

In 2022, surface water fecal coliform and Enterococci results indicated that the outfall plume was predominantly trapped below the ocean surface. The potential for human exposure to high fecal coliform and Enterococci concentrations around the outfall was very low, as fecal coliform and Enterococci surface water geometric mean results were only infrequently above thresholds used to assess risk to human health, as expected based on effluent quality and outfall design. These exceedances occurred mostly during the autumn sampling period when surfacing events are more frequently predicted.

The 2022 water column monitoring (at depths of 5 m or greater) confirmed that bacteriological indicators rarely exceeded either provincial or federal guidelines at the edge of the IDZ around the McLoughlin outfall. Magnitude and frequency of exceedances were much lower than historical observations around the Clover and Macaulay outfalls, affirming the environmental improvement of tertiary treatment at McLoughlin. These minor exceedances were expected, based on the wastewater concentrations of the bacteriological indicators (in the hundreds of thousands of bacteria per 100 mL) and the intended design of the outfall diffusers, even with tertiary treatment and the lack of disinfection. The diffusers were designed specifically to ensure that the wastewater plumes were predominantly trapped below the surface.

Overall, the fecal coliform and Enterococci results were within the concentrations predicted by plume dispersion and hydrodynamicty of the moderately high bacterial counts can be attributed to higher wastewater flows in winter, coupled with the oceanography of this area during the winter months (i.e., relative lack of water column stratification due to wind and relatively cool surface waters). Summer plume surfacing events are also predicted to occur occasionally at both outfalls, associated with the morning flush in the wastewater system, weak water column stratification and slack tide. Events are predicted to be much less frequent in summer than in winter.

Boron routinely exceeded guidelines throughout the water column at both the outfall and reference stations. These exceedances cannot be attributed to the outfall, as natural background concentrations of boron in the Salish Sea are routinely higher than guidelines.

While the plume was predominantly trapped below the surface, with low risk to human health, there is potential for higher risk to organisms that live in the water column. The 2022 water column monitoring results for metals were all low or at background levels (e.g., boron) indicating that risk to organisms was also likely low. However, the monitoring program has few definitive assessments of organisms living in the water column, except for the finfish monitoring component of the EMP. Assessing this potential risk is challenging, as organisms living in the water column may move in and out of the plume and, therefore, potential effects cannot be easily attributed to the outfalls. This is why the EMP focuses on sessile organisms living on the seafloor around the outfall.

Overall, the bacteriological monitoring results indicated that the surface water effects of the outfall were limited and substantively lower than the signals observed historically around the Clover and Macaulay outfalls. The McLoughlin plume was predominantly trapped at depth (below 40 m) for most of the year, and substantially diluted wastewater only occasionally reached the surface.

7.4 Overflow and Bypass Monitoring

The conveyance system is designed with numerous shoreline sanitary and combined sewer overflow and relief points that discharge during heavy rains, planned maintenance activities or following unexpected non-routine or emergency events. Shoreline monitoring is required to assess human health risk for people engaged in recreational activities on beaches adjacent to the overflows. No overflow monitoring was conducted in 2022 as there were no events that triggered the commitments to do so. Previous monitoring confirmed that wastewater overflow signals typically dissipate within 48-hours, but adjacent municipal stormwater discharge signals persist longer, sometimes continuously. Overall, risk to human health is short-lived following bypass and overflow events.

Plume dispersion and dilution modelling using concurrent effluent and receiving environment water quality samples at the edge of the IDZ at McLoughlin Point outfall, far-field sites (Haystock Islets, Ogden Point, Cook Street, Chatham and Discovery Islands, Trial Island) results were well below predicted concentrations.

7.5 Seafloor Monitoring

Seafloor monitoring is required every two to three years around the Macaulay and McLoughlin outfalls and every five years around the Clover outfall. Sediment chemistry, bioaccumulation, benthic invertebrates, and sediment toxicity sampling was conducted around the McLoughlin outfall in 2022. The data was not available in time to report results herein. Results will be presented in the 2023 report.

7.6 Additional Investigations

Additional investigations are important elements of the program that address specific questions or issues pertaining to the monitoring program, clarify aspects of the program and provide concurrent data for the assessment of environmental effects.

The CRD's ongoing participation in the Ocean Wise Conservation Association initiatives included ensuring the monitoring program's samples were collected using harmonized methodologies, thereby benefitting both the CRD when assessing monitoring results, as well as others doing similar monitoring elsewhere in the Salish Sea. In addition, participation in these initiatives provided access to other Salish Sea datasets for comparison to monitoring program results. By providing various types of samples to the Ocean Wise Conservation Association, the monitoring program has helped facilitate the development of new analytical methodologies for microplastics in wastewater and environmental samples, including working with a private contractor to develop methods for microplastics in commercial laundry and compost facility effluents. The Plans are underway to conduct a mass balance of microplastics at the McLoughlin WWTP. The death assemblage assessments are ongoing, and it is hoped that the development of the benthos toxicogenomic tools will provide the CRD and Metro Vancouver with a useful and inexpensive monitoring tool for filling in spatial and temporal gaps in the routine benthos programs. Ongoing submission of samples to the BC Centre for Disease Control will continue to give health authorities an advanced notice of local COVID-19 and influenza outbreaks prior to widespread increases in patient hospitalization. Finally, the CRD continues to provide McLoughlin wastewater samples to UBC which will hopefully result in an easy-to-use, handheld device that will allow operators to detect microorganisms in wastewater and ultimately inform health authorities.

8.0 REFERENCES

BCMoE (2004) Environmental Management Act. Formerly the Waste Management Act and the Environment Management Act. British Columbia Ministry of Environment, Victoria, BC, Canada.

Acharya-Patel, N., L.C. Bergman, K. Cram, S. Lyons, R. Warren, L. Coombe, C. Lowe, I. Birol, T. Macdonald, and C.C. Helbing (2021a) Enhancing marine pollution effects monitoring through new targeted environmental DNA (eDNA) testing in the Pacific Northwest. Presented at the 42nd SETAC North America virtual conference, Nov 14-18, 2021.

Acharya-Patel, N., L.C. Bergman, K. Cram, S. Lyons, R. Warren, L. Coombe, C. Lowe, I. Birol, T. Macdonald, and C.C. Helbing (2021b) Monitoring marine pollution effects through new targeted environmental DNA (eDNA) testing in the Pacific Northwest. Presented at the 47th Canadian Ecotoxicity Workshop, Halifax, Nova Scotia, Oct 3-6, 2021.

Acharya-Patel, N., L.C. Bergman, K. Cram, S. Lyons, R. Warren, L. Coombe, C.J. Lowe, I. Birol, T. Macdonald, and C.C. Helbing (2022) Monitoring marine pollution effects through new targeted environmental DNA (eDNA) testing in the Pacific Northwest. Presented at the 4th ICES/PICES Early Career Scientist Conference, St. John's, Newfoundland, Jul 17-21, 2022.

BCMoE (2006) British Columbia Approved Water Quality Guidelines 2006 Edition. Prepared pursuant to Section 2e of the *Environment Management Act*, 1981. Science and Information Branch, British Columbia Ministry of Environment, Victoria, BC, Canada.

BCMoE&CCS (2021a) British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection & Sustainability Branch, British Columbia Ministry of Environment & Climate Change Strategy, Victoria, BC, Canada.

BCMoE&CCS (2021b) British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Water Protection & Sustainability Branch, British Columbia Ministry of Environment & Climate Change Strategy, Victoria, BC, Canada.

Burd, B.J., C.J. Lowe, C. Morales-Caselles, M. Noel, P. Ross, and T. Macdonald. (2019) Uptake and trophic changes in polybrominated diphenyl ethers in the benthic marine food chain in southwestern British Columbia, Canada. FACETS 4(1): 20-51. https://doi.org/10.1139/facets-2018-0021.

Burd, B.J., C.J. Lowe, and C. Morales-Caselles. (2022) Uptake of PCBs into sediment dwellers and trophic transfer in relation to sediment conditions in the Salish Sea. FACETS 7(1): 936-965. https://doi.org/10.1139/facets-2021-0032.

CCME (2003) Canadian Environmental Quality Guidelines. Canadian Council of Ministers of the Environment, Winnipeg, MB, Canada.

CRD (2000) Core Area Liquid Waste Management Plan. Capital Regional District, Environmental Services Department, Victoria, BC, Canada.

CRD (2002) Macaulay and Clover Point Wastewater and Marine Environment Program 2000/2001 Annual Report. Capital Regional District, Environmental Services Department, Victoria, BC, Canada.

CRD (2009) Core Area Liquid Waste Management Plan Amendment #7. Capital Regional District, Environmental Sustainability Department, Victoria, BC, Canada.

CRD (2010) Core Area Liquid Waste Management Plan Amendment #8. Capital Regional District, Environmental Sustainability Department, Victoria, BC, Canada.

CRD (2011) Macaulay and Clover Points Wastewater and Marine Environment Program Annual Report 2010. Capital Regional District, Environmental Sustainability, Victoria, BC, Canada.

CRD (2014) Core Area Liquid Waste Management Plan Amendment #9. Capital Regional District, Environmental Sustainability Department, Victoria, BC, Canada.

CRD (2016) Core Area Liquid Waste Management Plan Amendment #10. Capital Regional District, Environmental Sustainability Department, Victoria, BC, Canada.

CRD (2016) Core Area Liquid Waste Management Plan Amendment #11. Capital Regional District, Environmental Sustainability Department, Victoria, BC, Canada.

CRD (2017) Macaulay and Clover Point Wastewater and Marine Environment Program 2016 Annual Report. Capital Regional District, Environmental Services Department, Victoria, BC, Canada.

CRD (2017a) Core Area Liquid Waste Management Plan Amendment #12. Capital Regional District, Environmental Sustainability Department, Victoria, BC, Canada.

CRD (2021) Macaulay and Clover Point Wastewater and Marine Environment Program 2020 Report. Capital Regional District, Environmental Services Department, Victoria, BC, Canada.

CRD (2022) Core Area Wastewater Treatment 2021 Report. Capital Regional District, Environmental Services Department, Victoria, BC, Canada.

CRD (2023) Residual Treatment Facility, Environment Protection Division 2022 Report. Capital Regional District, Environmental Services Department, Victoria, BC, Canada.

EVS (1992) Sediment and Related Investigations off the Macaulay and Clover Point Sewage Outfalls. EVS Consultants Ltd., North Vancouver, BC, Canada.

Golder (2011) Review of the Revised Wastewater and Marine Environmental Monitoring program for CRD Outfalls. Golder Associates Ltd, North Vancouver, BC, Canada.

Health Canada (2012) Guidelines for Canadian Recreational Water Quality Third Edition. Published by authority of the Minister of Health. 161 pp.

Hatfield (2021) Macaulay and Clover Point Outfalls Wastewater and Marine Environment Program Comprehensive Review (2011-2019). Hatfield Consultants LLP, North Vancouver, BC, Canada.

Hodgins, D. O. (2006) Technical Memorandum: Assessment of Plume Trapping and Dilution at the Clover Point Outfall and the Macaulay Point Outfall. Seaconsult Marine Research Ltd., Salt Spring Island, BC, Canada.

HRMG (2023) Capital Regional District Residual Treatment Facility, Annual Report for 2022. Prepared for the Capital Regional District by HRMG Synagro.

Krogh, J., D. Ianson, R.C. Hamme and C.J. Lowe (2018) Risks of hypoxia and acidification in the high energy coastal environment near Victoria, Canada's untreated municipal sewage outfalls. Marine Pollution Bulletin 133: 517-531. https://doi.org/10.1016/j.marpolbul.2018.05.018

Masri, N.Z., K.G. Card, E.A. Caws, A. Babcock, R. Powelle, C.J. Lowe, S. Donovan, S. Norum, S. Lyons, S. De Pol, L. Kostenchuk, C. Dorea, N.J. Lachowsky, S.M. Willerth, T.M. Fyles, H.L. Buckley (2022) Testing specificity and sensitivity of wastewater-based epidemiology for detecting SARS-CoV-2 in four communities on Vancouver Island, Canada. Environmental Advances 9: 100310. https://doi.org/10.1016/j.envadv.2022.100310.

Lorax (2019) Effluent Dispersion Modelling for the McLoughlin Wastewater Treatment Plant. Prepared for Capital Regional District by Donald Hodgins (Seaconsult Marine Research) and Scott Tinis (Lorax Environmental Services). Victoria, BC, Canada.

SETAC (2006) Scientific and Technical Review: Capital Regional District Core Area Liquid Waste Management Plan. Society of Environmental Toxicology and Chemistry, SETAC Scientific and Technical Review Panel, Willms, B., C. Alexander, D. Heywood and S. Travis. 2022. Microplastics in Municipal Wastewater. Royal Roads University BSc Major Project Report. Aug 14, 2022. 116 pp.

US EPA (2002) Clean Water Act. Section 307: 107-202. United States Environmental Protection Agency.

Veldhoen, N., Lowe, C., Davis, C., Mazumder, A., and Helbing, C. (2009). Gene Expression Profiling in the Deep Water Horse Mussel *Modiolus modiolus* (L.) Located Near a Municipal Wastewater Outfall. Aquatic Toxicity 93: 116 - 124.

Veldhoen, N., Kobylarz, M., Lowe, C., Meloche, L., deBruyn, A., and Helbing, C. (2011). Relationship Between mRNA Biomarker Candidates and Location Near a Marine Municipal Wastewater Outfall in the Benthic Indicator Species *Modiolus modiolus* (L.). Aquatic Toxicity 105: 119 - 126.

Willms, B., Alexander, C., Heywood, D. and Travis, S. (2022) Microplastics in Municipal Wasetwater. Royal Roads University BSc Major Project Report. Aug 14, 2022. 116 pp.

APPENDIX A
GUIDANCE MANUAL FOR
ASSESSMENT AND ANALYSIS OF WMEP DATA

Available upon request.

Contact: CRD’s Environmental Monitoring Program, 250.360.3296

APPENDIX B
2022 WASTEWATER MONITORING

Appendix B1 Priority Substance List and Sampling Frequency

Substance	McLoughlin WWTP Influent and Effluent	
	(full list)	(modified list)
	Quarterly	Monthly
CONVENTIONALS		
alkalinity	√	√
biochemical oxygen demand (BOD)	√	√
carbonaceous biochemical oxygen demand (CBOD)	√	√
chemical oxygen demand (COD)	√	√
chloride	√	√
conductivity	√	√
cyanide-SAD	√	√
cyanide-WAD	√	√
enterococci	√	√
fecal coliforms	√	√
hardness, total	√	√
nitrogen, ammonia	√	√
nitrogen, nitrate	√	√
nitrogen, nitrite	√	√
nitrogen, total Kjeldahl	√	√
oil and grease, mineral	√	√
oil and grease, total	√	√
organic carbon, total	√	√
pH	√	√
sulphate	√	√
sulphide	√	√
suspended solids, total	√	√
METALS		
Total Metals		
aluminum	√	√
antimony	√	√
arsenic	√	√
barium	√	√
beryllium	√	√
cadmium	√	√
calcium	√	√
chromium	√	√
chromium VI	√	√
cobalt	√	√
copper	√	√
iron	√	√
lead	√	√
magnesium	√	√
manganese	√	√
mercury	√	√
molybdenum	√	√
nickel	√	√
phosphorus	√	√
potassium	√	√
selenium	√	√
silver	√	√

Appendix B1, cont'd

Substance	McLoughlin WWTP Influent and Effluent	
	(full list)	(modified list)
	Quarterly	Monthly
thallium	√	√
tin	√	√
zinc	√	√
Dissolved Metals		
aluminum	√	√
antimony	√	√
arsenic	√	√
barium	√	√
beryllium	√	√
cadmium	√	√
calcium	√	√
chromium	√	√
cobalt	√	√
copper	√	√
iron	√	√
lead	√	√
magnesium	√	√
manganese	√	√
mercury	√	√
molybdenum	√	√
nickel	√	√
phosphorus	√	√
potassium	√	√
selenium	√	√
silver	√	√
thallium	√	√
tin	√	√
zinc	√	√
Speciated Metals		
dibutyltin	√	
dibutyltin dichloride	√	
methyl mercury	√	
monobutyltin	√	
monobutyltin trichloride	√	
tributyltin	√	
tributyltin dichloride	√	
ALDEHYDES		
acrolein	√	√
PHENOLIC COMPOUNDS		
total phenols	√	√
CHLORINATED PHENOLICS		
2,4,6-trichlorophenol	√	√
2,4/2,5-dichlorophenol	√	√
2-chlorophenol	√	√
4-chloro-3-methylphenol	√	√
pentachlorophenol	√	√
NON-CHLORINATED PHENOLICS		
2,4-dimethylphenol	√	√
2,4-dinitrophenol	√	√

Appendix B1, cont'd

Substance	McLoughlin WWTP Influent and Effluent	
	(full list)	(modified list)
	Quarterly	Monthly
2-methyl-4,6-dinitrophenol	√	√
2-nitrophenol	√	√
4-nitrophenol	√	√
phenol	√	√
ORGANOCHLORINE PESTICIDES		
2,4-DDD	√*	
2,4-DDE	√*	
2,4-DDT	√*	
4,4-DDD	√*	
4,4-DDE	√*	
4,4-DDT	√*	
aldrin	√*	
alpha chlordane	√*	
alpha-endosulfan	√*	
alpha-BHC	√*	
beta-endosulfan	√*	
beta-BHC	√*	
chlordane	√*	
delta-BHC	√*	
dieldrin	√*	
endosulfan sulfate	√*	
endrin	√*	
endrin aldehyde	√*	
gamma chlordane	√*	
heptachlor	√*	
heptachlor epoxide	√*	
gamma BHC	√*	
methoxyclor	√*	
mirex	√*	
octachlorostyrene	√*	
toxaphene	√*	
POLYCHLORINATED BIPHENYLS		
PCB-1	√*	
PCB-3	√*	
PCB-4/10	√*	
PCB-5/8	√*	
PCB-15	√*	
PCB-18	√*	
PCB-19	√*	
PCB-23/34	√*	
PCB-28	√*	
PCB-31	√*	
PCB-37	√*	
PCB-40	√*	
PCB-44	√*	
PCB-43/49	√*	
PCB-52/73	√*	
PCB-54	√*	
PCB-56/60	√*	

Appendix B1, cont'd

Substance	McLoughlin WWTP Influent and Effluent	
	(full list)	(modified list)
	Quarterly	Monthly
PCB-66/80	√*	
PCB-77	√*	
PCB-81	√*	
PCB-87/115/116	√*	
PCB-89/90/101	√*	
PCB-93/95	√*	
PCB-99	√*	
PCB-104	√*	
PCB-105/127	√*	
POLYCYCLIC AROMATIC HYDROCARBONS		
dibenzo(a,h)anthracene	√*	√
fluoranthene	√*	√
fluorene	√*	√
indeno(1,2,3-c,d)pyrene	√*	√
naphthalene	√*	√
phenanthrene	√*	√
pyrene	√*	√
total high molecular weight - PAH	√*	√
total low molecular weight - PAH	√*	√
total PAH	√*	√
SEMIVOLATILE ORGANICS		
Phthalates		
bis(2-ethylhexyl)phthalate	√	√
butylbenzyl phthalate	√	√
diethyl phthalate	√	√
dimethyl phthalate	√	√
di-n-butyl phthalate	√	√
di-n-octyl phthalate	√	√
MISCELLANEOUS SEMIVOLATILE ORGANICS		
1,2,4-trichlorobenzene	√	
1,2-diphenylhydrazine	√	√
2,4-dinitrotoluene	√	√
2,6-dinitrotoluene	√	√
3,3-dichlorobenzidine	√	√
4-bromophenyl phenyl ether	√	
4-chlorophenyl phenyl ether	√	
benzidine	√	√
bis(2-chloroethoxy)methane	√	
bis(2-chloroethyl)ether	√	
bis(2-chloroisopropyl)ether	√	
hexachlorobenzene	√	
hexachlorobutadiene	√	
hexachlorocyclopentadiene	√	
hexachloroethane	√	
isophorone	√	√
nitrobenzene	√	√
N-nitrosodimethylamine	√	√
N-nitrosodi-n-propylamine	√	√
N-nitrosodiphenylamine	√	√

Appendix B1, cont'd

Substance	McLoughlin WWTP Influent and Effluent	
	(full list)	(modified list)
	Quarterly	Monthly
VOLATILE ORGANICS		
Monocyclic Aromatic Hydrocarbons		
benzene	√	√
chlorobenzene	√	√
1,2-dichlorobenzene	√	√
1,3-dichlorobenzene	√	√
1,4-dichlorobenzene	√	√
ethylbenzene	√	√
m & p xylenes	√	√
o-xylene	√	√
styrene	√	√
toluene	√	√
xylenes	√	√
Aliphatic		
acrylonitrile	√	√
methyl tertiary butyl ether	√	√
Chlorinated Aliphatic		
1,1,1,2-tetrachloroethane	√	√
1,1,1-trichloroethane	√	√
1,1,2,2-tetrachloroethane	√	√
1,1,2-trichloroethane	√	√
1,1-dichloroethane	√	√
1,1-dichloroethene	√	√
1,2-dichloroethane	√	√
1,2-dichloropropane	√	√
bromomethane	√	√
chloroethane	√	√
chloroethene	√	√
chloromethane	√	√
cis-1,2-dichloroethene	√	√
cis-1,3-dichloropropene	√	√
dibromoethane	√	√
dibromomethane	√	√
dichloromethane	√	√
tetrabromomethane	√	√
tetrachloroethene	√	√
tetrachloromethane	√	√
trans-1,2-dichloroethene	√	√
trans-1,3-dichloropropene	√	√
trichloroethene	√	√
trichlorofluoromethane	√	√
Trihalomethanes		
bromodichloromethane	√	√
chlorodibromomethane	√	√
tribromomethane	√	√
trichloromethane	√	√
Ketones		
dimethyl ketone	√	√
methyl ethyl ketone	√	√

Appendix B1, cont'd

Substance	McLoughlin WWTP Influent and Effluent	
	(full list)	(modified list)
	Quarterly	Monthly
methyl isobutyl ketone	√	√
alpha-terpineol	√	√
High Resolution Analysis		
Nonylphenols (NP)	√	
Polybrominated Diphenyl Ethers (PBDE)	√	
Polycyclic Aromatic Hydrocarbons (PAH)	√	
Per and Polyfluoroalkyl Substances (PFOS)	√	
Pharmaceuticals and Personal Care Products (PPCP)	√	
Dioxins and Furans (PCDD)	√	
Polychlorinated Biphenyls (PCB)	√	
TOXICITY-ACUTE		
96-hr Rainbow Trout - pH stabilized		√
48-hr Daphnia magna		√
TOXICITY-CHRONIC (Annual)		
Rainbow Trout Avelin and Egg Test (EA)	√**	
Ceriodaphnia 7-day	√**	
Top smelt 7-day	√**	
Echinoderm fertilization	√**	

Notes:
√* Analyses were conducted at a higher resolution (i.e., at SGS AXYS Analytics), **annually.

Appendix B2 McLoughlin Wastewater Treatment Plant Influent Flow (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	96,900	96,700	142,700	91,000	86,300	79,000	76,600	74,600	74,500	75,100	114,600	88,700
2	140,800	97,600	122,500	90,800	86,600	77,500	73,000	74,800	75,100	76,100	121,100	83,100
3	142,600	98,900	111,800	89,300	87,200	82,300	92,100	74,100	73,200	75,500	127,000	105,300
4	123,000	97,300	104,800	100,500	83,700	81,500	80,700	73,400	75,300	75,000	150,900	90,600
5	118,300	95,100	101,000	160,900	94,400	86,500	80,500	76,600	80,000	75,400	120,200	86,100
6	214,200	96,300	100,800	131,100	89,100	81,400	76,700	71,900	76,200	75,600	126,000	90,600
7	219,600	92,800	97,400	108,100	83,700	79,700	77,400	74,200	74,600	74,500	129,300	86,400
8	160,900	92,500	95,700	105,500	85,100	78,600	75,700	76,500	75,400	74,000	122,100	88,900
9	144,500	92,000	92,400	100,900	88,200	112,700	76,200	75,000	71,700	73,600	113,400	83,800
10	150,400	89,600	91,900	98,400	86,200	91,100	75,300	74,500	78,000	76,900	111,800	84,500
11	234,100	89,500	93,700	112,700	80,900	83,500	76,200	77,400	77,100	75,700	110,200	83,800
12	232,700	89,500	93,700	104,700	83,600	83,800	76,800	74,700	75,500	74,800	108,400	81,000
13	163,800	92,100	91,700	118,600	83,200	85,600	78,600	72,600	75,200	70,200	109,400	81,100
14	141,600	89,200	107,400	104,800	78,700	81,000	76,500	73,800	75,200	77,700	108,600	80,500
15	130,900	70,100	108,900	94,800	96,100	80,800	75,200	75,000	75,200	72,700	106,400	79,100
16	125,400	87,100	98,400	92,500	86,800	81,300	73,900	74,700	74,800	75,000	105,700	79,100
17	134,400	85,300	144,600	90,600	83,700	79,800	78,400	77,000	76,400	74,500	105,700	81,400
18	121,700	86,800	117,700	93,300	85,900	77,400	76,900	74,600	75,400	74,500	104,500	87,800
19	133,100	85,600	107,700	93,000	81,900	79,500	75,500	74,200	76,400	75,100	105,600	79,400
20	133,700	88,000	103,300	90,700	80,800	82,300	75,500	72,900	74,400	75,100	107,000	76,600
21	120,400	93,600	111,400	88,600	79,400	79,200	77,500	73,900	74,400	76,300	85,900	79,000
22	113,900	87,100	108,400	90,200	77,000	78,300	75,300	75,400	74,400	74,400	97,300	77,900
23	111,900	85,700	103,000	88,000	82,100	79,500	73,400	77,100	78,600	77,500	81,100	90,500
24	105,700	86,300	101,600	89,700	81,500	78,200	73,900	74,400	79,800	89,900	79,300	207,600
25	102,800	82,500	98,900	90,900	79,400	75,400	77,400	74,800	81,000	80,600	88,500	189,300
26	102,800	86,300	103,500	86,100	85,000	76,200	76,200	74,100	76,200	78,100	100,300	191,100
27	98,500	106,800	98,000	84,700	86,200	80,200	74,900	73,300	76,500	101,500	104,500	188,300
28	95,800	195,000	101,600	84,400	80,400	76,300	75,300	74,000	75,000	103,800	88,100	140,800
29	97,500	---	94,700	83,900	82,000	76,000	74,400	76,900	76,000	80,800	87,800	122,600
30	110,600	---	92,100	88,500	79,900	75,800	72,600	74,700	76,800	149,000	105,300	135,800
31	100,400	---	91,000	---	79,300	---	72,900	74,200	---	137,100	---	138,500
Average	136,223	94,118	104,268	98,240	84,010	81,347	76,500	74,687	75,943	82,129	107,533	105,135
Maximum	95,800	70,100	91,000	83,900	77,000	75,400	72,600	71,900	71,700	70,200	79,300	76,600
Minimum	234,100	195,000	144,600	160,900	96,100	112,700	92,100	77,400	81,000	149,000	150,900	207,600
											Annual Average	**93,366**

Appendix B3 McLoughlin Wastewater Treatment Plant Effluent Flow (m^3/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	94,800	94,600	141,300	89,600	84,900	77,400	75,000	72,800	73,000	73,600	112,800	87,400
2	138,800	96,000	121,100	89,200	85,200	76,000	71,500	73,100	73,400	74,600	119,700	81,900
3	140,500	97,200	110,400	87,700	85,800	80,700	90,700	72,400	71,600	73,900	125,000	103,800
4	121,300	95,500	103,200	98,900	82,300	80,100	79,000	71,900	73,700	73,400	149,000	89,000
5	116,500	93,500	99,500	159,200	93,000	85,000	78,900	75,000	78,400	73,800	118,400	84,300
6	211,900	94,700	99,500	129,500	87,700	79,600	74,600	70,300	74,600	74,100	124,400	89,100
7	217,800	91,300	96,000	106,500	82,200	78,100	75,800	72,600	73,000	73,200	127,500	84,900
8	159,300	90,600	94,100	104,000	83,600	77,000	74,100	75,000	73,700	72,600	120,400	87,500
9	142,800	90,400	91,000	99,400	86,700	111,100	74,700	73,300	70,200	72,100	112,000	82,300
10	148,500	87,900	90,400	96,800	84,600	89,700	73,700	73,100	76,500	75,400	110,100	83,000
11	232,000	87,700	92,200	111,100	79,300	82,000	74,700	76,000	75,800	74,200	108,800	82,400
12	230,600	87,900	92,200	103,200	82,100	82,500	75,300	73,000	74,000	73,400	106,800	79,600
13	162,400	90,700	90,300	116,900	81,700	84,200	77,200	71,200	73,800	68,900	107,700	79,600
14	140,000	87,600	105,800	103,200	77,300	79,400	74,900	72,400	73,800	76,400	107,000	79,100
15	129,100	69,100	107,400	93,300	94,500	79,400	73,900	73,500	73,800	71,400	104,900	77,600
16	123,500	85,600	96,900	91,000	85,300	80,000	72,300	73,200	73,300	73,500	104,200	77,400
17	132,700	83,700	143,000	89,100	82,300	78,200	76,900	75,400	74,800	73,200	104,300	79,800
18	120,000	85,200	116,200	91,500	84,500	75,900	75,500	73,200	73,800	73,000	103,000	86,100
19	131,300	84,300	106,400	91,200	80,400	77,900	73,900	72,800	74,900	73,600	104,200	77,800
20	131,600	86,500	102,000	89,200	79,100	80,800	73,900	71,400	72,800	73,600	105,700	74,900
21	118,500	92,000	110,000	87,000	77,900	77,700	76,000	72,100	72,500	74,800	84,600	77,200
22	112,100	85,800	106,900	88,700	75,500	76,700	73,700	73,700	72,700	73,000	95,900	76,100
23	110,000	84,300	101,600	86,600	81,000	78,000	71,800	75,500	76,900	76,000	80,000	88,400
24	103,800	84,700	100,200	88,200	80,600	76,600	72,200	72,700	78,400	88,400	78,100	205,900
25	100,700	81,000	97,500	89,400	78,400	73,900	75,700	72,900	79,300	79,000	87,100	187,700
26	100,800	84,900	102,100	84,500	82,600	74,900	74,500	72,400	74,900	76,600	98,700	189,400
27	97,100	105,400	96,600	83,100	84,200	78,700	73,100	71,700	75,100	99,800	103,000	186,600
28	94,100	193,100	100,100	82,700	78,900	74,800	73,500	72,400	73,500	101,600	86,700	138,900
29	95,600	---	93,200	82,500	80,500	74,500	72,700	75,300	74,500	78,900	86,300	120,800
30	108,500	---	90,600	87,000	78,400	74,000	71,000	73,100	75,400	147,500	103,800	134,100
31	98,700	---	89,600	---	77,700	---	71,700	72,600	---	135,000	---	136,900
Average	134,365	92,543	102,816	96,673	82,523	79,827	74,916	73,097	74,403	80,597	106,003	103,532
Minimum	94,100	69,100	89,600	82,500	75,500	73,900	71,000	70,300	70,200	68,900	78,100	74,900
Maximum	232,000	193,100	143,000	159,200	94,500	111,100	90,700	76,000	79,300	147,500	149,000	205,900
											Annual Average	**91,796**

Notes: Shaded cells indicate exceedance to maximum daily flow = 432,000 m^3/day (comprising 216,000 m^3/day tertiary treated and 216,000 m^3/day primary treatment during wet weather).

Appendix B4 McLoughlin Point Wastewater Treatment Plant Bypassed Flow (m^3/day)

Date of Bypass	Amount of Bypass
03/01/2022	520
06/01/2022	21,600
07/01/2022	19,200
11/01/2022	59,800
12/01/2022	79,080
13/01/2022	21,930
14/01/2022	5,640
15/01/2022	170
28/01/2022	70
17/03/2022	290
04/04/2022	400
12/04/2022	10
12/10/2022	2,650
27/10/2022	3,600
30/10/2022	15,030
31/10/2022	820
22/11/2022	20
25/12/2022	46,850
26/12/2022	2,040
27/12/2022	10,720
28/12/2022	2,670

Appendix B5 Frequency of Detection, Loadings and Percent Removal of Substances in McLoughlin Influent and Final Effluent

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
BIO-MICROBIO	Enterococci	CFU/100 mL	100%	481,800	---	100%	28,740	---	---
BIO-MICROBIO	Fecal Coliforms	CFU/100 mL	100%	3,414,000	---	100%	175,600	---	---
CONV	Alkalinity - Total - Ph 4.5	mg/L	100%	233	---	100%	154	---	---
Conventionals - Cyanide	Total/SAD Cyanide	mg/L	83%	0.003	102	92%	0.002	75	26%
Conventionals - Cyanide	WAD Cyanide	mg/L	92%	0.002	64	83%	0.001	39	40%
Conventionals - Major Ions	Alkalinity - Bicarbonate	mg/L	100%	286.70	---	100%	188	---	---
Conventionals - Major Ions	Hardness (as CaCO3)	mg/L	100%	79.6	---	100%	71.0	----	---
Conventionals - Nutrients	N - Nh3 (As N)	mg/L	100%	41.5	1,359,036	100%	31.1	993,236	27%
Conventionals - Nutrients	N - Nh3 (As N)- Unionized	mg/L	100%	0.06	1,931	100%	0.12	3,734	-93%
Conventionals - Nutrients	N - Tkn (As N)	mg/L	100%	56.0	1,830,595	100%	28.9	924,178	50%
Conventionals - Nutrients	N - Total (As N)	mg/L	100%	56.0	1,833,449	100%	36.3	1,177,148	36%
Conventionals - Nutrients	Organic Carbon	mg/L	100%	478	20,892,157	100%	212	7,661,436	63%
Conventionals - Nutrients	P - Po4 - Total (As P)	µg/L	100%	7,148	231,919	100%	4,141	141,829	39%
Conventionals - Oil and Grease	Oil & Grease, Mineral	mg/L	33%	---	---	0%	---	---	---
Conventionals - Oil and Grease	Oil & grease, total	mg/L	100%	10.8	348,970	0%	---	---	100%
Conventionals - Oxygen Demand	BOD	mg/L	100%	311.7	10,305,238	100%	37.7	1,255,813	88%
Conventionals - Oxygen Demand	CBOD	mg/L	100%	290	9,486,297	100%	15.1	491,610	95%
Conventionals - Oxygen Demand	COD	mg/L	100%	690	21,039,749	100%	117	3,997,262	81%
Conventionals - Physical	pH	No Units	100%	7.6	---	100%	7.7	---	---
Conventionals - Physical	TSS	mg/L	100%	195	6,613,602	100%	10.7	366,593	94%
Conventionals - Sulphide	H2S	mg/L	100%	1.9	55,201	0%	---	---	100%
Conventionals - Sulphide	Sulfide	mg/L	100%	0.9	26,034	58%	0.04	1,190	95%
HALCO	Tetrabromomethane	µg/L	0%	---	---	0%	---	---	---
Metals - Alkali	Potassium	mg/L	100%	15.5	513,873	100%	14.9	484,649	6%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
Metals - Alkali	Sodium	mg/L	100%	47.1	1,454,957	100%	46.9	1,424,954	2%
Metals - Alkaline earth	Barium	µg/L	100%	19.0	640	100%	5.3	183	71%
Metals - Alkaline earth	Beryllium	µg/L	8%	---	---	0%	---	---	---
Metals - Alkaline earth	Calcium	mg/L	100%	20.3	710,865	100%	18	613,733	14%
Metals - Alkaline earth	Magnesium	mg/L	100%	7.0	245,657	100%	6.6	227,081	8%
Metals - Lanthanoids	Thallium	µg/L	100%	0.01	0	0%	---	---	100%
Metals - Metalloid	Antimony	µg/L	100%	0.3	11	100%	0.26	9	20%
Metals - Metalloid	Arsenic	µg/L	100%	0.6	21	100%	0.45	15	25%
Metals - Post transition metals	Aluminum	µg/L	100%	194	6,538	100%	33	1,129	83%
Metals - Post transition metals	Lead	µg/L	100%	3.0	97	100%	0.75	25	74%
Metals - Post transition metals	Tin	µg/L	100%	0.8	25	100%	0.58	19	22%
Metals - Reactive nonmetal	Selenium	µg/L	100%	0.3	10	100%	0.17	6	43%
Metals - Reactive nonmetal	Sulfur	mg/L	100%	8.1	251,123	100%	8.1	246,968	2%
Organics - Aromatic hydrocarbons	1,1,1,2-Tetrachloroethane	µg/L	0%	---	---	0%	---	---	---
Organics - Aromatic hydrocarbons	Dichlorodifluoromethane	µg/L	0%	---	---	0%	---	---	---
Organics - Aromatic hydrocarbons	Nitrobenzene	µg/L	0%	---	---	0%	---	---	---
Organics - Base Neutrals	N-nitrosodimethylamine	µg/L	0%	---	---	0%	---	---	---
Organics - Base Neutrals	N-Nitrosodi-N-Propylamine	µg/L	0%	---	---	0%	---	---	---
Organics - BTEX	Benzene	µg/L	0%	---	---	0%	---	---	---
Organics - BTEX	Ethylbenzene	µg/L	0%	---	---	0%	---	---	---
Organics - BTEX	Toluene	µg/L	92%	1.6	51	0%	---	---	100%
Organics - BTEX	Xylenes	µg/L	25%	---	---	0%	---	---	---
Organics - Misc	1,2,3,4-Tetrachlorobenzene	ng/L	33%	---	---	0%	---	---	---
Organics - Misc	1,3,5-Trichlorobenzene	ng/L	33%	---	---	0%	---	---	---
Organics - Misc	1,4-Dioxane	µg/L	50%	---	---	75%	0.71	26	---

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
Organics - Misc	1,7-Dimethylxanthine	ng/L	100%	40,800	1,477	100%	5,617	205	86%
Organics - Misc	Acrolein	µg/L	8%	---	---	0%	---	---	---
Organics - Misc	Acrylonitrile	µg/L	0%	---	---	0%	---	---	---
Organics - Misc	Delta-Hch Or Delta-Bhc	ng/L	0%	---	---	0%	---	---	---
Organics - Misc	Dibromomethane	µg/L	0%	---	---	0%	---	---	---
Organics - Misc	Pentachlorobenzene	ng/L	100%	0.3	0.01	75%	0.07	0.002	78%
Organics - Misc	Perfluorobutanoic acid	ng/L	75%	22.6	1.0	100%	20.9	0.8	15%
Organics - Misc	Tetrachloromethane	µg/L	0%	---	---	0%	---	---	---
Organics - Misc	Trans-Chlordane	ng/L	100%	0.24	0.008	75%	0.15	0.006	31%
Organics - Misc	Trans-Nonachlor	ng/L	67%	0.21	0.007	75%	0.12	0.004	46%
Organics - Misc	Tribromomethane	µg/L	0%	---	---	0%	---	---	---
Organics - Misc	Trichloromethane	µg/L	100%	2.6	85	0%	---	---	100%
Organics - Semi-Volatile	1,2-diphenylhydrazine	µg/L	0%	---	---	0%	---	---	---
Organics - Semi-Volatile	2,4-dinitrotoluene	µg/L	0%	---	---	0%	---	---	---
Organics - Semi-Volatile	2,6-dinitrotoluene	µg/L	0%	---	---	0%	---	---	---
Organics - Semi-Volatile	3,3-dichlorobenzidine	µg/L	0%	---	---	0%	---	---	---
Organics - Semi-Volatile	4-Bromophenyl Phenyl Ether	µg/L	0%	---	---	0%	---	---	---
Organics - Semi-Volatile	4-Chlorophenyl Phenyl Ether	µg/L	0%	---	---	0%	---	---	---
Organics - Semi-Volatile	Hexachlorocyclopentadiene	µg/L	0%	---	---	0%	---	---	---
Organics - Semi-Volatile	Hexachloroethane	µg/L	0%	---	---	0%	---	---	---
Organics - Terpenes	Alpha-Terpineol	µg/L	75%	5.95	198	0%	---	---	100%
Organics - VOCs	1,1,1-trichloroethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	1,1,2,2-tetrachloroethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	1,1,2-trichloroethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	1,1-dichloroethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	1,1-dichloroethene	µg/L	0%	---	---	0%	---	---	---

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
Organics - VOCs	1,2,3-Trichlorobenzene	ng/L	33%	---	---	0%	---	---	---
Organics - VOCs	1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ng/L	33%	---	---	0%	---	---	---
Organics - VOCs	1,2,4-trichlorobenzene	ng/L	67%	2.4	0.10	0%	---	---	100%
Organics - VOCs	1,2-dibromoethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	1,2-dichlorobenzene	ng/L	67%	3.5	0.14	100%	0.85	0.04	72%
Organics - VOCs	1,2-dichloroethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	1,2-dichloropropane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	1,3-dichlorobenzene	ng/L	100%	34	0.98	0%	---	---	100%
Organics - VOCs	1,4-dichlorobenzene	ng/L	100%	87	3.03	100%	57	2.3	25%
Organics - VOCs	Bromodichloromethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Bromomethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Chlorobenzene	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Chlorodibromomethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Chloroethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Chloroethene	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Chloromethane	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Cis-1,2-Dichloroethene	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Cis-1,3-dichloropropene	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Hexachlorobutadiene	ng/L	100%	0.75	0.02	100%	0.15	0.01	72%
Organics - VOCs	M & P Xylenes	µg/L	25%	---	---	0%	---	---	---
Organics - VOCs	Methyl Ethyl Ketone	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Methyl Tertiary Butyl Ether	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	O-Xylene	µg/L	17%	---	---	0%	---	---	---
Organics - VOCs	Styrene	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Tetrachloroethene	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Trans-1,2-Dichloroethene	µg/L	0%	---	---	0%	---	---	---

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
Organics - VOCs	Trans-1,3-dichloropropene	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Trichloroethene	µg/L	0%	---	---	0%	---	---	---
Organics - VOCs	Trichlorofluoromethane	µg/L	0%	---	---	0%	---	---	---
PHENO	Total Phenols	mg/L	100%	0.05	1526	0%	---	---	---
Phenols - Chlorinated phenols	2,4 + 2,5 Dichlorophenol	µg/L	0%	---	---	0%	---	---	---
Phenols - Chlorinated phenols	2-Chlorophenol	µg/L	0%	---	---	0%	---	---	---
Phenols - Chlorinated phenols	4-Chloro-3-Methylphenol	µg/L	0%	---	---	0%	---	---	---
Phenols - Chlorinated phenols	Pentachlorophenol	µg/L	0%	---	---	0%	---	---	---
Phenols - Non-chlorinated phenols	2,4-dimethylphenol	µg/L	0%	---	---	0%	---	---	---
Phenols - Non-chlorinated phenols	2,4-dinitrophenol	µg/L	0%	---	---	0%	---	---	---
Phenols - Non-chlorinated phenols	2-Methyl-4,6-Dinitrophenol	µg/L	0%	---	---	0%	---	---	---
Phenols - Non-chlorinated phenols	2-Nitrophenol	µg/L	0%	---	---	0%	---	---	---
Phenols - Non-chlorinated phenols	Phenol	µg/L	100%	8.72	269	0%	---	---	100%
Phenols - Semi-Volatile	2,4,6-trichlorophenol	µg/L	0%	---	---	0%	---	---	---
PHARMA	17 beta-Estradiol 3-benzoate	ng/L	0%	---	---	0%	---	---	---
PHARMA	Allyl Trenbolone	ng/L	0%	---	---	0%	---	---	---
PHARMA	Androstenedione	ng/L	100%	188	8.0	75%	5.1	0.2	97%
PHARMA	Androsterone	ng/L	67%	140	6.7	0%	---	---	100%
PHARMA	Desogestrel	ng/L	0%	---	---	0%	---	---	---
PHARMA	Mestranol	ng/L	0%	---	---	0%	---	---	---
PHARMA	Norethindrone	ng/L	0%	---	---	0%	---	---	---
PHARMA	Norgestrel	ng/L	0%	---	---	0%	---	---	---
PHARMA	Progesterone	ng/L	100%	37	1.6	25%	---	---	---
PHARMA	Testosterone	ng/L	100%	69	3.0	0%	---	---	---

