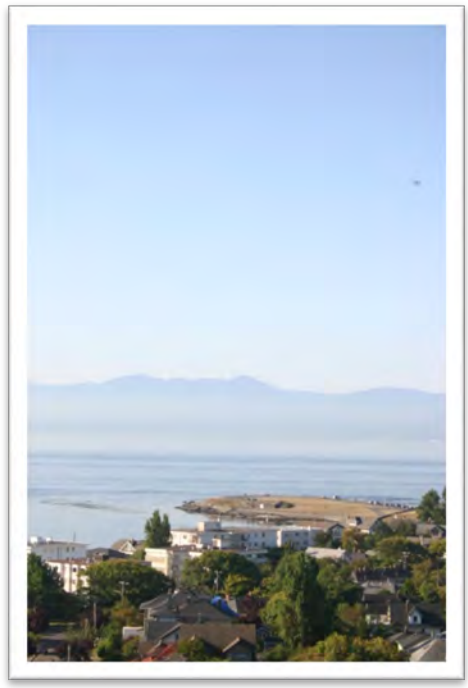
Core Area Wastewater Facilities

Environmental Monitoring Program 2019 Report

Cycle 2 – Year 4

Capital Regional District | Parks & Environmental Services, Environmental Protection



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CORE AREA WASTEWATER FACILITIES
ENVIRONMENTAL MONITORING PROGRAM
2019 REPORT

EXECUTIVE SUMMARY

The Capital Regional District (CRD) discharges fine-screened municipal wastewater through two core area outfalls located at Macaulay Point and Clover Point. Monitoring of wastewater quality, and the surface water and seafloor environments in the vicinity of the outfalls, has occurred on a regular basis since the late 1980s. The CRD is required to monitor wastewater facilities for compliance with the Municipal Wastewater Regulation under the provincial *Environmental Management Act* and the Wastewater Systems Effluent Regulations 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 2019 environmental monitoring program represents Year 4 of Cycle 2 and includes:

- wastewater monitoring and analysis for a list of substances, including conventional parameters, metals, and other priority substances (conducted monthly for each outfall)
- surface water and water column monitoring and analysis of bacteriological indicators of potential for human exposure to wastewater in the marine environment and a list of substances, including conventional parameters, metals, and other priority substances (conducted quarterly at each outfall)
- seafloor monitoring and analysis of sediment chemistry, sediment toxicity and bioaccumulation and benthic invertebrate taxonomy to assess accumulation of contaminants around the Macaulay outfall
- continuing and new additional investigations that address specific questions about water column and seafloor monitoring components and that look into emerging scientific issues regarding wastewater discharges and environmental effects
- a finfish survey (delayed from Cycle 1) to assess impacts to these organisms around both outfalls and at reference areas

Overall, risks to human health and the environment were low. Wastewater quality from Macaulay and Clover was similar to previous years with a few exceedances of provincial regulatory limits, but no exceedances of federal transitional regulatory limits. Surface water and water column sampling confirmed that the outfalls were operating as expected from a plume dispersion and dilution perspective. Impacts to the seafloor in 2019 were similar to previous sampling events, with impacts primarily limited to within approximately 400 m of each outfall. The finfish survey was the first such comprehensive assessment of these types of organisms around the outfalls; some limited impacts were observed.

MCLOUGHLIN POINT WASTEWATER TREATMENT PLANT

The CRD is currently building a new core area system consisting of a wastewater treatment plant at McLoughlin Point, to treat all of the Macaulay and Clover wastewaters to a tertiary standard, and a facility at Hartland Landfill to treat sewage residuals to a Class A biosolids standard. This new system will be complete by December 31, 2020.

Reporting in 2019 includes results and updates for the different elements of the Macaulay and Clover monitoring program, including the routine components and additional investigations. This report will be the last where Macaulay and Clover outfalls are the main core area wastewater discharge locations. The 2020 report will include monitoring results from the new McLoughlin plant, as it comes online.