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - Hormones and Sterols	17 alpha-Dihydroequilin	ng/L	0%	---	---	0%	---	---	---
POPs - Hormones and Sterols	17 alpha-Estradiol	ng/L	25%	---	---	0%	---	---	---
POPs - Hormones and Sterols	17 alpha-Ethinyl-Estradiol	ng/L	0%	---	---	0%	---	---	---
POPs - Hormones and Sterols	17 beta-Estradiol	ng/L	25%	---	---	0%	---	---	---
POPs - Hormones and Sterols	Equilenin	ng/L	25%	---	---	0%	---	---	---
POPs - Hormones and Sterols	Equilin	ng/L	0%	---	---	0%	---	---	---
POPs - Hormones and Sterols	Estriol	ng/L	100%	205	8.0	0%	---	---	100%
POPs - Hormones and Sterols	Estrone	ng/L	100%	50	1.9	100%	7.5	0.3	87%
POPs - Nonylphenols	4-Nitrophenol	µg/L	0%	---	---	0%	---	---	---
POPs - Nonylphenols	4-n-Octylphenol	ng/L	50%	---	---	0%	---	---	---
POPs - Nonylphenols	4-Nonylphenol Diethoxylates	ng/L	50%	---	---	100%	424	18	---
POPs - Nonylphenols	4-Nonylphenol Monoethoxylates	ng/L	100%	1313	47	100%	913	33	30%
POPs - Nonylphenols	Np	ng/L	100%	1076	36	100%	363	13	63%
POPs - PAH	1-Methylphenanthrene	ng/L	100%	13	0.50	100%	2.1	0.09	83%
POPs - PAH	2,3,5-trimethylnaphthalene	ng/L	100%	22	0.88	100%	2.7	0.11	87%
POPs - PAH	2,6-dimethylnaphthalene	ng/L	100%	35	1.35	100%	2.3	0.09	93%
POPs - PAH	2-Chloronaphthalene	µg/L	0%	---	---	0%	---	---	---
POPs - PAH	2-Methylnaphthalene	ng/L	100%	130	4.7	100%	5.2	0.2	95%
POPs - PAH	Acenaphthene	ng/L	100%	149	6.2	100%	32.7	1.4	77%
POPs - PAH	Acenaphthylene	ng/L	100%	3.7	0.2	100%	0.9	0.04	76%
POPs - PAH	Anthracene	ng/L	100%	25	0.9	100%	1.5	0.1	93%
POPs - PAH	Benzo[a]anthracene	ng/L	100%	26	1.0	100%	3.5	0.1	87%
POPs - PAH	Benzo[a]pyrene	ng/L	100%	25	1.0	100%	2.2	0.1	91%
POPs - PAH	Benzo[b]fluoranthene	ng/L	100%	20	0.8	100%	2.2	0.1	89%
POPs - PAH	Benzo[e]pyrene	ng/L	100%	20	0.8	100%	2.0	0.1	90%
POPs - PAH	Benzo[ghi]perylene	ng/L	100%	19	0.7	100%	1.8	0.1	90%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PAH	Benzo[J,K]Fluoranthenes	ng/L	100%	22	0.9	100%	1.9	0.1	91%
POPs - PAH	Chrysene	ng/L	100%	23	0.9	100%	4.2	0.2	82%
POPs - PAH	Dibenzo(a,h)anthracene	ng/L	100%	5.9	0.2	0%	---	---	100%
POPs - PAH	Dibenzothiophene	ng/L	100%	25	0.9	100%	2.9	0.1	87%
POPs - PAH	Fluoranthene	ng/L	100%	104	4.0	100%	18	0.7	81%
POPs - PAH	Fluorene	ng/L	100%	84	3.4	100%	16	0.7	80%
POPs - PAH	High Molecular Weight PAH`s	µg/L	92%	0.2	7.9	75%	0.040	1.3	84%
POPs - PAH	Indeno(1,2,3-C,D)Pyrene	ng/L	100%	17	0.7	100%	1.6	0.1	90%
POPs - PAH	Low Molecular Weight PAH`s	µg/L	100%	0.6	18	92%	0.06	2	88%
POPs - PAH	Naphthalene	ng/L	100%	246	9.9	100%	22	0.9	91%
POPs - PAH	Perylene	ng/L	100%	7.6	0.3	75%	0.53	0.02	93%
POPs - PAH	Phenanthrene	ng/L	100%	198	7.3	100%	19.7	0.8	89%
POPs - PAH	Pyrene	ng/L	100%	79	3.1	100%	17.8	0.7	77%
POPs - PAH	Total PAH	µg/L	100%	0.8	26	83%	0.10	3	88%
POPs - PBDE	Pbde 10	pg/L	25%	---	---	0%	---	---	---
POPs - PBDE	Pbde 100	pg/L	100%	3268	0.12	100%	775	0.03	76%
POPs - PBDE	Pbde 105	pg/L	0%	---	---	0%	---	---	---
POPs - PBDE	Pbde 116	pg/L	25%	---	---	0%	---	---	---
POPs - PBDE	Pbde 119/120	pg/L	100%	62	0.003	100%	9.81	0.000	86%
POPs - PBDE	Pbde 12/13	pg/L	100%	12	0.0005	100%	2.98	0.0001	74%
POPs - PBDE	Pbde 126	pg/L	25%	---	---	0%	---	---	---
POPs - PBDE	Pbde 128	pg/L	0%	---	---	0%	---	---	---
POPs - PBDE	Pbde 138/166	pg/L	100%	123	0.004	100%	49	0.002	59%
POPs - PBDE	Pbde 140	pg/L	100%	52	0.002	100%	13	0.0005	75%
POPs - PBDE	Pbde 15	pg/L	100%	28	0.001	100%	7.8	0.0003	72%
POPs - PBDE	Pbde 153	pg/L	100%	1,520	0.06	100%	345	0.01	77%
POPs - PBDE	Pbde 154	pg/L	100%	1,104	0.04	100%	274	0.01	75%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PBDE	Pbde 155	pg/L	100%	79	0.003	100%	21	0.001	72%
POPs - PBDE	Pbde 17/25	pg/L	100%	124	0.005	100%	43.1	0.002	66%
POPs - PBDE	Pbde 181	pg/L	25%	---	---	0%	---	---	---
POPs - PBDE	Pbde 183	pg/L	100%	271	0.01	100%	54.7	0.002	79%
POPs - PBDE	Pbde 190	pg/L	50%	---	---	75%	3.9	0.0002	---
POPs - PBDE	Pbde 203	pg/L	100%	258	0.009	100%	36.8	0.001	84%
POPs - PBDE	Pbde 206	pg/L	100%	2,823	0.10	100%	211	0.01	91%
POPs - PBDE	Pbde 207	pg/L	100%	3,160	0.11	100%	244	0.01	91%
POPs - PBDE	Pbde 208	pg/L	100%	1,893	0.06	100%	135	0.01	92%
POPs - PBDE	Pbde 209	pg/L	100%	82,900	2.8	100%	3,520	0.1	95%
POPs - PBDE	Pbde 28/33	pg/L	100%	316	0.01	100%	80.5	0.003	74%
POPs - PBDE	Pbde 30	pg/L	0%	---	---	0%	---	---	---
POPs - PBDE	Pbde 32	pg/L	50%	---	---	0%	---	---	---
POPs - PBDE	Pbde 35	pg/L	75%	4.0	0.0001	75%	1.9	0.0001	50%
POPs - PBDE	Pbde 37	pg/L	100%	9.0	0.0003	100%	8.4	0.0003	4%
POPs - PBDE	Pbde 47	pg/L	100%	15,550	0.6	100%	3,660	0.1	76%
POPs - PBDE	Pbde 49	pg/L	100%	502	0.02	100%	113	0.004	78%
POPs - PBDE	Pbde 51	pg/L	100%	50	0.002	100%	12.0	0.0005	77%
POPs - PBDE	Pbde 66	pg/L	100%	298	0.01	100%	78.9	0.003	72%
POPs - PBDE	Pbde 7	pg/L	75%	8.2	0.0003	75%	3.1	0.0001	63%
POPs - PBDE	Pbde 71	pg/L	100%	43	0.002	100%	13.4	0.001	70%
POPs - PBDE	Pbde 75	pg/L	100%	23	0.001	100%	6.1	0.0002	73%
POPs - PBDE	Pbde 77	pg/L	50%	---	---	0%	---	---	---
POPs - PBDE	Pbde 79	pg/L	100%	40	0.002	75%	15.1	0.001	58%
POPs - PBDE	Pbde 8/11	pg/L	100%	8.2	0.0003	75%	2.2	0.0001	69%
POPs - PBDE	Pbde 85	pg/L	100%	730	0.03	100%	161	0.01	77%
POPs - PBDE	Pbde 99	pg/L	100%	15,880	0.6	100%	3,735	0.1	76%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PCB - Conje	Decachloro Biphenyl	pg/L	100%	21	0.0007	100%	5.8	0.0002	71%
POPs - PCB - Conje	Pcb 1	pg/L	100%	66	0.002	100%	16.5	0.001	74%
POPs - PCB - Conje	Pcb 10	pg/L	100%	4.2	0.0002	0%	---	---	---
POPs - PCB - Conje	Pcb 103	pg/L	100%	2.6	0.0001	0%	---	---	---
POPs - PCB - Conje	Pcb 104	pg/L	75%	1.4	0.0001	0%	---	---	---
POPs - PCB - Conje	Pcb 105	pg/L	100%	73	0.003	100%	18.2	0.001	73%
POPs - PCB - Conje	Pcb 106	pg/L	25%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 107/124	pg/L	100%	8.2	0.0003	100%	2.5	0.0001	68%
POPs - PCB - Conje	Pcb 109	pg/L	100%	13	0.0005	100%	3.6	0.0001	71%
POPs - PCB - Conje	Pcb 11	pg/L	100%	339	0.012	100%	91	0.004	71%
POPs - PCB - Conje	Pcb 110/115	pg/L	100%	258	0.009	100%	68	0.003	73%
POPs - PCB - Conje	Pcb 111	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 112	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 114	pg/L	75%	5.5	0.0002	75%	2.3	0.0001	55%
POPs - PCB - Conje	Pcb 118	pg/L	100%	186	0.007	100%	47	0.002	73%
POPs - PCB - Conje	Pcb 12/13	pg/L	100%	18	0.001	75%	4.2	0.0002	75%
POPs - PCB - Conje	Pcb 120	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 121	pg/L	50%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 122	pg/L	25%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 123	pg/L	75%	5.7	0.0002	75%	2.2	0.0001	58%
POPs - PCB - Conje	Pcb 126	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 127	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 128/166	pg/L	100%	31	0.001	100%	7.8	0.0003	72%
POPs - PCB - Conje	Pcb 129/138/160/163	pg/L	100%	228	0.008	100%	55.7	0.002	74%
POPs - PCB - Conje	Pcb 130	pg/L	100%	14	0.001	100%	3.7	0.0001	71%
POPs - PCB - Conje	Pcb 131	pg/L	75%	4.0	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 132	pg/L	100%	78	0.003	100%	18.2	0.001	76%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PCB - Conje	Pcb 133	pg/L	100%	4.6	0.0002	0%	---	---	100%
POPs - PCB - Conje	Pcb 134/143	pg/L	100%	12	0.0004	100%	3.0	0.0001	74%
POPs - PCB - Conje	Pcb 135/151/154	pg/L	100%	78	0.003	100%	19.8	0.001	74%
POPs - PCB - Conje	Pcb 136	pg/L	75%	23	0.001	100%	7.5	0.0003	69%
POPs - PCB - Conje	Pcb 137	pg/L	100%	13	0.0005	100%	3.3	0.0001	74%
POPs - PCB - Conje	Pcb 139/140	pg/L	100%	6.3	0.0002	75%	1.9	0.0001	68%
POPs - PCB - Conje	Pcb 14	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 141	pg/L	100%	40	0.002	100%	9.0	0.0003	77%
POPs - PCB - Conje	Pcb 142	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 144	pg/L	100%	12	0.0005	100%	3.0	0.0001	77%
POPs - PCB - Conje	Pcb 145	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 146	pg/L	100%	32	0.001	100%	7.5	0.0003	76%
POPs - PCB - Conje	Pcb 147/149	pg/L	100%	172	0.007	100%	41.8	0.002	75%
POPs - PCB - Conje	Pcb 148	pg/L	50%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 15	pg/L	100%	66	0.002	100%	16.6	0.001	74%
POPs - PCB - Conje	Pcb 150	pg/L	75%	1.6	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 152	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 153/168	pg/L	100%	210	0.008	100%	51.3	0.002	75%
POPs - PCB - Conje	Pcb 155	pg/L	100%	22	0.001	100%	6.2	0.0002	70%
POPs - PCB - Conje	Pcb 156157	pg/L	100%	33	0.001	100%	8.1	0.0003	73%
POPs - PCB - Conje	Pcb 158	pg/L	100%	22	0.001	100%	5.1	0.0002	76%
POPs - PCB - Conje	Pcb 159	pg/L	50%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 16	pg/L	100%	88	0.003	100%	19.8	0.001	76%
POPs - PCB - Conje	Pcb 161	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 162	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 164	pg/L	100%	14	0.001	100%	3.4	0.0001	76%
POPs - PCB - Conje	Pcb 165	pg/L	0%	---	---	0%	---	---	---

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PCB - Conje	Pcb 167	pg/L	100%	10	0.0004	100%	2.8	0.0001	70%
POPs - PCB - Conje	Pcb 169	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 17	pg/L	100%	92	0.004	100%	19.6	0.001	78%
POPs - PCB - Conje	Pcb 170	pg/L	100%	45	0.002	100%	10.2	0.0004	77%
POPs - PCB - Conje	Pcb 171/173	pg/L	100%	13	0.0005	100%	3.3	0.0001	74%
POPs - PCB - Conje	Pcb 172	pg/L	100%	7.7	0.0003	75%	1.7	0.0001	77%
POPs - PCB - Conje	Pcb 174	pg/L	100%	44	0.002	100%	10.5	0.0004	76%
POPs - PCB - Conje	Pcb 175	pg/L	100%	2.6	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 176	pg/L	100%	7.0	0.0003	100%	1.6	0.0001	77%
POPs - PCB - Conje	Pcb 177	pg/L	100%	23	0.0009	100%	5.9	0.0002	74%
POPs - PCB - Conje	Pcb 178	pg/L	100%	13	0.0005	100%	3.2	0.0001	74%
POPs - PCB - Conje	Pcb 179	pg/L	100%	24	0.0009	100%	5.9	0.0002	75%
POPs - PCB - Conje	Pcb 18/30	pg/L	100%	169	0.006	100%	38.5	0.002	76%
POPs - PCB - Conje	Pcb 180/193	pg/L	100%	123	0.005	100%	28.3	0.001	76%
POPs - PCB - Conje	Pcb 181	pg/L	25%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 182	pg/L	50%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 183/185	pg/L	100%	34	0.0013	100%	7.61	0.0003	78%
POPs - PCB - Conje	Pcb 184	pg/L	100%	41	0.002	100%	8.88	0.0003	79%
POPs - PCB - Conje	Pcb 186	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 187	pg/L	100%	54	0.0020	100%	15.33	0.0006	70%
POPs - PCB - Conje	Pcb 188	pg/L	25%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 189	pg/L	75%	2.2	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 19	pg/L	100%	43	0.002	100%	12.4	0.001	70%
POPs - PCB - Conje	Pcb 190	pg/L	100%	8.0	0.0003	100%	2.0	0.0001	75%
POPs - PCB - Conje	Pcb 191	pg/L	100%	2.1	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 192	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 194	pg/L	100%	21	0.0009	100%	4.7	0.0002	79%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PCB - Conje	Pcb 195	pg/L	100%	7.6	0.0003	100%	1.3	0.0001	83%
POPs - PCB - Conje	Pcb 196	pg/L	100%	11	0.0004	100%	2.5	0.0001	79%
POPs - PCB - Conje	Pcb 197/200	pg/L	100%	5.5	0.0002	100%	1.7	0.0001	70%
POPs - PCB - Conje	Pcb 198/199	pg/L	100%	33	0.0013	100%	6.3	0.0002	82%
POPs - PCB - Conje	Pcb 2	pg/L	100%	12	0.0004	100%	4.5	0.0002	60%
POPs - PCB - Conje	Pcb 20/28	pg/L	100%	227	0.008	100%	56	0.002	74%
POPs - PCB - Conje	Pcb 201	pg/L	100%	4.0	0.0002	100%	1.2	0.00005	69%
POPs - PCB - Conje	Pcb 202	pg/L	100%	10	0.0004	100%	2.7	0.0001	75%
POPs - PCB - Conje	Pcb 203	pg/L	100%	20	0.0008	100%	3.8	0.0001	82%
POPs - PCB - Conje	Pcb 204	pg/L	75%	1.7	0.0001	0%	---	---	---
POPs - PCB - Conje	Pcb 205	pg/L	75%	1.5	0.0001	0%	---	---	---
POPs - PCB - Conje	Pcb 206	pg/L	100%	23	0.0009	100%	5.2	0.0002	77%
POPs - PCB - Conje	Pcb 207	pg/L	75%	3.5	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 208	pg/L	100%	9.0	0.0003	75%	2.2	0.0001	75%
POPs - PCB - Conje	Pcb 209	pg/L	100%	21	0.0008	100%	6.0	0.0002	70%
POPs - PCB - Conje	Pcb 21/33	pg/L	100%	130	0.0049	100%	27	0.0011	78%
POPs - PCB - Conje	Pcb 22	pg/L	100%	90	0.0034	100%	22	0.0009	75%
POPs - PCB - Conje	Pcb 23	pg/L	25%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 24	pg/L	75%	2.2	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 25	pg/L	100%	30	0.0012	100%	7.3	0.0003	74%
POPs - PCB - Conje	Pcb 26/29	pg/L	100%	53	0.0021	100%	13.0	0.0005	74%
POPs - PCB - Conje	Pcb 27	pg/L	100%	31	0.0013	100%	7.05	0.0003	77%
POPs - PCB - Conje	Pcb 3	pg/L	100%	23	0.0008	100%	6.6	0.0003	69%
POPs - PCB - Conje	Pcb 31	pg/L	100%	192	0.0073	100%	47	0.0019	74%
POPs - PCB - Conje	Pcb 32	pg/L	100%	53	0.0020	100%	13.9	0.0006	71%
POPs - PCB - Conje	Pcb 34	pg/L	75%	1.3	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 35	pg/L	100%	17	0.0006	100%	3.7	0.0001	78%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PCB - Conje	Pcb 36	pg/L	100%	3.7	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 37	pg/L	100%	54	0.0020	100%	13.2	0.0005	74%
POPs - PCB - Conje	Pcb 38	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 39	pg/L	75%	1.4	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 4	pg/L	100%	164	0.007	100%	51.3	0.002	67%
POPs - PCB - Conje	Pcb 40/41/71	pg/L	100%	91	0.003	100%	23.7	0.001	73%
POPs - PCB - Conje	Pcb 42	pg/L	100%	44	0.002	100%	11.7	0.0005	73%
POPs - PCB - Conje	Pcb 43	pg/L	100%	7.2	0.0003	75%	2.0	0.0001	72%
POPs - PCB - Conje	Pcb 44/47/65	pg/L	100%	290	0.01	100%	80.8	0.003	71%
POPs - PCB - Conje	Pcb 45/51	pg/L	100%	60	0.002	100%	15.6	0.001	74%
POPs - PCB - Conje	Pcb 46	pg/L	100%	15	0.0006	100%	4.2	0.0002	70%
POPs - PCB - Conje	Pcb 48	pg/L	100%	34	0.001	100%	8.7	0.0003	74%
POPs - PCB - Conje	Pcb 49/69	pg/L	100%	124	0.005	100%	31.2	0.001	74%
POPs - PCB - Conje	Pcb 5	pg/L	100%	3.5	0.0001	---	---	---	100%
POPs - PCB - Conje	Pcb 50/53	pg/L	100%	42	0.002	100%	10.7	0.0004	74%
POPs - PCB - Conje	Pcb 52	pg/L	100%	304	0.01	100%	72	0.003	76%
POPs - PCB - Conje	Pcb 54	pg/L	100%	2.4	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 55	pg/L	50%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 56	pg/L	100%	57	0.002	100%	15.3	0.001	72%
POPs - PCB - Conje	Pcb 57	pg/L	25%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 58	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 59/62/75	pg/L	100%	15	0.0006	100%	3.9	0.0002	74%
POPs - PCB - Conje	Pcb 6	pg/L	100%	38	0.001	75%	6.8	0.0003	79%
POPs - PCB - Conje	Pcb 60	pg/L	75%	21	0.0008	100%	8.4	0.0003	62%
POPs - PCB - Conje	Pcb 61/70/74/76	pg/L	100%	256	0.009	100%	67.1	0.003	73%
POPs - PCB - Conje	Pcb 63	pg/L	100%	5.2	0.0002	50%	1.5	---	---
POPs - PCB - Conje	Pcb 64	pg/L	100%	68	0.003	100%	18.1	0.001	72%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PCB - Conje	Pcb 66	pg/L	100%	106	0.004	100%	26.5	0.001	74%
POPs - PCB - Conje	Pcb 67	pg/L	100%	4.4	0.0002	0%	---	---	100%
POPs - PCB - Conje	Pcb 68	pg/L	100%	18	0.0007	100%	5.3	0.0002	69%
POPs - PCB - Conje	Pcb 7	pg/L	100%	6.6	0.0003	75%	3.2	0.0001	48%
POPs - PCB - Conje	Pcb 72	pg/L	50%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 73	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 77	pg/L	100%	11	0.0004	100%	3.1	0.0001	70%
POPs - PCB - Conje	Pcb 78	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 79	pg/L	100%	3.1	0.0001	0%	---	---	100%
POPs - PCB - Conje	Pcb 8	pg/L	100%	136	0.005	100%	24.8	0.001	79%
POPs - PCB - Conje	Pcb 80	pg/L	25%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 81	pg/L	0%	---	---	0%	---	---	---
POPs - PCB - Conje	Pcb 82	pg/L	100%	27	0.001	100%	7.3	0.0003	72%
POPs - PCB - Conje	Pcb 83/99	pg/L	100%	132	0.005	100%	36	0.001	72%
POPs - PCB - Conje	Pcb 84	pg/L	100%	69	0.003	100%	18	0.001	73%
POPs - PCB - Conje	Pcb 85/116/117	pg/L	100%	42	0.002	100%	10.5	0.000	74%
POPs - PCB - Conje	Pcb 86/87/97/108/119/125	pg/L	100%	172	0.006	100%	47.3	0.002	72%
POPs - PCB - Conje	Pcb 88/91	pg/L	100%	36	0.001	100%	9.7	0.0004	73%
POPs - PCB - Conje	Pcb 89	pg/L	75%	2.7	0.0001	---	---	---	100%
POPs - PCB - Conje	Pcb 9	pg/L	100%	7.9	0.0003	75%	2.7	0.0001	66%
POPs - PCB - Conje	Pcb 90/101/113	pg/L	75%	187	0.008	100%	66.5	0.003	67%
POPs - PCB - Conje	Pcb 92	pg/L	75%	34	0.001	100%	11.9	0.0005	67%
POPs - PCB - Conje	Pcb 93/95/98/100/102	pg/L	100%	227	0.008	100%	57.8	0.002	74%
POPs - PCB - Conje	Pcb 94	pg/L	75%	2.1	0.0001	0%	---	---	---
POPs - PCB - Conje	Pcb 96	pg/L	100%	2.0	0.0001	0%	---	---	---
POPs - PCB - Homol	Total Dichloro Biphenyls	pg/L	100%	776	0.03	100%	184	0.01	74%
POPs - PCB - Homol	Total Heptachloro Biphenyls	pg/L	100%	404	0.01	100%	70	0.003	83%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PCB - Homol	Total hexachloro biphenyls	pg/L	100%	1,006	0.04	100%	229	0.01	76%
POPs - PCB - Homol	Total Monochloro Biphenyls	pg/L	100%	101	0.004	100%	26	0.001	73%
POPs - PCB - Homol	Total Nonachloro Biphenyls	pg/L	100%	33	0.001	100%	5.2	0.0002	86%
POPs - PCB - Homol	Total Octachloro Biphenyls	pg/L	100%	95	0.004	100%	15	0.001	86%
POPs - PCB - Homol	Total Pentachloro Biphenyls	pg/L	100%	1,463	0.05	100%	377	0.01	74%
POPs - PCB - Homol	Total Tetrachloro Biphenyls	pg/L	100%	1,565	0.06	100%	390	0.02	74%
POPs - PCB - Homol	Total Trichloro Biphenyls	pg/L	100%	1,272	0.05	100%	281	0.01	77%
POPs - PCB TEQ	Pcb Teq 3	pg/L	100%	0.3	0.00001	100%	0.02	0.000001	93%
POPs - PCB TEQ	Pcb Teq 4	pg/L	100%	0.9	0.00004	100%	0.83	0.00003	14%
POPs - PCB Total	PCBs Total	pg/L	100%	6,728	0.3	100%	1,580	0.1	76%
POPs - PCDD	1,2,3,4,6,7,8-HPCDD	pg/L	100%	43	0.0014	100%	1.8	0.0001	95%
POPs - PCDD	1,2,3,4,6,7,8-HPCDF	pg/L	100%	2.7	0.00011	0%	---	---	100%
POPs - PCDD	1,2,3,4,7,8,9-HPCDF	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	1,2,3,4,7,8-HXCDD	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	1,2,3,4,7,8-HXCDF	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	1,2,3,6,7,8-HXCDD	pg/L	100%	1.1	0.00004	0%	---	---	100%
POPs - PCDD	1,2,3,6,7,8-HXCDF	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	1,2,3,7,8,9-HXCDD	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	1,2,3,7,8,9-HXCDF	pg/L	50%	---	---	0%	---	---	---
POPs - PCDD	1,2,3,7,8-PECDD	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	1,2,3,7,8-PECDF	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	2,3,4,6,7,8-HXCDF	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	2,3,4,7,8-PECDF	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	2,3,7,8-TCDD	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	2,3,7,8-TCDF	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	OCDD	pg/L	100%	389	0.01	100%	10.2	0.00	97%
POPs - PCDD	OCDF	pg/L	100%	9.1	0.0003	0%	---	---	100%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PCDD	TOTAL HEPTA-DIOXINS	pg/L	100%	84	0.003	100%	2.1	0.0001	97%
POPs - PCDD	TOTAL HEPTA-FURANS	pg/L	100%	4.2	0.0002	0%	---	---	100%
POPs - PCDD	TOTAL HEXA-DIOXINS	pg/L	100%	6.4	0.0002	0%	---	---	100%
POPs - PCDD	TOTAL HEXA-FURANS	pg/L	100%	1.2	0.0001	0%	---	---	100%
POPs - PCDD	TOTAL PENTA-DIOXINS	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	TOTAL PENTA-FURANS	pg/L	50%	---	---	0%	---	---	---
POPs - PCDD	TOTAL TETRA-DIOXINS	pg/L	0%	---	---	0%	---	---	---
POPs - PCDD	TOTAL TETRA-FURANS	pg/L	0%	---	---	0%	---	---	---
POPs - Pesticides	2,4-DDD	ng/L	100%	6.3	0.18	100%	1.3	0.05	75%
POPs - Pesticides	2,4-DDE	ng/L	33%	---	---	0%	---	---	---
POPs - Pesticides	2,4-DDT	ng/L	33%	---	---	0%	---	---	---
POPs - Pesticides	4,4-Ddd	ng/L	100%	0.2	0.01	0%	---	---	100%
POPs - Pesticides	4,4-DDE	ng/L	100%	0.9	0.03	75%	0.2	0.01	72%
POPs - Pesticides	4,4-DDT	ng/L	33%	---	---	0%	---	---	---
POPs - Pesticides	ABHC	ng/L	33%	---	---	0%	---	---	---
POPs - Pesticides	Aldrin	ng/L	50%	---	---	0%	---	---	---
POPs - Pesticides	Alpha Chlordane	ng/L	100%	0.2	0.01	0%	---	---	100%
POPs - Pesticides	Alpha-Endosulfan	ng/L	33%	---	---	75%	0.4	0.02	---
POPs - Pesticides	Beta-Endosulfan	ng/L	100%	0.5	0.02	75%	0.54	0.02	-11%
POPs - Pesticides	Beta-Hch Or Beta-Bhc	ng/L	100%	0.2	0.01	75%	0.13	0.004	32%
POPs - Pesticides	Bis(2-Chloroethoxy)Methane	µg/L	0%	---	---	0%	---	---	---
POPs - Pesticides	Bis(2-Chloroethyl)Ether	µg/L	0%	---	---	0%	---	---	---
POPs - Pesticides	Bis(2-Chloroisopropyl)Ether	µg/L	0%	---	---	0%	---	---	---
POPs - Pesticides	Cis-Nonachlor	ng/L	67%	0.1	0.005	0%	---	---	100%
POPs - Pesticides	Dieldrin	ng/L	100%	0.6	0.02	75%	0.34	0.01	44%
POPs - Pesticides	Endosulfan Sulfate	ng/L	33%	---	---	0%	---	---	---
POPs - Pesticides	Endrin	ng/L	0%	---	---	0%	---	---	---

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - Pesticides	Endrin Aldehyde	ng/L	0%	---	---	0%	---	---	---
POPs - Pesticides	Hch, Gamma	ng/L	67%	0.2	0.01	75%	0.17	0.01	8%
POPs - Pesticides	Heptachlor	ng/L	50%	---	---	0%	---	---	---
POPs - Pesticides	Heptachlor Epoxide	ng/L	33%	---	---	0%	---	---	---
POPs - Pesticides	Hexachlorobenzene	ng/L	100%	0.3	0.01	75%	0.08	0.003	69%
POPs - Pesticides	Methoxyclor	ng/L	33%	---	---	0%	---	---	---
POPs - Pesticides	Mirex	ng/L	33%	---	---	0%	---	---	---
POPs - Pesticides	Octachlorostyrene	ng/L	33%	---	---	0%	---	---	---
POPs - Pesticides	Oxychlordane	ng/L	33%	---	---	0%	---	---	---
POPs - PFOS	3:3 FTCA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	4:2 FTS	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	5:3 FTCA	ng/L	50%	---	---	0%	---	---	---
POPs - PFOS	6:2 FTS	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	7:3 FTCA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	8:2 FTS	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	ADONA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	EtFOSAA	ng/L	50%	---	---	0%	---	---	---
POPs - PFOS	HFPO-DA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	MeFOSAA	ng/L	50%	---	---	0%	---	---	---
POPs - PFOS	N-EtFOSA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	N-EtFOSE	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	NFDHA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	N-MeFOSA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	N-MeFOSE	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	Perfluorodecanoic acid (PFDA)	ng/L	50%	---	---	100%	1.6	0.063	---
POPs - PFOS	Perfluoroheptanoic Acid (PFHpA)	ng/L	75%	6.2	0.3	100%	5.2	0.2	19%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PFOS	Perfluorohexanoic Acid (PFHxA)	ng/L	100%	26	1.2	100%	26.9	1.2	1%
POPs - PFOS	Perfluorononanoic Acid (PFNA)	ng/L	50%	---	---	75%	1.2	0.051	---
POPs - PFOS	Perfluorooctane sulfonamide (PFOSA)	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	Perfluorooctanesulfonic acid (PFOS)	ng/L	100%	10	0.4	100%	5.4	0.2	43%
POPs - PFOS	Perfluorooctanoic acid (PFOA)	ng/L	100%	14	0.6	100%	11.8	0.5	15%
POPs - PFOS	Perfluoropentanoic Acid (PFPeA)	ng/L	100%	16	0.7	100%	18.9	0.8	-11%
POPs - PFOS	PFBS	ng/L	75%	10	0.5	100%	8.9	0.4	12%
POPs - PFOS	PFDoA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	PFDoS	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	PFDS	ng/L	50%	---	---	0%	---	---	---
POPs - PFOS	PFEESA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	PFHpS	ng/L	50%	---	---	0%	---	---	---
POPs - PFOS	PFHxS	ng/L	75%	9.3	0.4	100%	8.5	0.4	8%
POPs - PFOS	PFMBA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	PFMPA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	PFNS	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	PFPeS	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	PFTeDA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	PFTrDA	ng/L	0%	---	---	0%	---	---	---
POPs - PFOS	PFUnA	ng/L	0%	---	---	0%	---	---	---
POPs - Phthalates	Bis(2-Ethylhexyl)Phthalate	µg/L	17%	---	---	0%	---	---	---
POPs - Phthalates	Butylbenzyl Phthalate	µg/L	0%	---	---	0%	---	---	---
POPs - Phthalates	Diethyl Phthalate	µg/L	92%	0.6	19	0%	---	---	100%
POPs - Phthalates	Dimethyl Phthalate	µg/L	0%	---	---	0%	---	---	---
POPs - Phthalates	Di-N-Butyl Phthalate	µg/L	8%	---	---	0%	---	---	---

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - Phthalates	Di-N-Octyl Phthalate	µg/L	0%	---	---	0%	---	---	---
POPs - PPCPs	2-Hydroxy-Ibuprofen	ng/L	100%	25,280	948	100%	5,283	188	80%
POPs - PPCPs	Acetaminophen	ng/L	100%	140,800	4,926	100%	402	12	100%
POPs - PPCPs	Azithromycin	ng/L	100%	314	11	100%	351	13	-19%
POPs - PPCPs	Bisphenol A	ng/L	100%	8,389	387	100%	1,058	48	88%
POPs - PPCPs	Caffeine	ng/L	100%	88,570	2,971	100%	6,560	217	93%
POPs - PPCPs	Carbadox	ng/L	67%	16	0.5	67%	9.06	0.3	41%
POPs - PPCPs	Carbamazepine	ng/L	100%	593	19	100%	548	18	7%
POPs - PPCPs	Cefotaxime	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Ciprofloxacin	ng/L	100%	244	8.7	67%	120	4.1	52%
POPs - PPCPs	Clarithromycin	ng/L	100%	122	4.0	100%	137	4.7	-17%
POPs - PPCPs	Clinafloxacin	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Cloxacillin	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Dehydronifedipine	ng/L	100%	4.2	0.2	100%	4.5	0.2	-5%
POPs - PPCPs	Digoxigenin	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Digoxin	ng/L	33%	---	---	0%	---	---	---
POPs - PPCPs	Diltiazem	ng/L	100%	330	11	100%	288	10	9%
POPs - PPCPs	Diphenhydramine	ng/L	100%	908	30	100%	898	30	1%
POPs - PPCPs	Enrofloxacin	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Erythromycin-H2O	ng/L	100%	32	1.1	100%	37	1.2	-9%
POPs - PPCPs	Flumequine	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Fluoxetine	ng/L	100%	29	0.9	100%	29	0.9	2%
POPs - PPCPs	Furosemide	ng/L	100%	803	33	100%	601	25	24%
POPs - PPCPs	Gemfibrozil	ng/L	100%	77	3.0	100%	53	2.0	32%
POPs - PPCPs	Glipizide	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Glyburide	ng/L	100%	3.7	0.14	100%	3.5	0.13	10%

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PPCPs	Hydrochlorothiazide	ng/L	100%	1,288	50	100%	1,206	44	11%
POPs - PPCPs	Ibuprofen	ng/L	100%	15,050	577	100%	1,490	56	90%
POPs - PPCPs	Lincomycin	ng/L	100%	5.5	0.2	100%	6.6	0.3	-25%
POPs - PPCPs	Lomefloxacin	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Miconazole	ng/L	100%	7.1	0.3	100%	3.3	0.1	54%
POPs - PPCPs	Naproxen	ng/L	100%	7,413	285	100%	2,465	99	65%
POPs - PPCPs	Norfloxacin	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Norgestimate	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Ofloxacin	ng/L	100%	32	1.1	100%	16.1	0.5	53%
POPs - PPCPs	Ormetoprim	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Oxacillin	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Oxolinic Acid	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Penicillin G	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Penicillin V	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Roxithromycin	ng/L	33%	---	---	100%	1.2	0.04	---
POPs - PPCPs	Sarafloxacin	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Sulfachloropyridazine	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Sulfadiazine	ng/L	33%	---	---	0%	---	---	---
POPs - PPCPs	Sulfadimethoxine	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Sulfamerazine	ng/L	33%	---	---	0%	---	---	---
POPs - PPCPs	Sulfamethazine	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Sulfamethizole	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Sulfamethoxazole	ng/L	100%	1074	33	100%	553	18	46%
POPs - PPCPs	Sulfanilamide	ng/L	100%	75	2.1	100%	108	3.0	-42%
POPs - PPCPs	Sulfathiazole	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Thiabendazole	ng/L	100%	29	1.0	100%	25.4	0.8	19%
POPs - PPCPs	Triclocarban	ng/L	50%	---	---	100%	1.41	0.06	---

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
POPs - PPCPs	Triclosan	ng/L	100%	45	1.9	100%	22.3	0.9	52%
POPs - PPCPs	Trimethoprim	ng/L	100%	285	9.4	100%	222	7.2	24%
POPs - PPCPs	Tylosin	ng/L	33%	---	---	67%	3	0.12	---
POPs - PPCPs	Virginiamycin	ng/L	0%	---	---	0%	---	---	---
POPs - PPCPs	Warfarin	ng/L	100%	3.1	0.1	100%	3.0	0.1	9%
QAQC - PFOS	11Cl-PF3OUdS	ng/L	0%	---	---	0%	---	---	---
QAQC - PFOS	9Cl-PF3ONS	ng/L	0%	---	---	0%	---	---	---
Ketones	4-Methyl-2-Pentanone	µg/L	0%	---	---	0%	---	---	---
Ketones	Dimethyl Ketone	µg/L	100%	240	7,655	67%	34.5	1,108	86%
Ketones	Endrin Ketone	ng/L	0%	---	---	0%	---	---	---
Ketones	Isophorone	µg/L	0%	---	---	0%	---	---	---
Metals - Speciated	Chromium III	mg/L	58%	0.003	101	58%	0.0012	39	61%
Metals - Speciated	Chromium VI	mg/L	8%	---	---	0%	---	---	---
Metals - Speciated	Dibutyltin	µg/L	50%	---	---	0%	---	---	---
Metals - Speciated	Dibutyltin Dichloride	µg/L	50%	---	---	0%	---	---	---
Metals - Speciated	Methyl Mercury	ng/L	50%	---	---	75%	0.151	0.01	---
Metals - Speciated	Monobutyltin	µg/L	50%	---	---	75%	0.01	0.29	---
Metals - Speciated	Monobutyltin Trichloride	µg/L	50%	---	---	75%	0.016	0.47	---
Metals - Speciated	Tributyltin	µg/L	0%	---	---	0%	---	---	---
Metals - Speciated	Tributyltin Chloride	µg/L	0%	---	---	0%	---	---	---
Metals - Transition	Cadmium	µg/L	100%	0.1	4.6	100%	0.033	1.1	76%
Metals - Transition	Chromium	µg/L	100%	1.6	56	100%	1.1	37	34%
Metals - Transition	Cobalt	µg/L	100%	0.7	25	100%	0.56	19	25%
Metals - Transition	Copper	µg/L	100%	49	1,593	100%	23.8	770	52%
Metals - Transition	Iron	µg/L	100%	1,593	51,166	100%	609	19,571	62%
Metals - Transition	Manganese	µg/L	100%	58	1,960	100%	45.0	1,530	22%
Metals - Transition	Mercury	µg/L	17%	---	---	67%	0.013	0.41	---

Appendix B5, cont'd

		Unit	Influent			Effluent			% Removal
			% Freq	Average Concentration	Load kg/year	% Freq	Average Concentration	Load kg/year	
Metals - Transition	Molybdenum	µg/L	100%	2.1	71	100%	2.08	65	8%
Metals - Transition	Nickel	µg/L	100%	3.4	113	100%	3.17	106	6%
Metals - Transition	Silver	µg/L	100%	0.1	4.1	100%	0.086	2.7	33%
Metals - Transition	Zinc	µg/L	100%	0.1	3,358	100%	47	1,548	54%

Notes:
ND>50% Not detected above detection limit greater than 50% of the time.

Appendix B6 Acute Toxicity Test Results and Bench Sheets

Acute Toxicity Test Results and Bench Sheets available upon request
Contact: CRD’s Environmental Monitoring Program, 250.360.3261

Appendix B7 Chronic Toxicity Test Results and Bench Sheets

Chronic Toxicity Test Results and Bench Sheets available upon request
Contact: CRD’s Environmental Monitoring Program, 250.360.3261

APPENDIX C
2022 SURFACE WATER MONITORING

Appendix C1 Parameter List

Parameter	Edge of IDZ (3 depths top, middle, bottom)*	Surface Water (1 m depth)
CONVENTIONAL VARIABLES		
conductivity	x	
enterococci	x	x
fecal coliform	x	x
hardness (as $CaCO_3$)	x	
ammonia (NH3)	x	
total Kjeldahl nitrogen	x*	
nitrate	x	
nitrite	x	
nitrogen, total	x	
oil & grease, mineral	x*	
oil & grease, total	x*	
organic carbon, total	x*	
pH	x	
phosphate, dissolved	x*	
phosphate, total	x*	
salinity	x	
sulphate	x	
sulphide	x	
suspended solids, total	x	
temperature	x	
CTD parameters	x	
METALS TOTAL		
aluminum	x	
antimony	x	
arsenic	x	
barium	x	
beryllium	x	
bismuth	x	
cadmium	x	
calcium	x	
chromium	x	
chromium VI	x	
cobalt	x	
copper	x	
iron	x	
lead	x	
lithium	x	
magnesium	x	
manganese	x	
mercury	x	
molybdenum	x	
nickel	x	
phosphorus	x	
potassium	x	
selenium	x	
silver	x	
sodium	x	

Appendix C1, cont'd

Parameter	Edge of IDZ (3 depths top, middle, bottom)*	Surface Water (1 m depth)
strontium	x	
thallium	x	
tin	x	
titanium	x	
vanadium	x	
zinc	x	

Notes: IDZ – initial dilution zone, *Top=5 m depth, middle=in predicted plume, bottom=5 m off bottom, x* sampled once in each 5 in 30 sample quarter.

Appendix C2 Surface Water Stations

McLoughlin Point	Latitude 48º	Longitude 123º
McL-01	24.299	24.409
McL-14	24.515	24.411
McL-16	24.300	24.085
McL-18	24.083	24.407
McL-20	24.298	24.733
McL-22	24.731	24.412
McL-24	24.606	23.953
McL-26	24.302	23.760
McL-28	23.996	23.948
McL-30	23.867	24.405
McL-32	23.992	24.865
McL-34	24.297	25.057
McL-36	24.603	24.870
Sample D1	Variable location depending on wind and current	
+ four dynamic edge of IDZ stations (3 depths)		
Macaulay Point	**Latitude 48°**	**Longitude 123°**
Mac-01	24.186	24.616
Mac-14	24.402	24.616
Mac-16	24.186	24.290
Mac-18	23.970	24.616
Mac-20	24.186	24.941
Mac-22	24.617	24.616
Mac-24	24.491	24.155
Mac-26	24.186	23.965
Mac-28	23.880	24.155
Mac-30	23.754	24.616
Mac-32	23.880	25.076
Mac-34	24.186	25.266
Mac-36	24.491	25.076
+ four dynamic edge of IDZ stations (3 depths)		
Clover Point	**Latitude 48°**	**Longitude 123°**
Clo-01	23.701	20.764
Clo-14	23.916	20.764
Clo-16	23.701	20.438
Clo-18	23.485	20.764
Clo-20	23.701	21.089
Clo-22	24.132	20.764
Clo-24	24.006	20.304
Clo-26	23.701	20.113
Clo-28	23.395	20.304
Clo-30	23.269	20.764
Clo-32	23.395	21.224
Clo-34	23.701	21.414
Clo-36	24.006	21.224
+ four dynamic edge of IDZ stations (3 depths)		
Reference		
Constance Bank	20.640	19.080
Parry Bay	21.258	30.647

Appendix C3 McLoughlin Point Surface Results 5 Sampling Events in 30 Days - Fecal Coliforms

Fecal Coliforms	Winter						Spring						Summer						Autumn					
	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean
McL-01	2	5	4	1	<1	2	<1	<1	17	85	<1	4	<1	2	<1	<1	3	1	<1	<1	<1	3	12	2
McL-14	7	15	2	7	<1	4	<1	<1	1	1	2	1	<1	<1	<1	<1	4	1	<1	<1	<1	2	2	1
McL-16	4	3	12	9	<1	4	<1	1	<1	4	<1	1	<1	3	2	<1	2	2	<1	<1	<1	1	23	2
McL-18	3	<1	5	11	<1	3	1	3	<1	9	<1	2	<1	1	<1	<1	<1	1	<1	2	<1	1	1	1
McL-20	5	7	1	6	<1	3	<1	1	1	81	<1	2	<1	4	<1	<1	3	2	<1	<1	<1	1	<1	1
McL-22	18	19	4	6	<1	6	3	6	2	1	2	2	2	2	<1	<1	4	2	<1	1	<1	1	16	2
McL-24	7	3	7	3	<1	3	<1	1	<1	1	3	1	<1	2	<1	<1	2	1	<1	1	<1	1	7	1
McL-26	1	2	2	1	<1	1	1	2	<1	1	<1	1	<1	1	3	<1	2	1	<1	<1	<1	1	12	2
McL-28	1	3	6	14	1	3	<1	1	<1	1	<1	1	<1	2	4	<1	5	2	<1	2	<1	<1	3	1
McL-30	2	1	3	8	<1	2	<1	3	<1	<1	<1	1	<1	<1	<1	<1	4	1	<1	<1	<1	<1	1	1
McL-32	<1	3	1	9	<1	2	<1	<1	<1	<1	<1	1	<1	<1	2	<1	1	1	<1	<1	<1	<1	2	1
McL-34	<1	8	6	12	1	4	1	4	<1	3	1	2	1	<1	<1	<1	<1	1	1	<1	<1	<1	2	1
McL-36	5	11	1	4	2	3	2	1	<1	4	<1	2	<1	2	<1	<1	2	1	1	<1	<1	5	5	2
McL-D1	---	1	1	9	<1	2	<1	1	<1	9	1	2	<1	---	1	<1	---	1	<1	<1	1	3	93	3
Ref-CB	<1	<1	1	<1	<1	1	<1	2	2	<1	<1	1	<1	---	1	<1	---	1	<1	<1	<1	5	<1	1
Ref-PB	2	25	5	<1	2	3	<1	<1	4	8	<1	2	<1	<1	2	<1	3	1	<1	<1	<1	1	1	1

Notes: Red shaded cells indicate exceedance to historical BC WQG Geomean of 200 CFU/100 mL, Geomean = Geometric Mean --- denotes sample not taken due to weather issues

Appendix C4 McLoughlin Point Surface Results 5 Sampling Events in 30 Days - Enterococci

Enterococci	Winter						Spring						Summer						Autumn					
	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean	1	2	3	4	5	Geomean
McL-01	1	1	<1	2	<1	1	<1	<1	2	20	<1	2	<1	<1	<1	<1	<1	1	<1	<1	<1	5	56	3
McL-14	3	3	<1	<1	<1	2	<1	<1	<1	1	<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	28	<1	2
McL-16	<1	1	4	<1	<1	1	<1	<1	<1	<1	1	1	<1	<1	<1	<1	1	1	<1	<1	<1	170	4	4
McL-18	1	1	1	4	<1	1	<1	<1	<1	3	<1	1	<1	<1	<1	<1	1	1	<1	1	<1	<1	<1	1
McL-20	2	7	1	5	<1	2	<1	2	<1	16	<1	2	<1	<1	<1	<1	<1	1	<1	<1	<1	1	<1	1
McL-22	4	9	14	4	<1	5	<1	1	<1	<1	1	1	<1	<1	1	<1	<1	1	<1	<1	<1	21	12	3
McL-24	5	1	6	2	<1	2	<1	2	<1	<1	1	1	<1	<1	<1	2	<1	1	<1	<1	<1	8	3	2
McL-26	4	1	1	<1	1	1	<1	<1	<1	<1	1	1	<1	<1	<1	<1	1	1	<1	<1	<1	2	1	1
McL-28	<1	<1	<1	9	<1	2	<1	1	<1	<1	<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	4	<1	1
McL-30	<1	<1	<1	3	<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	1	1	<1	<1	<1	15	<1	2
McL-32	<1	5	1	5	<1	2	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	1	<1	<1	<1	5	<1	1
McL-34	1	3	1	4	<1	2	<1	<1	<1	<1	<1	1	<1	1	<1	<1	<1	1	<1	<1	<1	2	<1	1
McL-36	3	5	1	<1	<1	2	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	1	1	<1	1	<1	3	13	2
McL-D1	---	5	<1	2	<1	2	<1	<1	<1	24	<1	2	<1	---	<1	<1	---	1	<1	<1	<1	11	37	3
Ref-CB	<1	<1	<1	<1	<1	1	<1	<1	<1	<1	<1	1	<1	---	<1	<1	---	1	<1	<1	<1	1	<1	1
Ref-PB	1	12	<1	<1	1	2	<1	<1	<1	1	<1	1	<1	<1	<1	<1	1	1	<1	<1	<1	<1	<1	1

Notes: Red shaded cells indicate exceedance to Health Canada's Geomean of 35 CFU/100 mL. Blue shaded cells indicate exceedance to Health Canada (2012) WQG of 70 CFU/100 mL, Geomean = Geometric Mean. --- not sampled due to weather issues

Appendix C5 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days - Fecal Coliforms

Fecal Coliforms	Historical BC WQG GeoMean 200 CFU/100 mL						
		Winter					**GeoMean**
Station 1	Top	4	12	1	8	1	4
	Middle	3	8	46	81	7	10
	Bottom	4	6	43	35	43	10
Station 2	Top	9	9	1	15	1	4
	Middle	3	10	3	55	21	4
	Bottom	1	6	18	81	120	5
Station 3	Top	4	5	4	5	2	4
	Middle	3	8	4	62	2	5
	Bottom	1	1	5	80	1	2
Station 4	Top	5	3	8	49	4	5
	Middle	1	7	3	64	6	3
	Bottom	3	4	<1	13	3	2
Ref-CB	Top	<1	<1	<1	<1	1	1
	Middle	<1	1	<1	3	1	1
	Bottom	2	1	<1	1	<1	1
Ref-PB	Top	5	18	2	<1	1	6
	Middle	2	26	1	1	<1	4
	Bottom	1	4	<1	<1	1	2
		Spring					**GeoMean**
Station 1	Top	7	3	13	100	<1	8
	Middle	4	13	380	17	7	19
	Bottom	64	49	410	10	16	46
Station 2	Top	6	4	5	82	66	15
	Middle	5	6	440	46	1	14
	Bottom	280	24	430	25	130	99
Station 3	Top	41	3	2	220	2	10
	Middle	10	10	12	40	15	15
	Bottom	94	130	97	40	74	81
Station 4	Top	62	420	27	64	83	82
	Middle	43	3	2	80	51	16
	Bottom	2	<1	2	10	1	2
Ref-CB	Top	<1	7	<1	1	<1	1
	Middle	<1	4	1	<1	1	1
	Bottom	1	2	<1	1	<1	1
Ref-PB	Top	<1	6	3	8	<1	3
	Middle	1	<1	3	5	<1	2
	Bottom	4	5	3	1	1	2
		Summer					**GeoMean**
Station 1	Top	1	1	71	<1	5	3
	Middle	2	<1	3	120	17	7
	Bottom	3	3	2	98	190	13
Station 2	Top	1	1	60	100	5	8
	Middle	1	23	240	140	14	26
	Bottom	6	5	2	150	110	16
Station 3	Top	<1	1	100	1	2	3
	Middle	<1	<1	240	3	7	6
	Bottom	3	1	30	25	15	8

Appendix C5, cont'd

Fecal Coliforms	Historical BC WQG GeoMean 200 CFU/100 mL						
Station 4	Top	1	1	23	3	12	4
	Middle	1	<1	220	6	13	7
	Bottom	1	<1	100	3	4	4
Ref-CB	Top	<1	---	3	1	---	1
	Middle	1	---	<1	1	---	1
	Bottom	<1	---	1	<1	---	1
Ref-PB	Top	<1	<1	1	<1	1	1
	Middle	<1	<1	<1	2	1	1
	Bottom	1	1	<1	2	5	2
Autumn							**GeoMean**
Station 1	Top	3	4	<1	<1	3	2
	Middle	2	1	3	89	4	5
	Bottom	<1	100	2	51	2	7
Station 2	Top	1	2	<1	2	1	1
	Middle	80	8	250	200	2	36
	Bottom	210	84	220	180	3	73
Station 3	Top	<1	2	<1	2	16	2
	Middle	10	80	180	76	3	32
	Bottom	98	8	180	81	2	30
Station 4	Top	170	18	47	9	2	19
	Middle	14	190	67	<1	26	22
	Bottom	<1	4	<1	<1	42	3
Ref-CB	Top	<1	<1	<1	<1	1	1
	Middle	<1	1	<1	<1	<1	1
	Bottom	<1	<1	<1	<1	<1	1
Ref-PB	Top	<1	4	<1	3	<1	2
	Middle	<1	1	<1	2	<1	1
	Bottom	1	1	<1	1	1	1

Notes:
Orange shaded cells indicate exceedance to BC WQG Geomean of 200 CFU/100 mL, Geomean = Geometric Mean, --- not sampled due to weather issues

Appendix C6 - McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days - Enterococci

Enterococci	Health Canada Geometric Mean 35 CFU/100 mL and Maximum 70 CFU/100mL						
	Winter						**GeoMean**
Station 1	Top	<1	3	<1	5	<1	2
	Middle	3	7	19	26	1	6
	Bottom	<1	4	21	12	27	8
Station 2	Top	<1	3	1	1	<1	1
	Middle	<1	6	2	29	7	5
	Bottom	1	<1	6	27	38	6
Station 3	Top	1	3	1	2	1	1
	Middle	1	3	<1	30	1	2
	Bottom	1	2	<1	27	<1	2
Station 4	Top	2	1	1	28	2	3
	Middle	3	4	1	42	<1	3
	Bottom	3	1	1	5	1	2
Ref-CB	Top	<1	<1	<1	<1	<1	1
	Middle	<1	<1	<1	<1	<1	1
	Bottom	<1	<1	1	<1	2	1
Ref-PB	Top	<1	7	<1	<1	<1	1
	Middle	<1	15	<1	<1	<1	2
	Bottom	<1	2	<1	1	<1	1
	Spring						**GeoMean**
Station 1	Top	1	<1	5	42	<1	3
	Middle	2	2	64	7	<1	4
	Bottom	20	10	56	4	14	14
Station 2	Top	<1	<1	1	20	32	4
	Middle	1	3	68	16	1	5
	Bottom	35	8	58	63	65	37
Station 3	Top	1	1	<1	8	1	2
	Middle	1	1	2	17	5	3
	Bottom	14	37	24	7	56	22
Station 4	Top	14	98	8	25	43	26
	Middle	10	5	<1	42	16	8
	Bottom	<1	<1	<1	4	<1	1
Ref-CB	Top	<1	<1	<1	<1	1	1
	Middle	<1	1	<1	<1	<1	1
	Bottom	<1	1	<1	<1	<1	1
Ref-PB	Top	<1	<1	<1	2	<1	1
	Middle	<1	<1	1	2	<1	1
	Bottom	<1	<1	1	<1	1	1
	Summer						**GeoMean**
Station 1	Top	<1	1	6	<1	1	1
	Middle	<1	<1	<1	38	5	3
	Bottom	1	<1	<1	26	69	4
Station 2	Top	<1	<1	7	19	<1	3
	Middle	<1	6	67	15	6	8
	Bottom	<1	1	<1	38	57	5
Station 3	Top	<1	<1	17	<1	1	2
	Middle	<1	<1	61	1	5	3
	Bottom	<1	1	3	2	3	2

Appendix C6, cont'd

Enterococci	Health Canada Geometric Mean 35 CFU/100 mL and Maximum 70 CFU/100mL						
Station 4	Top	<1	<1	6	1	5	2
	Middle	<1	<1	56	3	4	4
	Bottom	<1	<1	16	<1	1	2
Ref-CB	Top	<1	---	<1	<1	---	1
	Middle	<1	---	<1	<1	---	1
	Bottom	<1	---	<1	<1	---	1
Ref-PB	Top	1	<1	<1	<1	1	1
	Middle	<1	1	<1	<1	<1	1
	Bottom	<1	<1	<1	<1	1	1
Autumn							**GeoMean**
Station 1	Top	<1	<1	<1	1	1	1
	Middle	<1	<1	1	34	2	2
	Bottom	<1	8	1	14	<1	3
Station 2	Top	<1	<1	<1	<1	1	1
	Middle	9	1	81	71	<1	9
	Bottom	18	13	57	63	2	18
Station 3	Top	<1	1	<1	<1	1	1
	Middle	<1	5	45	31	<1	6
	Bottom	5	<1	45	29	1	6
Station 4	Top	16	1	7	4	1	3
	Middle	2	26	18	<1	16	7
	Bottom	<1	1	<1	<1	26	2
Ref-CB	Top	<1	<1	<1	<1	<1	1
	Middle	<1	<1	<1	<1	2	1
	Bottom	<1	<1	<1	<1	1	1
Ref-PB	Top	<1	1	<1	<1	2	1
	Middle	<1	<1	1	1	1	1
	Bottom	<1	1	<1	<1	1	1

Notes:
Orange Shaded cells indicate exceedance to Health Canada (2012) Geomean of 35 CFU/100 mL, Blue Shaded cells indicate exceedances to Health Canada (2012) single sample WQG of 70 CFU/100 mL, *Geomean = Geometric Mean, --- not sampled due to weather issues.

Appendix C7 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – NH3

NH3	BC Approved WQG = 20 mg/L N (average over 5 samples) or 148 mg/L N (max) for the protection of aquatic life						
Winter							**Average**
Station 1	Top	0.037	0.059	0.052	0.043	0.037	0.0456
	Middle	0.036	0.063	0.072	0.08	0.072	0.0646
	Bottom	0.023	0.043	0.052	0.044	0.12	0.0564
Station 2	Top	0.042	0.061	0.044	0.037	0.04	0.0448
	Middle	0.039	0.049	0.044	0.064	0.037	0.0466
	Bottom	0.034	0.062	0.048	0.092	0.12	0.0712
Station 3	Top	0.034	0.053	0.046	0.046	0.032	0.0422
	Middle	0.073	0.06	0.047	0.079	0.042	0.0602
	Bottom	0.041	0.051	0.041	0.083	0.039	0.051
Station 4	Top	0.036	0.048	0.046	0.067	0.03	0.0454
	Middle	0.029	0.045	0.037	0.197	0.036	0.0688
	Bottom	0.034	0.06	0.041	0.043	0.039	0.0434
Ref-CB	Top	0.027	0.131	0.053	0.047	0.033	0.0582
	Middle	0.019	0.056	0.045	0.042	0.018	0.036
	Bottom	0.023	0.027	0.057	0.044	0.014	0.033
Ref-PB	Top	0.033	0.058	0.04	0.047	0.042	0.044
	Middle	0.044	0.053	0.044	0.043	0.012	0.0392
	Bottom	0.039	0.062	0.025	0.03	0.011	0.0334
Spring							**Average**
Station 1	Top	0.042	0.052	0.048	0.057	0.042	0.0482
	Middle	0.045	0.054	0.12	0.032	0.041	0.0584
	Bottom	0.14	0.064	0.13	0.02	0.055	0.0818
Station 2	Top	0.045	0.054	0.045	0.042	0.042	0.0456
	Middle	0.043	0.065	0.14	0.023	0.061	0.0664
	Bottom	0.13	0.052	0.13	0.02	0.1	0.0864
Station 3	Top	0.031	0.049	0.054	0.17	0.041	0.069
	Middle	0.05	0.051	0.057	0.024	0.049	0.0462
	Bottom	0.06	0.072	0.05	0.019	0.094	0.059
Station 4	Top	0.055	0.11	0.048	0.029	0.065	0.0614
	Middle	0.031	0.05	0.047	0.047	0.049	0.0448
	Bottom	0.028	0.055	0.058	0.038	0.045	0.0448
Ref-CB	Top	0.041	0.051	0.055	0.013	0.092	0.0504
	Middle	0.041	0.062	0.052	0.015	0.036	0.0412
	Bottom	0.043	0.045	0.042	0.005	0.029	0.0328
Ref-PB	Top	0.041	0.056	0.086	0.011	0.038	0.0464
	Middle	0.042	0.129	0.038	0.02	0.04	0.0538
	Bottom	0.07	0.058	0.045	0.005	0.032	0.042
Summer							**Average**
Station 1	Top	0.063	0.063	0.005	0.051	0.034	0.0432
	Middle	0.019	0.055	0.046	0.12	0.033	0.0546
	Bottom	0.058	0.049	0.053	0.087	0.12	0.0734
Station 2	Top	0.062	0.045	0.06	0.058	0.047	0.0544
	Middle	0.061	0.041	0.11	0.071	0.04	0.0646
	Bottom	0.051	0.042	0.045	0.12	0.11	0.0736
Station 3	Top	0.064	0.053	0.066	0.05	0.038	0.0542
	Middle	0.043	0.054	0.12	0.043	0.037	0.0594
	Bottom	0.048	0.042	0.051	0.061	0.046	0.0496

Appendix C7, cont'd

NH3	BC Approved WQG = 20 mg/L N (average over 5 samples) or 148 mg/L N (max) for the protection of aquatic life						
Station 4	Top	0.055	0.041	0.043	0.044	0.042	0.045
	Middle	0.043	0.033	0.09	0.061	0.038	0.053
	Bottom	0.054	0.048	0.074	0.062	0.061	0.0598
Ref-CB	Top	0.105	---	0.105	0.107	---	0.1057
	Middle	0.044	---	0.058	0.036	---	0.046
	Bottom	0.039	---	0.053	0.043	---	0.045
Ref-PB	Top	0.074	0.118	0.056	0.081	0.086	0.083
	Middle	0.051	0.052	0.042	0.06	0.033	0.0476
	Bottom	0.038	0.042	0.047	0.042	0.022	0.0382
Autumn							**Average**
Station 1	Top	0.045	0.041	0.052	0.023	0.044	0.041
	Middle	0.044	0.03	0.059	0.034	0.026	0.0386
	Bottom	0.059	0.041	0.06	0.027	0.025	0.0424
Station 2	Top	0.044	0.036	0.059	0.021	0.033	0.0386
	Middle	0.064	0.056	0.14	0.095	0.04	0.079
	Bottom	0.097	0.089	0.12	0.066	0.041	0.0826
Station 3	Top	0.062	0.049	0.055	0.026	0.031	0.0446
	Middle	0.07	0.045	0.12	0.038	0.043	0.0632
	Bottom	0.088	0.028	0.089	0.042	0.031	0.0556
Station 4	Top	0.12	0.41	0.056	0.015	0.03	0.1262
	Middle	0.066	0.1	0.08	0.016	0.068	0.066
	Bottom	0.062	0.033	0.059	0.019	0.05	0.0446
Ref-CB	Top	0.139	0.036	0.115	0.02	0.076	0.0772
	Middle	0.038	0.023	0.047	0.02	0.055	0.0366
	Bottom	0.043	0.0064	0.027	0.005	0.049	0.02608
Ref-PB	Top	0.044	0.039	0.032	0.017	0.053	0.037
	Middle	0.034	0.034	0.033	0.014	0.047	0.0324
	Bottom	0.032	0.047	0.038	0.041	0.036	0.0388

Notes:
Shaded cells indicate exceedance to BC WQG, --- not sampled due to weather issues, Approved Guideline is based on Salinity = 30 g/kg, Temperature = 10ºC and pH = 7.0

Appendix C8 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – Silver

Silver	BC Approved WQG for protection of marine aquatic life = 0.003 mg/L (geometric mean over 5 samples) or 0.0015 mg/L (max)						
Winter							**Geomean**
Station 1	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 2	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 3	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 4	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Ref-CB	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Ref-PB	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Spring							**Geomean**
Station 1	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 2	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 3	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 4	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Ref-CB	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Ref-PB	Top	<0.0001	<0.0001	<0.0001	---	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	---	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	---	<0.0001	<0.0001
Summer							**Geomean**
Station 1	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 2	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 3	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Appendix C8, cont'd

Silver	BC Approved WQG = 0.003 mg/L (geometric mean over 5 samples) or 0.00015 mg/L (max) for the protection of aquatic life						
Station 4	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Ref-CB	Top	<0.0001	---	<0.0001	<0.0001	<0.0001	---
	Middle	<0.0001	---	<0.0001	<0.0001	<0.0001	---
	Bottom	<0.0001	---	<0.0001	<0.0001	<0.0001	---
Ref-PB	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Autumn						**Geomean**
Station 1	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 2	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 3	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Station 4	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Ref-CB	Top	<0.0001	<0.0001	<0.0001	0.000052	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	0.000022	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Ref-PB	Top	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Middle	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
	Bottom	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Notes:
Shaded cells indicate exceedance to BC WQG, --- not sampled due to weather issues, Geomean = Geometric Mean, Detection limit was used in calculations of average values.

Appendix C9 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – Arsenic

Arsenic	BC Approved WQG = 0.0125 mg/L (max) for the protection of aquatic life					
Winter						
Station 1	Top	0.00156	0.00166	0.00167	0.00164	0.00158
	Middle	0.00151	0.00163	0.00162	0.00172	0.00166
	Bottom	0.00171	0.00164	0.00163	0.0017	0.0017
Station 2	Top	0.00162	0.00156	0.00163	0.00158	0.00157
	Middle	0.00161	0.00157	0.00167	0.00162	0.00167
	Bottom	0.00163	0.00167	0.0016	0.00169	0.00165
Station 3	Top	0.0017	0.00161	0.0016	0.00157	0.00156
	Middle	0.00162	0.00154	0.00166	0.00161	0.00159
	Bottom	0.00171	0.00166	0.00161	0.00172	0.0017
Station 4	Top	0.0016	0.00168	0.00168	0.00158	0.00171
	Middle	0.00156	0.00158	0.0016	0.00168	0.00158
	Bottom	0.00161	0.0016	0.00166	0.00162	0.00165
Ref-CB	Top	0.00164	0.00162	0.00163	0.00163	0.00155
	Middle	0.00171	0.00158	0.00167	0.00166	0.0017
	Bottom	0.00162	0.00157	0.00161	0.00167	0.00166
Ref-PB	Top	0.00158	0.00158	0.00158	0.00167	0.0016
	Middle	0.00161	0.00165	0.00158	0.00169	0.00177
	Bottom	0.00161	0.00164	0.00161	0.00185	0.00183
Spring						
Station 1	Top	0.00174	0.00156	0.00166	0.00172	0.00183
	Middle	0.00152	0.00159	0.00149	0.00167	0.00166
	Bottom	0.00163	0.00179	0.00175	0.00191	0.00187
Station 2	Top	0.00174	0.00181	0.00169	0.00191	0.00164
	Middle	0.00156	0.00166	0.00187	0.00169	0.00175
	Bottom	0.00168	0.0017	0.00187	0.00176	0.00171
Station 3	Top	0.00172	0.00147	0.00169	0.00162	0.00155
	Middle	0.00167	0.00182	0.00185	0.00163	0.00154
	Bottom	0.00156	0.00161	0.00189	0.00182	0.0019
Station 4	Top	0.00229	0.0016	0.00164	0.00173	0.00165
	Middle	0.00179	0.00172	0.00159	0.00162	0.00182
	Bottom	0.00163	0.00177	0.00153	0.0018	0.00137
Ref-CB	Top	0.00365	0.0016	0.00155	0.00188	0.00168
	Middle	0.00168	0.0032	0.00183	0.00177	0.0017
	Bottom	0.00153	0.00195	0.00349	0.00172	0.00185
Ref-PB	Top	0.00172	0.00176	0.00195	0.00334	0.00176
	Middle	0.00155	0.00197	0.00162	0.0018	0.00326
	Bottom	0.00163	0.00152	0.00174	0.00184	0.00181
Summer						
Station 1	Top	0.002	0.00347	0.00201	0.00529	0.00253
	Middle	0.00203	0.00375	0.0023	0.00273	0.00242
	Bottom	0.0019	0.0037	0.00231	0.00254	0.00279
Station 2	Top	0.00197	0.00361	0.00189	0.0032	0.0024
	Middle	0.00202	0.0036	0.00276	0.00297	0.00225
	Bottom	0.00206	0.00417	0.00244	0.00327	0.00257
Station 3	Top	0.00214	0.00353	0.00274	0.00305	0.0029
	Middle	0.00208	0.00367	0.00283	0.00283	0.00239
	Bottom	0.00224	0.00401	0.0025	0.00283	0.00293

Appendix C9, cont'd

Arsenic	BC Approved WQG* 0.0125 mg/L (max) for the protection of aquatic life					
Summer						
Station 4	Top	0.00233	0.00397	0.0031	0.0031	0.00305
	Middle	0.00227	0.004	0.00285	0.00294	0.00284
	Bottom	0.00232	0.00364	0.00249	0.00281	0.00268
Ref-CB	Top	0.00323	---	0.00557	0.00227	---
	Middle	0.0018	---	0.00239	0.0022	---
	Bottom	0.0017	---	0.00253	0.00244	---
Ref-PB	Top	0.00176	0.00338	0.00211	0.00248	0.0046
	Middle	0.00186	0.00335	0.00237	0.00265	0.00228
	Bottom	0.00184	0.0034	0.0036	0.00247	0.00253
Autumn						
Station 1	Top	0.00188	0.00212	0.00214	0.00233	0.00206
	Middle	0.00182	0.00194	0.00222	0.00243	0.00196
	Bottom	0.00207	0.00235	0.00205	0.00289	0.00199
Station 2	Top	0.00185	0.00203	0.00215	0.00225	0.00176
	Middle	0.00227	0.00199	0.00219	0.00222	0.00161
	Bottom	0.00246	0.00206	0.00226	0.00242	0.00175
Station 3	Top	0.00214	0.00199	0.00234	0.00248	0.0018
	Middle	0.00171	0.00208	0.00223	0.00227	0.0018
	Bottom	0.00185	0.00171	0.0021	0.00275	0.00183
Station 4	Top	0.00192	0.00188	0.00219	0.00211	0.00181
	Middle	0.00181	0.00194	0.00228	0.00239	0.00183
	Bottom	0.00215	0.00189	0.00231	0.00239	0.00166
Ref-CB	Top	0.00426	0.00396	0.00198	0.00435	0.00351
	Middle	0.00177	0.00224	0.00397	0.00229	0.00176
	Bottom	0.00199	0.00233	0.00219	0.00251	0.00172
Ref-PB	Top	0.00195	0.00207	0.0021	0.00212	0.00169
	Middle	0.00225	0.0016	0.0022	0.00244	0.00174
	Bottom	0.00196	0.00183	0.0021	0.00226	0.00175

Notes:
Shaded cells indicate exceedance to BC WQG, --- not sampled due to weather issues, *Guideline is interim.

Appendix C10 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – Boron

Boron	BC Approved WQG = 1.2 mg/L (max) for the protection of aquatic life					
Winter						
Station 1	Top	4.12	4.66	4.39	4.38	4.42
	Middle	4.09	4.54	4.4	4.6	4.63
	Bottom	4.17	4.65	4.37	4.64	4.13
Station 2	Top	4.22	4.65	4.31	4.37	4.17
	Middle	4.18	4.51	4.42	4.43	4.4
	Bottom	4.23	4.68	4.31	4.67	4.47
Station 3	Top	4.22	4.44	4.39	4.41	4.27
	Middle	4.31	4.54	4.37	4.36	4.32
	Bottom	4.27	4.49	4.4	4.49	4.5
Station 4	Top	4.37	4.74	4.45	4.41	4.46
	Middle	4.27	4.66	4.45	4.61	4.14
	Bottom	4.35	4.79	4.41	4.4	4.27
Ref-CB	Top	4.07	4.28	4.2	4.84	4.51
	Middle	4.52	4.25	4.36	4.65	4.78
	Bottom	4.4	4.39	4.38	4.92	4.6
Ref-PB	Top	4.07	4.32	4.27	4.87	4.62
	Middle	4.12	4.54	4.44	4.98	4.89
	Bottom	4.31	4.69	4.44	5.18	4.82
Spring						
Station 1	Top	4.24	4.15	4.54	4.19	4.06
	Middle	4.11	4.28	4.23	4.2	4.01
	Bottom	4.3	4.19	4.07	4.19	3.95
Station 2	Top	4.23	4.17	4.11	4.17	4.04
	Middle	4.22	4.1	4.21	4	3.91
	Bottom	4.28	3.96	4.09	4.11	4.08
Station 3	Top	4.19	4.15	4.01	4.17	4.12
	Middle	4.42	4.22	4.16	4.17	4.08
	Bottom	4.36	4.21	4.22	4.2	4.04
Station 4	Top	4.36	4.16	4.13	4.17	4.16
	Middle	4.28	4.11	4.15	4.11	4.16
	Bottom	4.16	4.02	4.18	4.09	4.02
Ref-CB	Top	8.23	4.18	4.19	4.36	3.97
	Middle	4.17	8.14	4.25	4.13	4.07
	Bottom	4.38	4.35	8.14	4.25	4.08
Ref-PB	Top	4.25	4.39	4.17	8.22	4.07
	Middle	4.3	4.29	4.33	4.08	8.15
	Bottom	4.19	4.37	4.26	4.28	4.02
Summer						
Station 1	Top	4.16	4.02	4	8.57	4.26
	Middle	4.15	4.32	4.04	4.43	4.51
	Bottom	4.29	4.19	4.08	4.77	4.25
Station 2	Top	4.32	4.13	4.22	4.29	3.98
	Middle	4.31	4.15	4.3	4.59	4.21
	Bottom	4.34	4.57	4.2	4.63	4.7
Station 3	Top	4.15	4.16	4.15	4.53	4.88
	Middle	4.26	4.33	4.64	4.52	4.34
	Bottom	4.56	4.55	4.12	4.51	5.29

Appendix C10, cont'd

Boron	BC Approved WQG = 1.2 mg/L (max) for the protection of aquatic life					
Station 4	Top	4.45	4.3	4.39	4.92	4.47
	Middle	4.44	4.45	4.48	4.93	5.14
	Bottom	4.31	4.11	3.96	4.65	4.57
Ref-CB	Top	7.59	---	8.52	4.01	---
	Middle	3.91	---	4.06	4.51	---
	Bottom	4.04	---	4.17	4.53	---
Ref-PB	Top	3.98	8.63	4.04	4.28	7.88
	Middle	3.89	3.98	4.49	4.41	4.33
	Bottom	4.22	4.07	7.82	4.32	4.15
Autumn						
Station 1	Top	4.47	4.51	4.49	4.76	4.58
	Middle	4.54	4.8	4.43	4.74	4.23
	Bottom	4.59	5.32	4.53	5.7	4.6
Station 2	Top	4.42	4.74	4.56	4.73	4.47
	Middle	4.53	5.2	4.71	4.78	4.15
	Bottom	4.55	4.6	4.82	5.15	4.49
Station 3	Top	4.62	4.68	4.84	4.71	4.32
	Middle	4.65	5.19	4.57	4.66	4.56
	Bottom	4.57	4.68	4.65	5.4	4.57
Station 4	Top	4.8	4.7	4.38	4.84	4.72
	Middle	4.67	4.57	5.13	4.56	4.64
	Bottom	4.76	4.49	4.67	4.44	4.5
Ref-CB	Top	7.82	8.35	5.34	9.58	8.32
	Middle	4.76	5.26	7.83	4.65	4.19
	Bottom	4.73	4.7	4.51	4.96	4.44
Ref-PB	Top	4.47	4.6	4.62	4.35	4.26
	Middle	4.71	4.59	4.45	4.94	4.37
	Bottom	4.65	4.55	4.61	4.84	4.26

Notes:
Shaded cells indicate exceedance to BC WQG for protection of marine aquatic life, --- not sampled due to weather issues. Note that the BC WQG is above background levels for boron in this area which are around 4.0 mg/L.

Appendix C11 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – Cadmium

Cadmium	BC Working WQG = 0.00012 mg/L (max) For the protection of shellfish consumers.					
Winter						
Station 1	Top	0.000077	0.000076	0.000071	0.000084	0.000083
	Middle	0.00007	0.000076	0.000083	0.000077	0.000084
	Bottom	0.00007	0.000069	0.000078	0.000082	0.000082
Station 2	Top	0.00008	0.000074	0.000066	0.000081	0.000079
	Middle	0.000077	0.000082	0.000075	0.000075	0.000073
	Bottom	0.000079	0.000074	0.000084	0.00008	0.00007
Station 3	Top	0.000077	0.000063	0.000088	0.000075	0.000078
	Middle	0.000082	0.000069	0.000074	0.000072	0.000074
	Bottom	0.000074	0.000061	0.000083	0.000076	0.000075
Station 4	Top	0.000073	0.000082	0.000075	0.000081	0.000078
	Middle	0.000088	0.00008	0.000083	0.000081	0.000072
	Bottom	0.000085	0.000065	0.000084	0.000073	0.000073
Ref-CB	Top	0.000077	0.000066	0.000079	0.000074	0.000067
	Middle	0.000088	0.000062	0.000079	0.00007	0.000078
	Bottom	0.000102	0.000077	0.000072	0.000079	0.000076
Ref-PB	Top	0.000077	0.000078	0.000071	0.00007	0.000075
	Middle	0.000073	0.00007	0.000074	0.000076	0.000082
	Bottom	0.00007	0.000067	0.000079	0.000083	0.000074
Spring						
Station 1	Top	0.000042	0.000033	0.00003	0.000037	0.000027
	Middle	0.000032	0.000049	0.000043	0.000047	0.000012
	Bottom	0.000081	0.000038	0.000054	0.000016	0.000051
Station 2	Top	0.000048	0.000042	0.00001	0.000052	0.000028
	Middle	0.000127	0.000114	0.00001	0.00004	0.000045
	Bottom	0.00007	0.000034	0.000072	0.000063	0.000042
Station 3	Top	0.000067	0.000044	0.000047	0.000082	0.000056
	Middle	0.000106	0.000058	0.00001	0.000058	0.00006
	Bottom	0.000051	0.000024	0.000109	0.000068	0.000415
Station 4	Top	0.000445	0.00009	0.000025	0.000033	0.000051
	Middle	0.000091	0.000064	0.000051	0.000029	0.000085
	Bottom	0.000071	0.000027	0.000046	0.000038	0.000054
Ref-CB	Top	0.00011	0.000035	0.000051	0.000049	0.000014
	Middle	0.000071	0.000131	0.000023	0.00001	0.000097
	Bottom	0.000068	0.000083	0.000146	0.000058	0.00001
Ref-PB	Top	0.000024	0.000054	0.000104	0.000055	0.000042
	Middle	0.000069	0.000058	0.000105	0.000082	0.000126
	Bottom	0.00006	0.000047	0.000153	0.000026	0.000043
Summer						
Station 1	Top	0.000031	0.000062	0.000057	0.00017	0.000079
	Middle	0.00003	0.000067	0.000047	0.000017	0.000096
	Bottom	0.000022	0.000035	0.000059	0.00001	0.000086
Station 2	Top	0.000065	0.000076	0.000058	0.000025	0.000071
	Middle	0.000016	0.000052	0.000084	0.00001	0.000105
	Bottom	0.000054	0.00008	0.000058	0.00001	0.000078
Station 3	Top	0.000046	0.000085	0.000063	0.00001	0.000134
	Middle	0.000036	0.000111	0.000066	0.00001	0.000098
	Bottom	0.000031	0.000062	0.000037	0.00001	0.000107

Appendix C11, cont'd

Cadmium	BC Working WQG = 0.00012 mg/L (max) to protect of consumers of shellfish					
Station 4	Top	0.000047	0.000071	0.000083	0.00001	0.000083
	Middle	0.00001	0.000085	0.000078	0.00001	0.000145
	Bottom	0.00002	0.000081	0.00005	0.00001	0.00008
Ref-CB	Top	0.000072	---	0.000114	0.000031	---
	Middle	0.000061	---	0.000073	0.00001	---
	Bottom	0.000041	---	0.000077	0.000037	---
Ref-PB	Top	0.000036	0.000276	0.000058	0.00001	0.000172
	Middle	0.000014	0.000072	0.000067	0.00001	0.00008
	Bottom	0.000044	0.000053	0.000112	0.00001	0.000127
Autumn						
Station 1	Top	0.000144	0.000071	0.000108	0.000113	0.00001
	Middle	0.00007	0.000046	0.00011	0.000116	0.00001
	Bottom	0.000097	0.000122	0.000112	0.00013	0.00001
Station 2	Top	0.000099	0.000138	0.00011	0.000102	0.00001
	Middle	0.000195	0.000078	0.000155	0.000098	0.00001
	Bottom	0.000462	0.000029	0.000111	0.000121	0.00001
Station 3	Top	0.000053	0.00006	0.000154	0.00028	0.00001
	Middle	0.000097	0.000043	0.000095	0.00009	0.00001
	Bottom	0.000131	0.000086	0.000116	0.000136	0.00001
Station 4	Top	0.00021	0.0001	0.000092	0.000146	0.000018
	Middle	0.000148	0.000038	0.000107	0.000114	0.00001
	Bottom	0.000046	0.000062	0.000349	0.00013	0.00001
Ref-CB	Top	0.000133	0.000194	0.000022	0.00002	0.00002
	Middle	0.000265	0.00008	0.000147	0.00007	0.00001
	Bottom	0.000126	0.00005	0.000069	0.000109	0.00001
Ref-PB	Top	0.000181	0.0002	0.000114	0.000063	0.00001
	Middle	0.00023	0.000075	0.000072	0.000129	0.00001
	Bottom	0.000194	0.000106	0.000135	0.000086	0.00001

Notes: Shaded cells indicate exceedance to BC WQG, --- not sampled due to weather issues

Appendix C12 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – Copper

Copper	BC Approved WQG = 0.002 mg/L (average over 5 samples) or 0.003 mg/L (max)						
			Winter				Average
Station 1	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	0.00058	0.000516
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
Station 2	Top	<0.0005	<0.0009	<0.0005	<0.0005	<0.0005	0.00058
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
Station 3	Top	<0.0005	<0.0005	<0.0005	0.00054	<0.0005	0.000508
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001218
Station 4	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
	Middle	0.0011	0.00065	<0.0005	<0.0005	<0.0005	0.00065
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
Ref-CB	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
Ref-PB	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	0.00058	0.000516
			Spring				Average
Station 1	Top	0.00083	<0.0005	<0.0005	<0.0005	<0.0005	0.000566
	Middle	0.00149	<0.0005	<0.0005	<0.0005	<0.0005	0.000698
	Bottom	0.00086	<0.0005	<0.0005	10.0005	<0.0005	0.000572
Station 2	Top	0.00069	<0.0005	<0.0005	0.0007	<0.0005	0.000578
	Middle	0.00088	<0.0005	<0.0005	<0.0005	<0.0005	0.000576
	Bottom	0.00103	0.00072	<0.0005	<0.0005	<0.0005	0.00065
Station 3	Top	0.00111	<0.0005	0.00067	<0.0005	<0.0005	0.000656
	Middle	0.00092	<0.0005	<0.0005	<0.0005	0.00232	0.000948
	Bottom	0.00211	0.00086	<0.0005	<0.0005	<0.0005	0.000894
Station 4	Top	0.00065	<0.0005	<0.0005	<0.0005	<0.0006	0.00055
	Middle	0.00084	<0.0005	<0.0005	<0.0005	<0.0005	0.000568
	Bottom	0.00178	0.00113	<0.0005	<0.0005	<0.0005	0.000882
Ref-CB	Top	0.00231	0.00103	<0.0005	<0.0005	<0.0005	0.000968
	Middle	0.00083	<0.0005	<0.001	<0.0005	<0.0005	0.000666
	Bottom	0.00152	<0.0005	<0.0005	0.00115	0.00095	0.000924
Ref-PB	Top	0.00126	<0.0005	<0.0005	<0.0005	<0.0005	0.000652
	Middle	0.00083	<0.0005	<0.0005	<0.0005	<0.0005	0.000566
	Bottom	0.00149	<0.0005	<0.0005	<0.0005	<0.0005	0.000698
			Summer				Average
Station 1	Top	0.00072	<0.0005	<0.0005	<0.0005	0.00072	<0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Station 2	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	0.00113	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	0.00071	<0.0005	<0.0005	<0.0005	<0.0005
Station 3	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	0.00067	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005

Appendix C12, cont'd

Copper	BC Approved WQG = 0.002 mg/L (average over 5 samples) or 0.003 mg/L (max)						
Station 4	Top	0.00054	<0.0005	0.00057	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	---	<0.0005	<0.0005	---	<0.0005
Ref-CB	Top	<0.0005	---	<0.0005	<0.0005	---	<0.0005
	Middle	<0.0005	---	<0.0005	<0.0005	---	<0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ref-PB	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	<0.0005	0.00127	<0.0005	<0.0005	<0.0005
Autumn							**Average**
Station 1	<0.0005	0.00095	0.00082	<0.0005	0.00077	0.000708	<0.0005
	<0.0005	<0.0005	0.00154	<0.0005	0.00055	0.000718	<0.0005
	<0.0005	<0.0005	0.0008	0.0005	10.0005	0.00056	<0.0005
Station 2	<0.0005	<0.0005	0.00541	0.00233	0.00058	0.001864	<0.0005
	0.00272	<0.0005	0.0147	0.00064	0.00072	0.003856	0.00272
	<0.0005	<0.0005	0.174	0.00066	<0.0005	0.035232	<0.0005
Station 3	<0.0005	<0.0005	0.00075	<0.0005	0.0023	0.00091	<0.0005
	<0.0106	<0.0005	0.0105	0.00055	<0.0005	0.00453	<0.0106
	<0.0005	<0.0005	0.00121	<0.0005	0.00128	0.000798	<0.0005
Station 4	<0.0005	<0.0005	0.00068	<0.0005	0.00138	0.000712	<0.0005
	<0.0005	<0.0005	0.156	<0.0005	0.00085	0.03167	<0.0005
	0.001	0.00108	0.0005	0.00138	0.00249	0.00129	0.001
Ref-CB	0.0005	<0.0005	0.00319	0.00053	0.00064	0.001072	0.0005
	0.0005	<0.0005	0.00082	<0.0011	<0.0005	0.000684	0.0005
	<0.0005	<0.0005	0.00069	0.00054	0.00144	0.000734	<0.0005
Ref-PB	<0.0005	0.00133	0.00091	0.00546	0.00098	0.001836	<0.0005
	<0.0005	0.00095	0.00082	<0.0005	0.00077	0.000708	<0.0005
	<0.0005	<0.0005	0.00154	<0.0005	0.00055	0.000718	<0.0005

Notes:
Shaded cells indicate exceedance to BC WQG, --- not sampled due to weather issues, Detection limit was used in calculations of average values.

Appendix C13 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – Lead

Lead	BC Approved WQG = 0.002 mg/L (average of 5 samples) or 0.140 mg/L (max)						
Winter							**Average**
Station 1	Top	0.00005	0.00005	0.000079	0.00005	0.00005	0.0000558
	Middle	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
	Bottom	0.000074	0.00005	0.000072	0.000052	0.000097	0.000069
Station 2	Top	0.00005	0.00005	0.000104	0.00005	0.00005	0.0000608
	Middle	0.00005	0.00005	0.000101	0.00005	0.00005	0.0000602
	Bottom	0.000059	0.00005	0.000072	0.000067	0.000139	0.0000774
Station 3	Top	0.00005	0.00005	0.000056	0.00005	0.00005	0.0000512
	Middle	0.00005	0.00005	0.000069	0.00006	0.00005	0.0000558
	Bottom	0.00005	0.00005	0.000064	0.000076	0.00005	0.000058
Station 4	Top	0.00005	0.00005	0.00005	0.00005	0.000072	0.0000544
	Middle	0.000066	0.00005	0.00005	0.00005	0.00005	0.0000532
	Bottom	0.000098	0.000052	0.00005	0.00005	0.00005	0.00006
Ref-CB	Top	0.00007	0.000063	0.000256	0.00005	0.000082	0.0001042
	Middle	0.000055	0.00005	0.00005	0.00005	0.00005	0.000051
	Bottom	0.000115	0.00005	0.00005	0.00005	0.000068	0.0000666
Ref-PB	Top	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
	Middle	0.00005	0.00005	0.00005	0.00005	0.00009	0.000058
	Bottom	0.000065	0.00005	0.00005	0.00005	0.000077	0.0000584
Spring							**Average**
Station 1	Top	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
	Middle	0.000138	0.00005	0.00005	0.00005	0.00005	0.0000676
	Bottom	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Station 2	Top	0.000133	0.00005	0.00005	0.00005	0.00005	0.0000666
	Middle	0.00005	0.00005	0.00005	0.000057	0.00005	0.0000514
	Bottom	0.000057	0.00005	0.000053	0.00005	0.00005	0.000052
Station 3	Top	0.000131	0.00005	0.00011	0.00005	0.00005	0.0000782
	Middle	0.000083	0.00005	0.00005	0.00005	0.00005	0.0000566
	Bottom	0.00005	0.00005	0.000051	0.000058	0.0011	0.0002618
Station 4	Top	0.000176	0.000114	0.000056	0.00005	0.00005	0.0000892
	Middle	0.00005	0.000119	0.00005	0.00005	0.00005	0.0000638
	Bottom	0.000086	0.00005	0.000198	0.00005	0.00005	0.0000868
Ref-CB	Top	0.000388	0.000138	0.00005	0.00005	0.00005	0.0001352
	Middle	0.00005	0.00005	0.000057	0.00005	0.00005	0.0000514
	Bottom	0.000059	0.00005	0.000056	0.00005	0.00005	0.000053
Ref-PB	Top	0.000095	0.000064	0.000072	0.000178	0.00005	0.0000918
	Middle	0.00005	0.00005	0.00005	0.000052	0.0001	0.0000604
	Bottom	0.00009	0.00005	0.000126	0.000068	0.00005	0.0000768
Summer							**Average**
Station 1	Top	0.000105	0.00005	0.00005	0.0001	0.000083	0.0000776
	Middle	0.00005	0.000074	0.000131	0.00005	0.000087	0.0000784
	Bottom	0.00005	0.00005	0.00005	0.00005	0.000103	0.0000606
Station 2	Top	0.000074	0.000066	0.000083	0.00005	0.000069	0.0000684
	Middle	0.00005	0.000074	0.00005	0.00005	0.00005	0.0000548
	Bottom	0.000332	0.000066	0.00005	0.00005	0.000077	0.000115
Station 3	Top	0.00005	0.00005	0.000086	0.00005	0.000086	0.0000644
	Middle	0.00005	0.000057	0.00005	0.00005	0.00005	0.0000514
	Bottom	0.00005	0.0001	0.00005	0.00005	0.000101	0.0000702

Appendix C13, cont'd

Lead	BC Approved WQG = 0.002 mg/L (average of 5 samples) or 0.140 mg/L (max)						
Station 4	Top	0.000261	---	0.000108	0.000072	---	0.000147
	Middle	0.000167	---	0.00005	0.00026	---	0.000159
	Bottom	0.000147	---	0.000094	0.00005	---	0.000097
Ref-CB	Top	0.00005	0.000132	0.00005	0.00005	0.00005	0.0000664
	Middle	0.00005	0.00006	0.00005	0.00005	0.000051	0.0000522
	Bottom	0.00005	0.00005	0.00005	0.00005	0.000107	0.0000614
Ref-PB	Top	0.000189	0.0001	0.00005	0.00005	0.000148	0.0001074
	Middle	0.000063	0.000072	0.00005	0.00005	0.00009	0.000065
	Bottom	0.000092	0.000092	0.0001	0.00005	0.000153	0.0000974
Autumn							**Average**
Station 1	Top	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
	Middle	0.00005	0.00007	0.000099	0.000326	0.00005	0.000119
	Bottom	0.00005	0.000218	0.00005	0.000056	0.00005	0.0000848
Station 2	Top	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
	Middle	0.0002	0.00007	0.000051	0.00006	0.00005	0.0000862
	Bottom	0.000333	0.00005	0.00005	0.00015	0.00005	0.0001266
Station 3	Top	0.00011	0.00005	0.000237	0.00013	0.00005	0.0001154
	Middle	0.00005	0.00005	0.000053	0.00012	0.00005	0.0000646
	Bottom	0.00005	0.000152	0.000058	0.000099	0.00005	0.0000818
Station 4	Top	0.000179	0.000135	0.00005	0.0001	0.000493	0.0001914
	Middle	0.000076	0.000084	0.000335	0.00008	0.00005	0.000125
	Bottom	0.000073	0.00005	0.000078	0.00005	0.000071	0.0000644
Ref-CB	Top	0.000118	0.00005	0.000055	0.000053	0.000091	0.0000734
	Middle	0.00026	0.00005	0.000092	0.000105	0.00005	0.0001114
	Bottom	0.00005	0.00005	0.001	0.00005	0.00005	0.00024
Ref-PB	Top	0.000174	0.000217	0.00005	0.00005	0.00005	0.0001082
	Middle	0.000084	0.000076	0.00005	0.00005	0.00005	0.000062
	Bottom	0.000093	0.000121	0.000103	0.000101	0.00213	0.0005096

Notes:
Shaded cells indicate exceedance to BC WQG, --- not sampled due to weather issues, Detection limit was used in calculations of average values.

Appendix C14 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – Manganese

Manganese	BC Approved WQG = 0.1 mg/L (max)					
Winter						
Station 1	Top	0.00296	0.00247	0.00239	0.00205	0.00221
	Middle	0.00272	0.00248	0.00286	0.00232	0.00256
	Bottom	0.0043	0.00304	0.00365	0.00291	0.00402
Station 2	Top	0.00304	0.00242	0.00248	0.00218	0.00225
	Middle	0.00318	0.00236	0.00468	0.00241	0.00236
	Bottom	0.00388	0.00275	0.00348	0.00373	0.00474
Station 3	Top	0.00307	0.00227	0.00265	0.00212	0.00223
	Middle	0.00302	0.00231	0.00303	0.00244	0.00252
	Bottom	0.00317	0.00283	0.00281	0.00455	0.00217
Station 4	Top	0.00341	0.00346	0.00288	0.0024	0.00403
	Middle	0.00295	0.00244	0.00282	0.00243	0.0027
	Bottom	0.00318	0.00249	0.00251	0.00213	0.00239
Ref-CB	Top	0.00258	0.00247	0.00271	0.0021	0.00216
	Middle	0.00328	0.00244	0.00255	0.00215	0.00205
	Bottom	0.00337	0.00323	0.00252	0.00224	0.00206
Ref-PB	Top	0.00371	0.00233	0.00261	0.00218	0.00227
	Middle	0.00308	0.00237	0.00244	0.00233	0.00379
	Bottom	0.00413	0.00377	0.00276	0.00191	0.00325
Spring						
Station 1	Top	0.00176	0.00131	0.00107	0.00376	0.00103
	Middle	0.00206	0.00204	0.00197	0.0015	0.00127
	Bottom	0.0022	0.00127	0.00197	0.00154	0.00119
Station 2	Top	0.0021	0.00141	0.00117	0.00116	0.00131
	Middle	0.00358	0.00123	0.0013	0.00136	0.00087
	Bottom	0.00162	0.0014	0.00161	0.00165	0.001
Station 3	Top	0.0025	0.00166	0.00171	0.00155	0.00139
	Middle	0.00166	0.00133	0.0013	0.00127	0.00112
	Bottom	0.00168	0.0017	0.00167	0.00127	0.00231
Station 4	Top	0.015	0.00211	0.00123	0.00141	0.00143
	Middle	0.0016	0.00155	0.0011	0.00147	0.00111
	Bottom	0.00495	0.00159	0.00169	0.00152	0.00118
Ref-CB	Top	0.00324	0.0017	0.00145	0.00157	0.00131
	Middle	0.00448	0.00331	0.00111	0.00135	0.00167
	Bottom	0.00188	0.00125	0.00325	0.00157	0.00156
Ref-PB	Top	0.00223	0.00156	0.00156	0.00378	0.00109
	Middle	0.00135	0.00143	0.00127	0.00231	0.00208
	Bottom	0.00148	0.00127	0.00145	0.00182	0.0009
Summer						
Station 1	Top	0.00175	0.00177	0.00191	0.00378	0.00285
	Middle	0.00135	0.00196	0.00176	0.00179	0.00224
	Bottom	0.00141	0.00266	0.00216	0.00224	0.00255
Station 2	Top	0.00145	0.00187	0.00218	0.00193	0.00254
	Middle	0.00133	0.00193	0.00236	0.00178	0.00239
	Bottom	0.00161	0.00206	0.00214	0.00172	0.00275
Station 3	Top	0.00128	0.00156	0.00213	0.00185	0.00309
	Middle	0.00131	0.00166	0.00245	0.00163	0.00244
	Bottom	0.00148	0.00286	0.00199	0.00167	0.00357

Appendix C14, cont'd

Manganese	BC Approved WQG = 0.1 mg/L (max)					
Station 4	Top	0.00155	0.00395	0.00269	0.00159	0.00303
	Middle	0.00133	0.00234	0.00241	0.00174	0.00326
	Bottom	0.0014	0.00171	0.00185	0.00186	0.00274
Ref-CB	Top	0.00329	---	0.00466	0.00187	---
	Middle	0.00158	---	0.00254	0.00171	---
	Bottom	0.00139	---	0.00194	0.00194	---
Ref-PB	Top	0.00148	0.00238	0.00222	0.00154	0.00478
	Middle	0.00161	0.00172	0.00208	0.00211	0.00194
	Bottom	0.00103	0.0017	0.00392	0.00163	0.00199
Autumn						
Station 1	Top	0.0062	0.00287	0.00209	0.00245	0.00355
	Middle	0.00308	0.00272	0.0024	0.00201	0.0028
	Bottom	0.0039	0.0038	0.00193	0.0038	0.00315
Station 2	Top	0.00265	0.00196	0.00232	0.00192	0.00236
	Middle	0.0042	0.00244	0.00293	0.00211	0.0028
	Bottom	0.012	0.00229	0.00248	0.00332	0.00298
Station 3	Top	0.0024	0.0023	0.00905	0.00293	0.0027
	Middle	0.00216	0.00243	0.00243	0.00234	0.00463
	Bottom	0.00446	0.00272	0.0039	0.0031	0.00274
Station 4	Top	0.00295	0.00258	0.00258	0.00243	0.00421
	Middle	0.00288	0.00269	0.00451	0.00219	0.00324
	Bottom	0.00242	0.00241	0.0248	0.00187	0.00262
Ref-CB	Top	0.00524	0.00616	0.00288	0.00532	0.00586
	Middle	0.0034	0.00256	0.00577	0.00224	0.00264
	Bottom	0.00315	0.00248	0.00248	0.0024	0.00466
Ref-PB	Top	0.00483	0.00357	0.00239	0.00154	0.00323
	Middle	0.00325	0.00256	0.00191	0.00263	0.00265
	Bottom	0.00501	0.00336	0.00412	0.00239	0.0026

Notes:
Shaded cells indicate exceedance to BC WQG, --- not sampled due to weather issues.

Appendix C15 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – Nickel

Nickel		BC Working WQG = 0.0083 mg/L (max)				
Winter						
Station 1	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	0.00056
	Bottom	0.00294	<0.0005	<0.0005	<0.0005	0.00051
Station 2	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Station 3	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Station 4	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	0.00082	<0.0005	<0.0005	<0.0005
Ref-CB	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Ref-PB	Top	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Middle	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
	Bottom	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Spring						
Station 1	Top	0.00108	0.00031	0.00044	0.00051	0.00055
	Middle	0.00061	0.0002	0.0004	0.00025	0.0003
	Bottom	0.00047	0.00048	0.00027	0.00032	0.00037
Station 2	Top	0.00064	0.00021	0.00044	0.0003	0.00063
	Middle	0.00041	0.0005	0.00035	0.00028	0.00038
	Bottom	0.00088	0.00049	0.00077	0.00038	0.00049
Station 3	Top	0.00029	0.00042	0.0004	0.00044	0.00042
	Middle	0.00135	0.00027	0.0006	0.00025	0.00036
	Bottom	0.00056	0.0005	0.00048	0.00035	0.00116
Station 4	Top	0.00094	0.00048	0.00051	0.00115	0.00037
	Middle	0.00055	0.00035	0.00063	0.0002	0.00115
	Bottom	0.00061	0.00032	0.0002	0.00041	0.0002
Ref-CB	Top	0.00139	0.00072	0.00064	0.00098	0.0002
	Middle	0.0006	0.00117	0.00044	0.00054	0.00037
	Bottom	0.00054	0.00067	0.00084	0.001	0.00021
Ref-PB	Top	0.00055	0.00176	0.00032	0.00095	0.00028
	Middle	0.00079	0.0002	0.0002	0.00052	0.00063
	Bottom	0.00049	0.0002	0.00031	0.00045	0.00036
Summer						
Station 1	Top	0.0185	0.00051	0.00034	0.00082	0.00055
	Middle	0.00064	0.00041	0.00041	0.00036	0.00061
	Bottom	0.00034	0.00098	0.00046	0.00111	0.00038
Station 2	Top	0.00053	0.00088	0.00042	0.00082	0.00633
	Middle	0.00094	0.00083	0.00059	0.0002	0.00075
	Bottom	0.00032	0.0006	0.00059	0.00032	0.00062
Station 3	Top	0.00101	0.00027	0.00069	0.0002	0.00057
	Middle	0.00049	0.0003	0.00047	0.0002	0.00078
	Bottom	0.0006	0.00026	0.00055	0.00023	0.00072

Appendix C15, cont'd

Nickel	BC Working WQG = 0.0083 mg/L (max)					
Station 4	Top	0.00082	0.0009	0.00072	0.00035	0.00045
	Middle	0.00031	0.0002	0.00109	0.0002	0.00032
	Bottom	0.00027	0.00033	0.00071	0.00039	0.00067
Ref-CB	Top	0.00049	---	0.00157	0.00034	---
	Middle	0.00039	---	0.0006	0.00035	---
	Bottom	0.00042	---	0.00063	0.00042	---
Ref-PB	Top	0.00104	0.00075	0.0036	0.00074	0.00108
	Middle	0.00095	0.00052	0.00064	0.00045	0.00069
	Bottom	0.00035	0.00055	0.00091	0.00031	0.00046
Autumn						
Station 1	Top	0.0002	0.00233	0.00131	0.00021	0.0002
	Middle	0.00026	0.00185	0.00166	0.00056	0.0002
	Bottom	0.00037	0.00254	0.00195	0.00047	0.0002
Station 2	Top	0.00025	0.00099	0.00169	0.0002	0.0002
	Middle	0.00117	0.00055	0.00241	0.00111	0.00025
	Bottom	0.00065	0.00378	0.00216	0.00053	0.00063
Station 3	Top	0.0002	0.00155	0.0139	0.00061	0.0105
	Middle	0.0002	0.001	0.00233	0.0002	0.0286
	Bottom	0.0007	0.00164	0.00695	0.00141	0.0002
Station 4	Top	0.00027	0.00036	0.00243	0.0002	0.00458
	Middle	0.0002	0.00028	0.00122	0.00058	0.0011
	Bottom	0.0002	0.00096	0.0743	0.00177	0.0004
Ref-CB	Top	0.00124	0.00159	0.0002	0.00054	0.00184
	Middle	0.0002	0.00129	0.00454	0.00113	0.00031
	Bottom	0.00043	0.0002	0.00182	0.00072	0.00374
Ref-PB	Top	0.0002	0.00086	0.00132	0.00069	0.0047
	Middle	0.00075	0.00098	0.00107	0.00228	0.0002
	Bottom	0.00039	0.00127	0.0019	0.00093	0.00118

Notes:
Shaded cells indicate exceedance to BC WQG, --- not sampled due to weather issues.