Data from this report, Cycle 2 years 1 through 3, and all of Cycle 1 are currently being incorporated into a comprehensive statistical assessment and program review, which will be completed late 2020. Findings and recommendations from this assessment will be presented in next year's 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 are reviewed by the Marine Monitoring Advisory Group on a regular basis.

In April 2020, the CRD was asked to provide weekly wastewater samples from Macaulay, Clover and the Saanich Peninsula wastewater treatment plant by a consortium of researchers from the University of Victoria and Pani Energy Inc. The samples will be analyzed using similar methodologies to those used elsewhere on the BC Lower Mainland, across Canada and internationally, and the group plans to solicit samples from other Vancouver Island wastewater facilities, as their laboratory capacity increases. McLoughlin samples will also eventually be provided once the new plant is commissioned, and these samples will be used to assess the effectiveness of various treatment components to reduce COVID-19 concentrations. All results will be used to inform local health authority COVID-19 response plans.

In 2019, the CRD continued to participate in two Vancouver Aquarium Ocean Pollution Research Program initiatives: the Salish Sea Ambient Monitoring Exchange (SSAMEx) and Pollution Tracker. The CRD and Pollution Tracker data from elsewhere in the Salish Sea are being incorporated into a scientific journal manuscript that will characterize monitoring program biota concentrations of polychlorinated biphenyls and how concentrations change with trophic level and sediment physical and geochemical characteristics. A draft manuscript is expected in late 2020. The Vancouver Aquarium has been using CRD samples to develop analytical methodologies for microplastics in environmental samples and to add to the broader Pollution Tracker dataset.

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.

The CRD also continued participation in a second collaborative project with the contract benthic taxonomist, the University of Victoria 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 historic monitoring stations that have been abandoned. The project has a five-year timeline and the CRD will continue to provide support, including future sampling vessel and sample access.

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1.0 BACKGROUND

Wastewater has been discharged from the Macaulay Point and Clover Point outfalls for approximately 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.

Wastewater from both of these outfalls is fine-screened to 6 mm before released through the diffusers 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 45-60 m, with some plume surfacing predicted during periods of slack tide, predominantly during the winter months (Hodgins, 2006).

In March 2003, the CRD Core Area Liquid Waste Management Plan (CRD, 2000) was approved by the BC Ministry of Environment and Climate Change Strategy (the ministry). The plan outlined the CRD's plans 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 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 ministry in December 2009, with follow up amendments #8 in June 2010, #9 in July 2014, #10 in March 2016, #11 in September 2016, and #12 in February 2017. These amendments have all been conditionally approved by the ministry and commit the CRD to building a new plant at McLoughlin Point to treat the wastewaters from Macaulay and Clover to a tertiary level, and 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 combined sewer overflow locations in the Clover system, was also conditionally approved in June 2018.

The outfalls at Macaulay and Clover operate under the long-term direction of the plan (see Section 1.1.1 for more detail), and under permits on a day-to-day basis. The permits for Macaulay (PE-270) and Clover (PE-1877) were issued by the ministry under the 2004 *BC Environmental Management Act* [formerly the *BC Waste Management Act* (BCMoE, 2004)]. In addition, the outfalls operate under transitional authorizations to discharge deleterious substances under the Federal Wastewater Systems Effluent Regulation. These transitional authorizations are valid until December 31, 2020, by which time treatment must be in place to eliminate the discharge of deleterious substances, as defined under this regulation.

The CRD and participating municipalities are currently building a system that will treat Macaulay and Clover wastewaters and sewage residuals at the two abovementioned facilities. This new system will meet current provincial and federal requirements, with commissioning starting fall of 2020, and full operation expected by December 31, 2020. This 2019 monitoring year will be the last where Macaulay and Clover outfalls are the main discharge locations for CRD core area wastewaters; the 2020 report will include results from the new McLoughlin plant, as is comes online.