Appendix C16 McLoughlin Point IDZ Results - 5 Sampling Events in 30 Days – Zinc

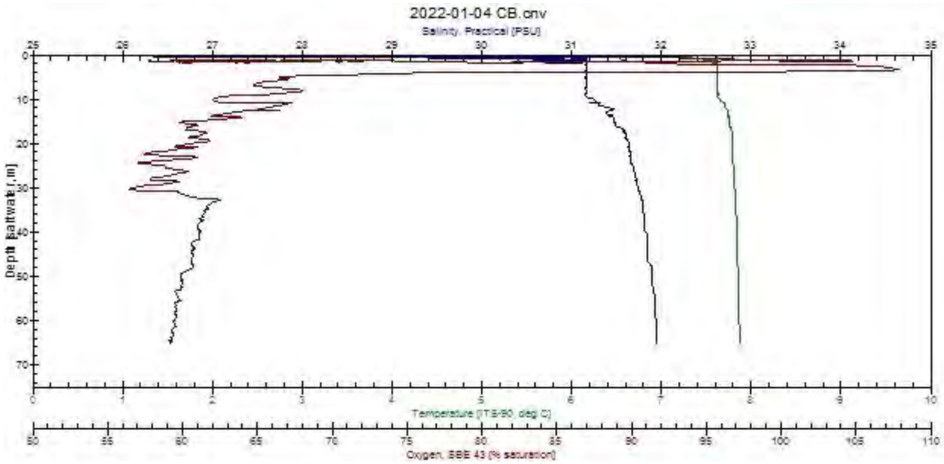
Zinc	BC Approved WQG = 0.01 mg/L (average of 5 samples)						
Winter							Average
Station 1	Top	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Middle	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Bottom	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Station 2	Top	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Middle	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Bottom	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Station 3	Top	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Middle	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Bottom	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Station 4	Top	0.0041	<0.003	0.0035	<0.003	<0.003	<0.003
	Middle	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Bottom	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Ref-CB	Top	<0.003	<0.003	<0.003	0.0068	<0.003	0.0038
	Middle	0.0042	<0.003	<0.003	<0.003	<0.003	0.0032
	Bottom	0.0049	<0.003	<0.003	<0.003	<0.003	0.0034
Ref-PB	Top	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Middle	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Bottom	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Spring							Average
Station 1	Top	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Middle	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Bottom	0.004	<0.003	<0.003	<0.003	<0.003	0.0032
Station 2	Top	0.0049	<0.003	<0.003	<0.003	<0.003	0.0034
	Middle	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Bottom	0.0077	<0.003	<0.003	0.0079	<0.003	0.0049
Station 3	Top	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Middle	0.0065	<0.003	<0.003	<0.003	<0.003	0.0037
	Bottom	0.0054	<0.003	<0.003	<0.003	0.0154	0.006
Station 4	Top	0.0064	<0.003	<0.003	<0.003	<0.003	0.0037
	Middle	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Bottom	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Ref-CB	Top	0.0205	0.0091	<0.003	<0.003	<0.003	0.0077
	Middle	<0.003	0.006	<0.003	<0.003	<0.003	0.0036
	Bottom	<0.003	<0.003	0.006	<0.003	<0.003	0.0036
Ref-PB	Top	0.0055	<0.003	<0.003	0.006	<0.003	0.0041
	Middle	<0.003	<0.003	<0.003	0.003	0.006	0.0036
	Bottom	<0.003	<0.003	0.003	0.003	<0.003	<0.003
Summer							Average
Station 1	Top	<0.003	0.0033	<0.003	0.006	0.0034	0.00374
	Middle	<0.003	0.0043	0.0147	0.003	<0.003	0.0056
	Bottom	<0.003	0.0042	0.0047	0.003	<0.003	0.00358
Station 2	Top	<0.003	<0.003	0.0035	0.0192	0.0039	0.00652
	Middle	<0.003	0.0037	0.0045	<0.003	0.0053	0.0039
	Bottom	<0.003	0.0448	<0.003	<0.003	<0.003	0.01136
Station 3	Top	<0.003	0.003	<0.003	<0.003	0.006	0.0036
	Middle	<0.003	0.408	<0.003	<0.003	0.0048	0.08436
	Bottom	0.0187	0.0088	<0.003	<0.003	0.0057	0.00784

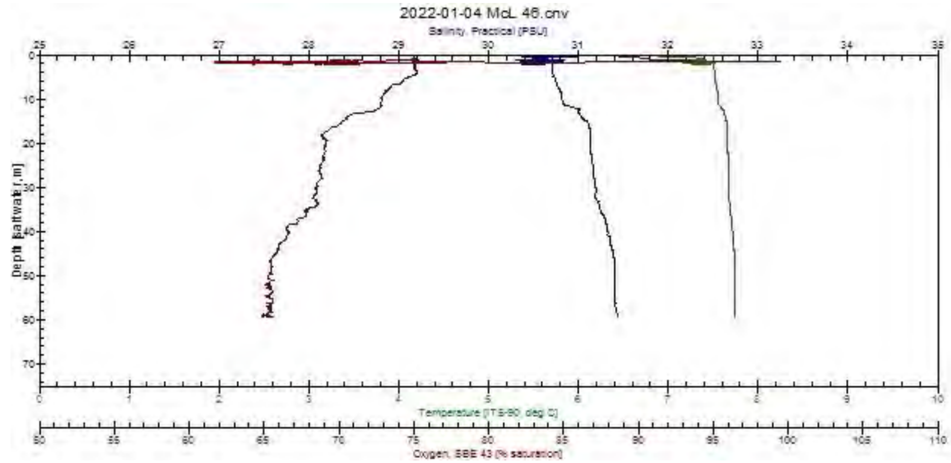
Appendix C16, cont'd

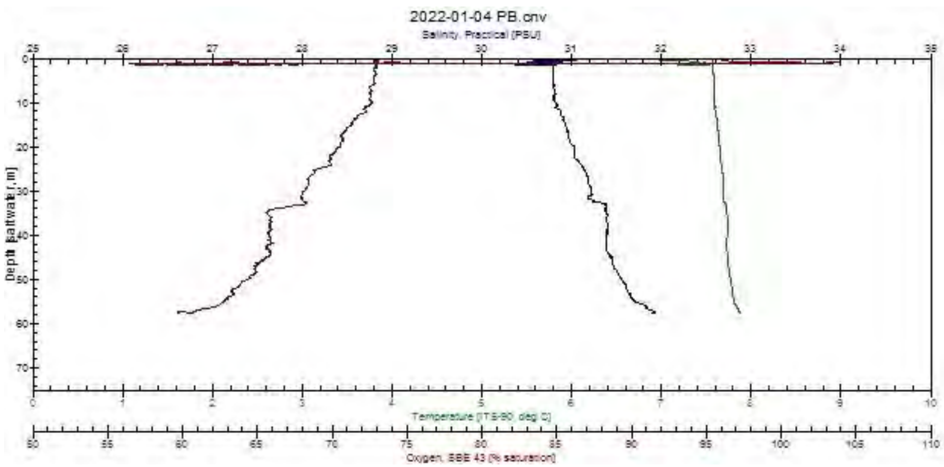
Zinc	BC Approved WQG = 0.01 mg/L (average of 5 samples)						
Station 4	Top	<0.003	0.0033	<0.003	<0.003	<0.003	0.00306
	Middle	<0.003	<0.003	0.0145	<0.003	<0.003	0.0053
	Bottom	<0.003	<0.003	<0.003	<0.003	0.0043	0.00326
Ref-CB	Top	0.006	---	0.006	<0.003	---	0.005
	Middle	0.0069	---	0.005	<0.003	---	0.00496
	Bottom	0.0055	---	<0.003	<0.003	---	0.00383
Ref-PB	Top	<0.003	0.0061	<0.003	<0.003	0.006	0.00422
	Middle	0.0031	0.0048	0.0035	<0.003	0.0057	0.00402
	Bottom	<0.003	0.0054	0.0102	<0.003	0.0033	0.00498
Autumn							**Average**
Station 1	Top	<0.003	0.852	0.0406	0.0048	0.0044	0.9535
	Middle	<0.003	0.0734	0.084	<0.003	<0.003	0.2244
	Bottom	<0.003	0.0059	0.0369	<0.003	<0.003	0.1007
Station 2	Top	<0.003	<0.003	0.0349	<0.003	<0.003	0.1114
	Middle	<0.003	0.0159	0.794	0.0056	<0.003	0.871
	Bottom	<0.003	<0.003	0.00193	<0.003	<0.003	0.11033
Station 3	Top	<0.003	0.0048	0.0188	0.0039	<0.003	0.0815
	Middle	<0.003	0.0061	0.0444	0.0033	0.0116	0.5237
	Bottom	<0.003	0.0276	0.00469	0.0083	0.0045	0.13209
Station 4	Top	<0.003	0.0065	0.036	0.0034	0.159	0.2582
	Middle	<0.003	<0.003	0.0259	0.0032	<0.003	0.0946
	Bottom	<0.003	0.0442	0.0678	0.0043	<0.003	0.1686
Ref-CB	Top	0.0081	0.012	0.0087	0.0066	0.006	0.1138
	Middle	0.0064	0.0057	0.0614	0.0395	<0.003	0.1651
	Bottom	0.0066	<0.003	0.0195	<0.003	0.0129	0.1184
Ref-PB	Top	0.0049	0.0163	0.0257	0.0038	0.0095	0.1168
	Middle	0.0058	0.0083	0.0371	0.0054	<0.003	0.1127
	Bottom	<0.003	<0.003	0.0527	0.0075	<0.003	0.1241

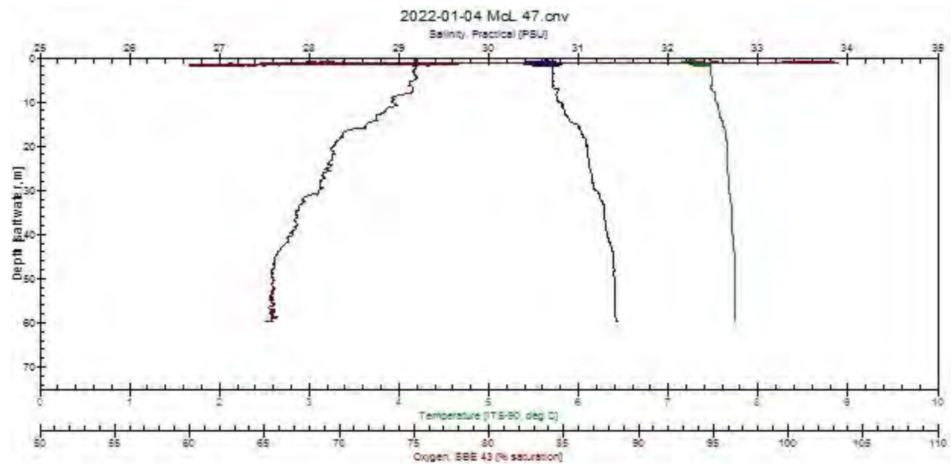
Notes:
Shaded cells indicate exceedance to BC WQG, --- not sampled due to weather issues, Detection limit was used in calculations of average values.

Appendix C17 CTD Plots









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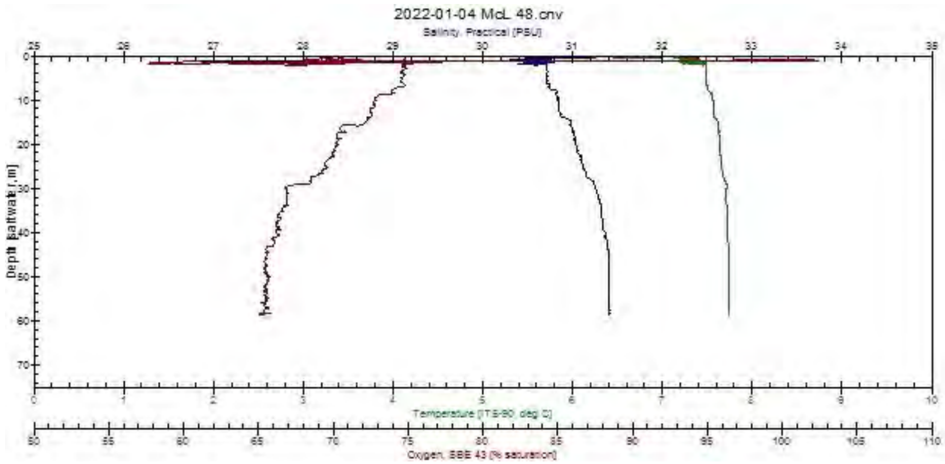

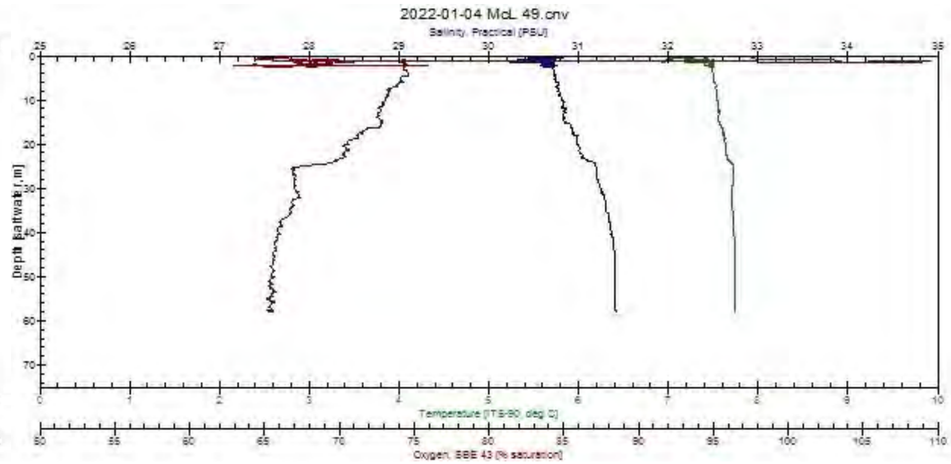

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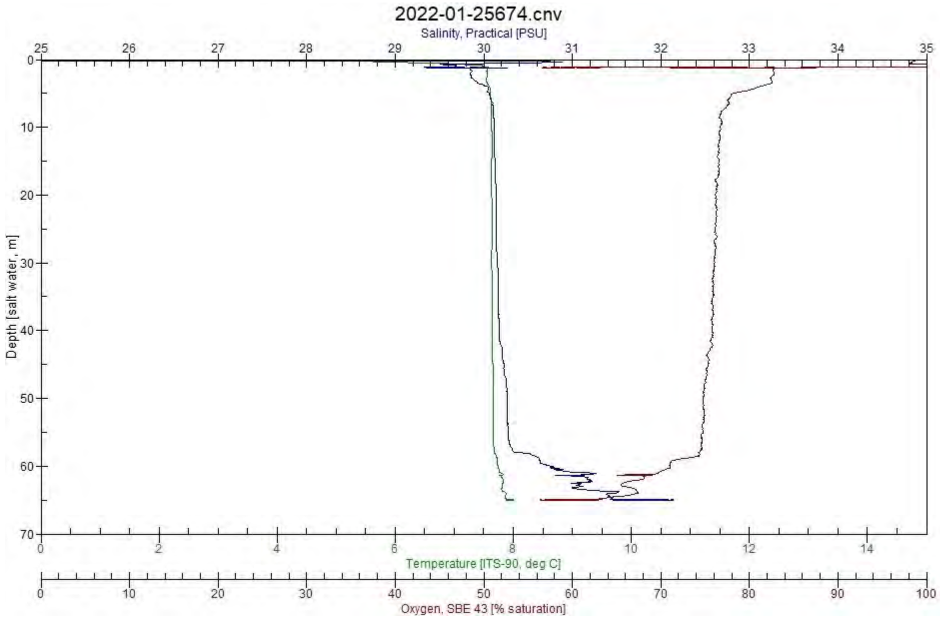

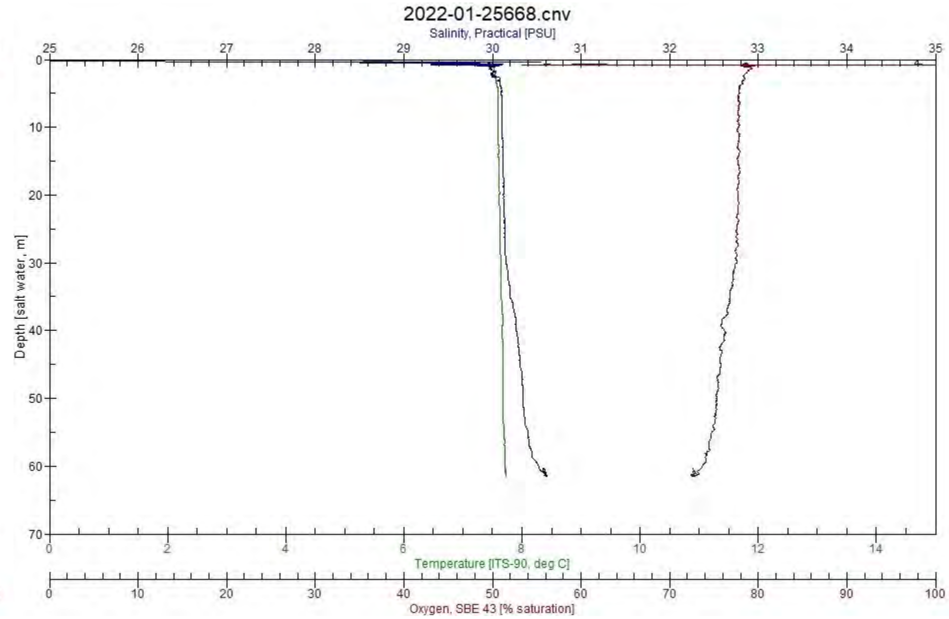

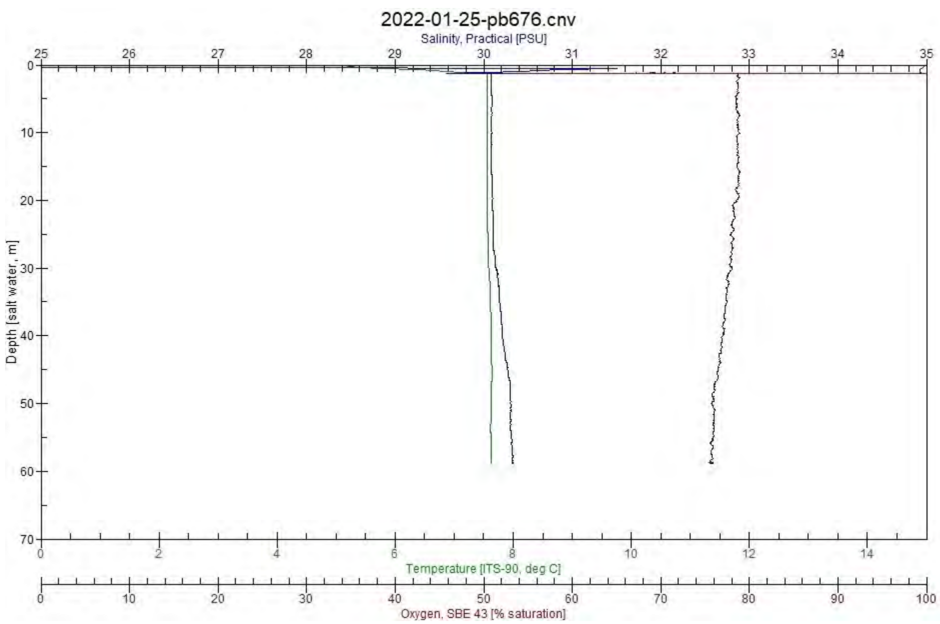

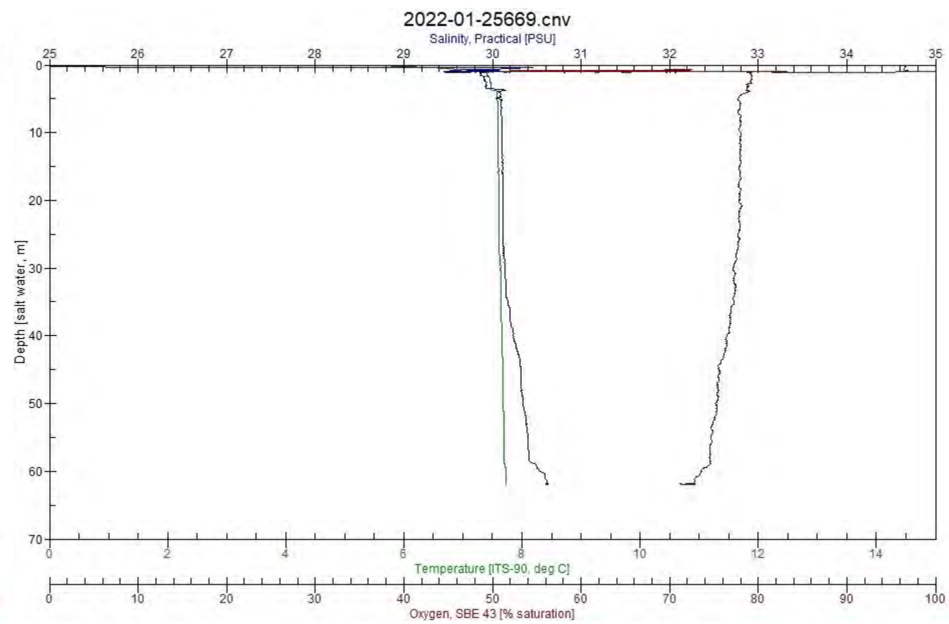

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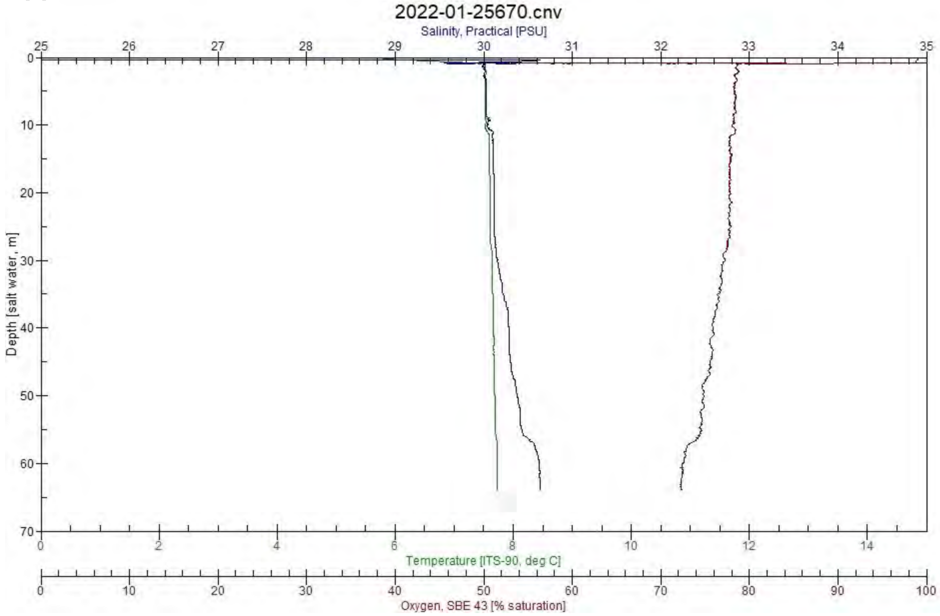

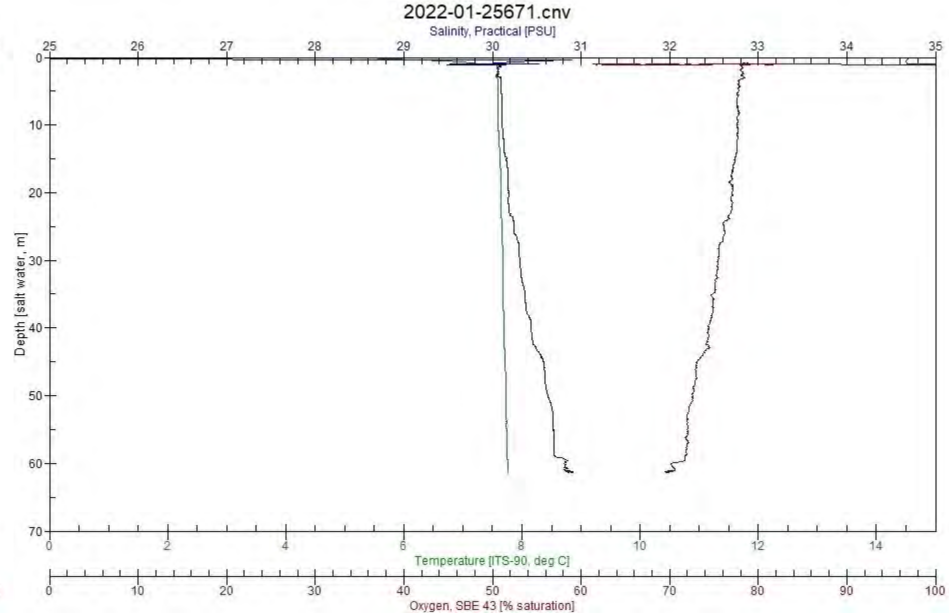

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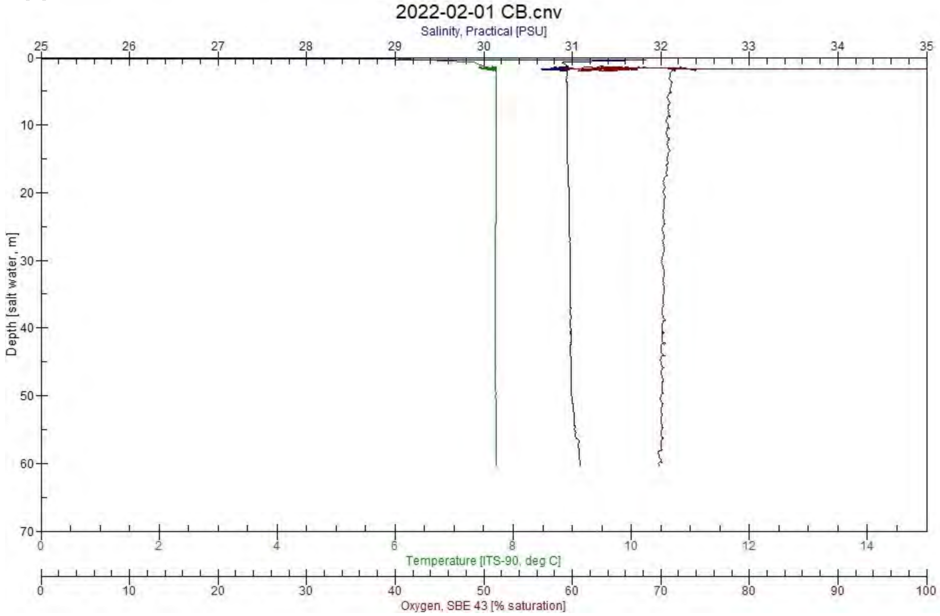

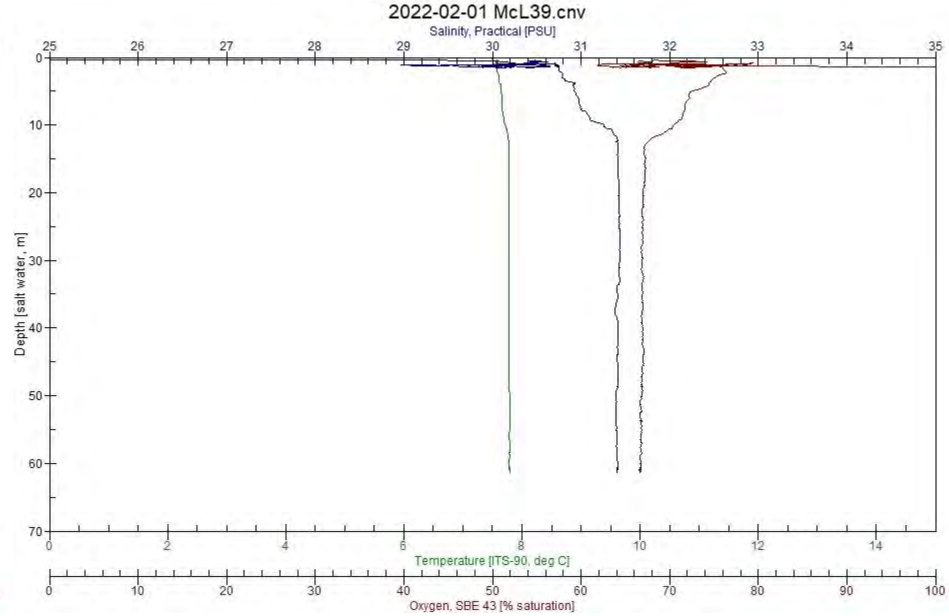

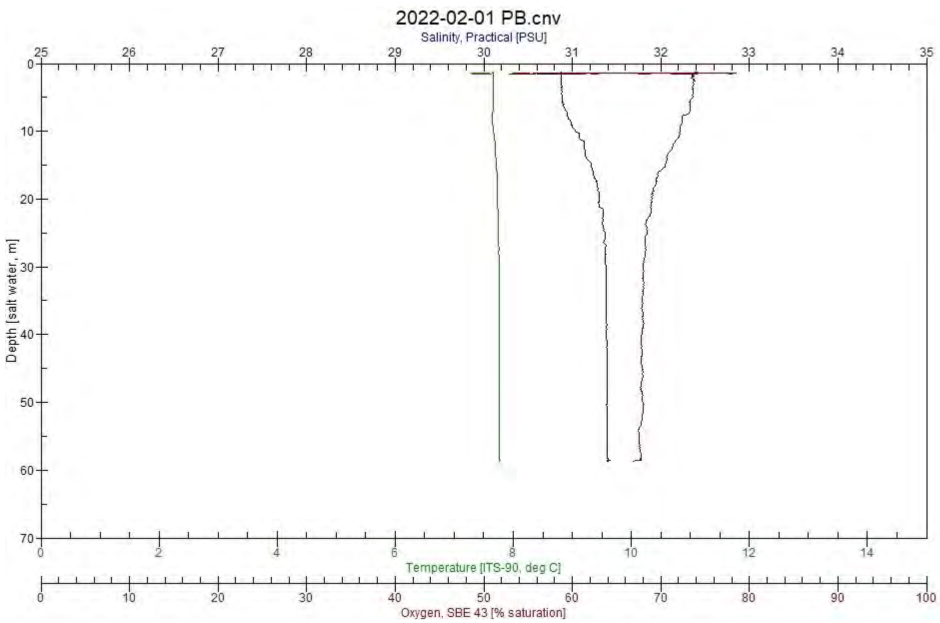

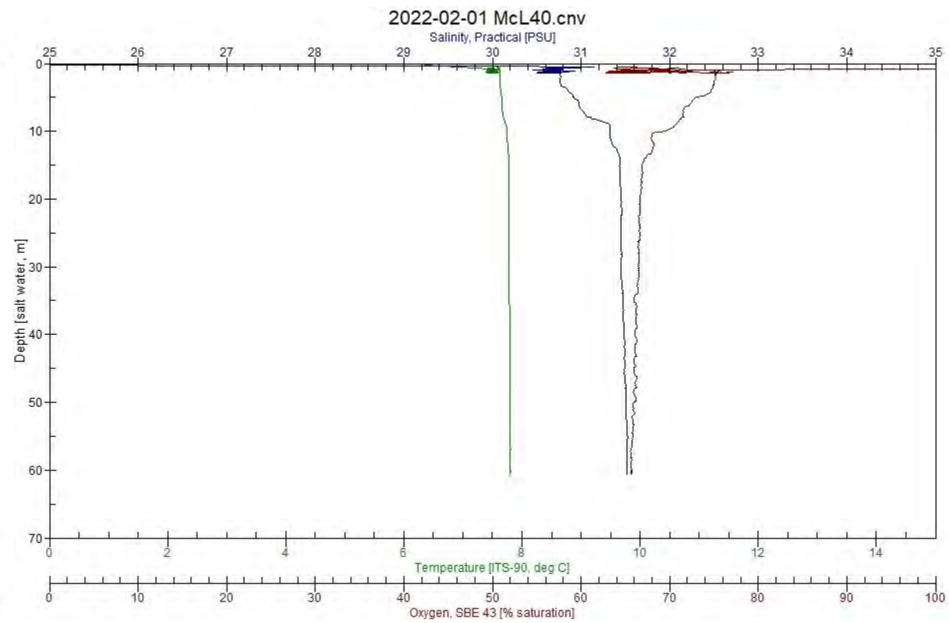

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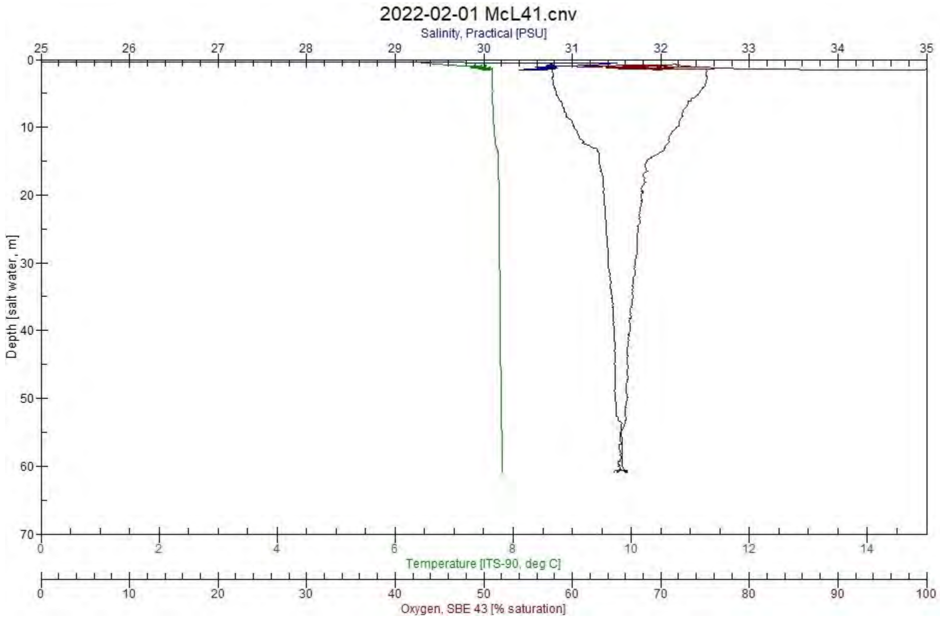

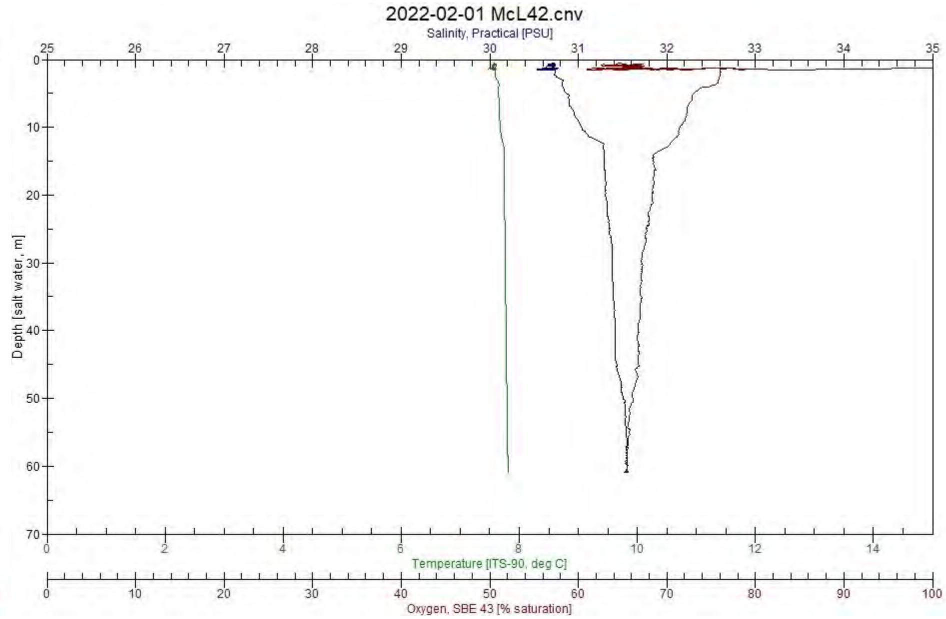

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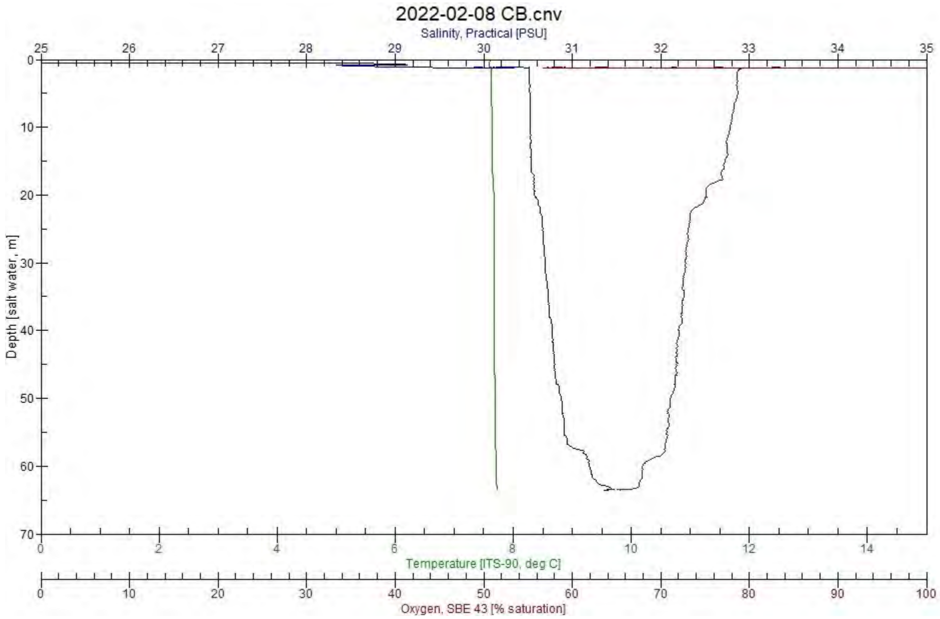

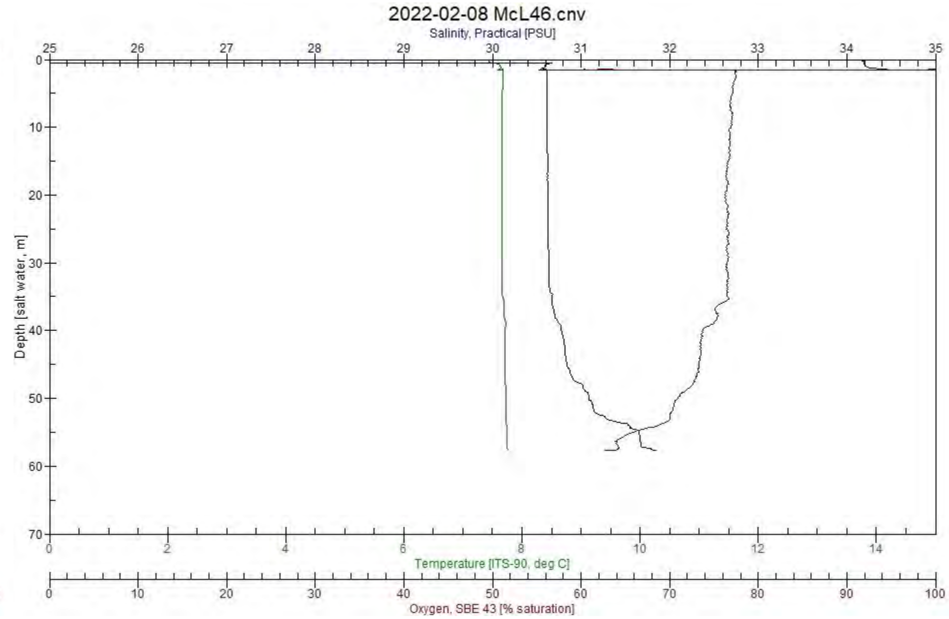

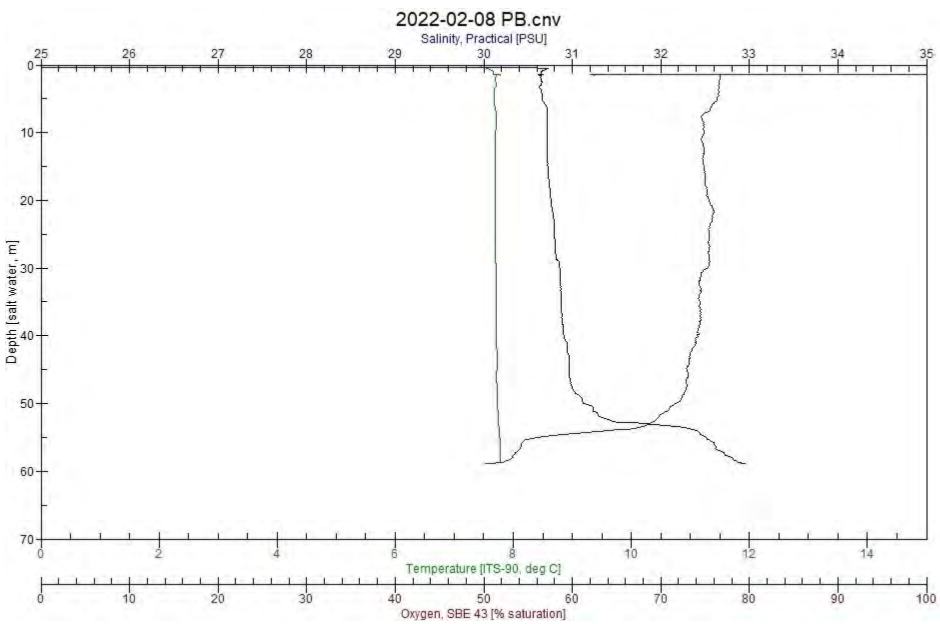

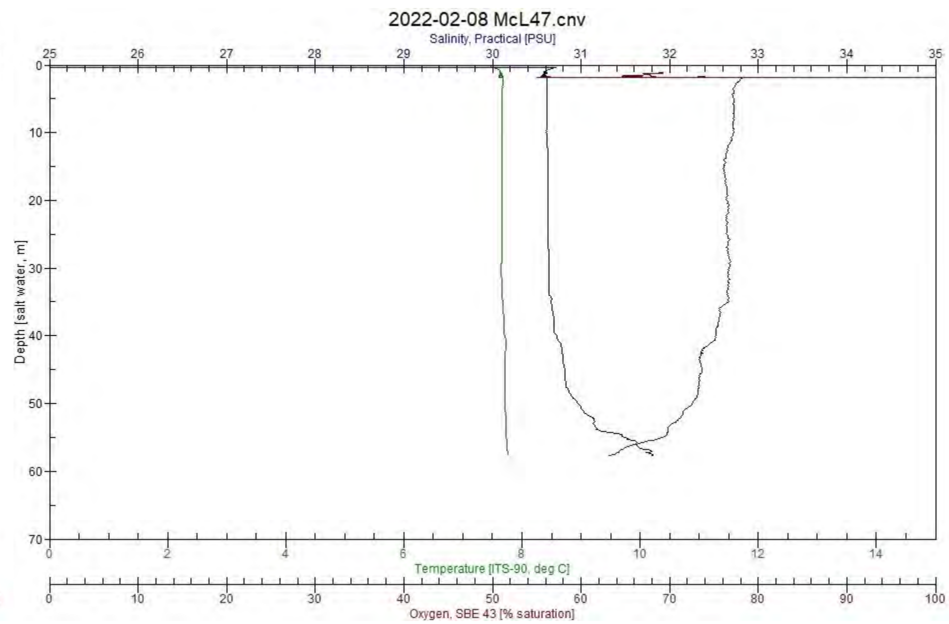

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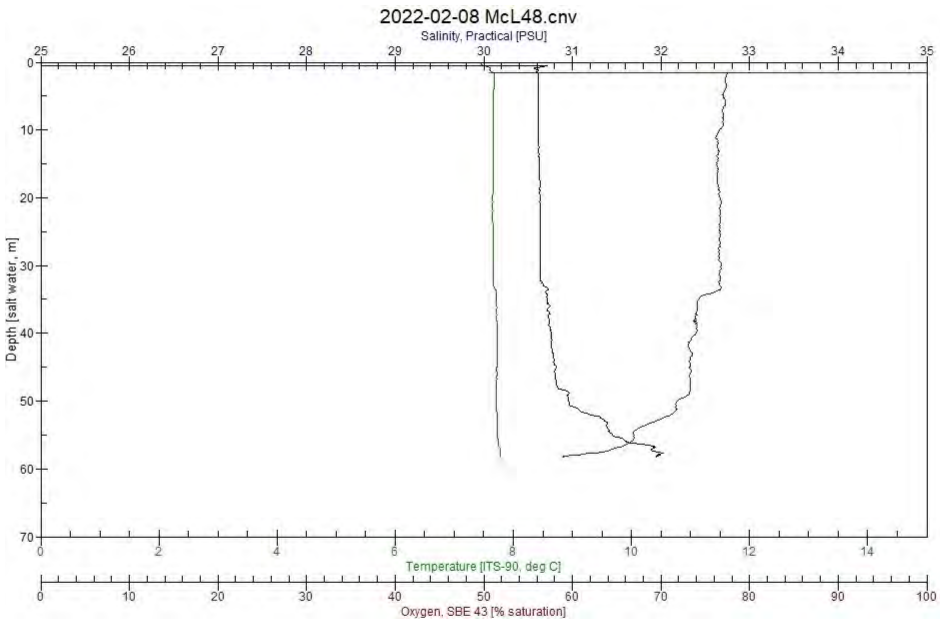

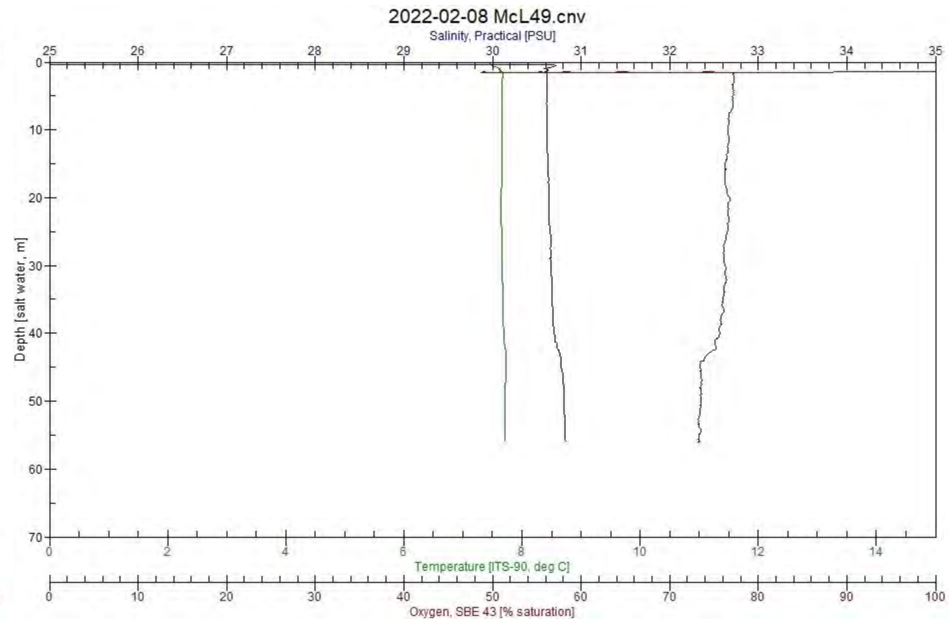

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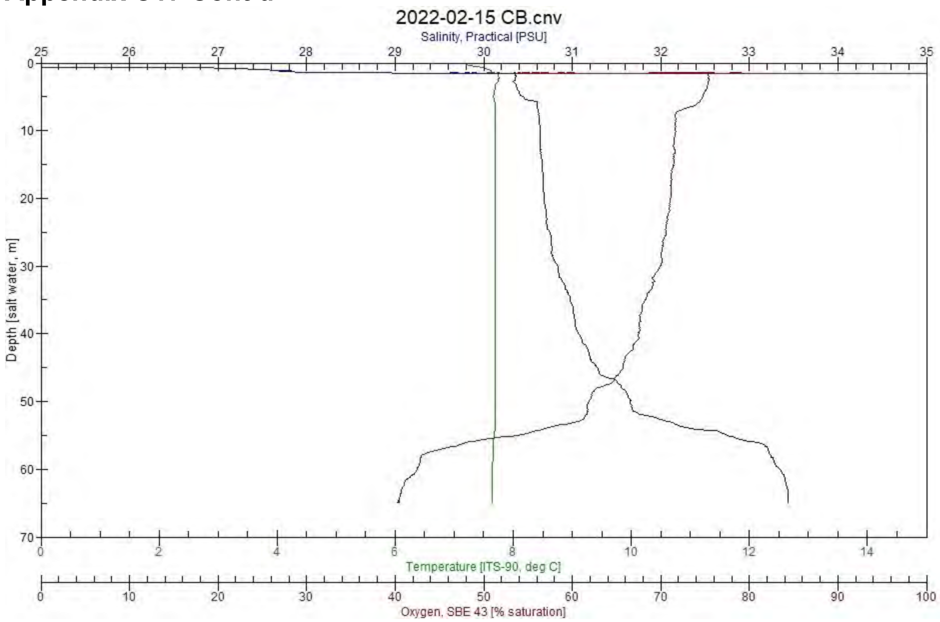

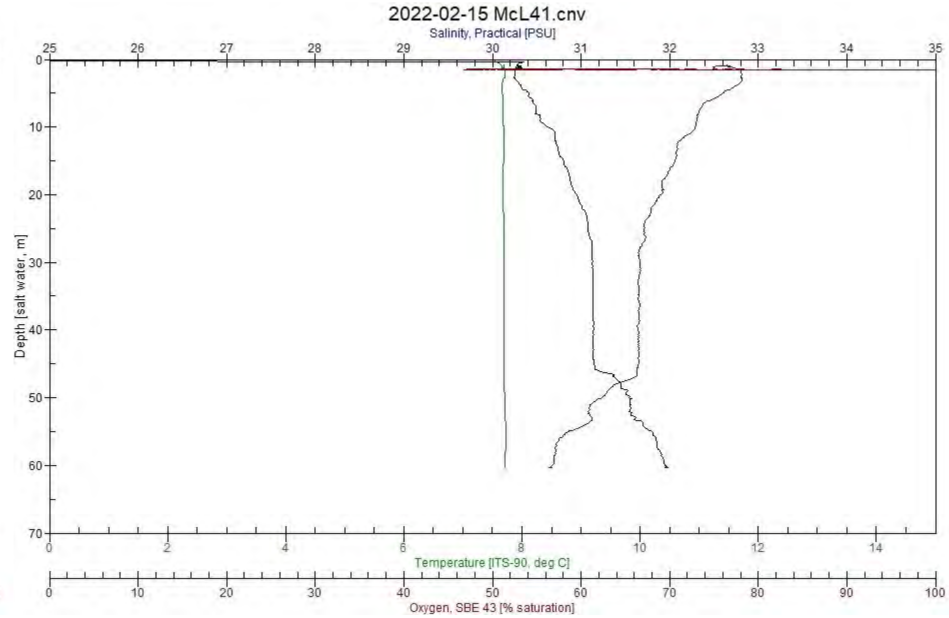

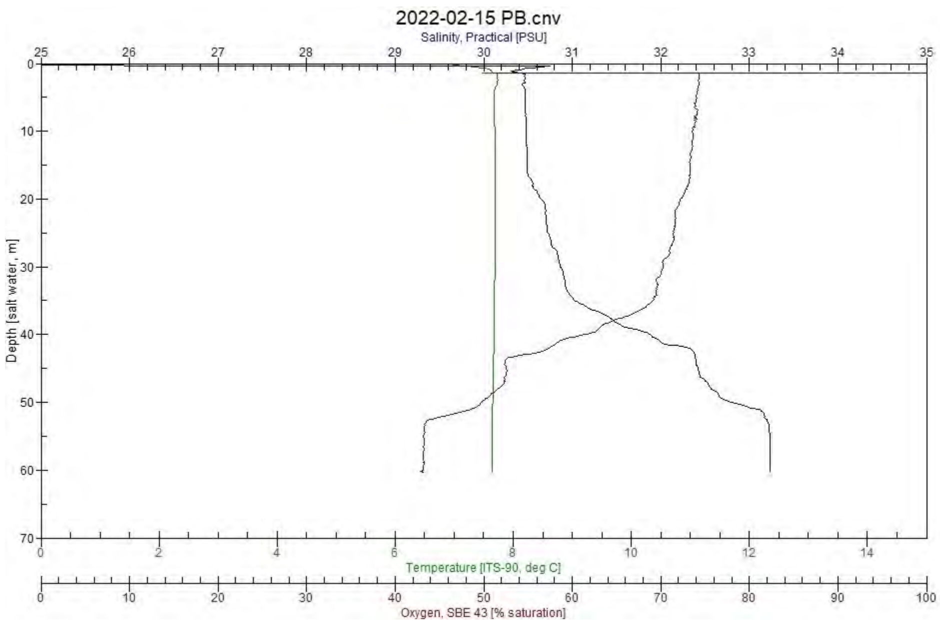

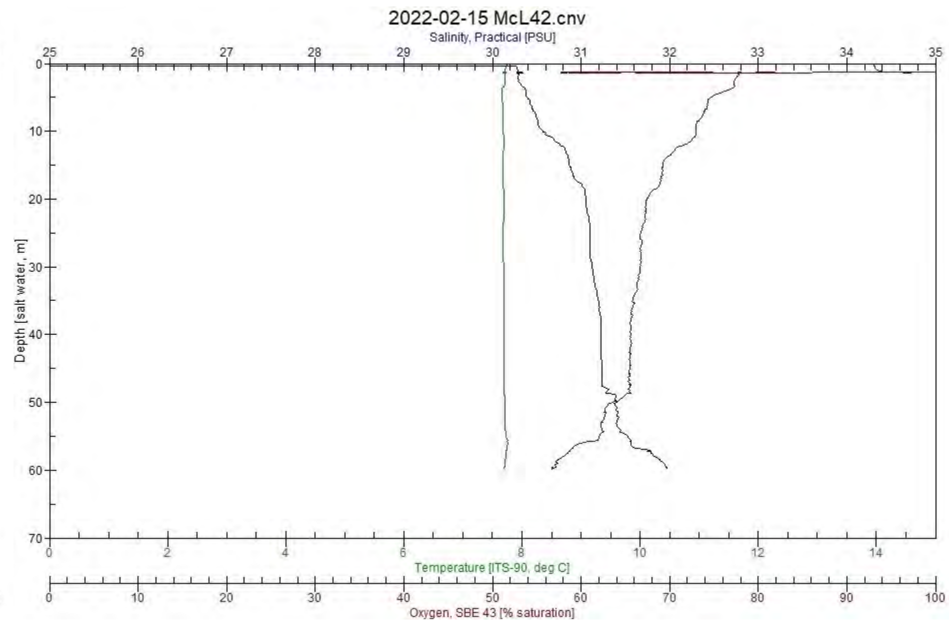

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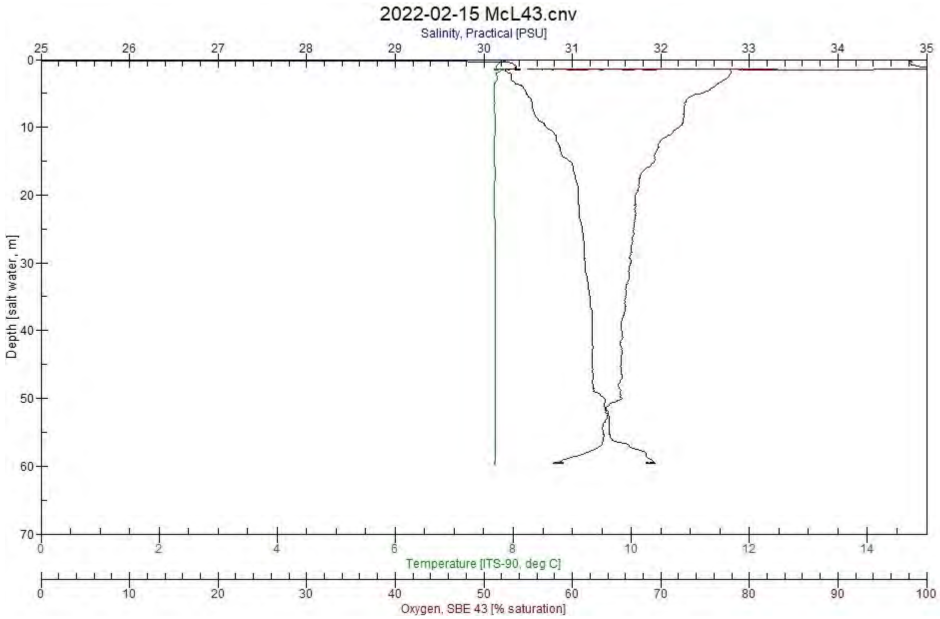

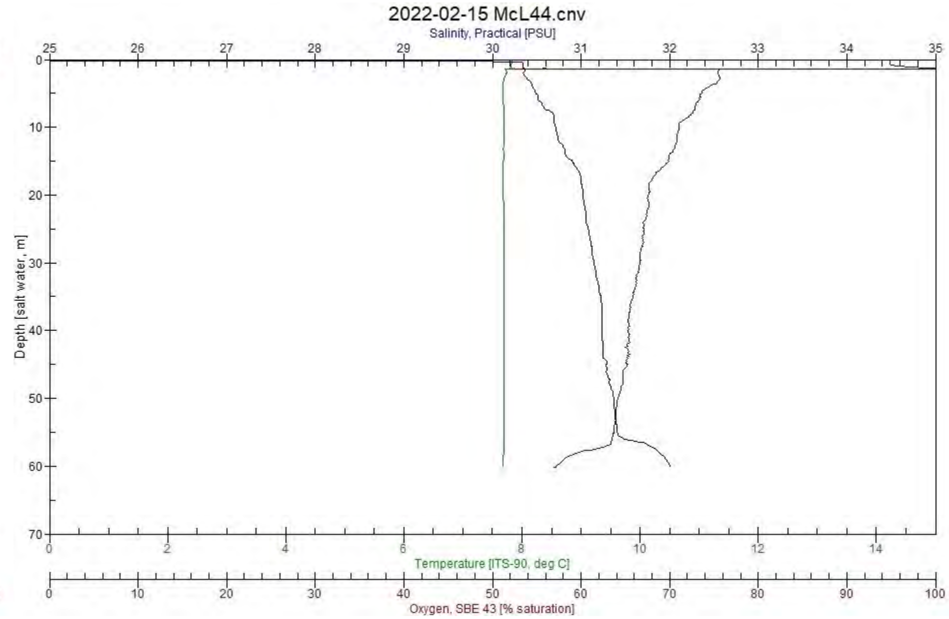

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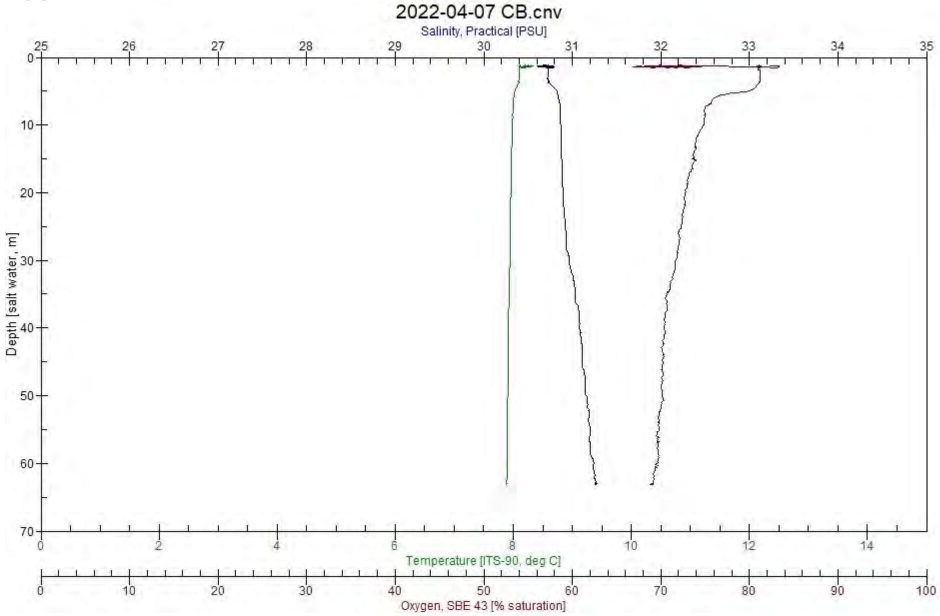

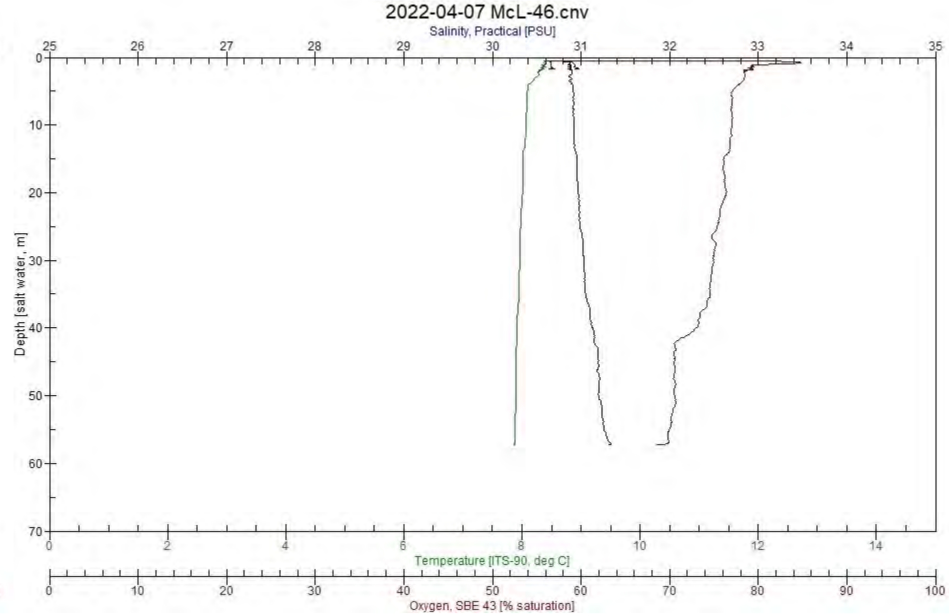

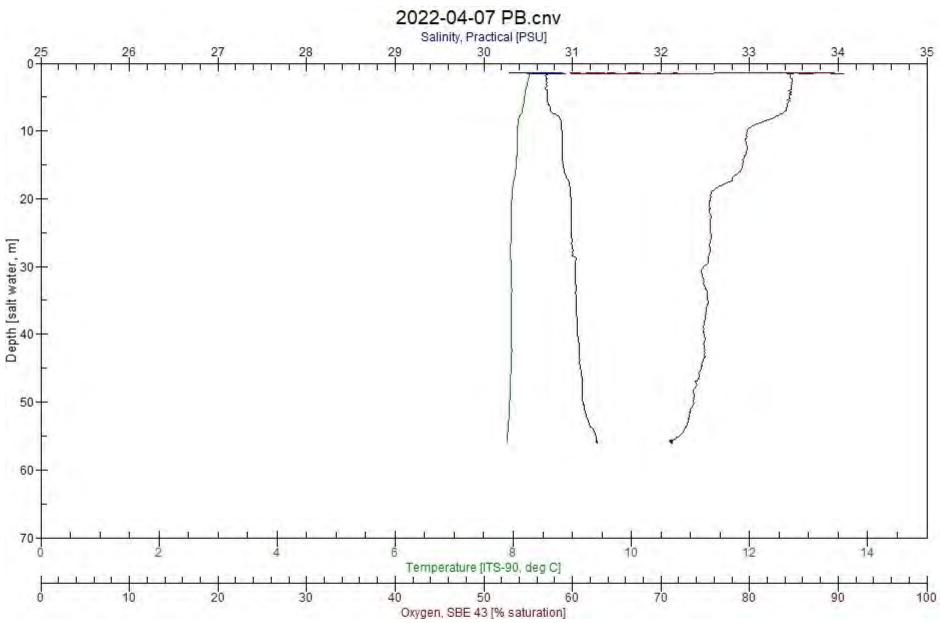

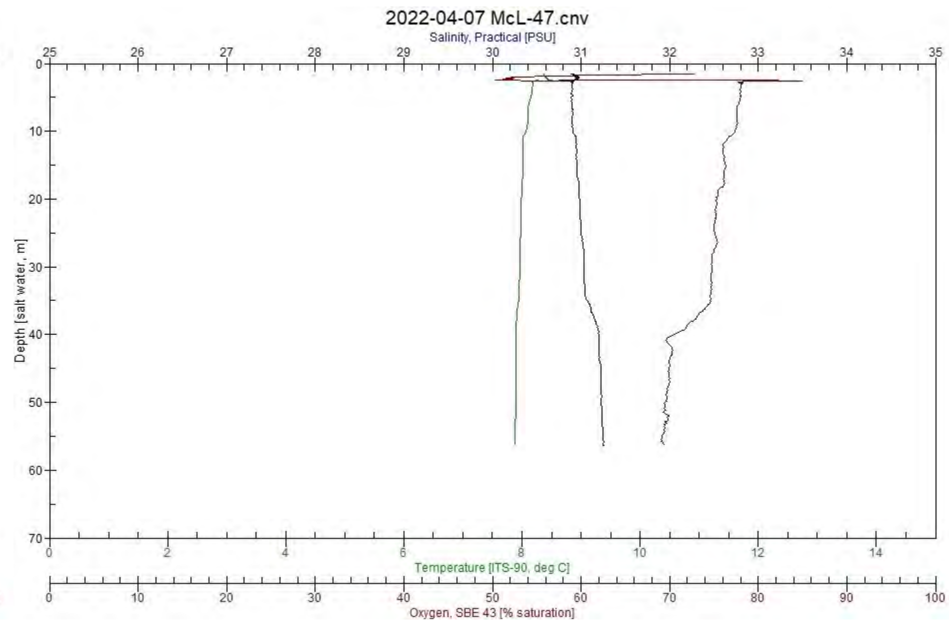

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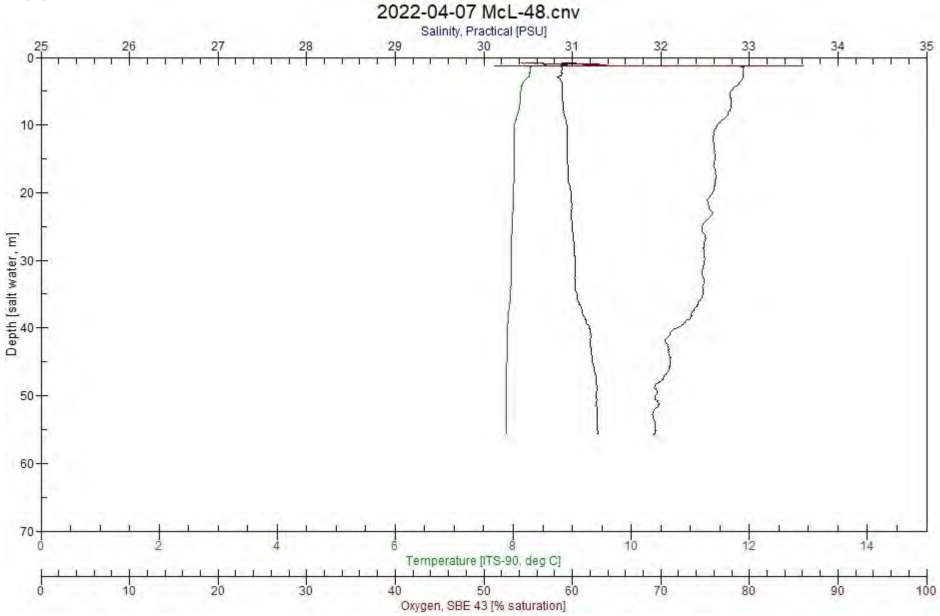

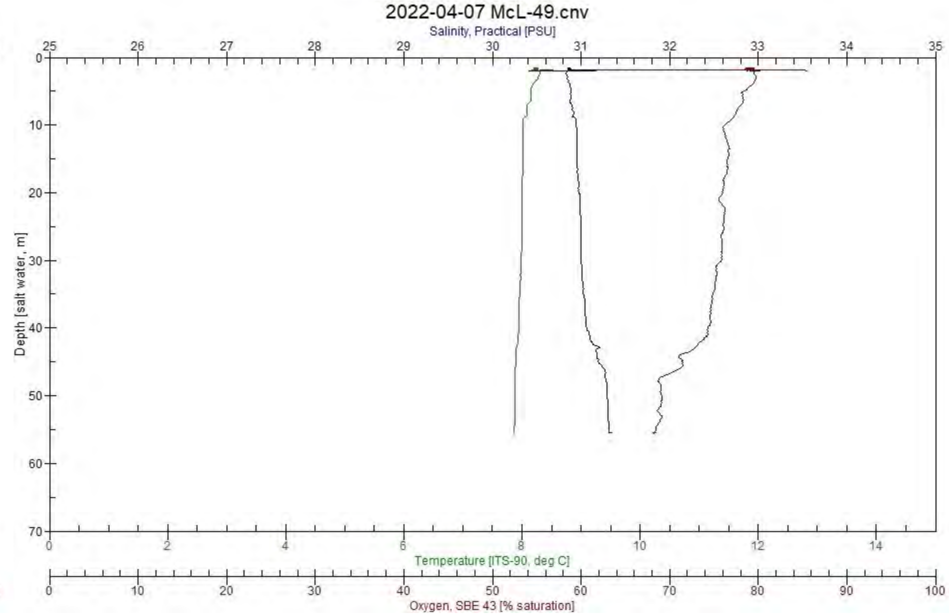

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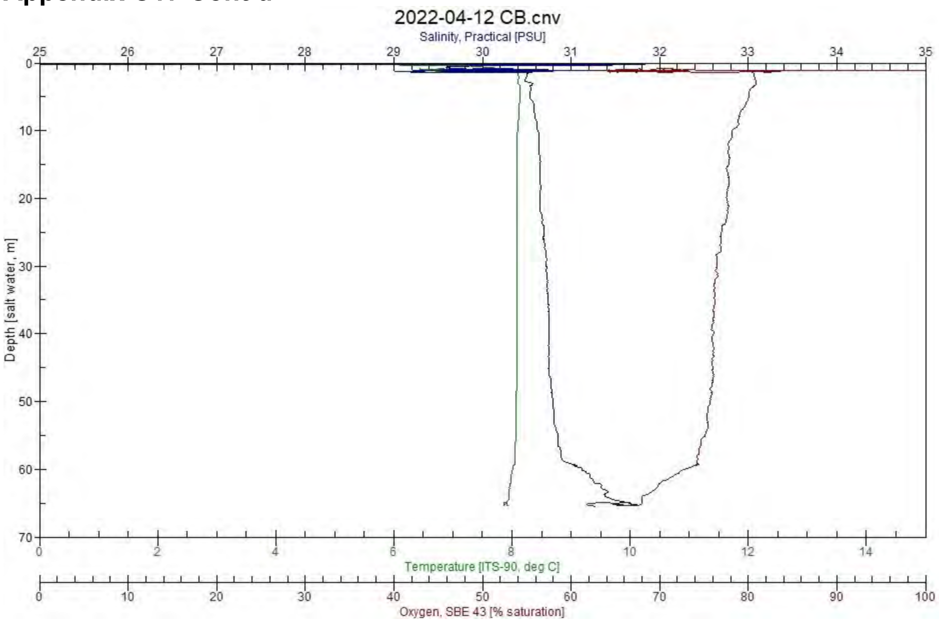

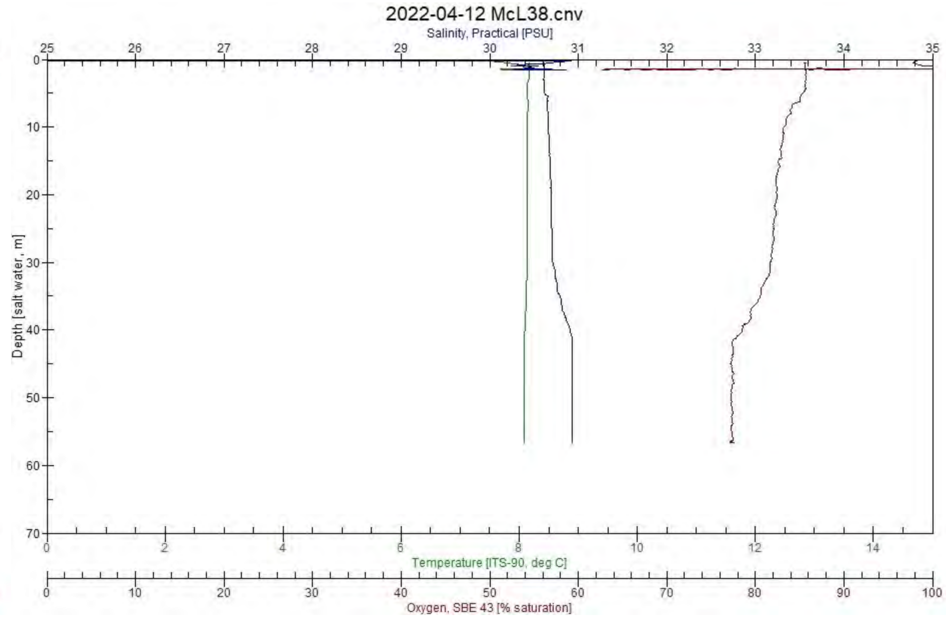

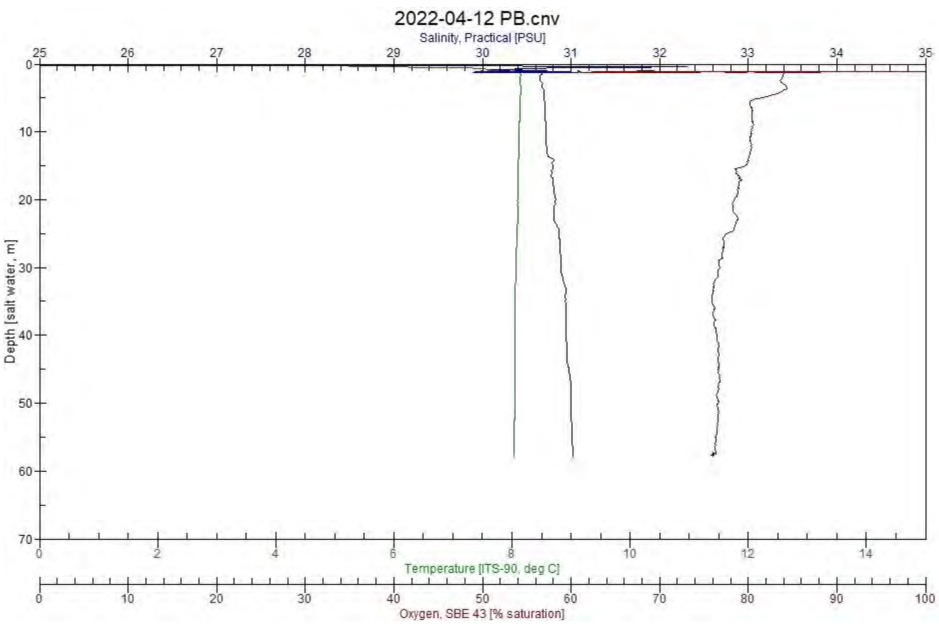

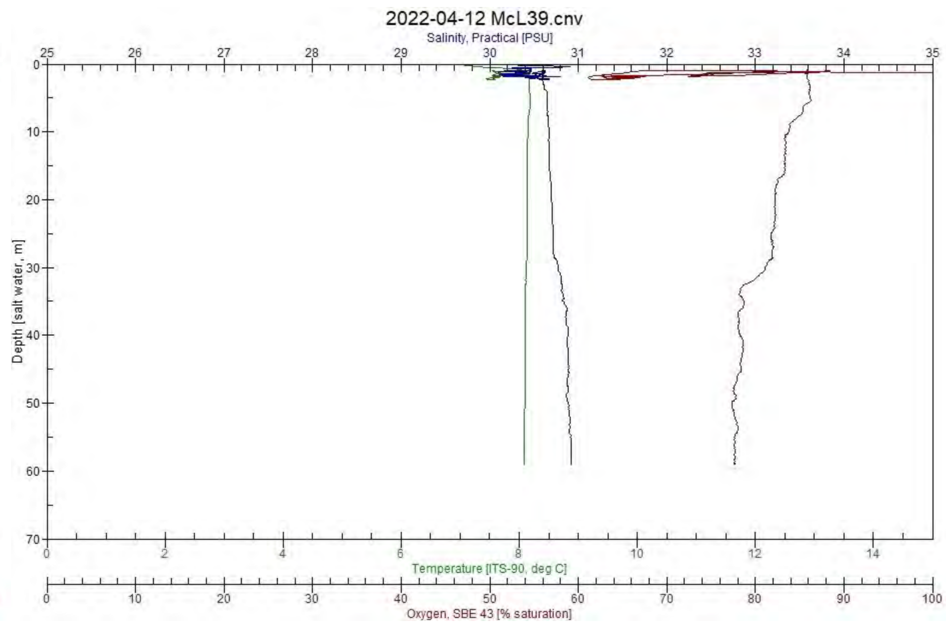

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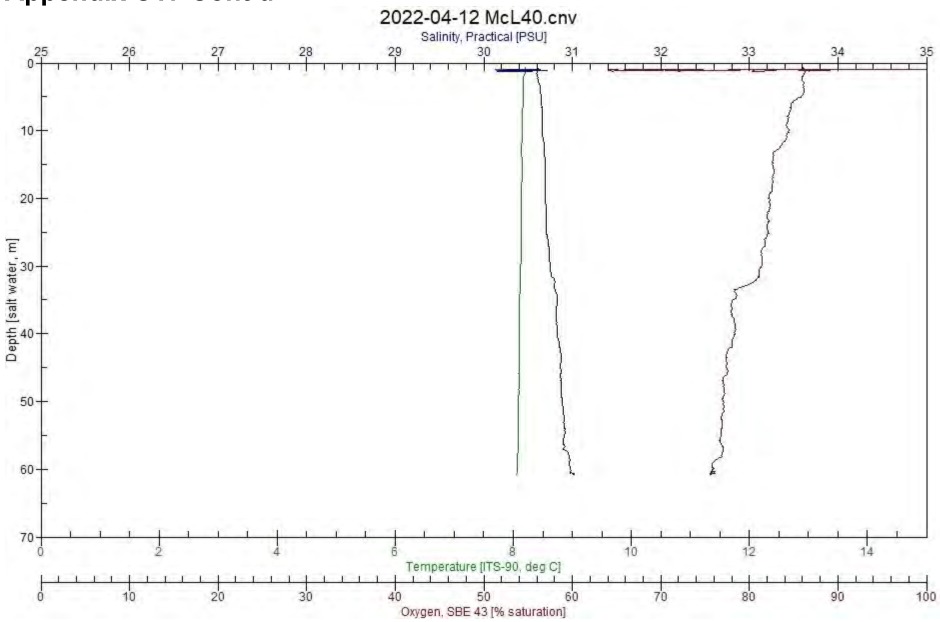

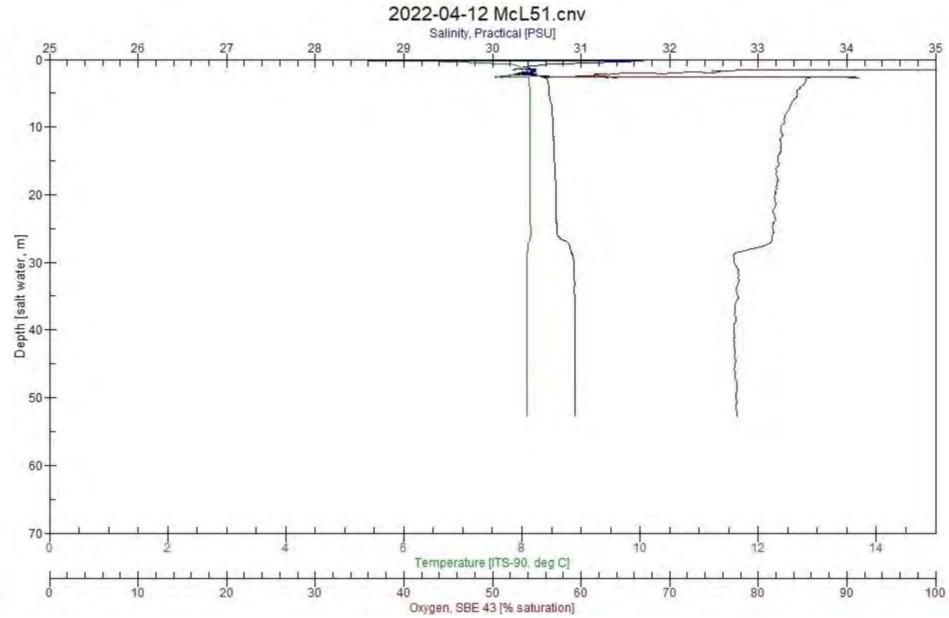

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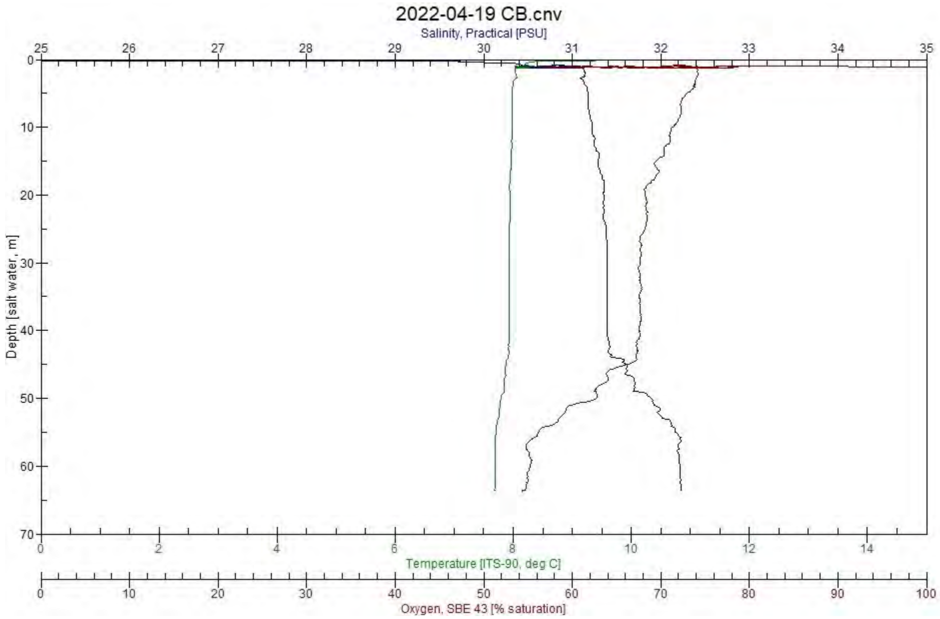

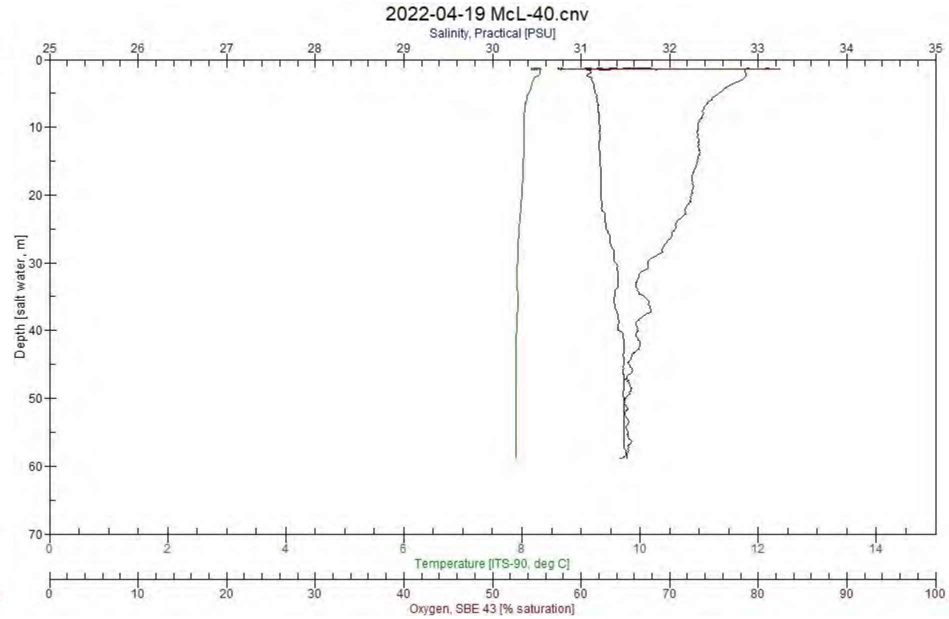

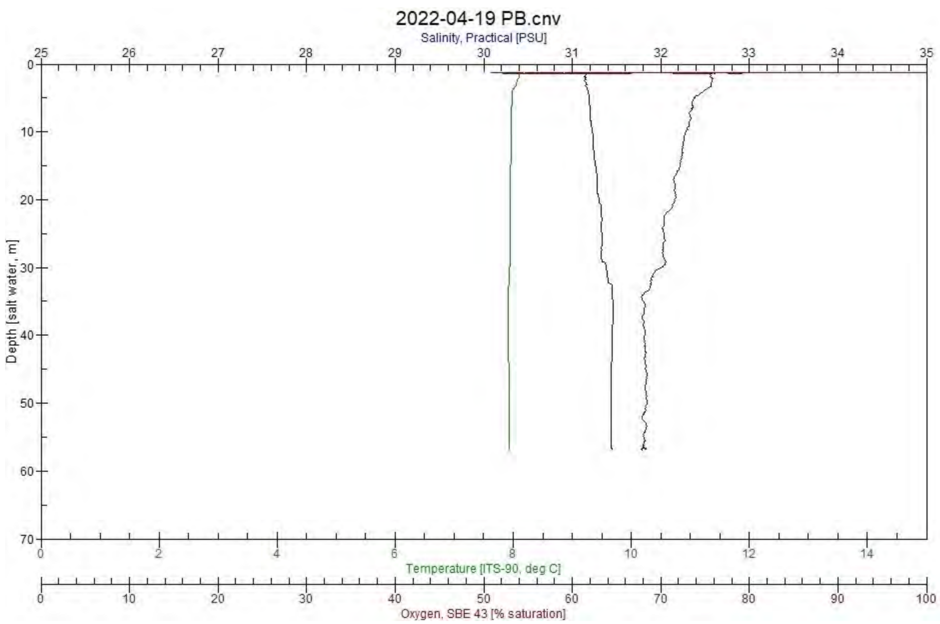

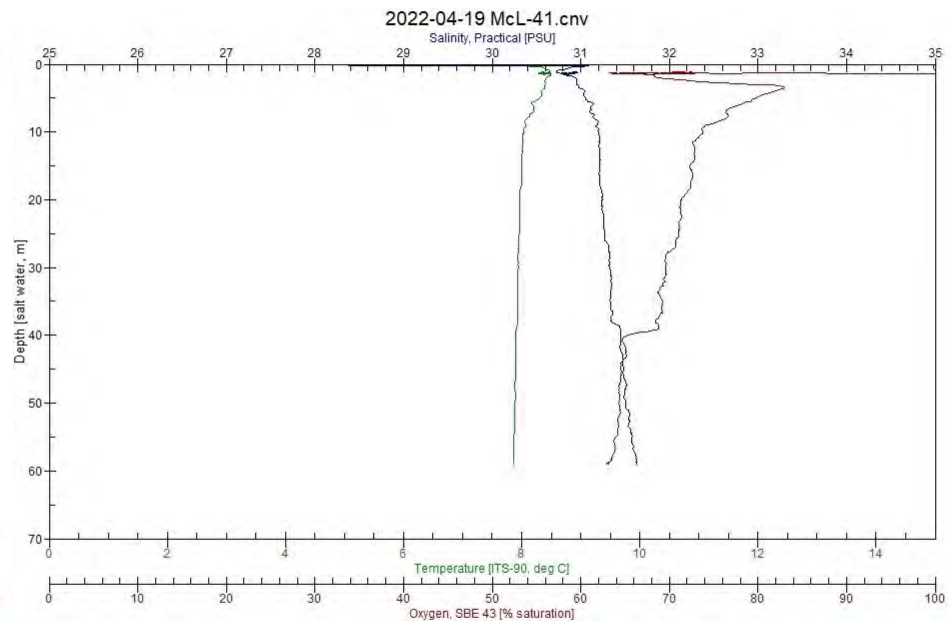

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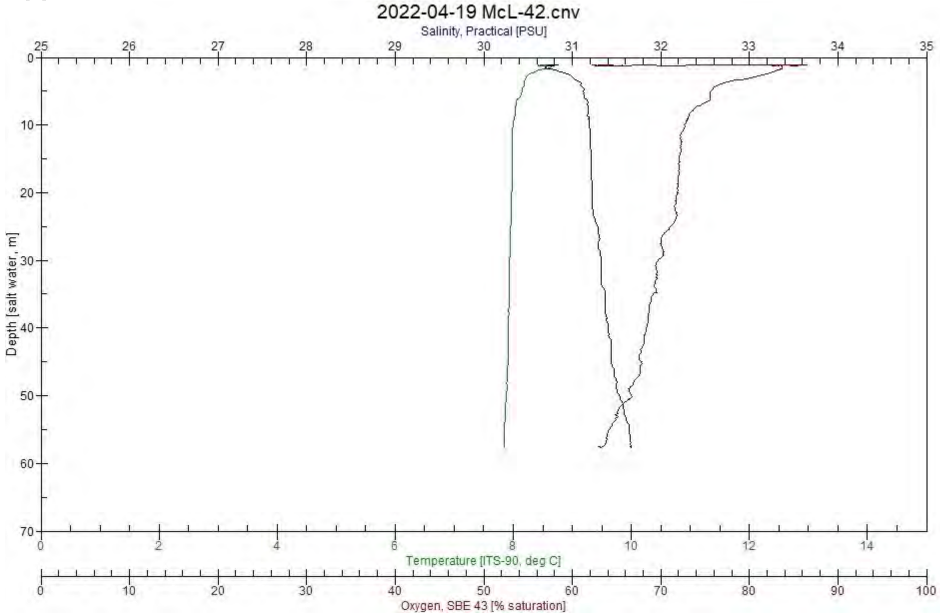

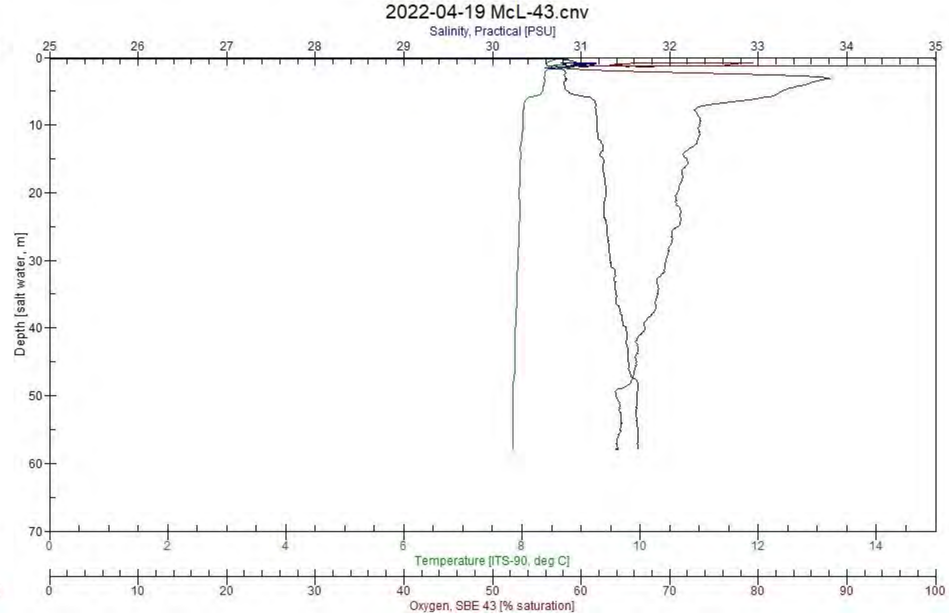

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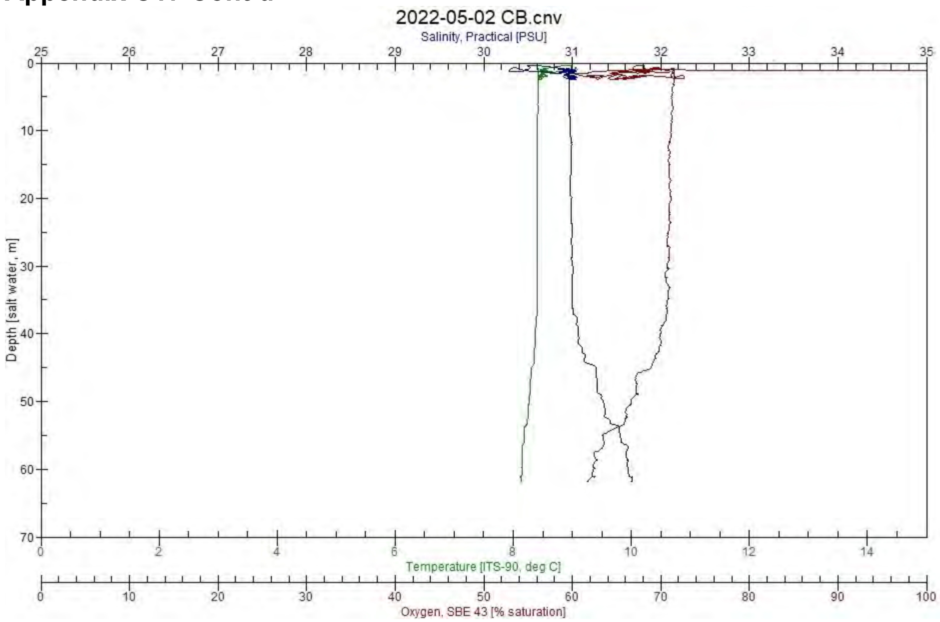

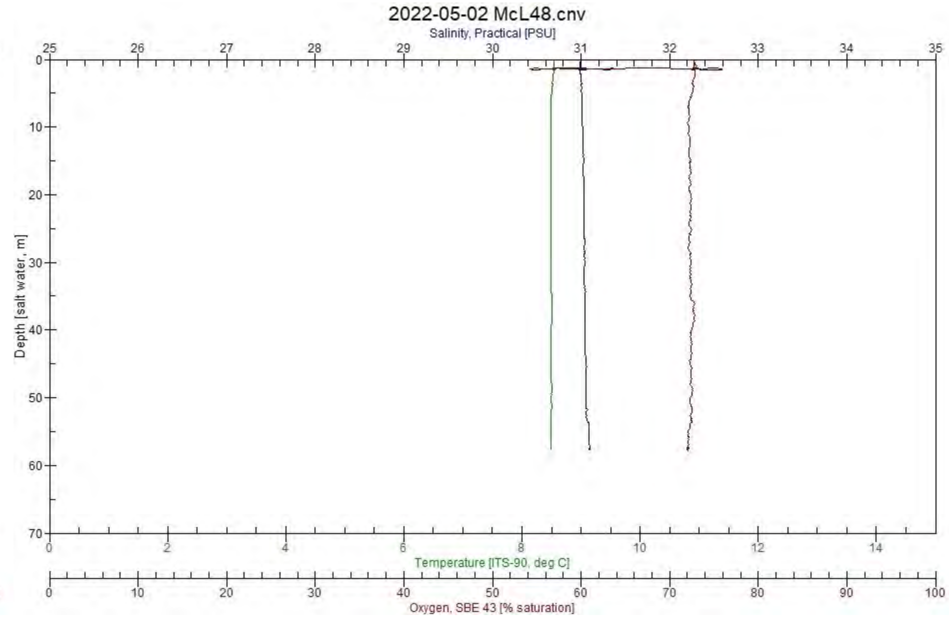

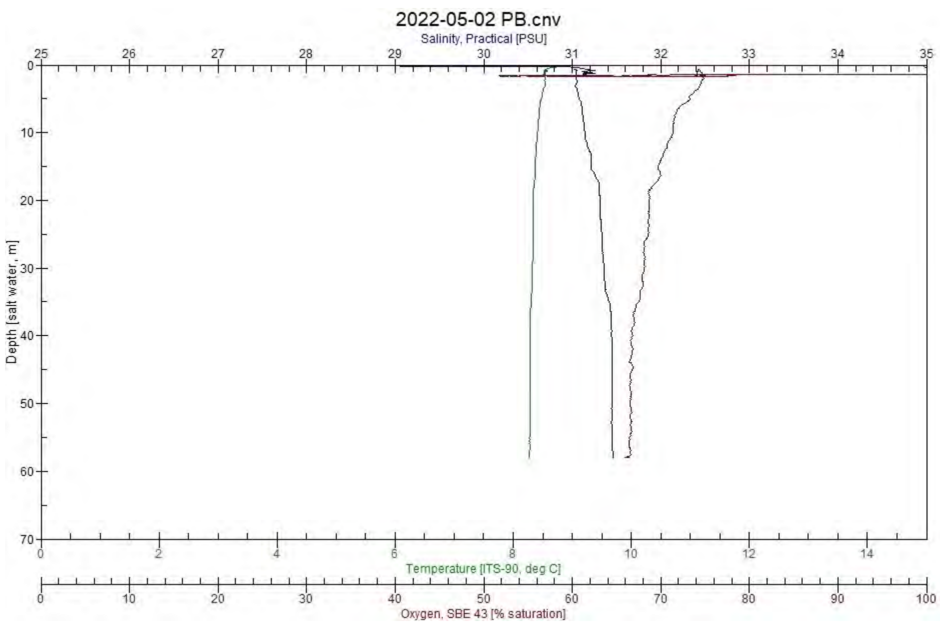

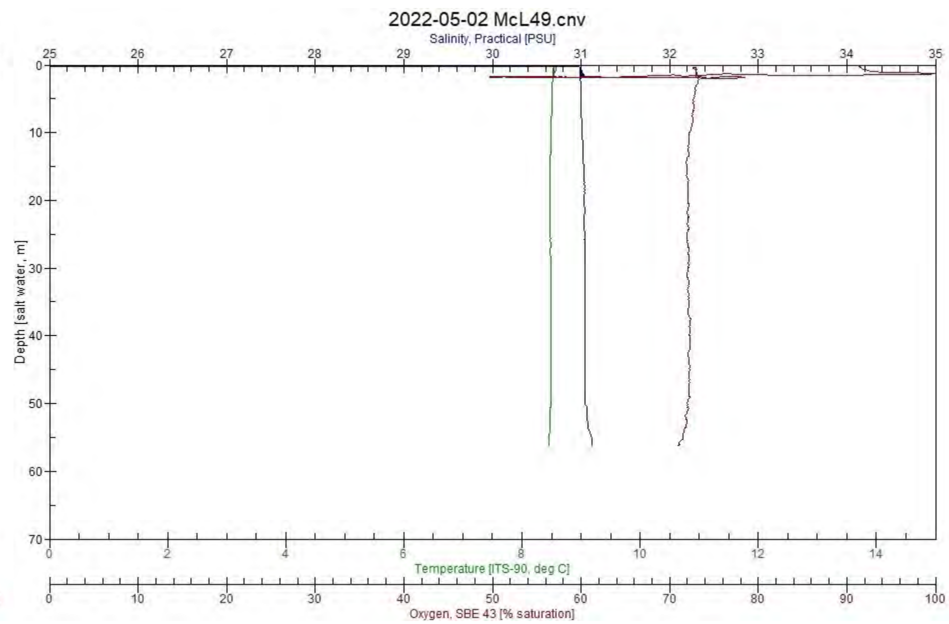

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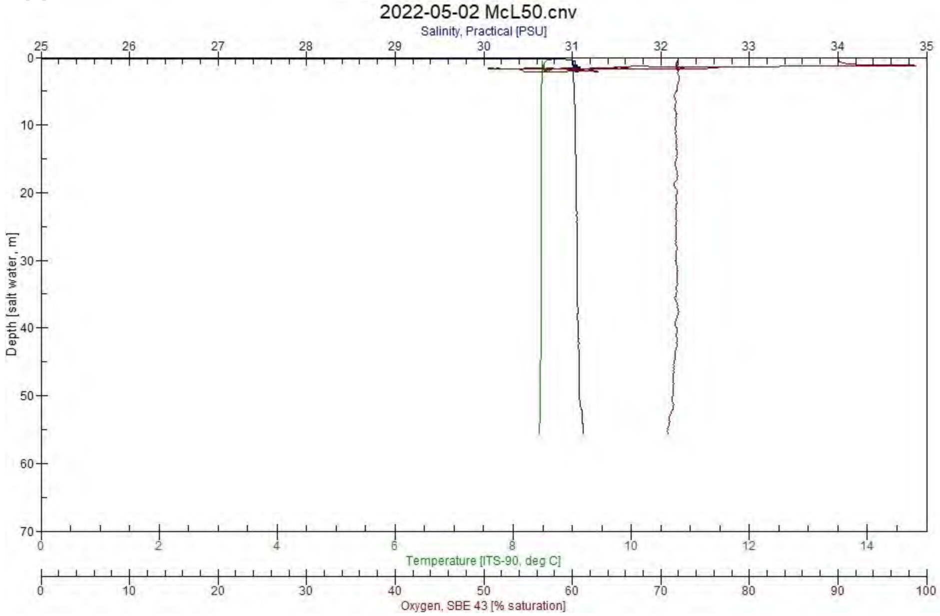

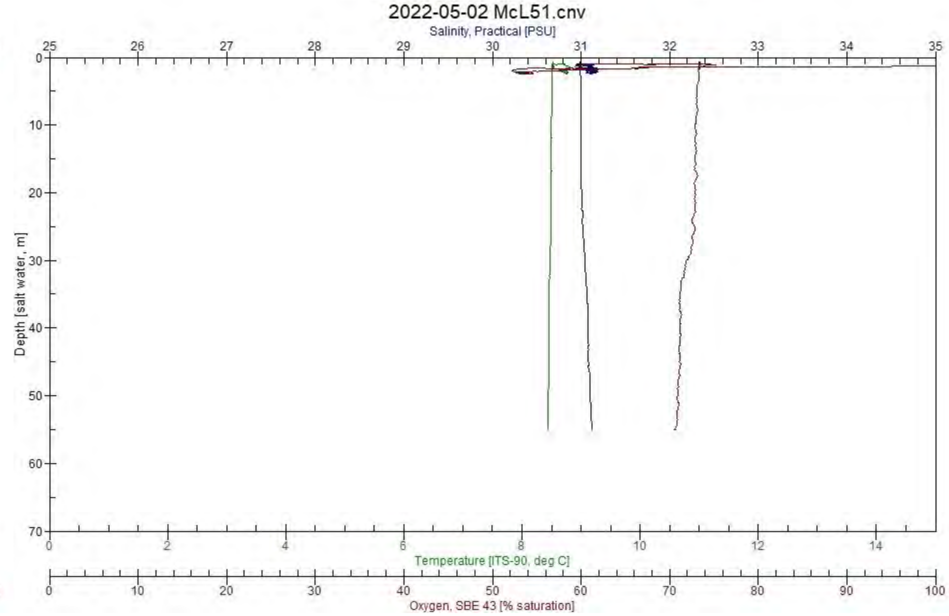

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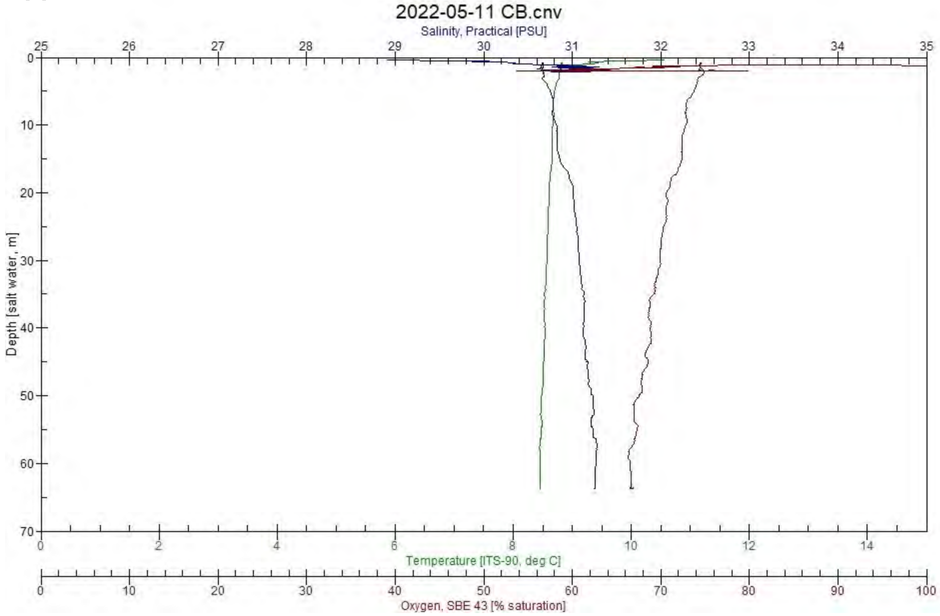