1.1 Environmental Monitoring Program Components

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 Environmental Monitoring Program (formerly the Wastewater and Marine Environment Program) on a regular basis since the late 1980s. The program has undergone a number of changes over the years. Monitoring of wastewater, marine waters close to the outfalls, and benthic communities were conducted in the 1970s and 1980s in collaboration with the University of Victoria 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 (the advisory group) (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 the advisory group. The major changes were not in the components of the program, but rather in the frequency of monitoring which increased. 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 the advisory group and the ministry, 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 will be provided below.

The Society of Environmental Toxicology and Chemistry (SETAC) completed a review of the CRD Core Area Liquid Waste Management Plan 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 a number of 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 ministry staff initiated a review of the objectives and design of the monitoring program in light of 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 advisory group and consultants familiar with monitoring program data reviewed the new program (Golder, 2011) and provided recommendations, as necessary.

There is a commitment within the five-year monitoring program that CRD and ministry staff will meet on an annual basis to review the results of the previous monitoring year. Monitoring program design for future years of the cycle will likely be revised based on these annual collaborative reviews, the transition to treatment at McLoughlin in 2020, as well as comments from the advisory group reviews and other external experts.

In 2019, monitoring was initiated at some new seafloor sampling stations associated with the recently constructed, but not yet commissioned McLoughlin plant outfall; results from these new stations are also included in this report to characterize pre-discharge conditions.

1.1.2 Approach and Program Components

The current monitoring program components were developed in conjunction with the ministry and the advisory group, as part of a new 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 started in 2016 and will extend to 2020. The current objectives of the monitoring program [as contained in the Core Area Liquid Waste Management Plan (2000) and updated in amendment #7 (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 monitoring program is presented in Table 1.1. The 2019 monitoring program consisted of the following components:

- wastewater monitoring and analysis for a list of substances, including conventional parameters, metals, and other priority substances (conducted monthly for each outfall)
- surface water and water column monitoring and analysis of bacteriological indicators of potential for human exposure to wastewater in the marine environment and a list of substances, including conventional parameters, metals, and other priority substances (conducted quarterly at each outfall)
- seafloor monitoring and analysis of sediment chemistry to assess accumulation of contaminants and impacts to benthos around the Macaulay outfall, and at five new stations around the new McLoughlin outfall
- continuing additional investigations that address specific questions about water column and seafloor monitoring components and that looks into emerging scientific issues regarding wastewater discharges and environmental effects
- a finfish survey (delayed from Cycle 1) to assess logistical concerns of sampling these organisms around both outfalls and to guide final sampling program design

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, based on 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. 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 communities off the Macaulay and McLoughlin outfalls and mussel communities off the Clover outfall. Prior to 2011, these organisms were monitored annually. As part of the revised five-year monitoring cycle, 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 determined by assessing what organisms are present, along with their abundance, growth and reproductive status. These biological indicators provide a direct assessment of 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 (eventually) 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. Some of these investigations are part of the requirements under the Core Area Liquid Waste Management Plan 2003 approval, including the study of the potential effects of pharmaceuticals and personal care products (PPCP) and polybrominated diphenyl ethers (PBDE) (flame retardants) on the marine environment. Current additional investigations are presented in Table 5.1 and are discussed in Section 5.0. 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 advisory group in 1987 to advise on and provide an independent assessment of CRD marine monitoring programs. The advisory group consisted of university and government scientists with expertise in the fields of marine science, oceanography, toxicology, chemistry and environmental health. Since 1987, the advisory group 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 the ministry. In September 2010, the ministry waived all formal advisory group reporting requirements. The CRD, however, retained the advisory group 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, with the exception of adding new seafloor stations adjacent to the new McLoughlin outfall. Advice of the advisory group has not been solicited since 2015, but there are plans to resurrect the group once the new McLoughlin treatment system is commissioned.

1.3 Data Presentation and Analysis

Until 2000, the results of the monitoring program were tabulated in separate reports according to each 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).

However, following the review and redesign of the monitoring program, the need for annual comprehensive reporting was reassessed. Going forward, summary data reports will be provided following each of the first four years of a five-year cycle, and this started with the 2011 monitoring year. These data reports will include any completed statistical assessments of the data and the results will be 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 delayed until completion of the 2018 Cycle 1 finfish survey. Consultants are currently working on this review, which has been expanded to include 2016-2019 Cycle 2 data. A final report is expected in the fall of 2020.

This report presents only a relatively brief summary of the results of the 2019 Macaulay and Clover environmental monitoring program (Cycle 2 – Year 4), results from then new McLoughlin seafloor stations, as well as data and analyses from previous years that have not yet already been presented. Limited statistical analyses have been performed on the 2019 data; a more detailed and comprehensive statistical assessment of the 2019 results will be undertaken as part of the 2011-2019 review noted above.

Table 1.1 Monitoring Components of the Five-Year Macaulay and Clover Environmental Monitoring Program (Cycle 2)

Monitoring Component	Sub-component	Year 1 (2016)		Year 2 (2017)		Year 3 (2018)		Year 4 (2019)		Year 5 (2020)	
		Mac[1]	Clo[1]	Mac	Clo	Mac	Clo	Mac	Clo	Mac	Clo
WASTEWATER											
Wastewater	monthly and quarterly chemistry	√	√	√	√	√	√	√	√	√	√
	quarterly high resolution chemistry	√	√	√	√	√	√	√	√	√	√
	quarterly toxicity testing	√	√	√	√	√	√	√	√	√	√
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]			√[3]	√[3]
	whole fish and fillet tissue chemistry					√[2]	√[2]			√[3]	√[3]
SURFACE WATER AND WATER COLUMN											
Surface Water	bacteria	√	√	√	√	√	√	√	√	√	√
Water Column	bacteria, conventionals, metals	√	√	√	√	√	√	√	√	√	√
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] Mac-Macaulay, Clo-Clover, **[2]** delayed from Cycle 1, **[3]** Timing of this study to be determined

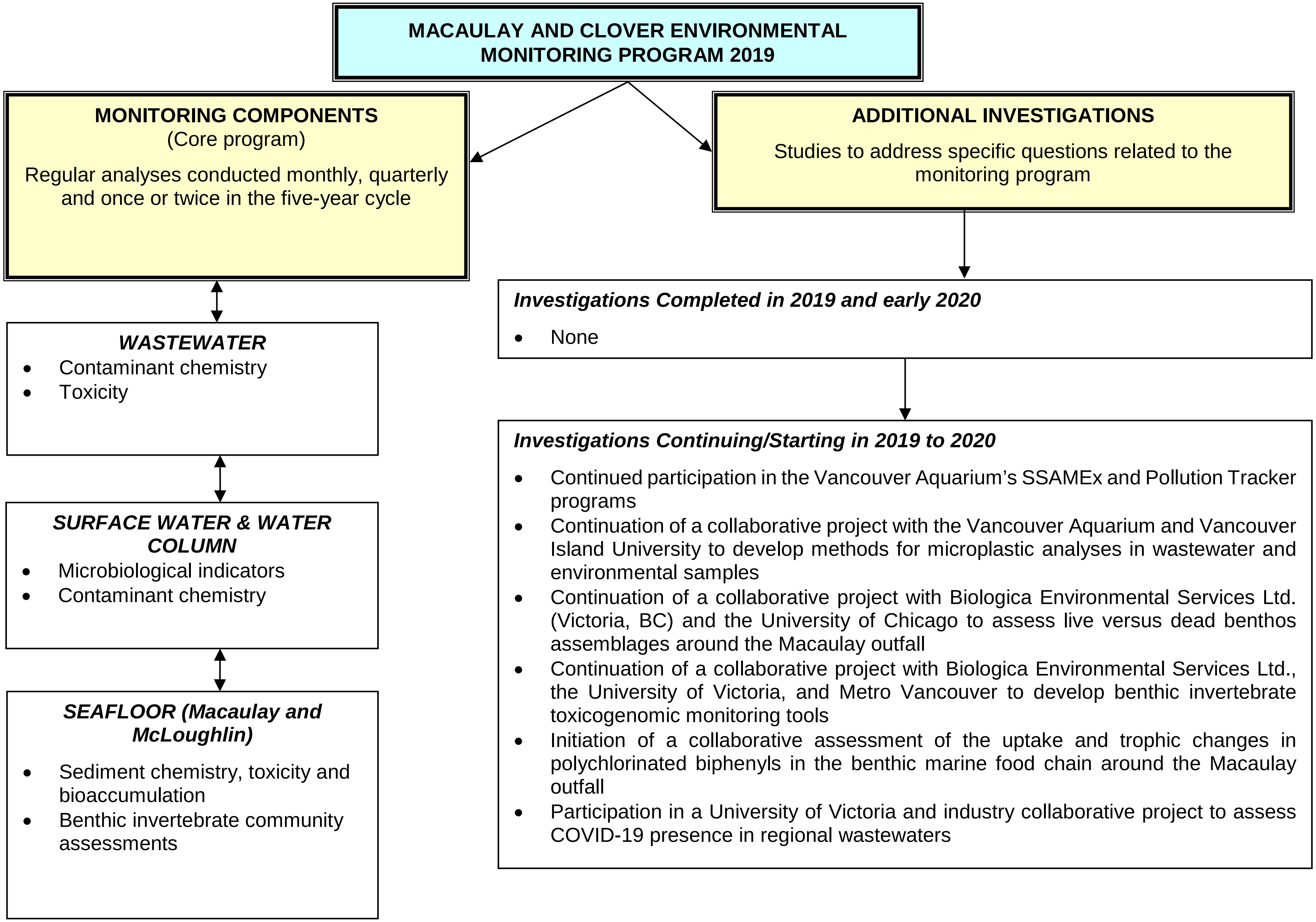
*Plus five new seafloor stations associated with the new McLoughlin plant