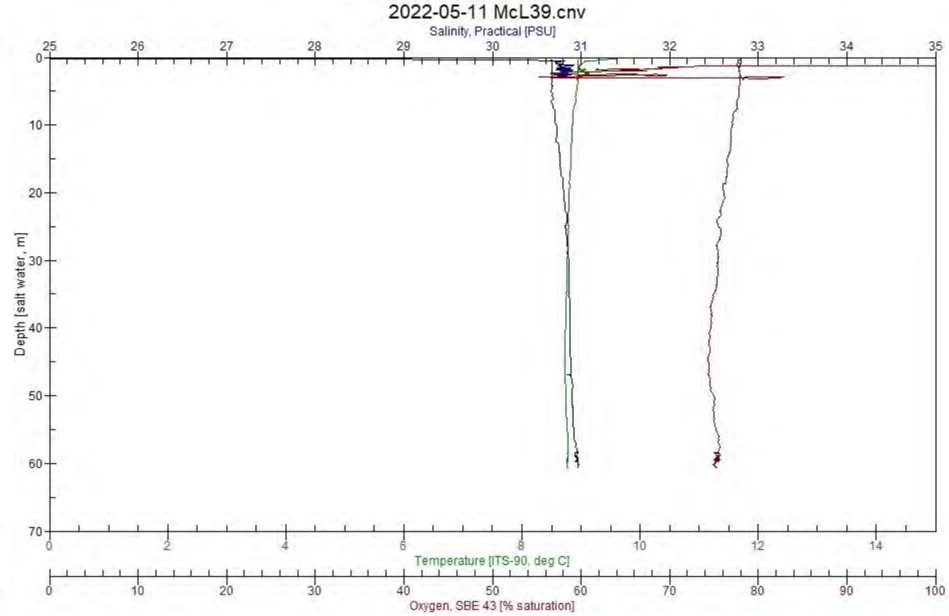

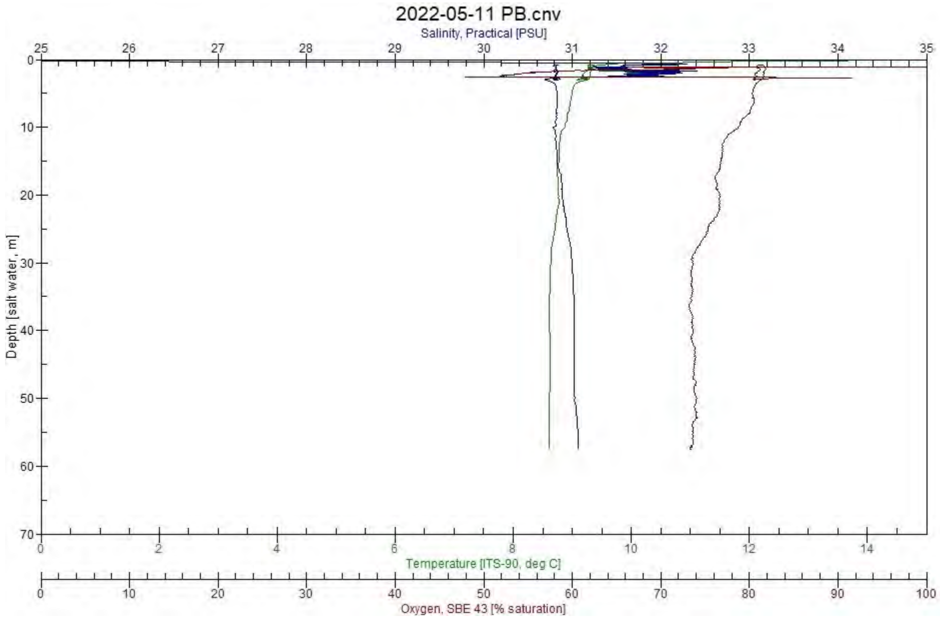

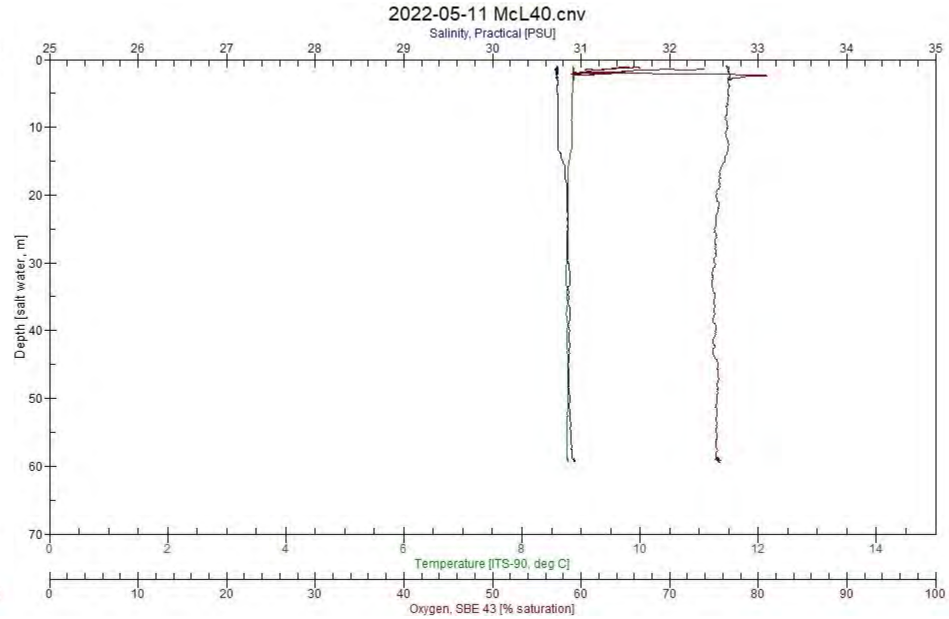

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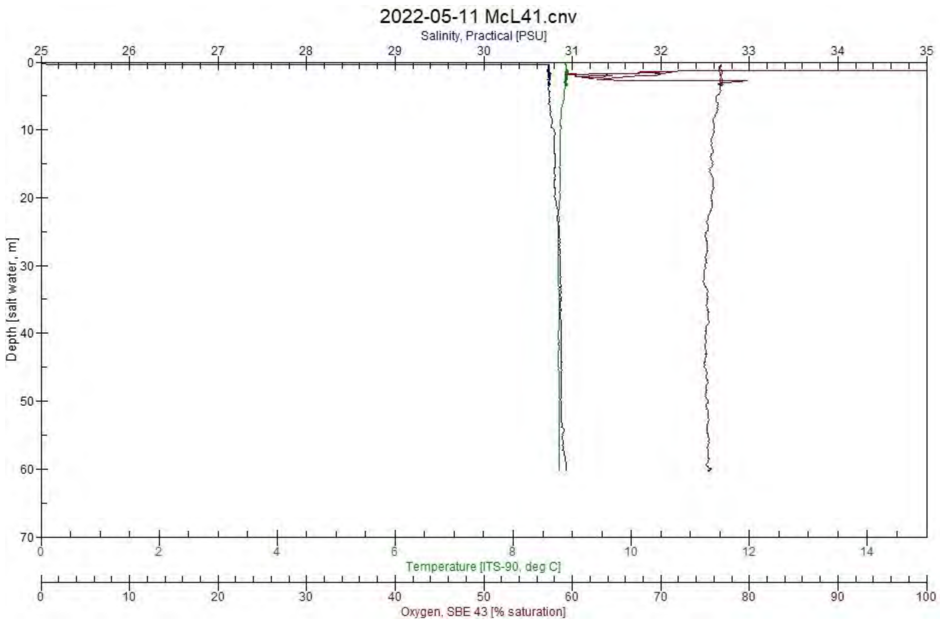

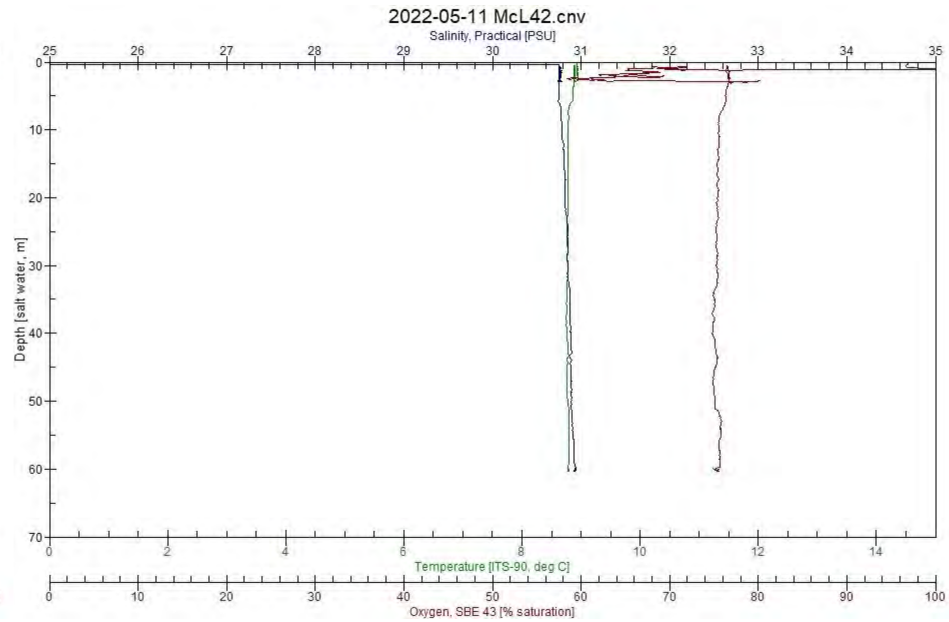

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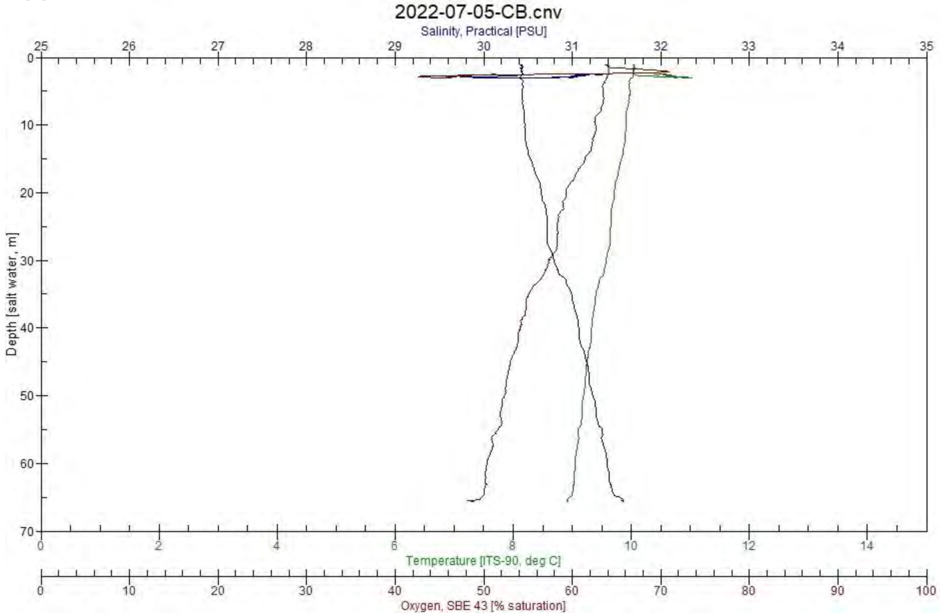

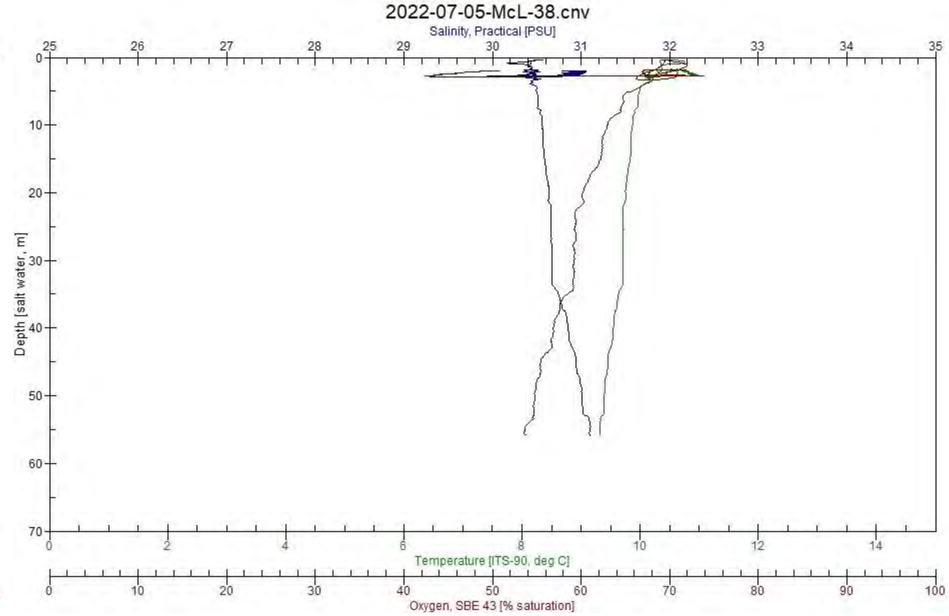

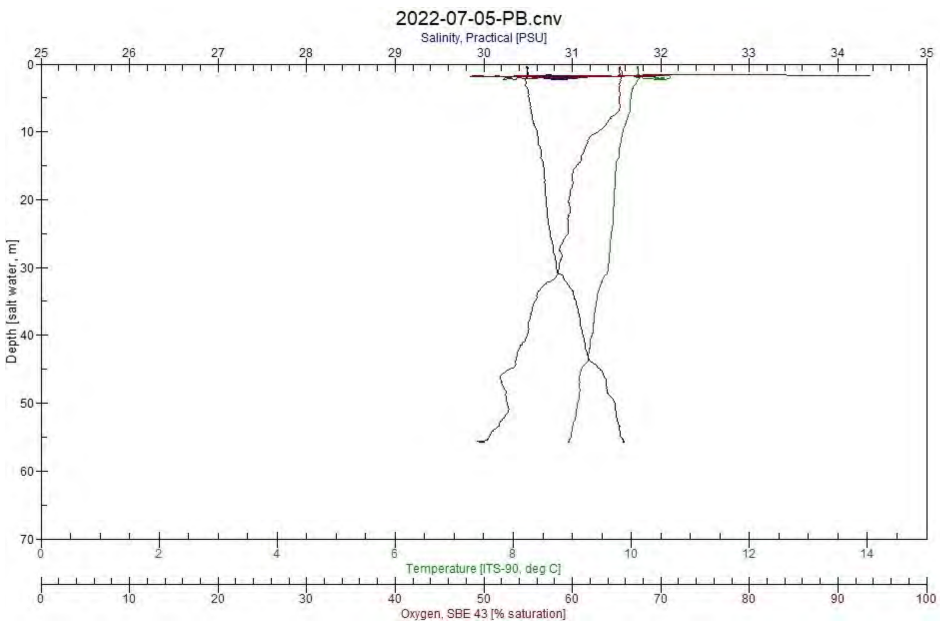

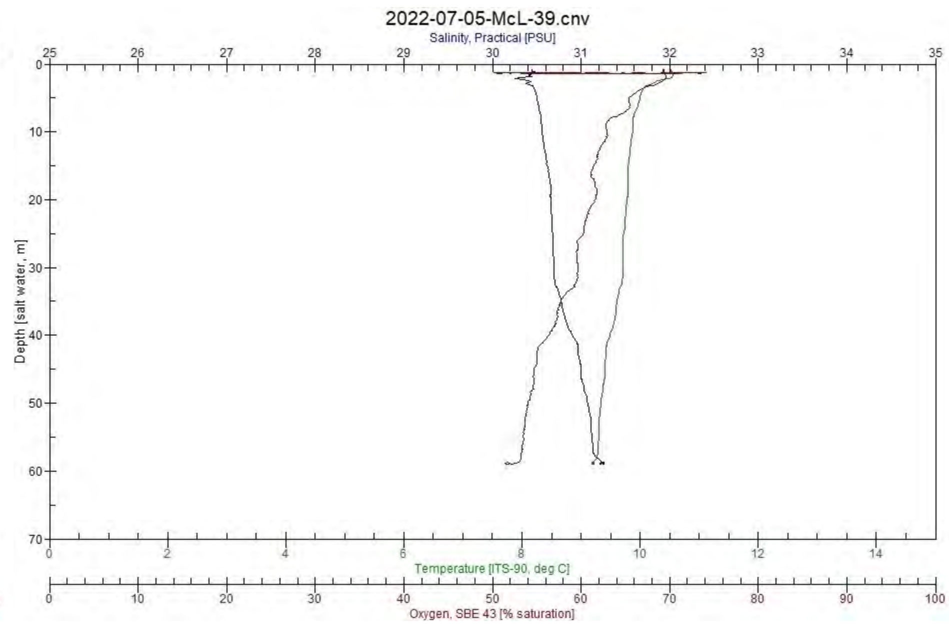

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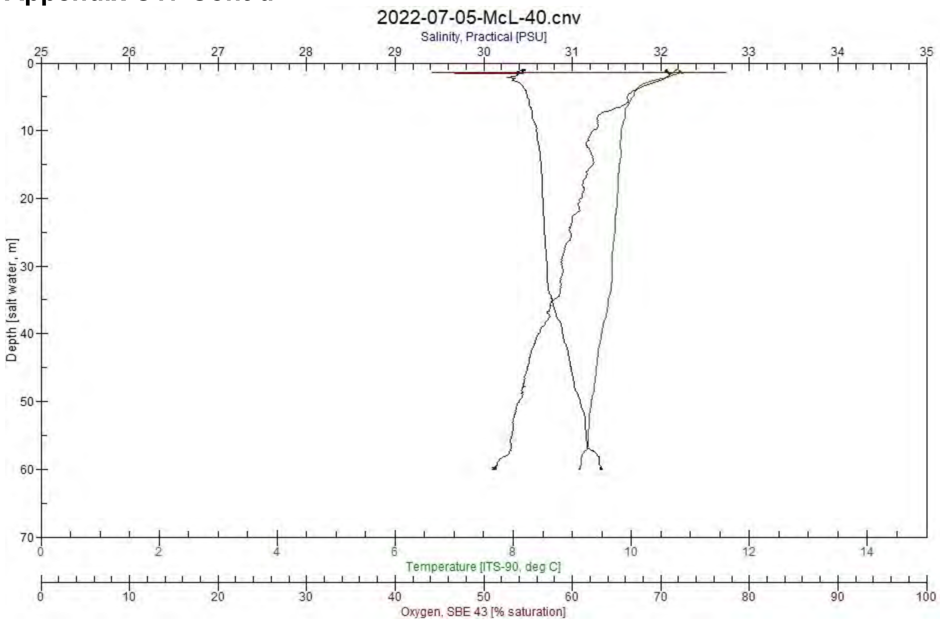

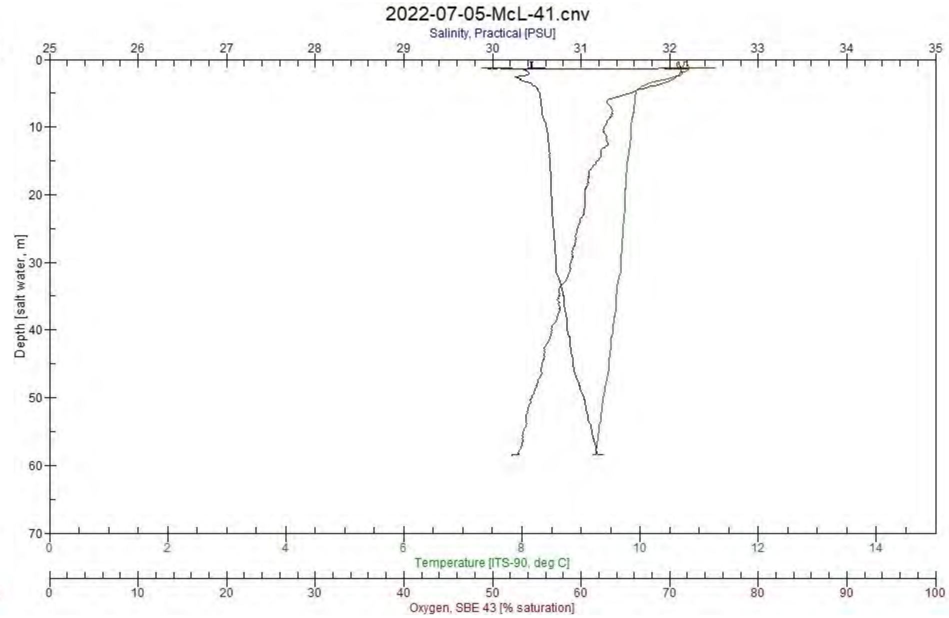

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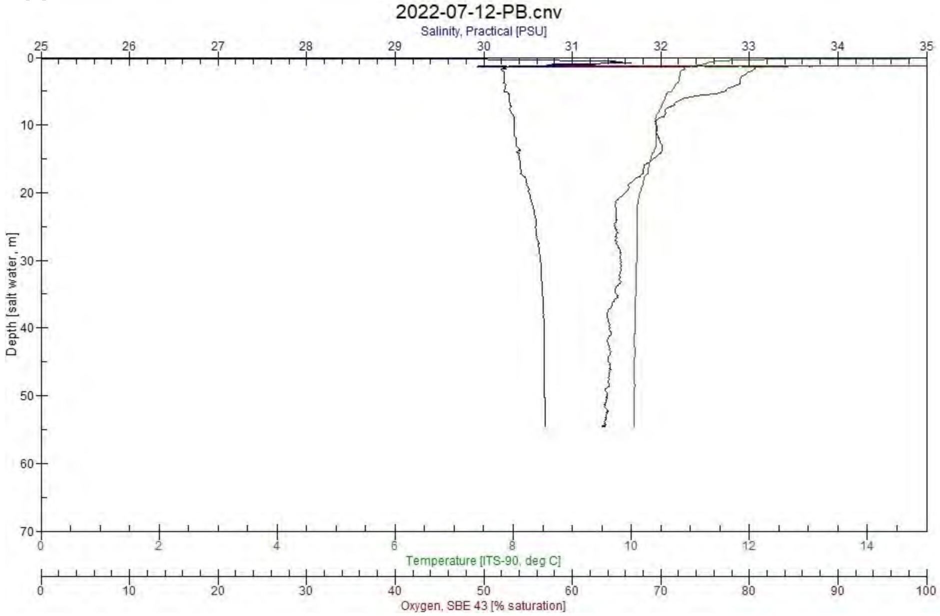

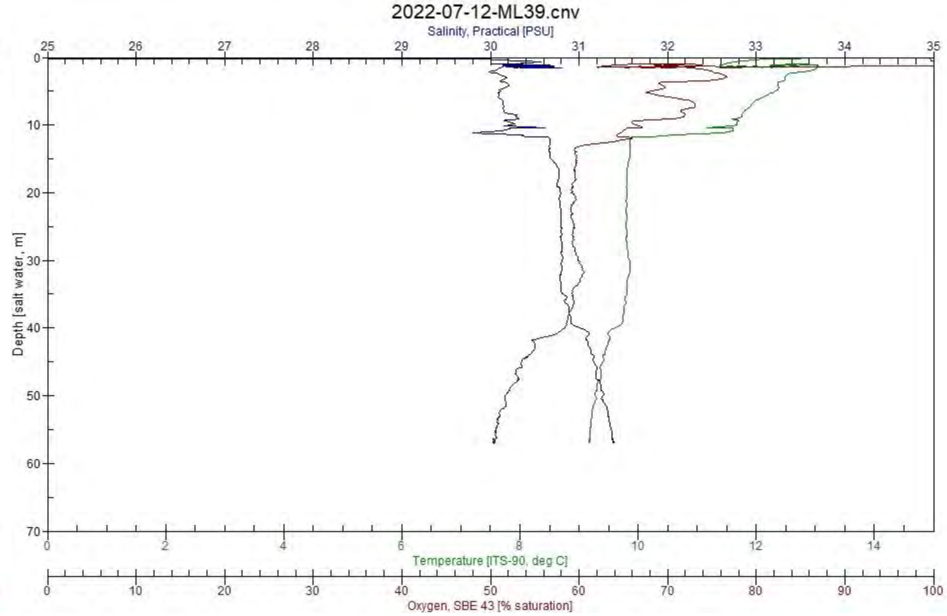

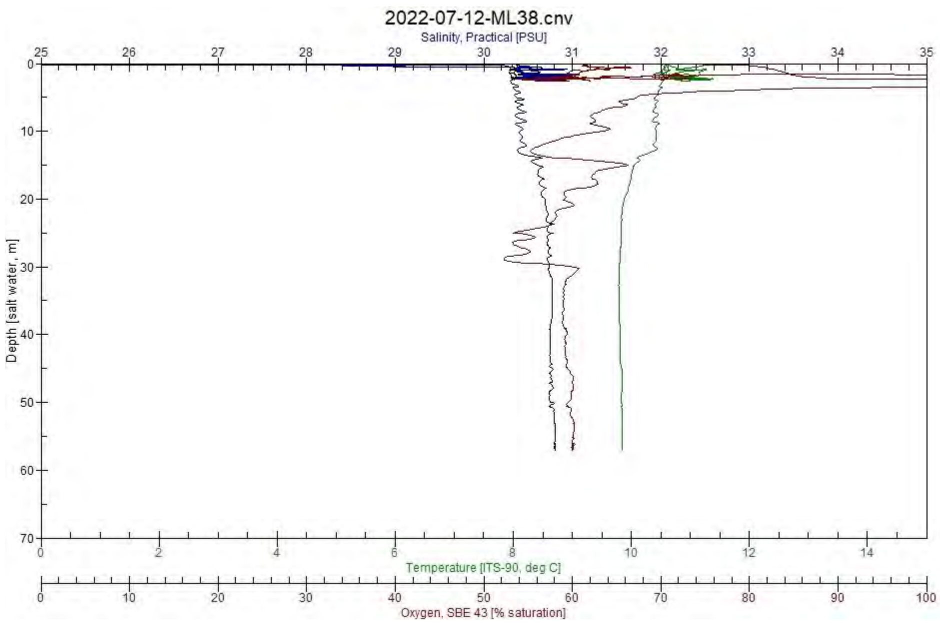

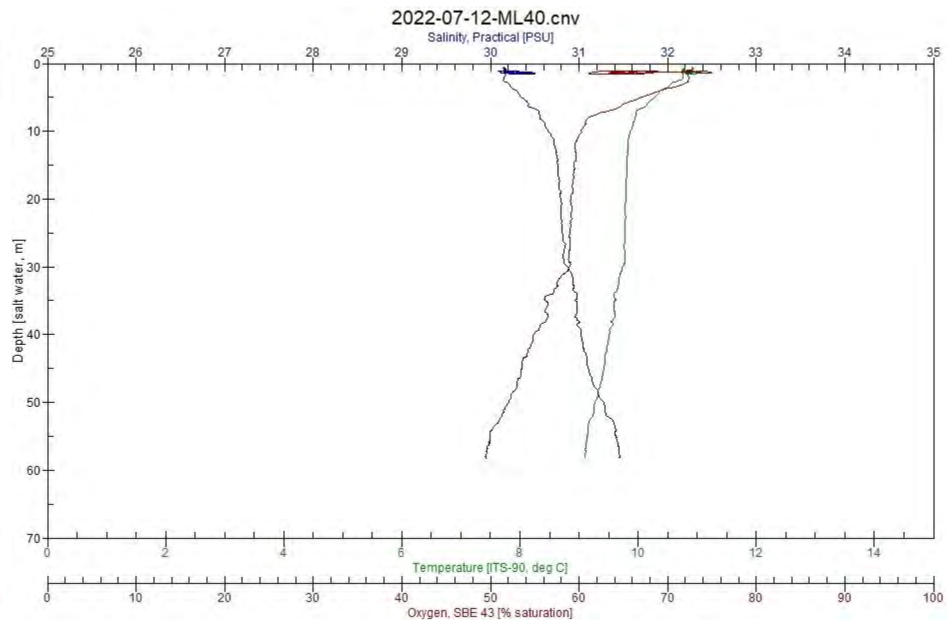

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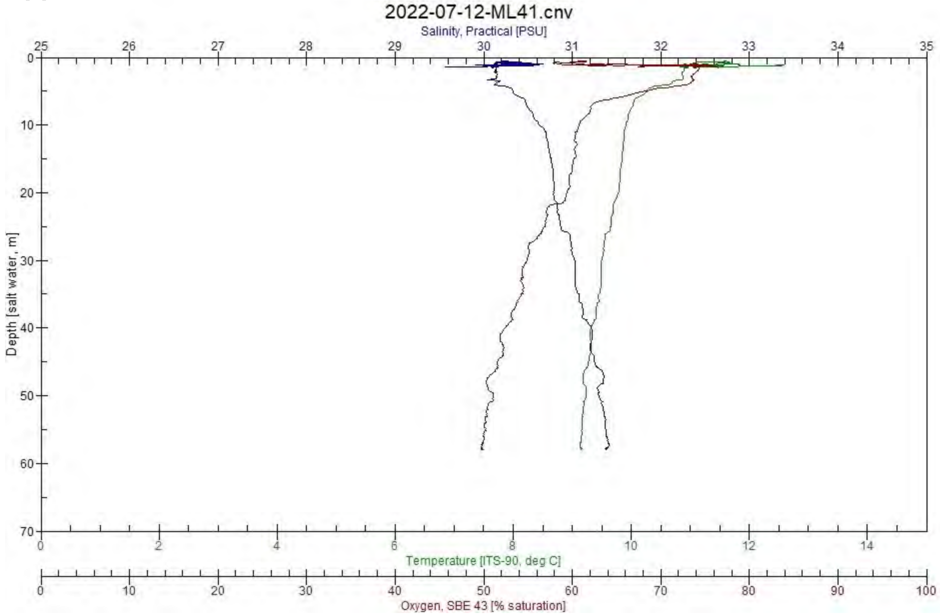

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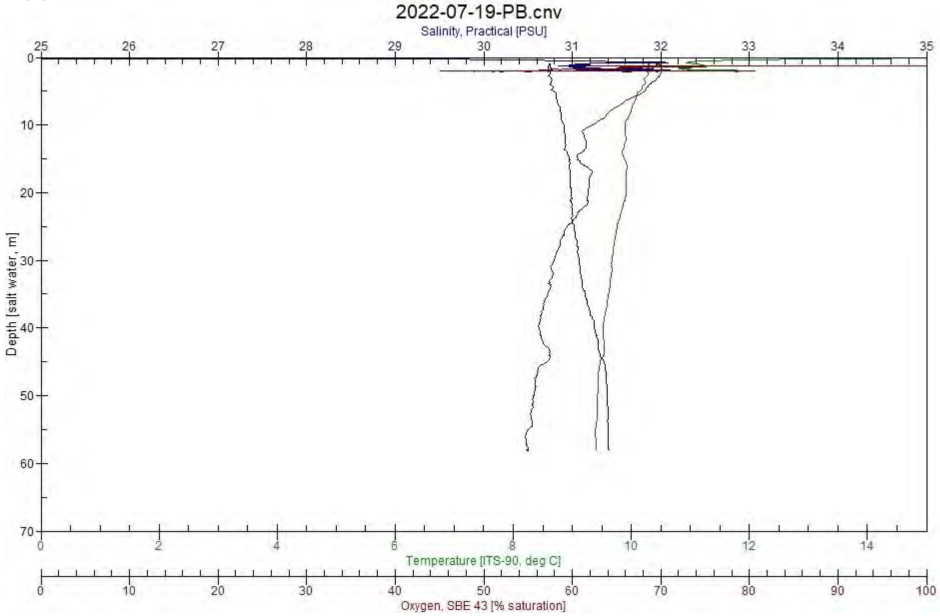

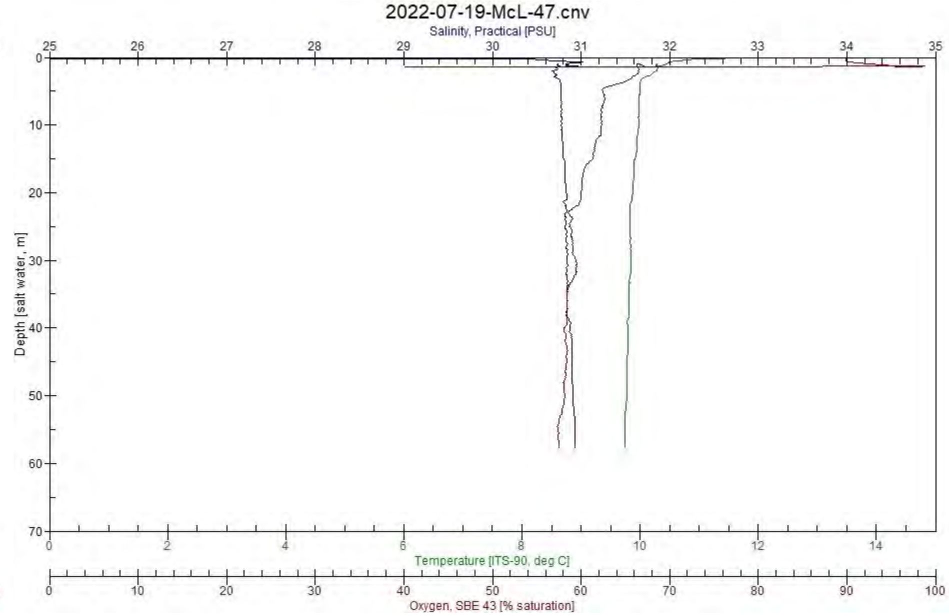

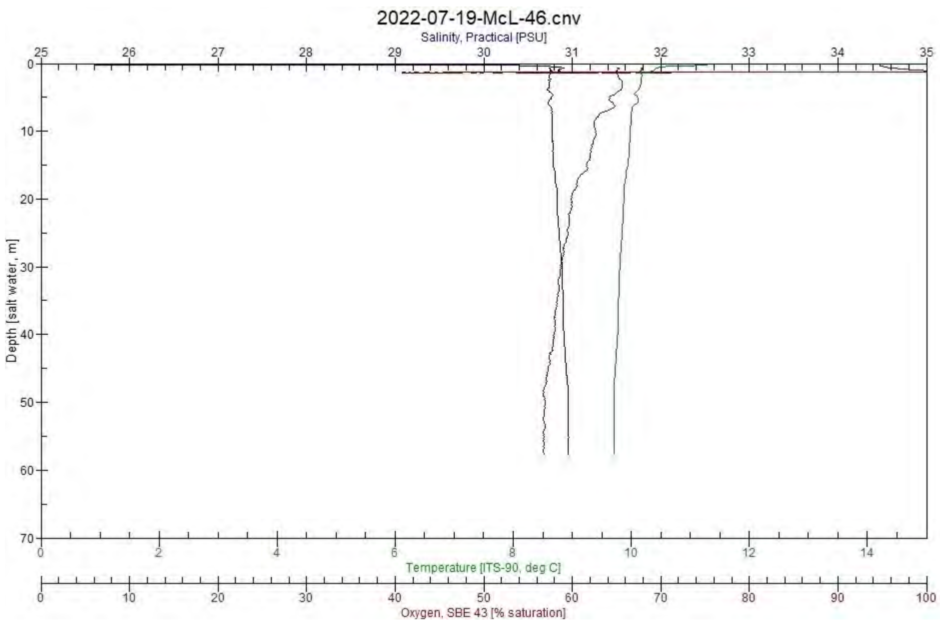

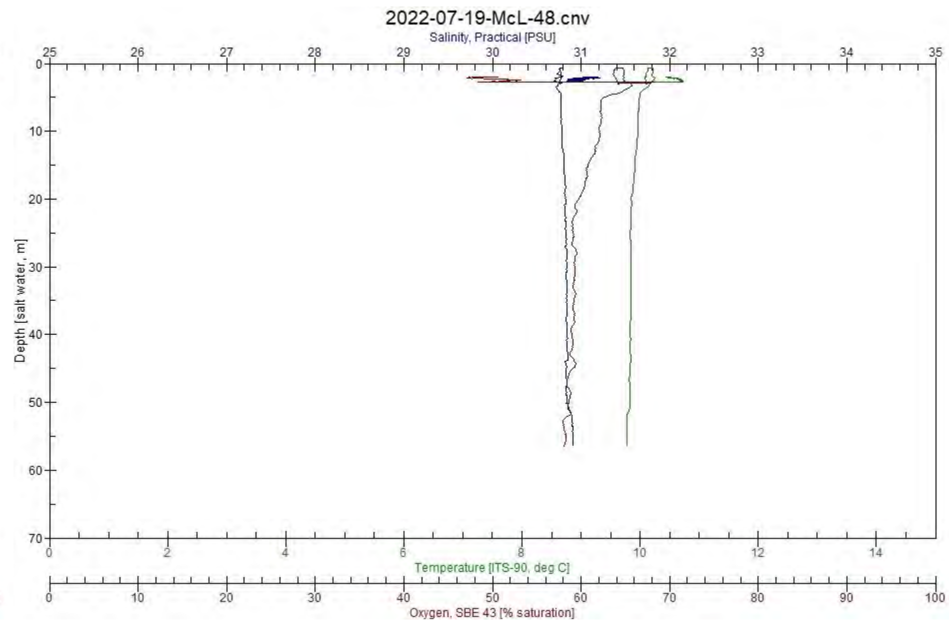

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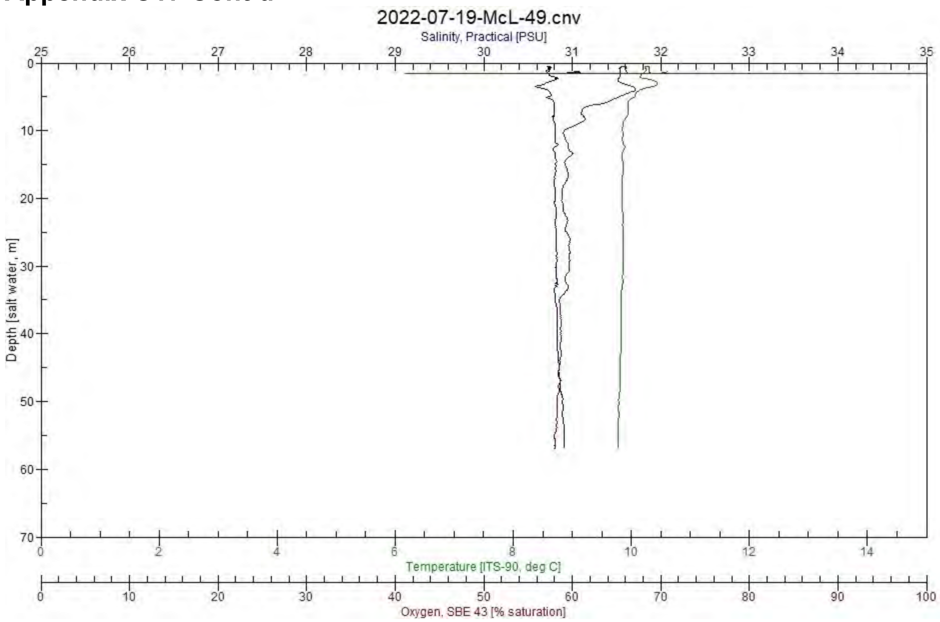

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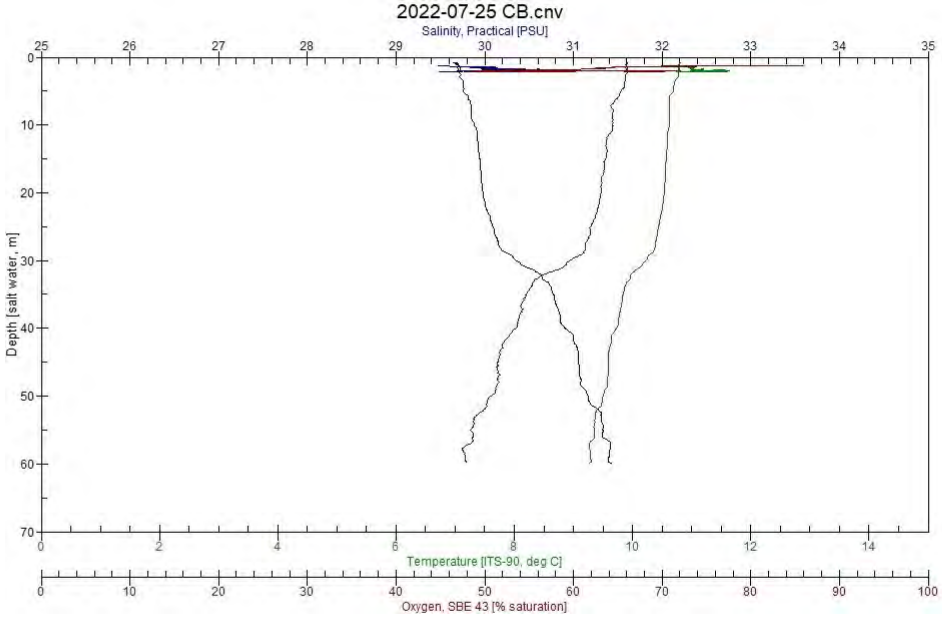

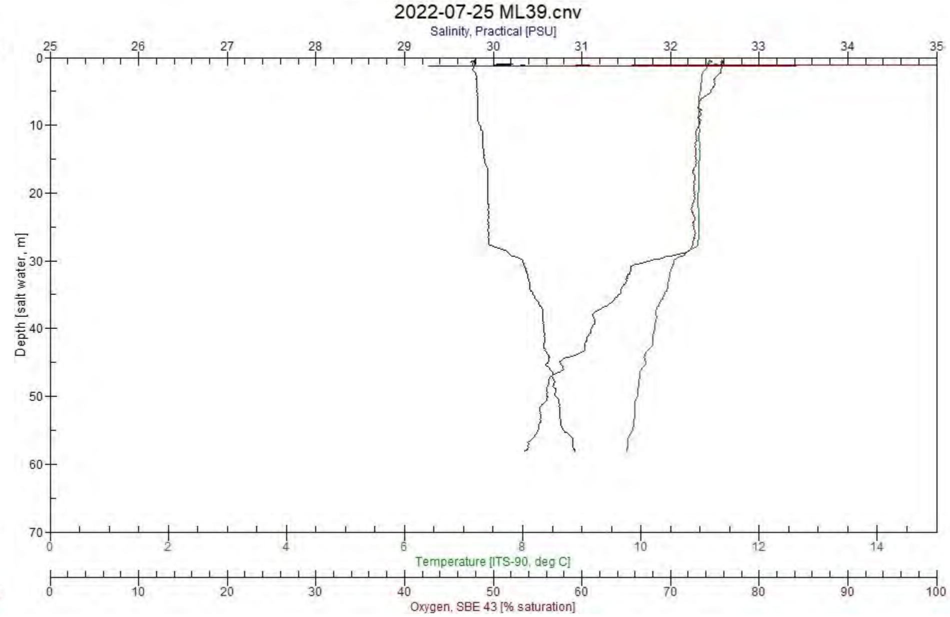

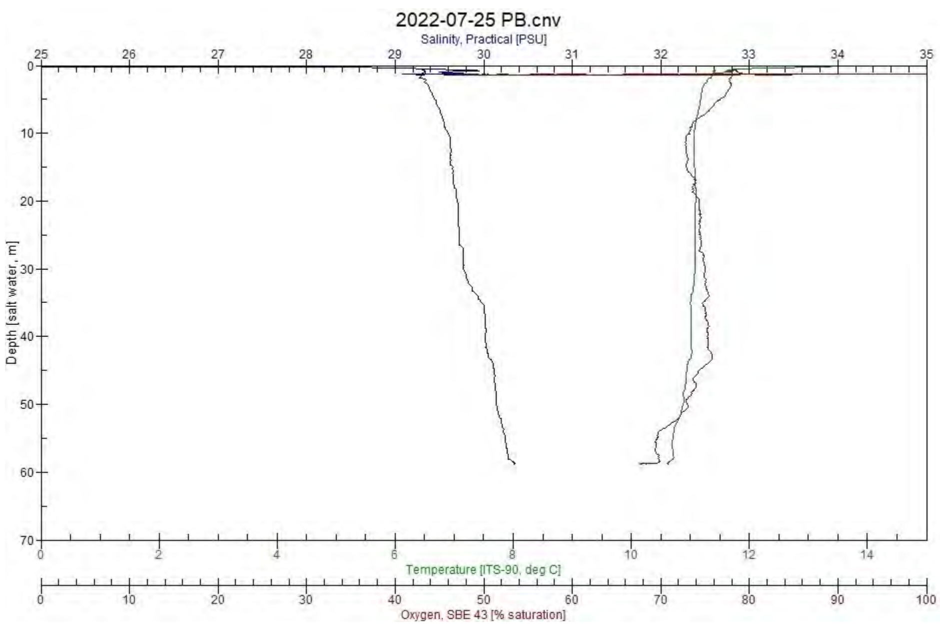

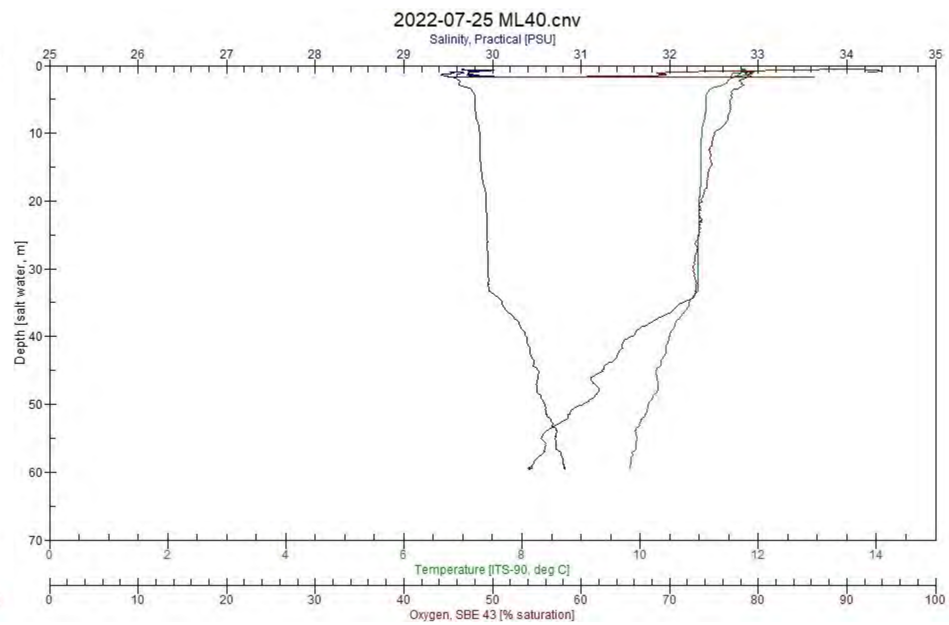

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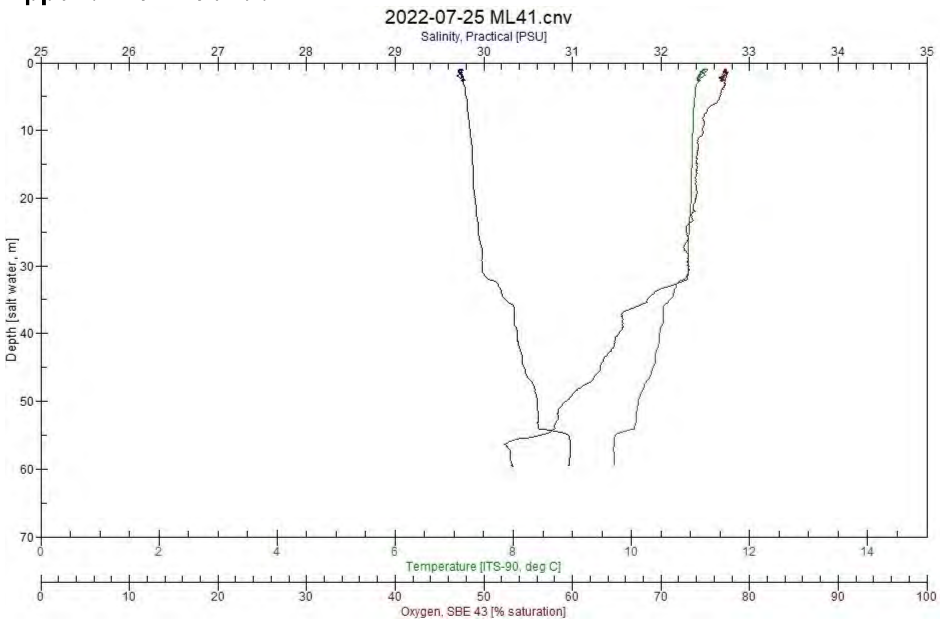