Table 1.2 Monitoring Components of the 2019 Macaulay and Clover Environmental Monitoring Program

Macaulay Outfall	Parameter	Monitoring Frequency
Wastewater	Flow	Daily
	Compliance monitoring	Federal – Weekly Provincial – Monthly
	Conventional parameters[1] and priority substances[1]	Monthly
	Priority substances[1]	Quarterly (January, April, July and October)
	Toxicity – acute	Quarterly
	Toxicity – chronic	Annually
Surface Water & Water Column	Indicator bacteria (fecal coliform and *Enterococci*) and CTD (DO, beam attenuation, salinity, temperature) Conventional parameters[1] and metals[1]	Quarterly with a set of five sampling events in 30 days during each quarter
Seafloor[3]	Particle size analysis, TOC[2], AVS[2] and sediment chemistry[1] sediment toxicity, bioaccumulation assessment, benthic invertebrate community structure	See Table 1.1
Clover Outfall	**Parameter**	**Monitoring Frequency**
Wastewater	Flow	Daily
	Compliance monitoring	Federal – Weekly Provincial – Monthly
	Conventional parameters[1] and priority substances[1]	Monthly
	Priority substances[1]	Quarterly (January, April, July and October)
	Toxicity – acute	Quarterly
	Toxicity – chronic	Annually
Surface Water & Water Column	Indicator bacteria (fecal coliform and *Enterococci*) and CTD (DO, beam attenuation, salinity, temperature) Conventional parameters[1] and metals[1]	Quarterly with a set of five sampling events in 30 days during each quarter

Notes:
[1]Analyte lists can be found in Appendices B1 (wastewater); C1 (water column), D1 (sediment and mussel tissue)
[2]TOC—total organic carbon, AVS—acid volatile sulphide
[3]Similar analyses included at the five new seafloor stations associated with the new McLoughlin plant

Figure 1-1 Elements of the 2019 Macaulay and Clover Environmental Monitoring Program



2.0 WASTEWATER MONITORING

2.1 Introduction

Wastewater monitoring is conducted regularly at both the Macaulay and Clover outfalls to assess compliance with the ministry's permits for flow, carbonaceous biochemical oxygen demand (CBOD) and total suspended solids (TSS) and federal wastewater regulations (for CBOD, unionized ammonia and TSS), and to profile the chemical and physical constituents of wastewater before it is released to the marine receiving environment. Assessment of wastewater provides information on the concentrations and loadings of wastewater constituents to the marine environment, ultimately providing an indication of which substances may be of environmental concern. The results are then used to direct the efforts of the monitoring program and the CRD's Regional Source Control Program.

Changes to the wastewater monitoring component of the monitoring program were made in 2011, based on the program review by CRD and ministry staff, the implementation of the revised five-year monitoring cycle and the new federal wastewater regulations. The changes included the addition of quarterly wastewater acute toxicity tests (Rainbow trout and *Daphnia magna*), the continuation of high resolution wastewater testing of several contaminants of potential concern on a quarterly basis, and the addition of weekly monitoring.

Detailed statistical trend analyses are undertaken every three to five years to quantitatively assess temporal trends in concentrations and loadings of wastewater parameters. In 2012, Golder Associates (Golder, 2013) updated the trend assessment (Golder, 2009) to include the 2009-2011 results. Results of this assessment were presented in the 2011 annual report (CRD, 2012). The most recent trend assessment was completed in 2017 (Golder, 2017a) for the 2012-2015 data, and the results were included in the 2016 monitoring program annual report (CRD, 2017). The 2016-2018 data is currently being assessed as part of the comprehensive review of Cycle 1 Plus 2016-2019 results. This assessment is expected in the fall of 2020.

2.2 Methods

In 2019, wastewater samples were collected on a weekly basis and conventional parameters were analysed for compliance with federal and provincial wastewater regulations. Samples were also analyzed monthly or quarterly for over 20 conventional parameters (such as TSS and nutrients) and a comprehensive list of over 500 additional priority substances (Table 2.1, Appendix B1), including metals, aldehydes, phenolic compounds, polycyclic aromatic hydrocarbons (PAH), volatile organic compounds (VOC) and terpenes. High resolution analysis of polychlorinated biphenyl (PCB), PBDE, organochlorine pesticides, PPCP, polycyclic aromatic hydrocarbons (PAH) and nonylphenols (NP), per- and polyfluoroalkyl substances (PFAS), as well as acute toxicity tests were done on a quarterly basis (January, April, July and October) in 2019 (Appendix B1). An annual set of chronic toxicity tests was run in October 2019.

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 on a periodic basis 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.

Wastewater samples were taken as 24-hour composites (400 mL wastewater collected every 30 minutes for a 24-hour period and composited into one large sample) at the Macaulay and Clover wet wells post screening. Grab samples were also collected for a few substances, including those that have very short hold times (e.g., fecal coliforms), those that are volatile (e.g., sulphide and volatile organic substances) and those that cannot be sampled correctly by composite sampling (e.g., oil and grease). Samples were immediately dispatched to qualified laboratories to conduct chemical analyses. Conventional parameters were analyzed by the CRD Saanich Peninsula plant laboratory (Sidney, BC) and Bureau Veritas Laboratories (BV Labs, formerly Maxxam Analytics Inc., Burnaby, BC); priority substance analyses were conducted by BV Labs and high resolution analyses were conducted at SGS AXYS Analytical Services (Sidney, BC). Substances were analyzed using analytical 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 were conducted by Nautilus Environmental (Burnaby, BC) in 2019, using standardized and approved protocols.

Wastewater flow volumes were measured continuously (every few minutes) by a Supervisory Control and Data Acquisition system at the Macaulay and Clover outfalls (Appendix B2 and B3). Flow measurements were compared to maximum daily and annual mean flow limits specified in the permits for these facilities. These 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.