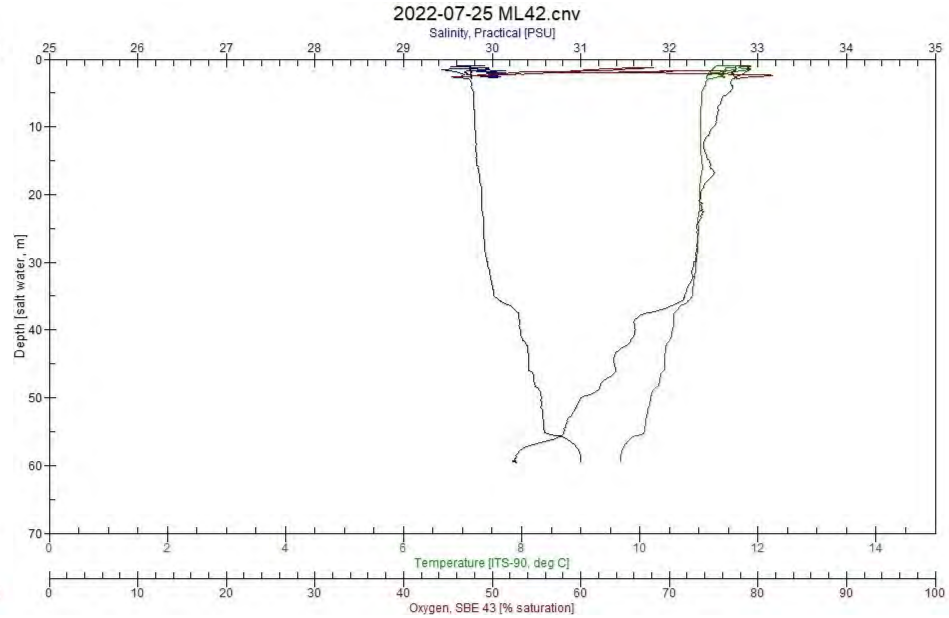

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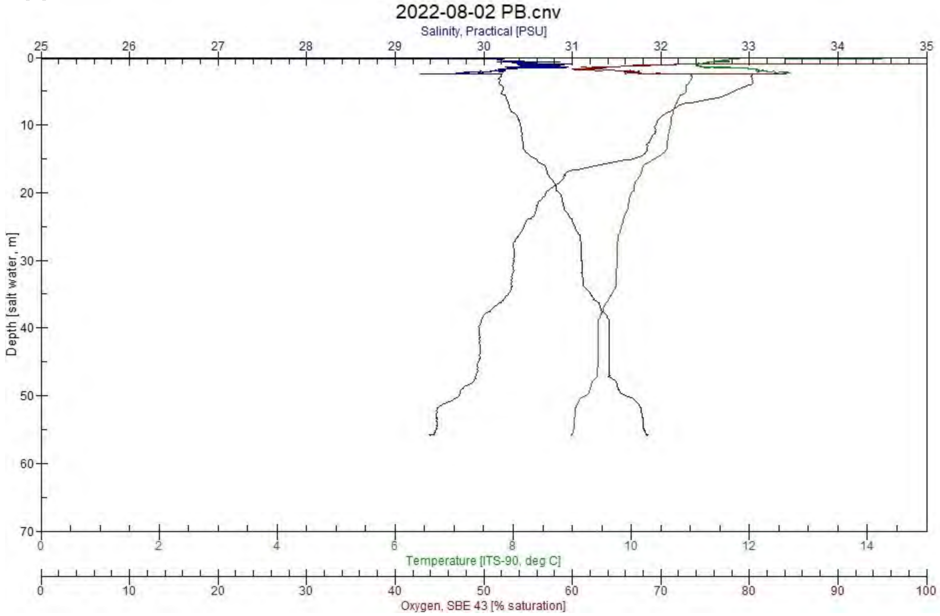

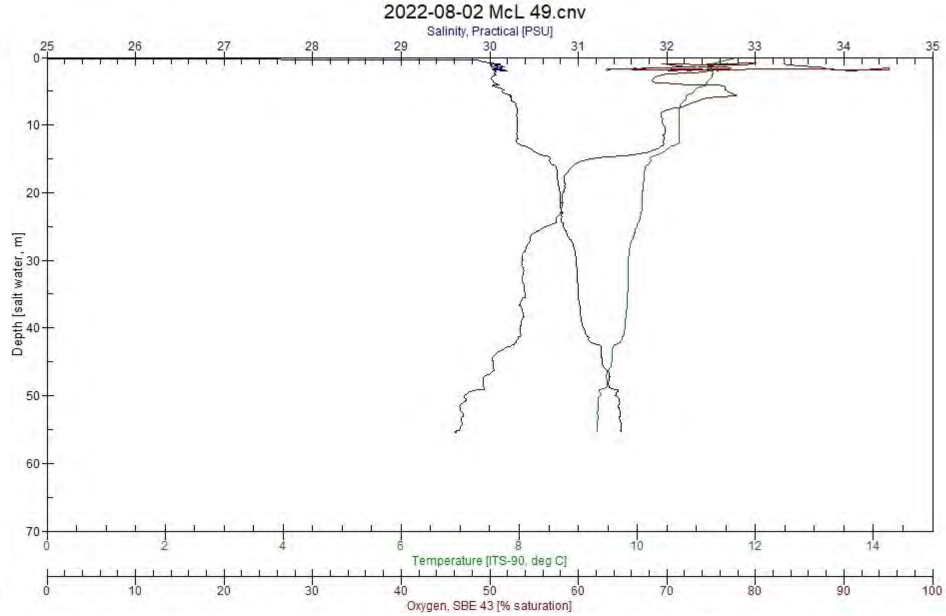

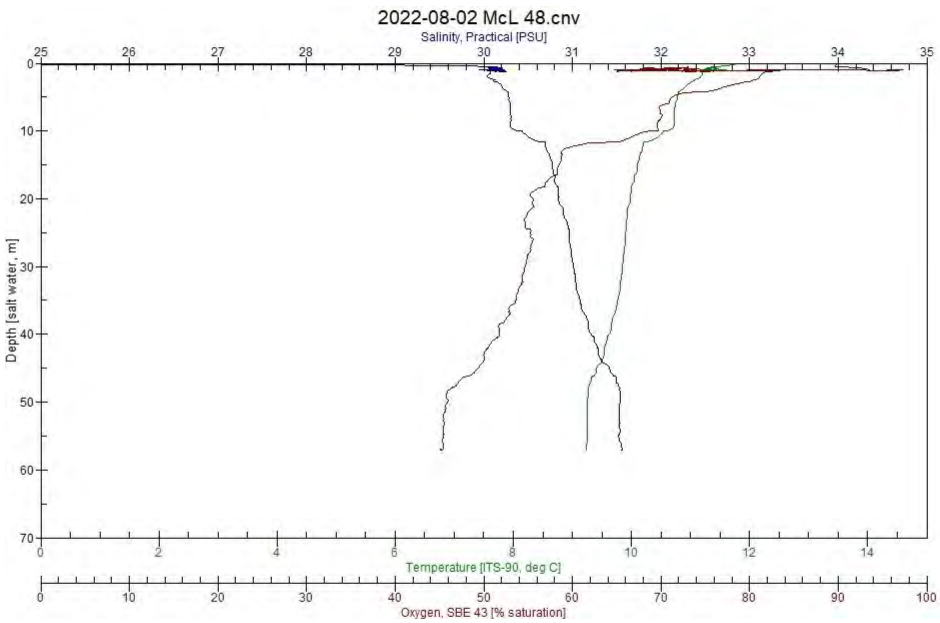

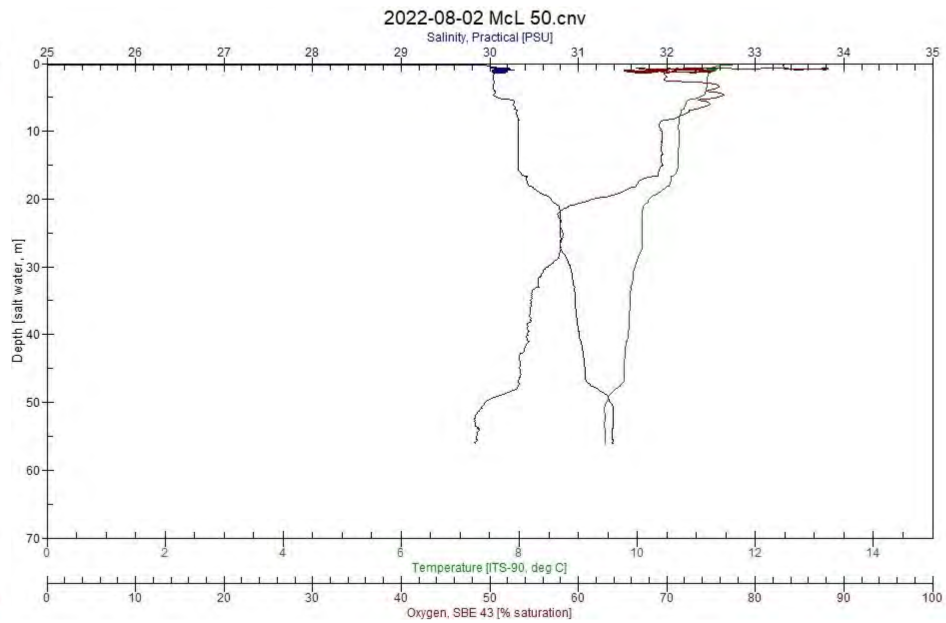

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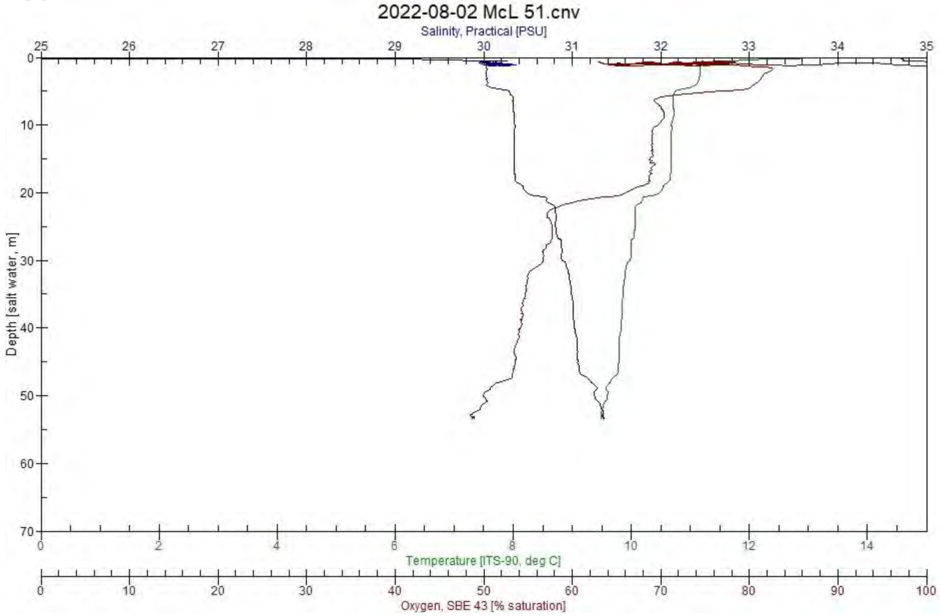

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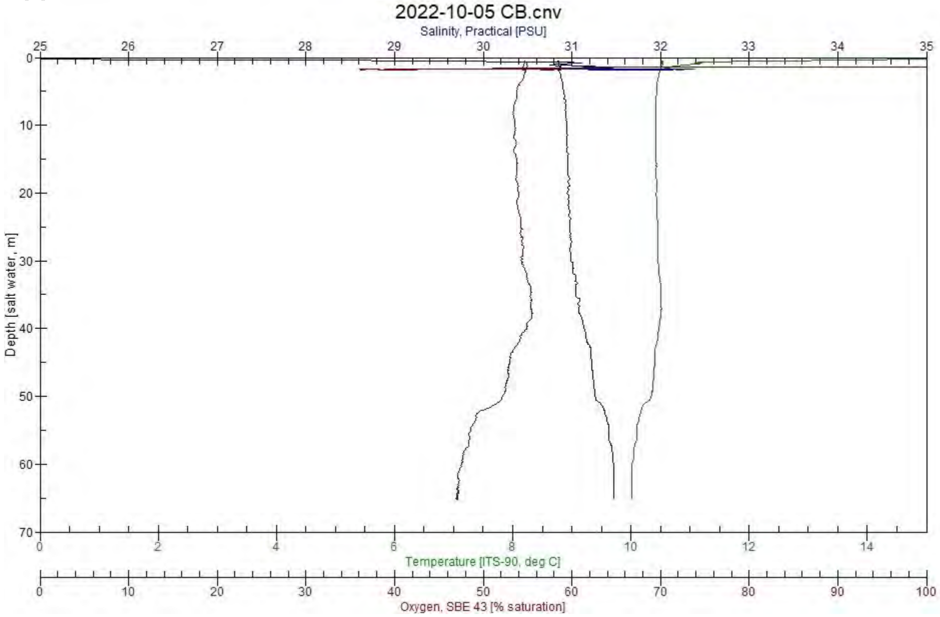

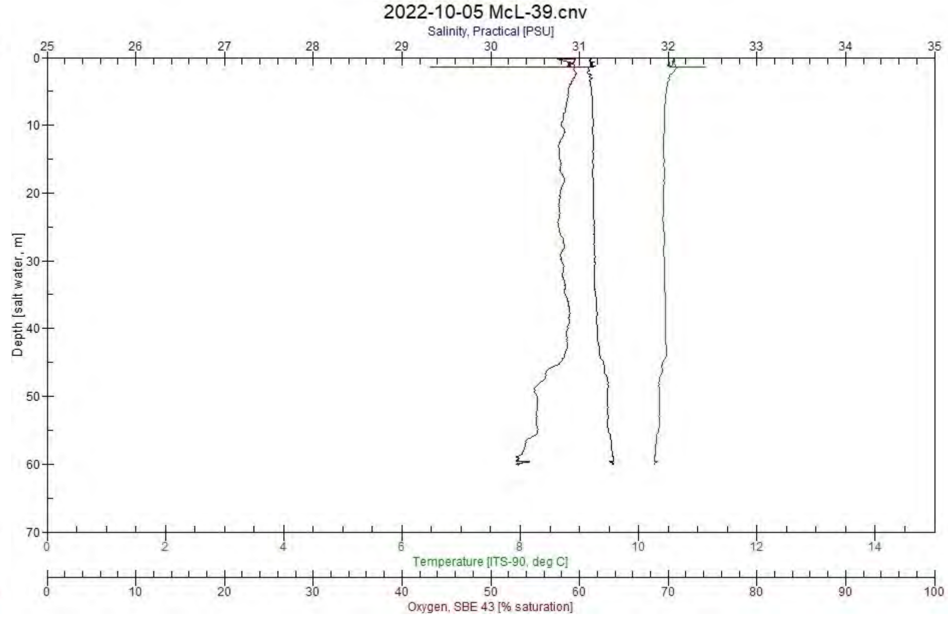

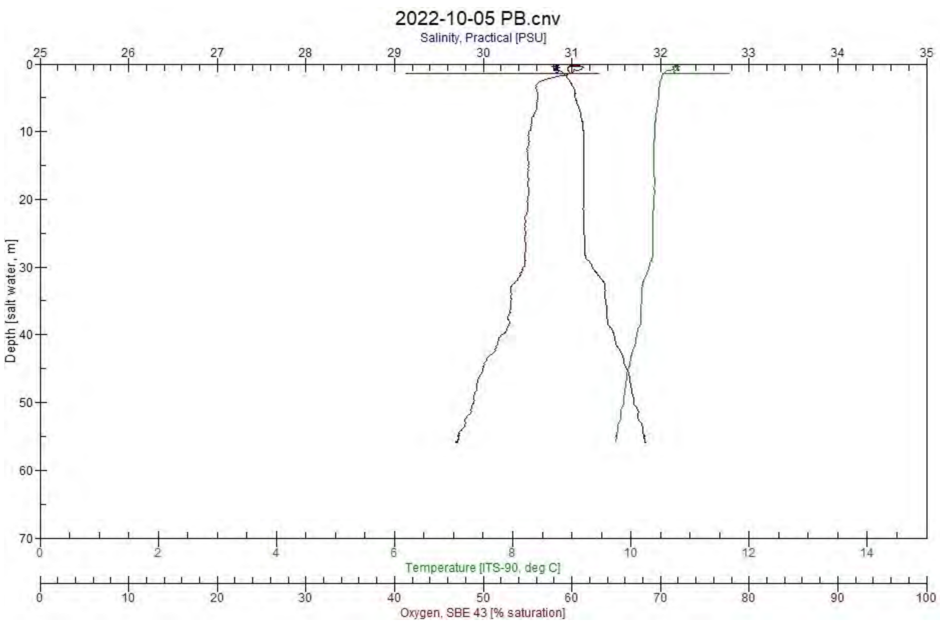

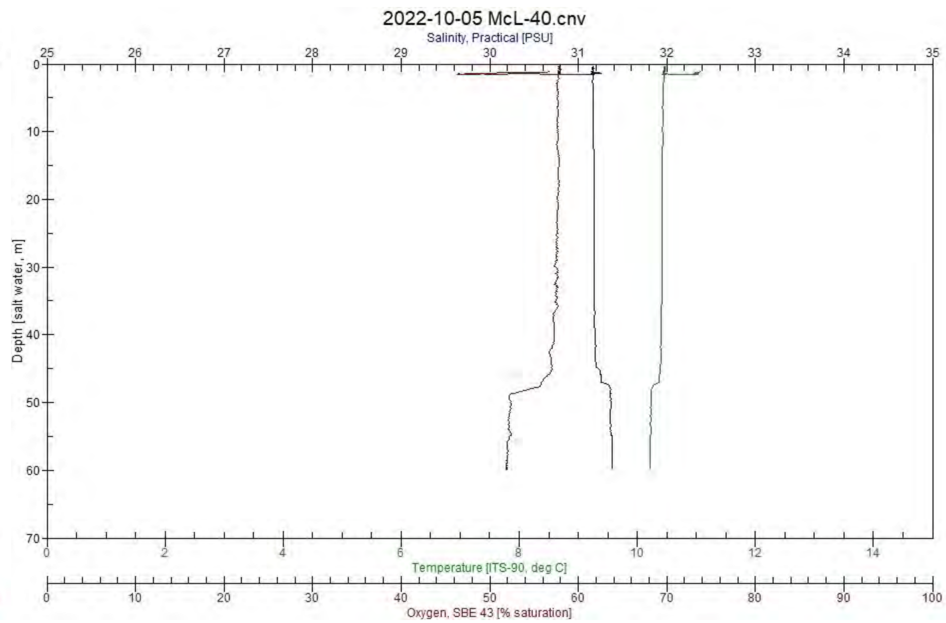

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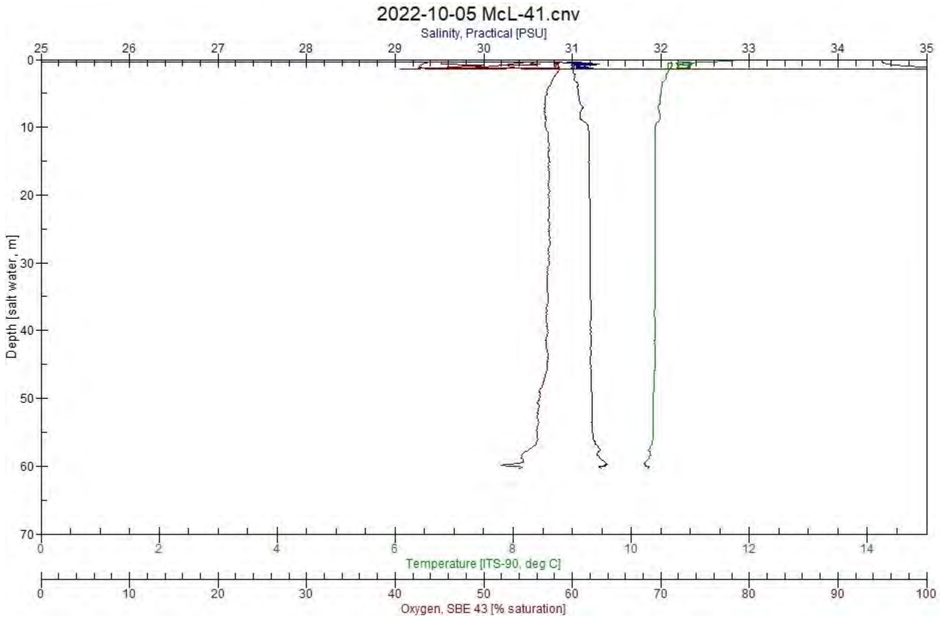

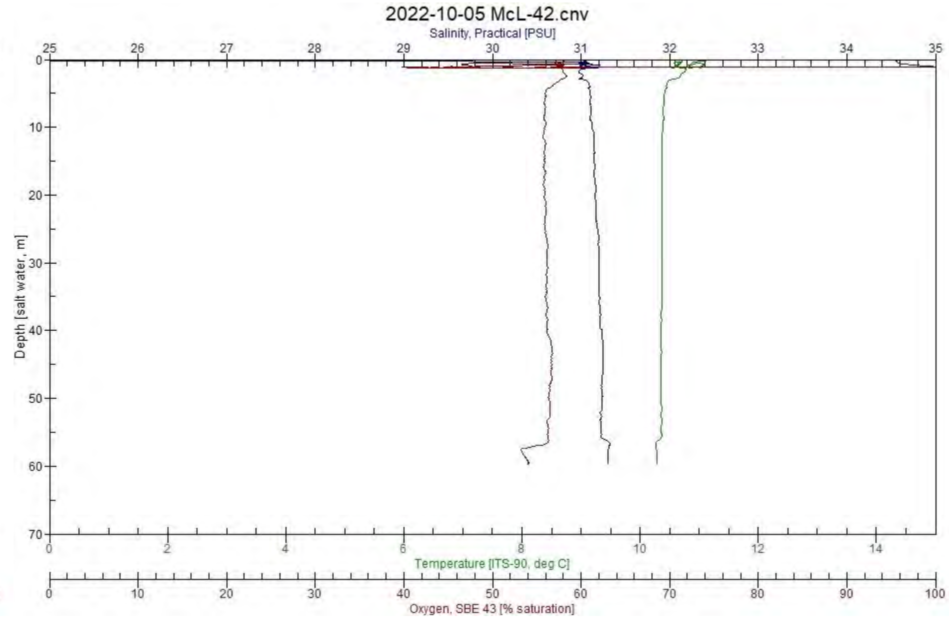

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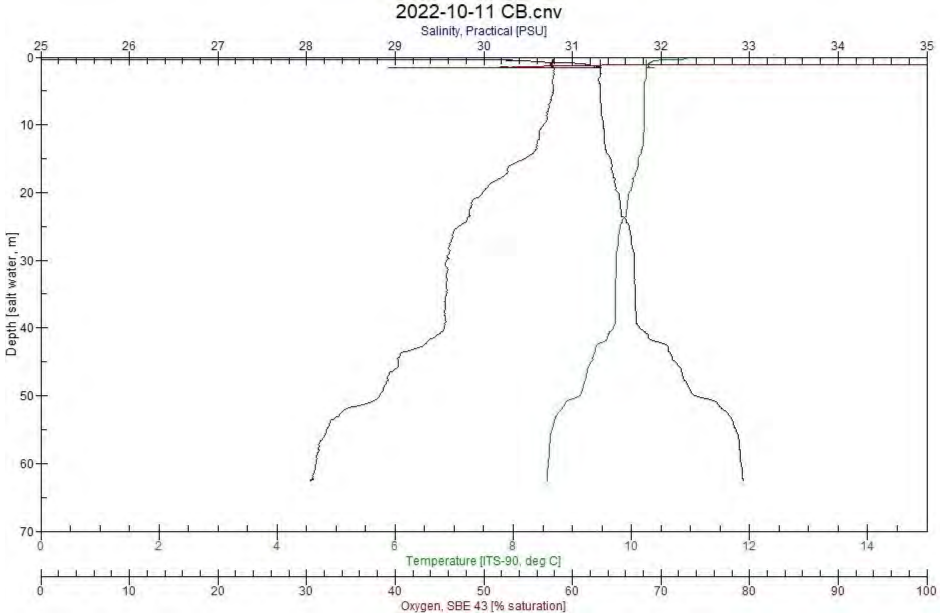

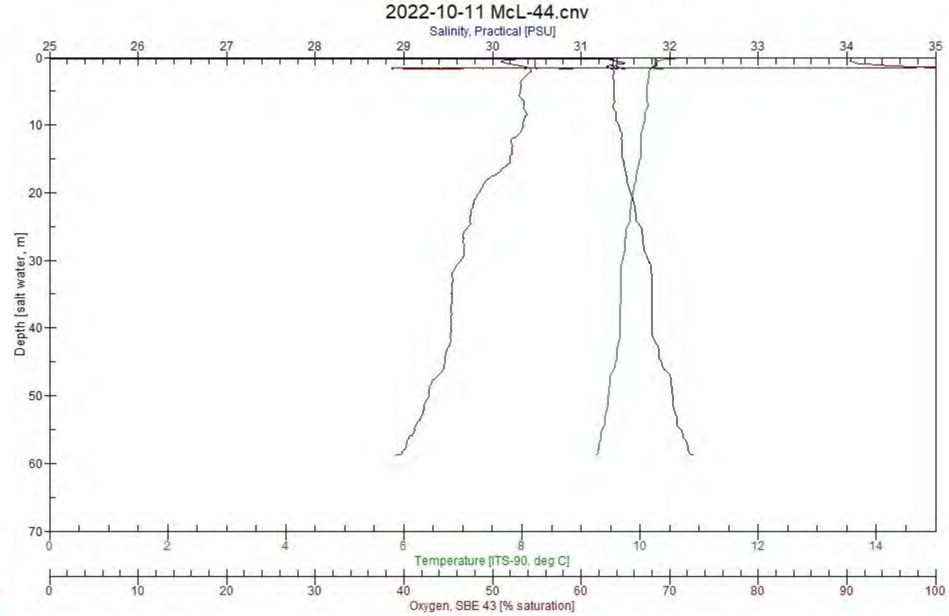

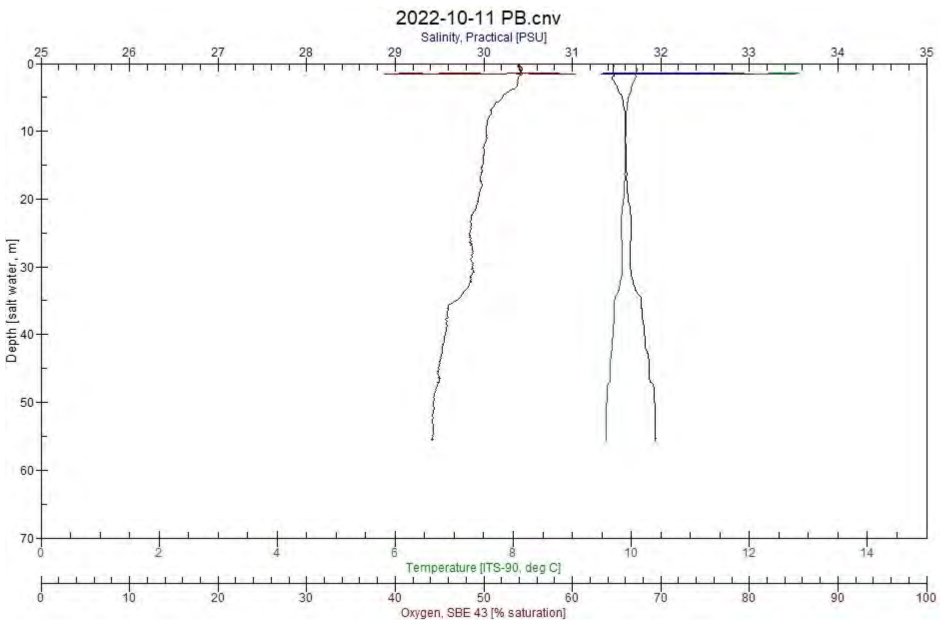

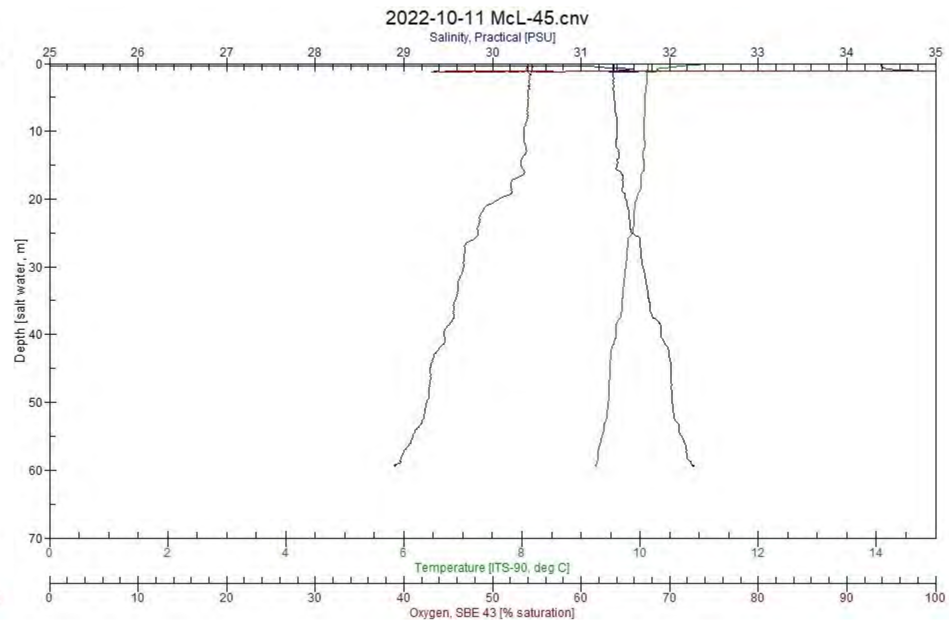

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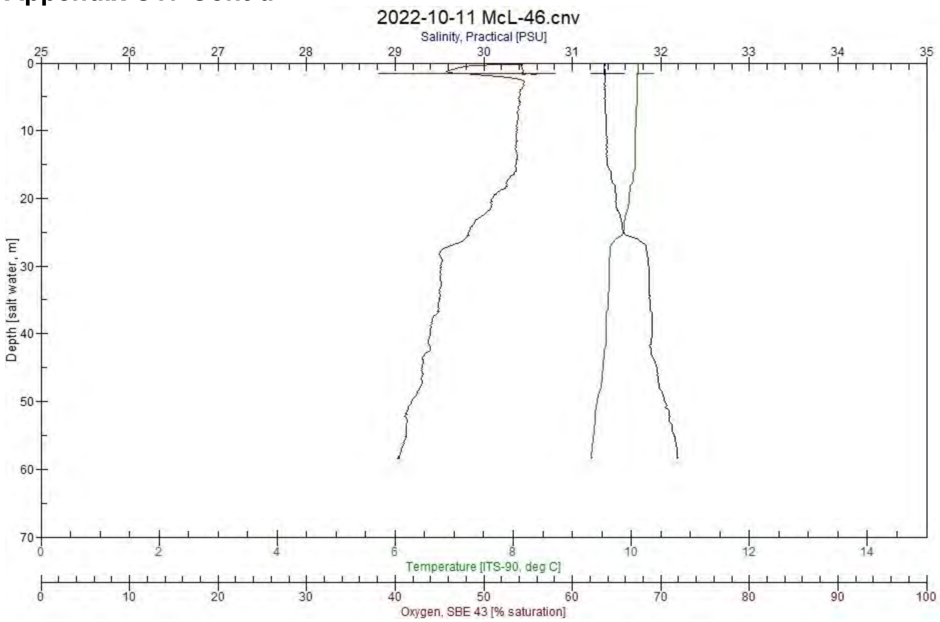

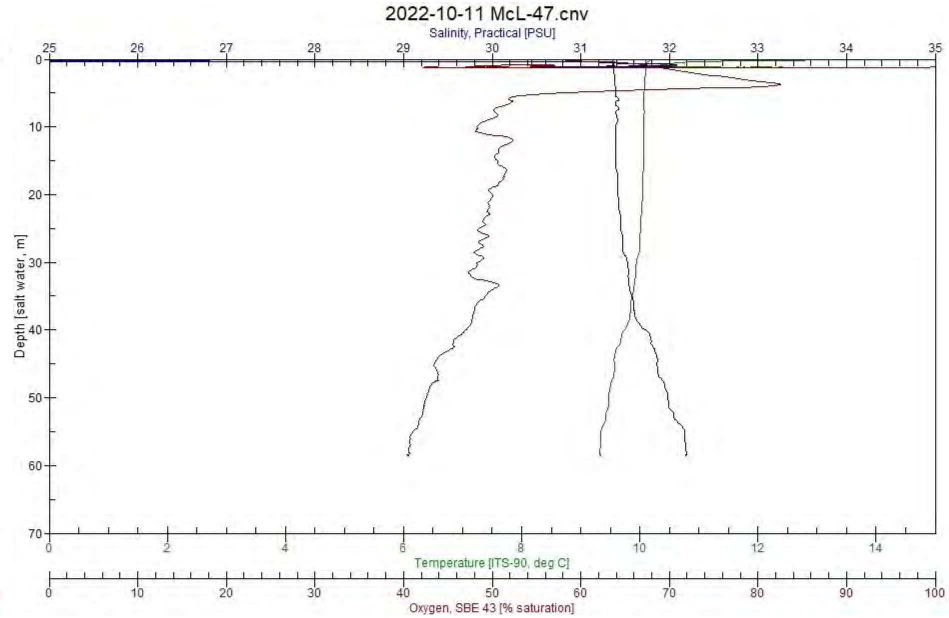

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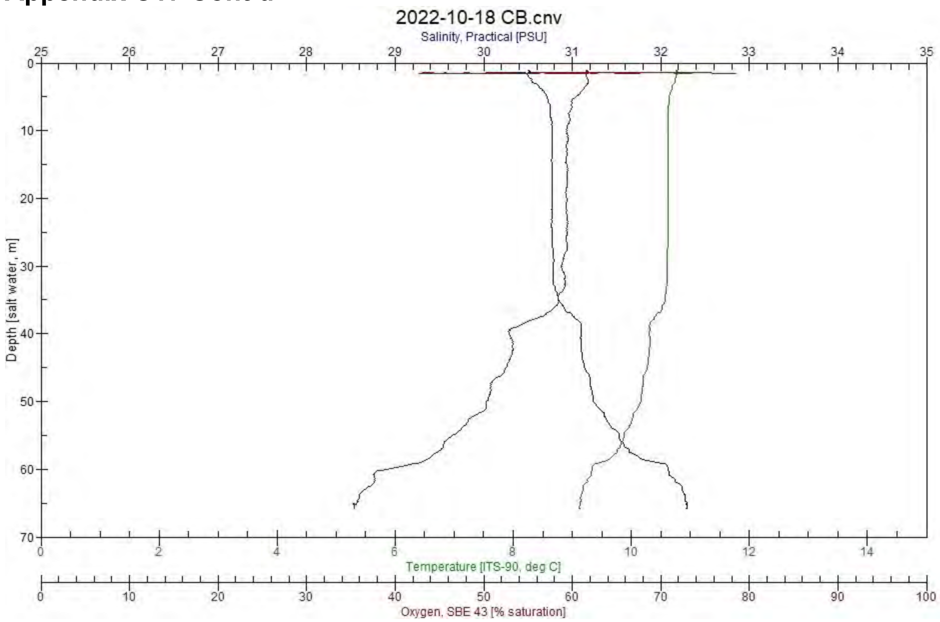

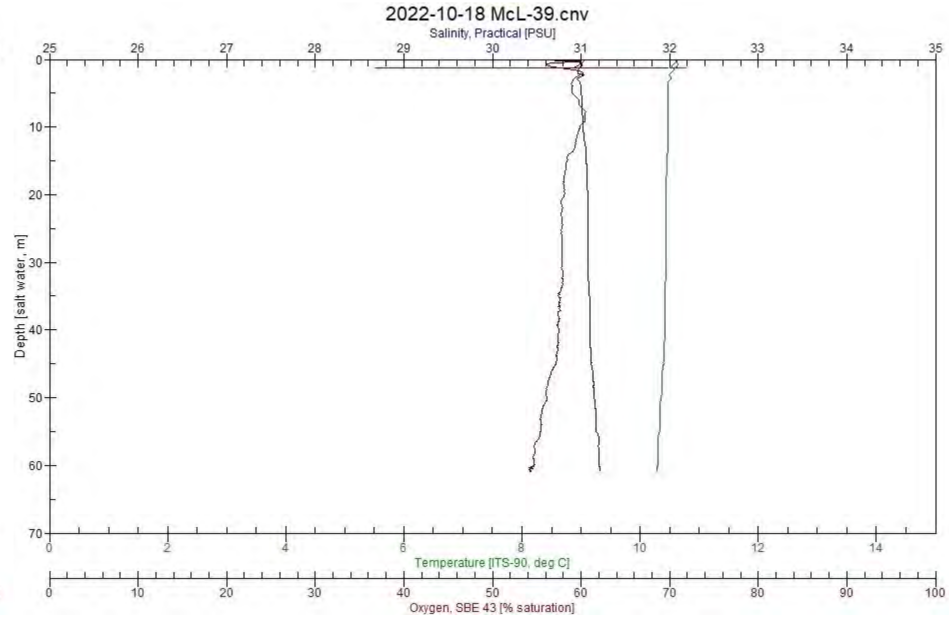

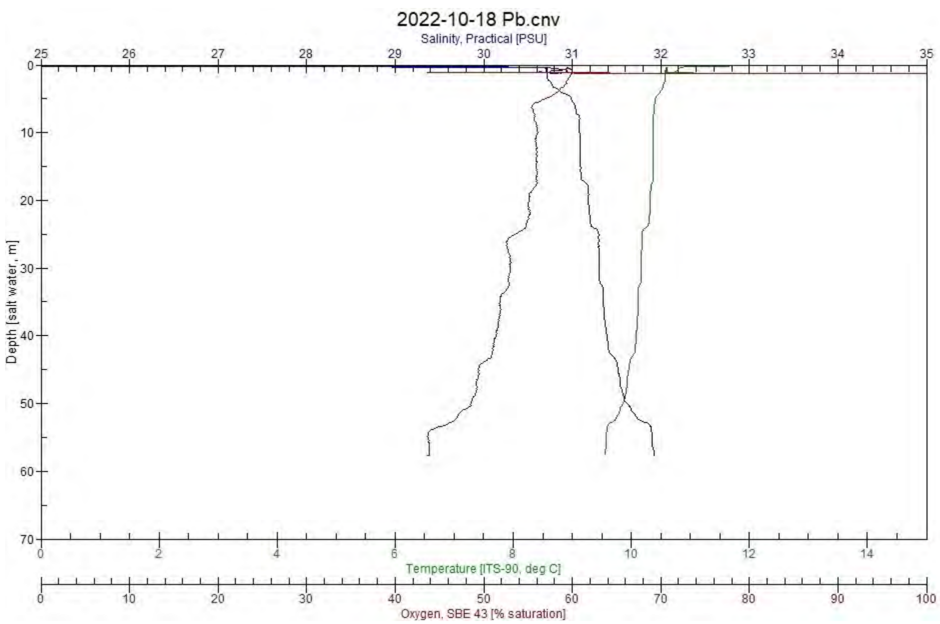

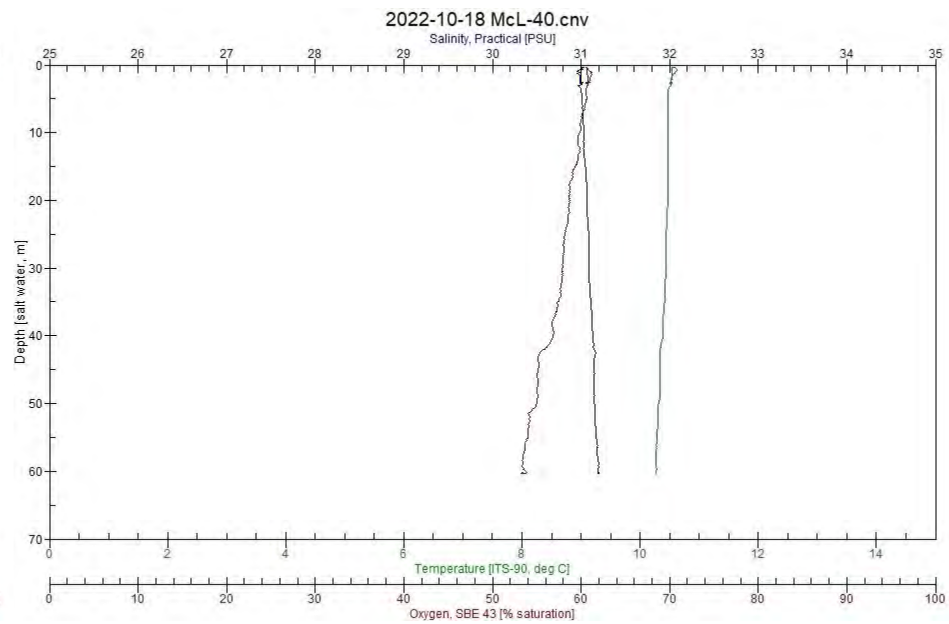

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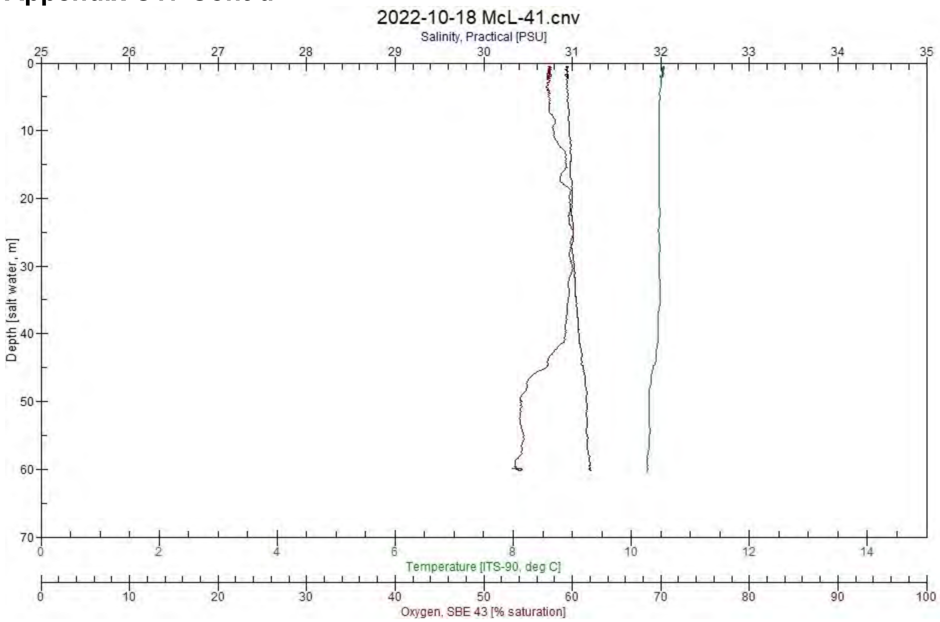

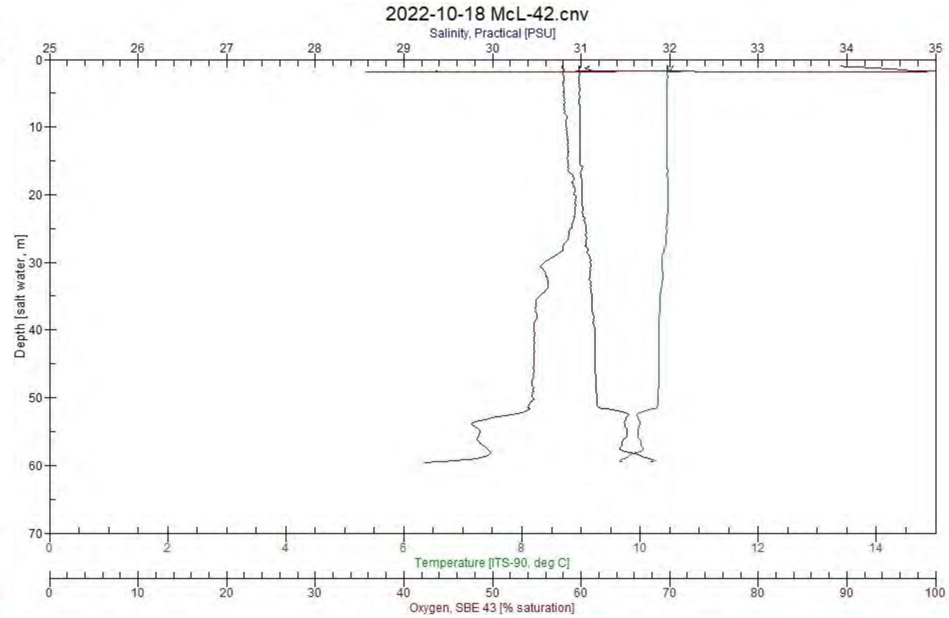

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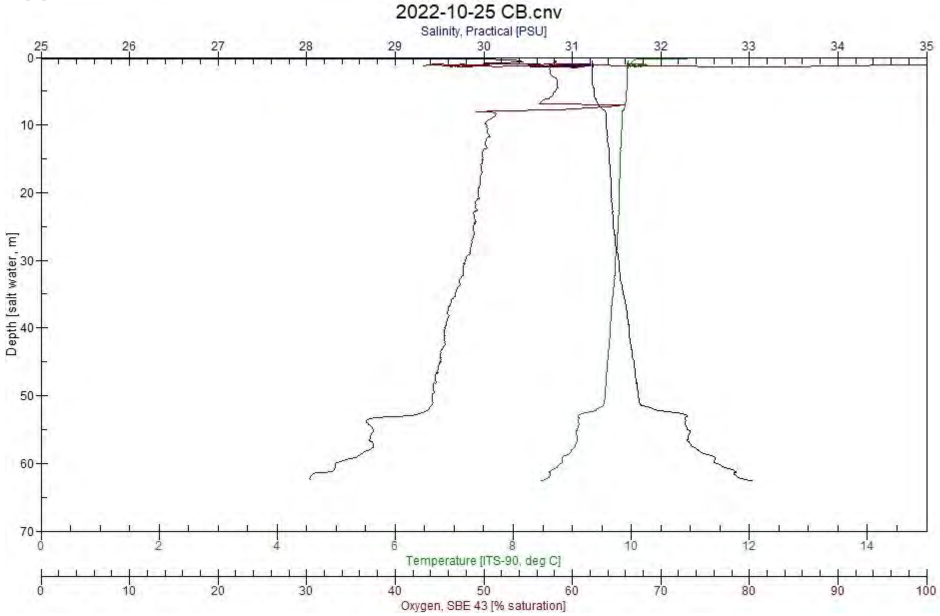

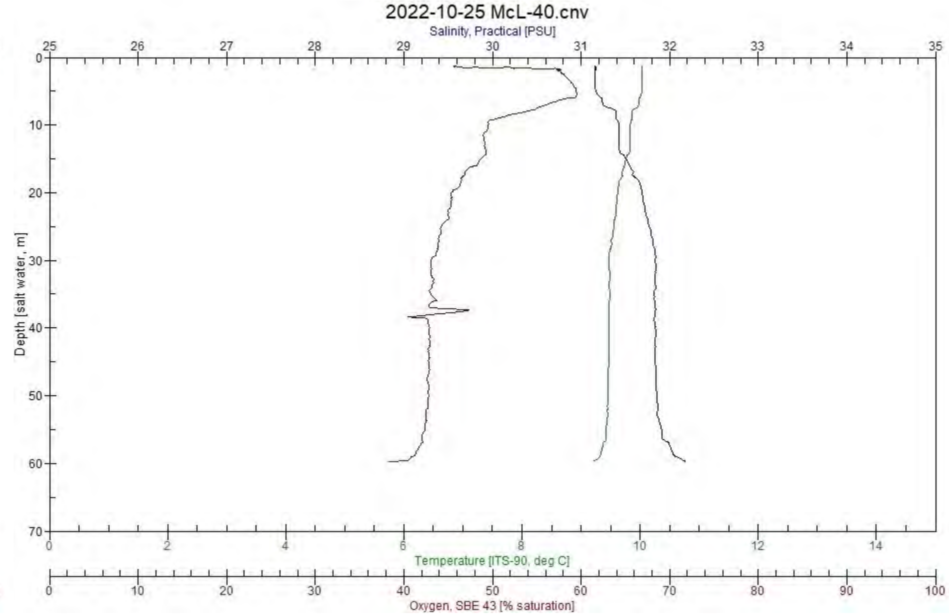

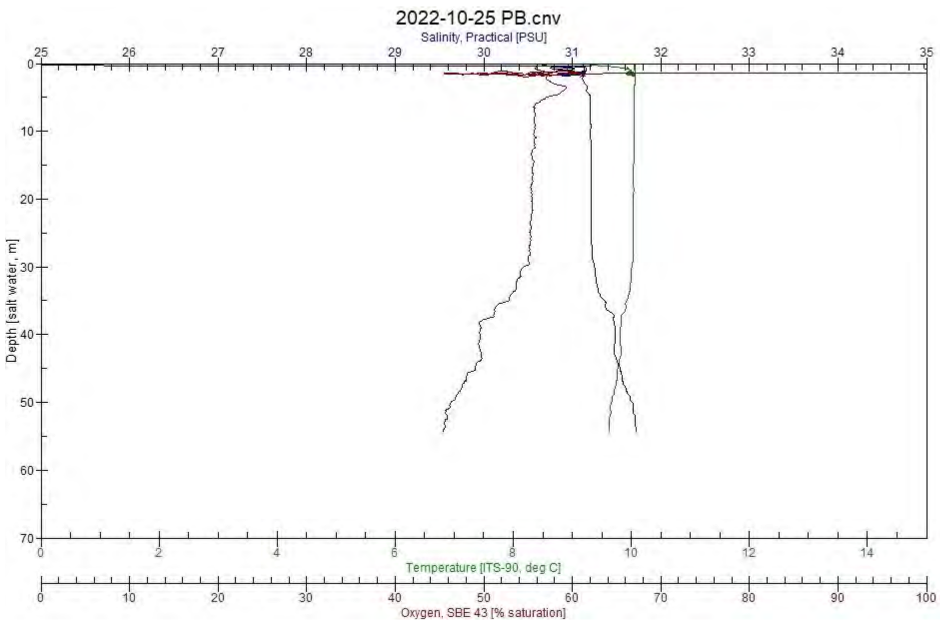

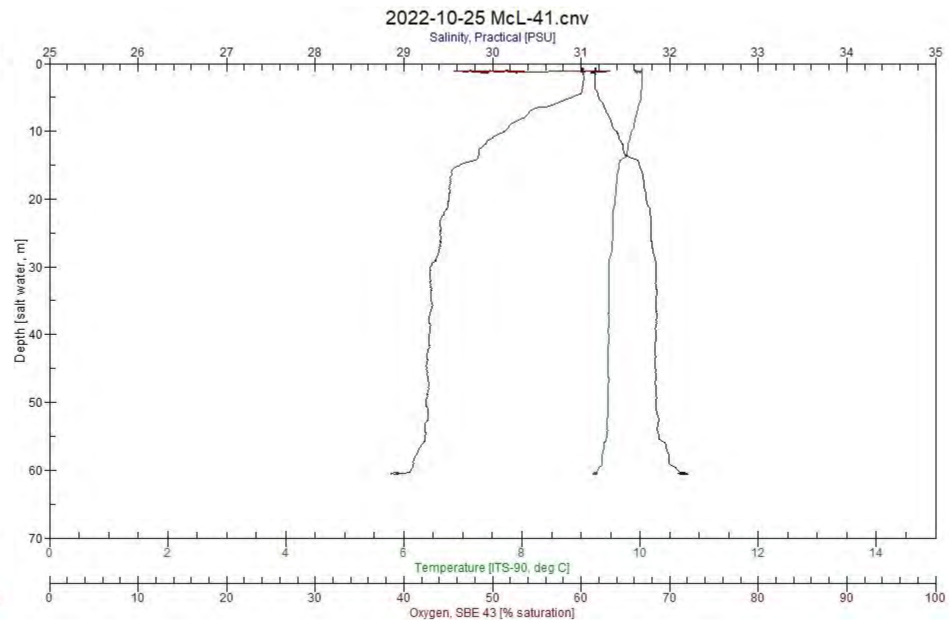

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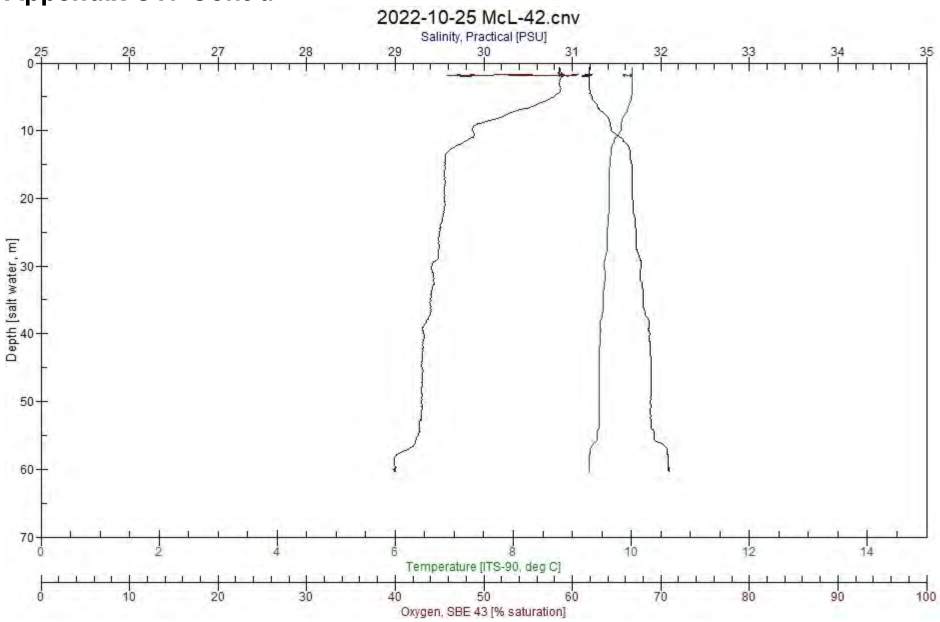

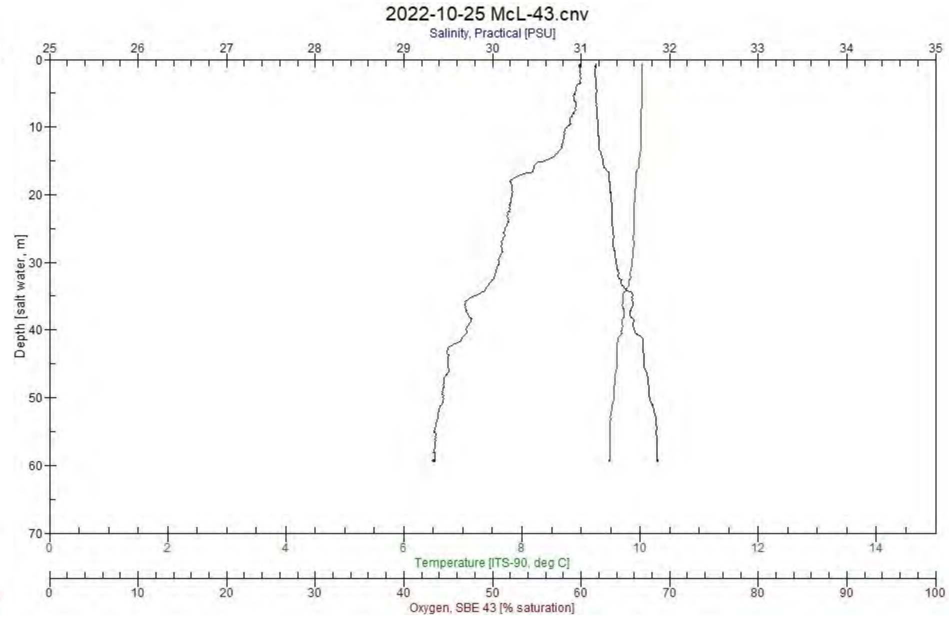

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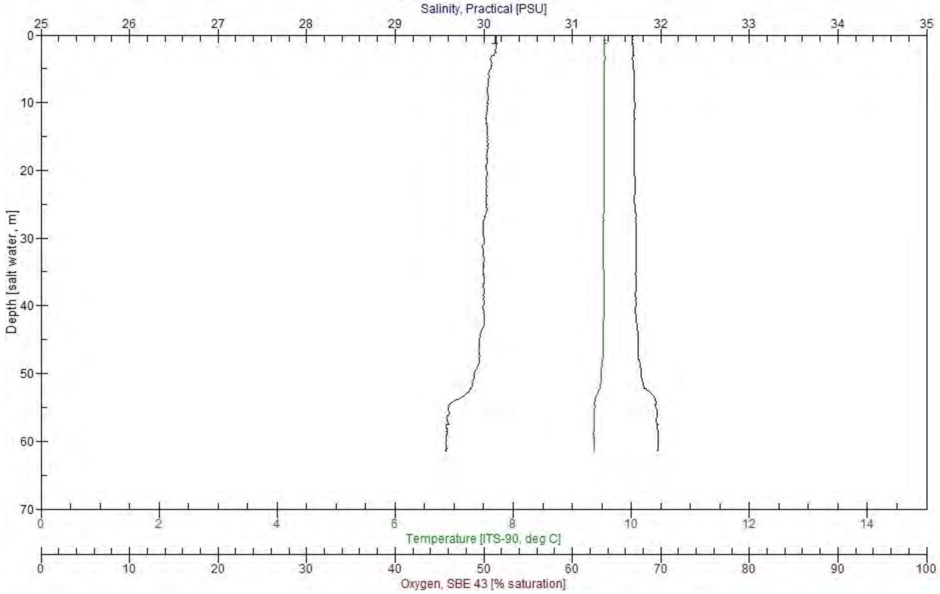

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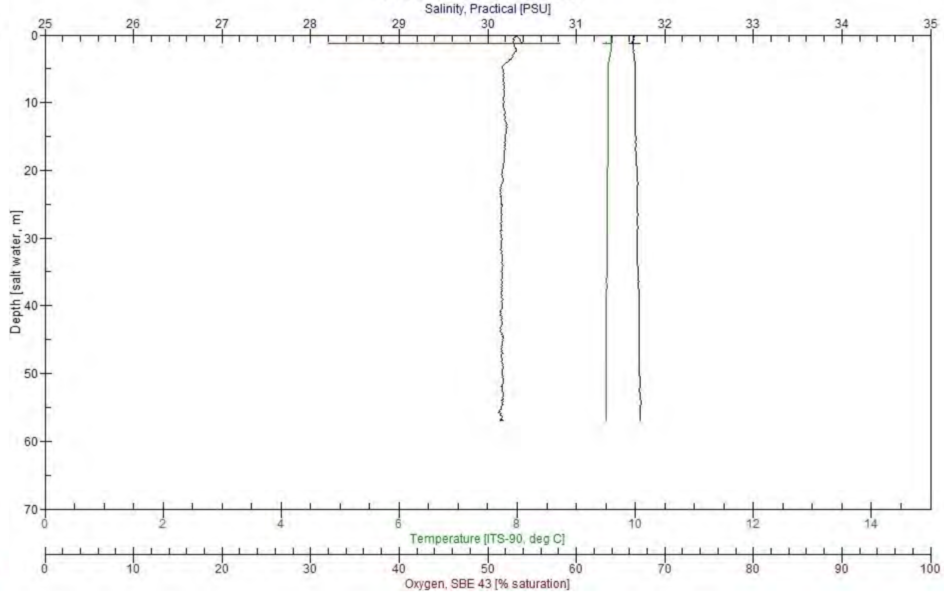

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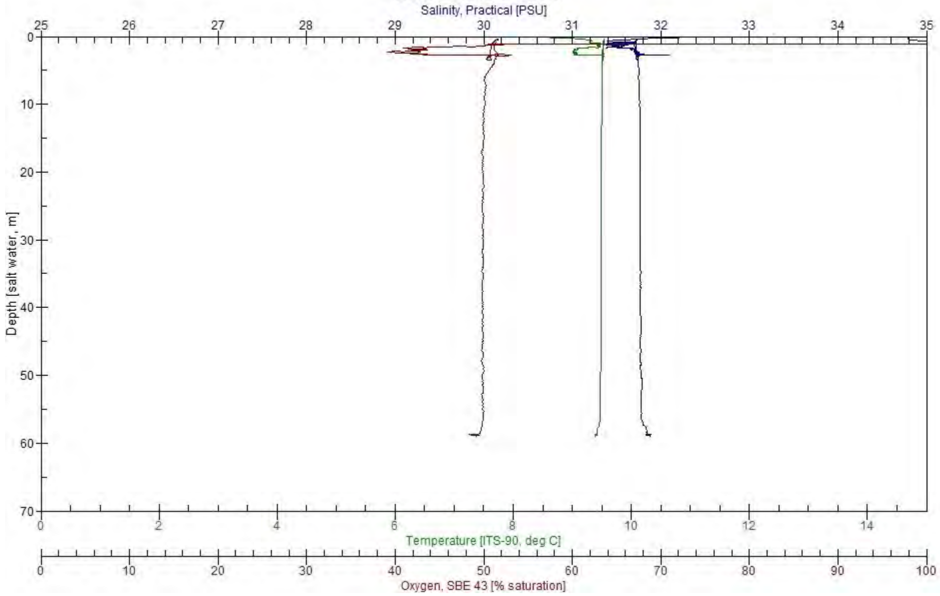

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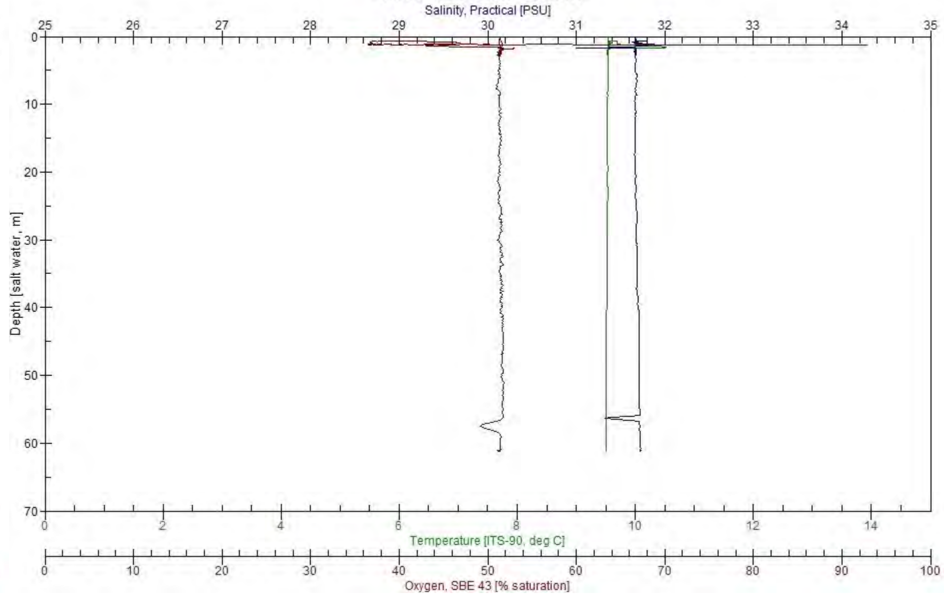

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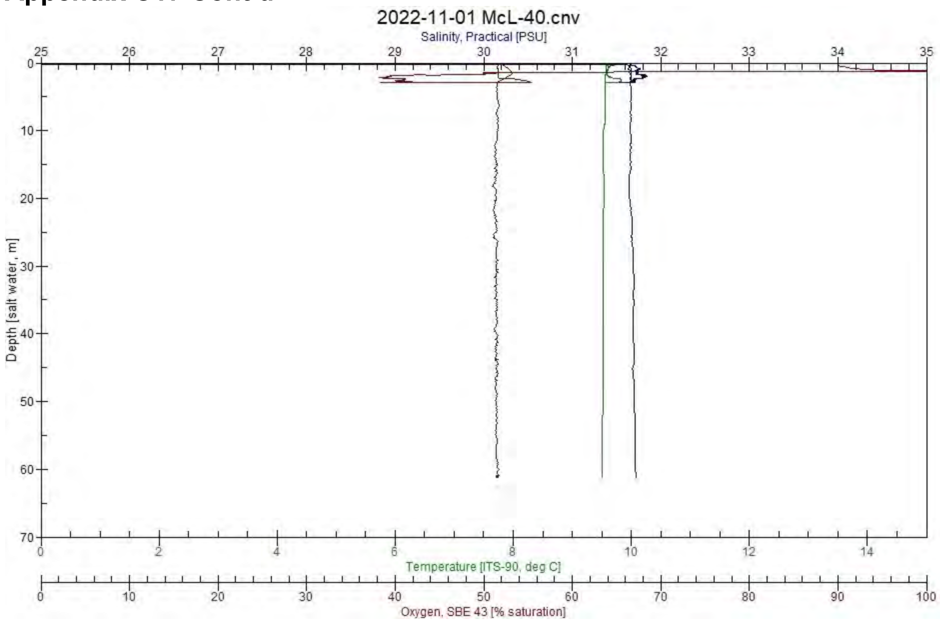

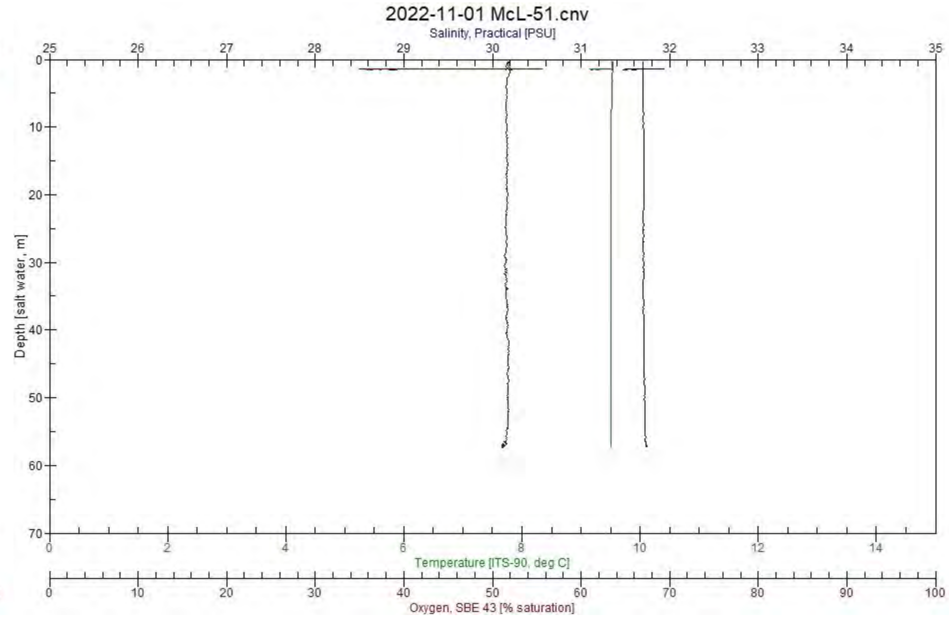

APPENDIX D
2022 SHORELINE, OVERFLOW AND BYPASS MONITORING

EMERGENCY OVERFLOW SAMPLING SITES
CLOVER

Making a difference...together

Metres
0 50 100 200 300

Projection: UTM ZONE 10N NAD 83

- Emergency Overflow Sampling Site
- !! Denotes potentially unsafe access during certain conditions

Stormwater Discharge Location

- End of Pipe/Manhole, High Impact
- End of Pipe, High Impact
- End of Pipe, Low Impact
- Manhole, High Impact
- Manhole, Low Impact
- Marine, High Impact
- Marine, Low Impact
- Upstream, High Impact
- PS CRD Pump Station
- Sanitary Emergency Overflow Outfall
- Sanitary Outfall
- Stream/Ditch
- Stormwater Culvert/Drain Pipe
- Lake/Pond/Reservoir/Storage Basin
- Lot Line

CRD - Parks & Environmental Services - Environmental Engineering - Mar 16, 2020 - Technologist: sruljancich - Map Document: EmergencyOverflowSampSites2020.mxd

CRD - Parks & Environmental Services - Environmental Engineering - Mar 16, 2020 - Technologist: srujancich - Map Document: EmergencyOverflowSampSites2020.mxd

Making a difference...together

Metres
0 50 100 200 300

Projection: UTM ZONE 10N NAD 83

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- Emergency Overflow Sampling Site
- !! Denotes potentially unsafe access during certain conditions

Stormwater Discharge Location

- End of Pipe/Manhole, High Impact
- End of Pipe, High Impact
- End of Pipe, Low Impact
- Manhole, High Impact
- Manhole, Low Impact
- Marine, High Impact
- Marine, Low Impact
- Upstream, High Impact
- PS CRD Pump Station
- Sanitary Emergency Overflow Outfall
- Sanitary Outfall
- Stream/Ditch
- Stormwater Culvert/Drain Pipe
- Lake/Pond/Reservoir/Storage Basin
- Lot Line

EMERGENCY OVERFLOW SAMPLING SITES
MACAULAY

CRD - Parks & Environmental Services - Environmental Engineering - Apr 16, 2020 - Technologist: sruljancich - Map Document: EmergencyOverflowSampSites2020.mxd

Metres

0 25 50 100

Projection: UTM ZONE 10N NAD 83

- Emergency Overflow Sampling Site
- !! Denotes potentially unsafe access during certain conditions

Stormwater Discharge Location

- End of Pipe/Manhole, High Impact
- End of Pipe, High Impact
- End of Pipe, Low Impact
- Manhole, High Impact
- Manhole, Low Impact
- Marine, High Impact
- Marine, Low Impact
- Upstream, High Impact
- PS CRD Pump Station
- Sanitary Emergency Overflow Outfall
- Sanitary Outfall
- Stream/Ditch
- Stormwater Culvert/Drain Pipe
- Lake/Pond/Reservoir/Storage Basin
- Lot Line

EMERGENCY OVERFLOW SAMPLING SITES
MCMICKING

CRD
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Metres
0 50 100 200 300

Projection: UTM ZONE 10N NAD 83

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- Emergency Overflow Sampling Site
- !! Denotes potentially unsafe access during certain conditions

Stormwater Discharge Location

- End of Pipe/Manhole, High Impact
- End of Pipe, High Impact
- End of Pipe, Low Impact
- Manhole, High Impact
- Manhole, Low Impact
- Marine, High Impact
- Marine, Low Impact
- Upstream, High Impact
- PS CRD Pump Station
- Sanitary Emergency Overflow Outfall
- Sanitary Outfall
- Stream/Ditch
- Stormwater Culvert/Drain Pipe
- Lake/Pond/Reservoir/Storage Basin
- Lot Line

EMERGENCY OVERFLOW SAMPLING SITES
HUMBER & RUTLAND

CRD - Parks & Environmental Services - Environmental Engineering - Mar 16, 2020 - Technologist: sruljancich - Map Document: EmergencyOverflowSampSites2020.mxd

EMERGENCY OVERFLOW SAMPLING SITES
HARLING

Metres
0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

- Emergency Overflow Sampling Site
- !! Denotes potentially unsafe access during certain conditions

Stormwater Discharge Location

- End of Pipe/Manhole, High Impact
- End of Pipe, High Impact
- End of Pipe, Low Impact
- Manhole, High Impact
- Manhole, Low Impact
- Marine, High Impact
- Marine, Low Impact
- Upstream, High Impact
- CRD Pump Station
- Sanitary Emergency Overflow Outfall
- Sanitary Outfall
- Stream/Ditch
- Stormwater Culvert/Drain Pipe
- Lake/Pond/Reservoir/Storage Basin
- Lot Line

CRD - Parks & Environmental Services - Environmental Engineering - Mar 16, 2020 - Technologist: sruljancich - Map Document: EmergencyOverflowSampSites2020.mxd

CRD - Parks & Environmental Services - Environmental Engineering - Mar 16, 2020 - Technologist: sruljancich - Map Document: EmergencyOverflowSampSites2020.mxd

Making a difference...together

Metres
0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

- Emergency Overflow Sampling Site
- !! Denotes potentially unsafe access during certain conditions

Stormwater Discharge Location

- End of Pipe/Manhole, High Impact
- End of Pipe, High Impact
- End of Pipe, Low Impact
- Manhole, High Impact
- Manhole, Low Impact
- Marine, High Impact
- Marine, Low Impact
- Upstream, High Impact
- PS CRD Pump Station
- Sanitary Emergency Overflow Outfall
- Sanitary Outfall
- Stream/Ditch
- Stormwater Culvert/Drain Pipe
- Lake/Pond/Reservoir/Storage Basin
- Lot Line

EMERGENCY OVERFLOW SAMPLING SITES FINNERTY

CRD - Parks & Environmental Services - Environmental Engineering - Mar 16, 2020 - Technologist: sruljancich - Map Document: EmergencyOverflowSampSites2020.mxd

CRD
Making a difference...together

Metres
0 25 50 100

Projection: UTM ZONE 10N NAD 83

- Emergency Overflow Sampling Site
- !! Denotes potentially unsafe access during certain conditions

Stormwater Discharge Location

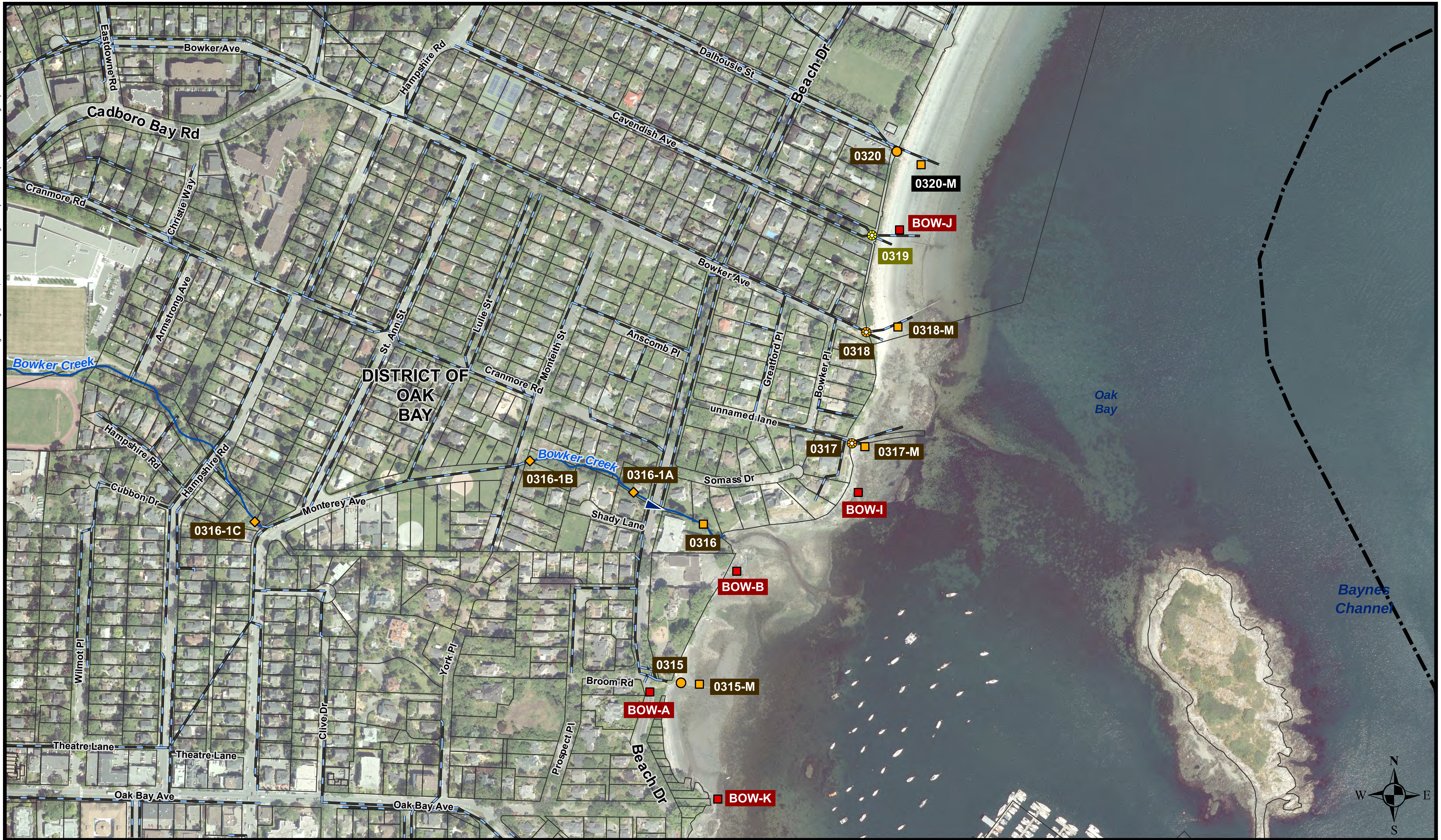
- End of Pipe/Manhole, High Impact
- End of Pipe, High Impact
- End of Pipe, Low Impact
- Manhole, High Impact
- Manhole, Low Impact
- Marine, High Impact
- Marine, Low Impact
- Upstream, High Impact

- PS CRD Pump Station
- Sanitary Emergency Overflow Outfall
- Sanitary Outfall

- Stream/Ditch
- Stormwater Culvert/Drain Pipe
- Lake/Pond/Reservoir/Storage Basin
- Lot Line

EMERGENCY OVERFLOW SAMPLING SITES
BROOM ROAD

CRD - Parks & Environmental Services - Environmental Engineering - Mar 16, 2020 - Technologist: sruljancich - Map Document: EmergencyOverflowSampSites2020.mxd



Making a difference...together

Metres
0 25 50 100 150

Projection: UTM ZONE 10N NAD 83

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- Emergency Overflow Sampling Site
- !! Denotes potentially unsafe access during certain conditions

Stormwater Discharge Location

- End of Pipe/Manhole, High Impact
- End of Pipe, High Impact
- End of Pipe, Low Impact
- Manhole, High Impact
- Manhole, Low Impact
- Marine, High Impact
- Marine, Low Impact
- Upstream, High Impact
- PS CRD Pump Station
- Sanitary Emergency Overflow Outfall
- Sanitary Outfall
- Stream/Ditch
- Stormwater Culvert/Drain Pipe
- Lake/Pond/Reservoir/Storage Basin
- Lot Line

EMERGENCY OVERFLOW SAMPLING SITES
BOWKER

Appendix D2

Modelling Validation Sampling – Summer and Fall - 2022

The CRD assumed the operation of the McLoughlin Point Wastewater Treatment Plant (MPWWTP) in January 2021 and is required by Registration under the Municipal Wastewater Regulation (MWR), Authorization #108831, to undertake minimum dilution model field testing. Testing is required using concurrent effluent and receiving environment water quality samples at the edge of the IDZ of the McLoughlin Point outfall, as well as at five far-field sites (Haystock Islets, Ogden Point, Cook Street, Chatham and Discovery Islands, Trial Island) and at Clover (CPS) and Macaulay Pump Stations (MPS) during potential overflow events, for four modelled scenarios (Lorax 2019).

The four modelled scenarios are based on the influent flow hydrographs prepared by Lorax (2019)[1] representing typical conditions expected up to the year 2030, and are:

1. Summer conditions with flows of about 80% of the average dry weather flow (ADWF) for MPWWTP (ADWF of 108,000 m3/day) of tertiary effluent.
2. Wet weather conditions providing discharge through only the MPWWTP outfall (flows up to 4xADWF when MPWWTP is discharging primary + tertiary blended effluent).
3. Wet weather storm conditions providing discharge through both the MPWWTP (primary + tertiary blended effluent) and CPS (screened effluent) deep outfalls.
4. Wet weather large storm conditions yielding discharges through all deep-water outfalls (blended at McLoughlin and screened at Clover/Macaulay) and the Clover short overflow outfall (screened effluent).

This report presents the results from two rounds of model validation sampling that were conducted in July 2022 and October 2022.

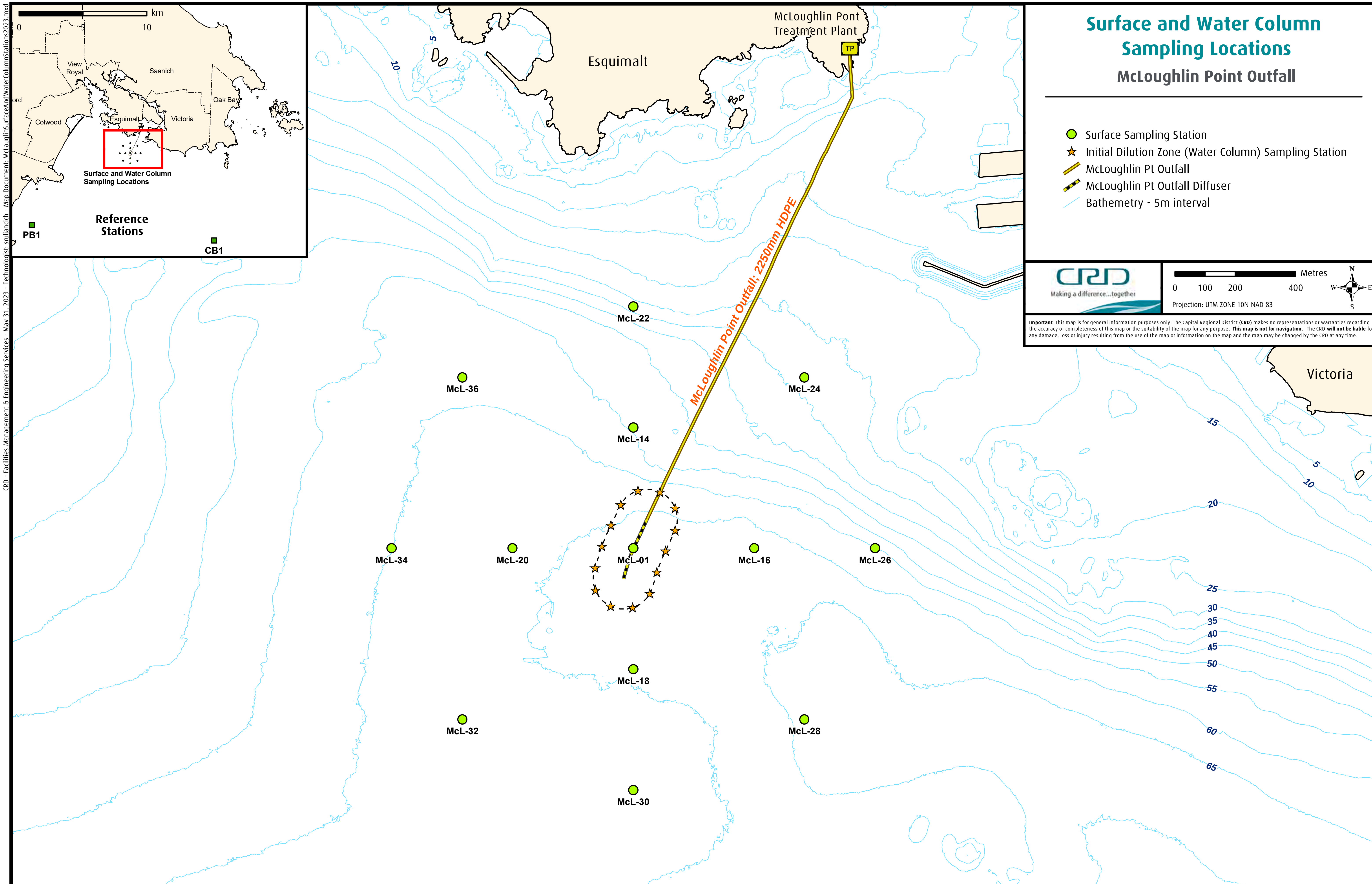
The first round of model validation sampling was conducted on July 7, 2022 and represents Scenario 1, with typical summer conditions. On this day, MPWWTP discharged 75,300 m^3 of wastewater. Samples were collected from the five far-field stations. October model validation sampling was conducted on October 12, and was timed to coincide with a bypass of the MPWWTP treatment works that was required to conduct maintenance activities. This represents Scenario 2, with discharge through the McLoughlin outfall of primary plus tertiary blended effluent. On this day, 73,400 m^3 of treated effluent was discharged from the MPWWTP plus 2,650m^3 of primary/bypass flow. During the bypass, surface water samples were collected from around the MPWWTP IDZ and from the five far-field stations. For both sampling events, samples were analyzed for gut bacteria as well as for DNA-based bacterial source tracking.

Methods

Sampling was conducted using the CRD's 18-foot aluminum sampling boat. Samples were collected at 1 m depth using an extendable sampling pole from the preassigned MPWWTP surface water stations (Figure 1), and/or from the five far-field stations (Figure 2). All samples were tested for fecal coliforms and *Enterococci*. In addition, the five far-field stations were analyzed using DNA-based bacterial source tracking, an assessment tool that identifies whether the gut bacteria in the sample originated from humans or other animals (i.e., dog, bird, or human source). Far-field surface water samples were collected from sample sites at Haystock Islets (HI), Ogden Point (OP), Cook Street (CS), Chatham and Discovery Islands (DI), and Trial Island (TI) (Figure 2).

Fecal coliform and *Enterococci* samples were analyzed at Bureau Veritas laboratories (BV, Burnaby, BC) and bacterial source tracking (BST) samples were analyzed at Microbial Insights (Knoxville, Tennessee).

[1] Lorax (2019) Effluent Dispersion Modelling for the McLoughlin WWTP



Surface and Water Column Sampling Locations
McLoughlin Point Outfall
Surface Sampling Station
Initial Dilution Zone (Water Column) Sampling Station
McLoughlin Pt Outfall
McLoughlin Pt Outfall Diffuser
Bathemetry - 5m interval
Making a difference...together
Metres
0 100 200 400
Projection: UTM ZONE 10N NAD 83
N
W
E
S
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km
0 5 10
View Royal
Saanich
Oak Bay
Colwood
Esquimalt
Victoria
Surface and Water Column Sampling Locations
Reference Stations
PB1
CB1
McLoughlin Pont Treatment Plant
TP
Esquimalt
Victoria
McLoughlin Point Outfall; 2250mm HDPE
McL-22
McL-36
McL-24
McL-14
McL-34
McL-20
McL-01
McL-16
McL-26
McL-18
McL-32
McL-28
McL-30
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45
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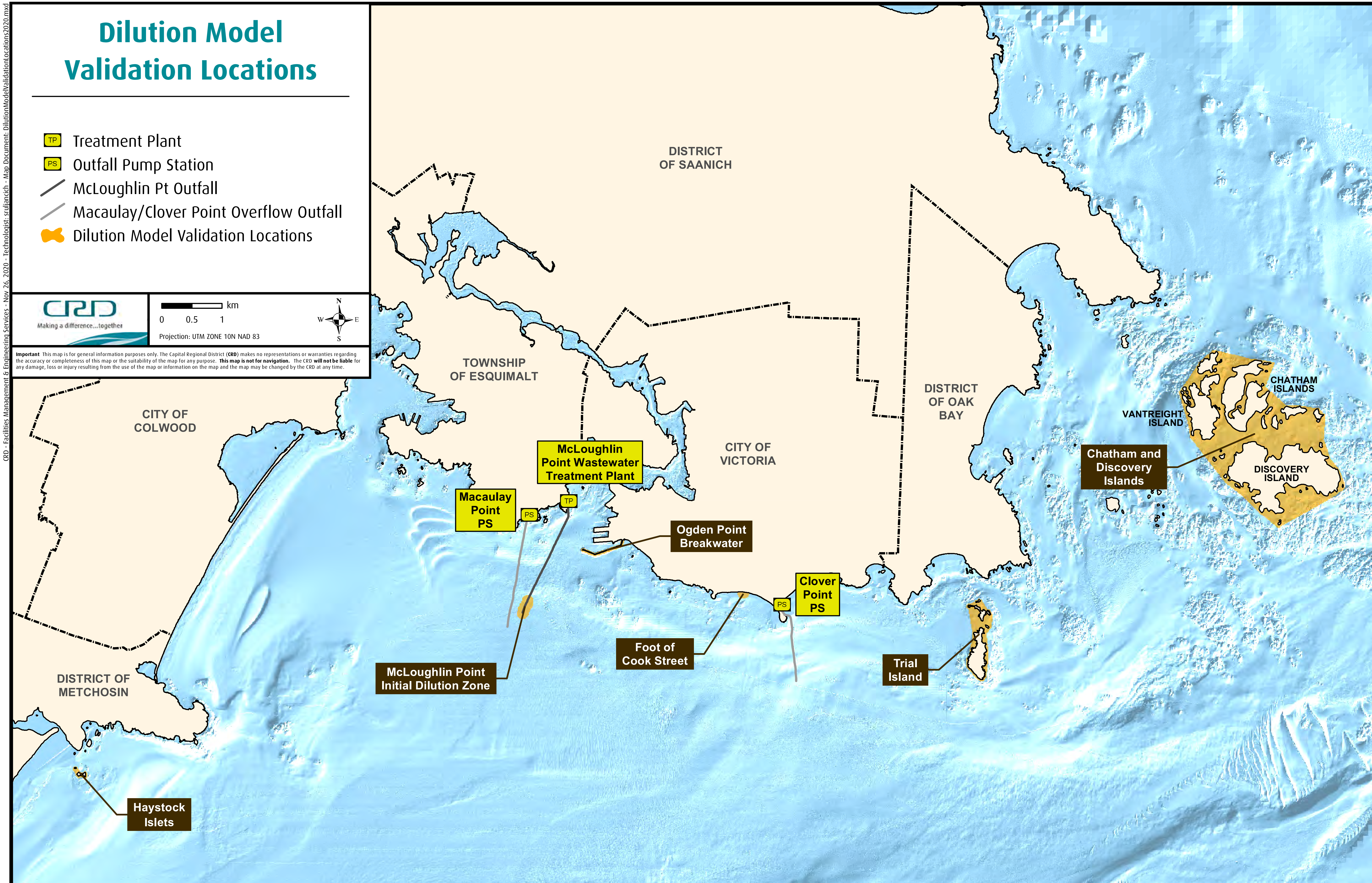
60
65



CRD - Facilities Management & Engineering Services - Nov 26, 2020 - Technologist: sruljancich - Map Document: DilutionModelValidationLocations2020.mxd

Results

Figure 3 presents tidal conditions for July sampling, with sample collection times coinciding with the beginning of ebb tide. Table 1 presents the July bacteria and BST results of the five far field stations.

Figure 3 Tidal Predictions for Victoria During July Sampling Event (sampling event indicated in yellow)

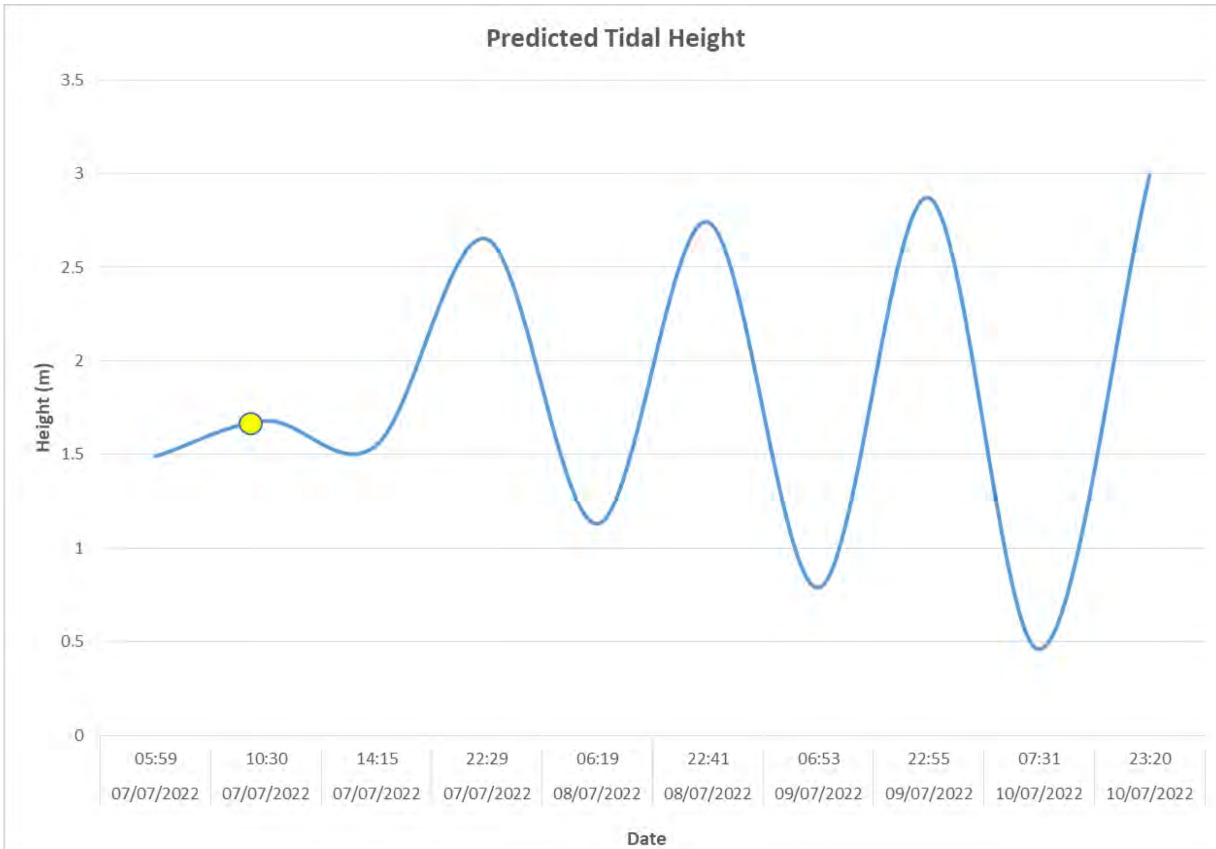


Table 1 Model Validation Far-field Surface Water Sampling Results July 2022

		Bacteria (CFU/100mL)		Bacterial Source Tracking (gene copies/mL)			
Station Name	**Depth (m)**	**Enterococci**	**Fecal Coliform**	**Human**	**Gull**	**Canada Goose**	**Dog**
Haystock Islets	1	<1	<1	ND	ND	ND	ND
Ogden Point Breakwater	1	1	5	ND	ND	ND	ND
Foot of Cook Street	1	<1	4	2.17(J)	36.3(J)	ND	ND
Trial Island	1	<1	3	ND	ND	ND	ND
Chatham Island	1	<1	<1	ND	ND	ND	ND

Notes:
(J) - Detected below practical level of quantification
ND - Not Detected

Figure 4 presents tidal conditions for October sampling, with sample collection times coinciding with the beginning of flow tide. Table 2 presents the October bacteria results of McLoughlin surface water station results. Table 3 presents the October bacteria and BST results of the five far field stations.

Figure 4 Tidal Predictions for Victoria During October Sampling Event (sampling event indicated in yellow)

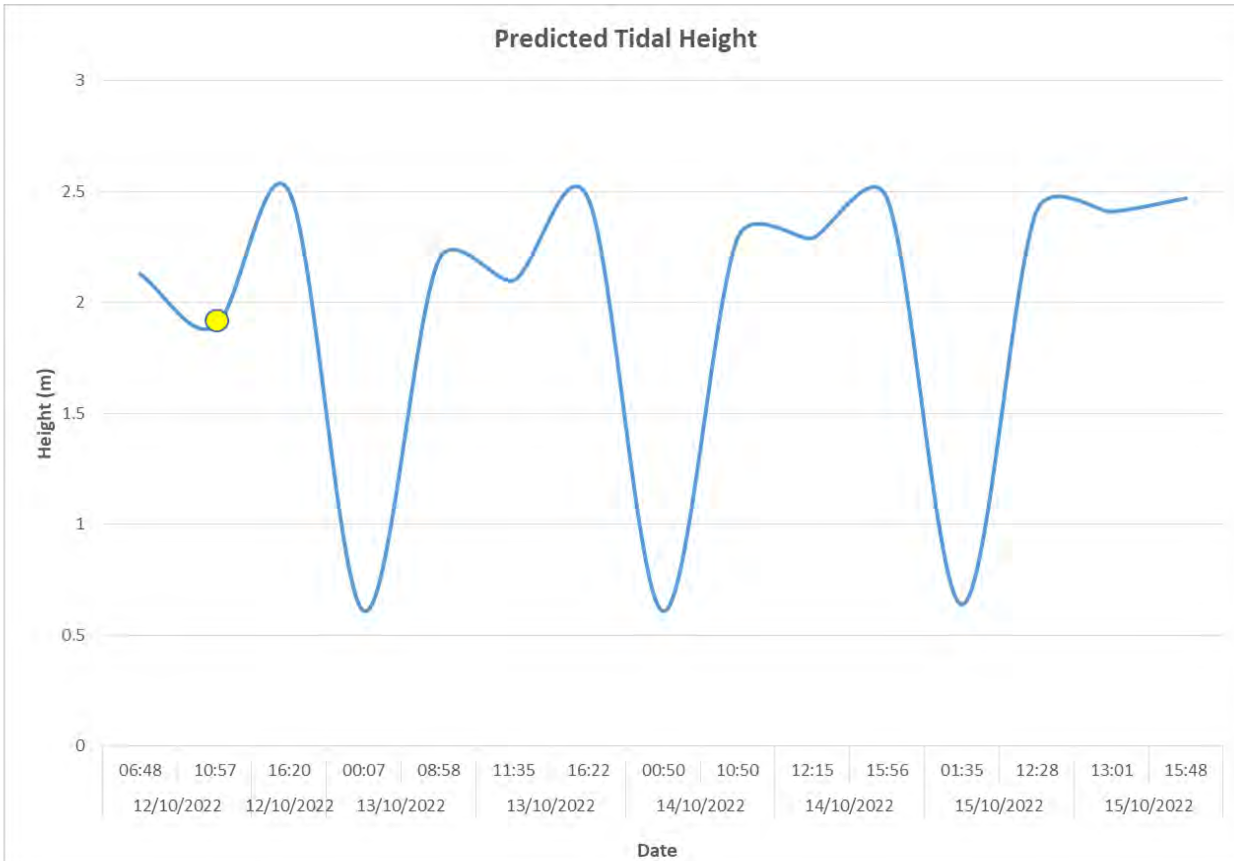


Table 2 McLoughlin WWTP SFFC Results October 2022

Station	Depth (m)	Enterococci (CFU/100mL)	Fecal Coliform (CFU/100mL)
McL-01	1	<1	2
McL-14	1	<1	1
McL-16	1	1	1
McL-18	1	<1	2
McL-20	1	1	<1
McL-22	1	<1	<1
McL-24	1	<1	<1
McL-26	1	<1	1
McL-28	1	<1	2
McL-30	1	1	<1
McL-32	1	4	<1
McL-34	1	<1	<1
McL-36	1	<1	1

Table 3 Model Validation Far-field Surface Water Sampling Results October 2022

		Bacteria (CFU/100mL)		Bacterial Source Tracking (gene copies/mL)			
Station name	**Depth (m)**	**Enterococci**	**Fecal Coliform**	**Human**	**Gull**	**Canada Goose**	**Dog**
Haystock Islets	1	<1	<1	26.4	ND	ND	80.0(J)
Ogden Point Breakwater	1	1	<1	ND	ND	ND	ND
Foot of Cook Street	1	<1	1	ND	ND	ND	ND
Trial Island	1	<1	1	ND	ND	ND	ND
Chatham Island	1	<1	<1	19.6	ND	ND	ND

Notes:
(J) - Detected below practical level of quantification
ND - Not Detected

The surface water samples collected around the McLoughlin Point outfall in October 2022 all had non-detect or extremely low levels of bacteria.

Far-field investigation BST results indicated evidence of very low levels human sourced bacteria at the Foot of Cook Street in July sampling, though results cannot be confirmed due to concentrations being detected below the practical level of quantification. This aligns with the Lorax (2019) model prediction for this scenario which indicated no predicted exposure at any of the far-field sites.

The October far-field investigation indicated evidence of low levels of human sourced bacteria at Haystock Islets and Chatham Island, consistent with the Lorax (2019) model prediction for this scenario, which indicated low to negligible bacterial presence.

Conclusions

Sampling results indicate the presence of human sourced bacteria during bypass flow events in October 2022 but not during typical operations (April 2022). These results are consistent with the predicted modelling and indicate that the McLoughlin Point treatment works and diffuser are operating as expected.