Table 2.1 Frequency of Wastewater Sampling by Analytical Group

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

Parameter Group	Wastewater Priority Substances		
	Monthly	**Quarterly**	**Annual**
Conventionals	√	√	
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		√	
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		√	
Organochlorine pesticides		√	
Pharmaceuticals and Personal Care Products		√	
Polychlorinated biphenyls		√	
Polycyclic aromatic hydrocarbons		√	
Polybrominated diphenyl ethers		√	
Per- and polyfluoroalkyl substances		√	

DATA QUALITY ASSESSMENT

A rigorous quality assurance/quality control (QA/QC) assessment procedure was followed for both field sampling procedures and laboratory analyses for the routine wastewater monitoring component. From each analytical batch (12 monthly batches in 2019), 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 2019. The analytical laboratories also conducted internal QA/QC analyses, including method analyte spikes, method blanks and standard reference materials.

All data that exhibited failures of QA/QC criteria (Golder, 2017b) were not included in any statistical analysis, except for the determination of frequency of detection.

2.3 Results and Discussion

Wastewater was sampled on a weekly basis at both the Clover and Macaulay outfalls to ensure compliance with federal Wastewater Systems Effluent Regulations (WSER) under the *Fisheries Act*, and monthly to ensure compliance with permits issued by the ministry under the *Environmental Management Act*. Monthly averages or maximum results are reported to Environment Canada on a quarterly basis through the online Effluent Regulatory Reporting Information System and on a monthly basis to the ministry by email.

2.3.1 Federal Compliance Monitoring

The required frequency of sampling, to satisfy federal monitoring requirements, is based on the average daily flows from the previous calendar year (2018 flows); as a result, weekly monitoring was required in 2019. The federal wastewater regulations stipulate monthly average effluent quality limits for TSS and CBOD and a maximum individual weekly limit for unionized ammonia that are equivalent to secondary treatment. As the Macaulay and Clover outfalls discharge only screened effluent, the federal government granted transitional authorizations for these facilities that allow for effluent quality limits to be exceeded temporarily until new treatment can be installed. These transitional authorizations came into effect January 1, 2015 and they require treatment equivalent to secondary (or better) to be in place by December 31, 2020.

Table 2.2 and Table 2.3 present results from the 2019 weekly sampling, as well as the monthly averages for TSS and CBOD. Clover and Macaulay monthly average results for TSS, unionized ammonia or CBOD did not exceed the transitional authorizations' limits.

2.3.2 Provincial Compliance Monitoring

Monthly wastewater monitoring is undertaken to ensure compliance with the provincial permits issued for the Macaulay and Clover outfalls. Among other day-to-day operation requirements, the permits stipulate maximum operating levels for flow, and expectations for the wastewater concentrations of TSS and CBOD (Table 2.2 and Table 2.3). The ministry expects the Clover and Macaulay wastewaters to be within the expected ranges for fine-screened wastewater (Metcalf and Eddy, 2013).

Flow information for 2019 is presented in Figure 2.1 and Appendix B2 (Macaulay) and Figure 2.2 and Appendix B3 (Clover). Flows did not exceed the allowable daily maximum for either the Macaulay (150,000 m^3) or Clover (185,000 m^3) discharges in 2019. The mean daily flow at Macaulay was 42,946 m^3/day in 2019, slightly lower (3.7%) than the daily average flow in 2018 (44,574 m^3/day). The mean daily flow at Clover was 42,412 m^3/day in 2019, which is slightly lower (5.4%) than in 2018 (44,854 m^3/day).

Results indicate that the quality of the wastewaters from Macaulay and Clover outfalls in 2019 were generally similar to the previous year's results. Macaulay had biochemical oxygen demand (BOD) outside the expected range for fine-screened wastewater in March and April (Table 2.2) and Clover was outside expected ranges for TSS twice in June (Table 2.3). With the exception of these four exceedances, the remainder of the results met provincial regulatory expectations. The predicted environmental concentrations (taking estimated minimum initial dilution into consideration) did not exceed BC or Canadian Council of Ministers of the Environment (CCME) water quality guidelines (Table 2.4) except for bacterial indicators. More information about the minimum initial dilution calculations can be found in Section 2.3.3.

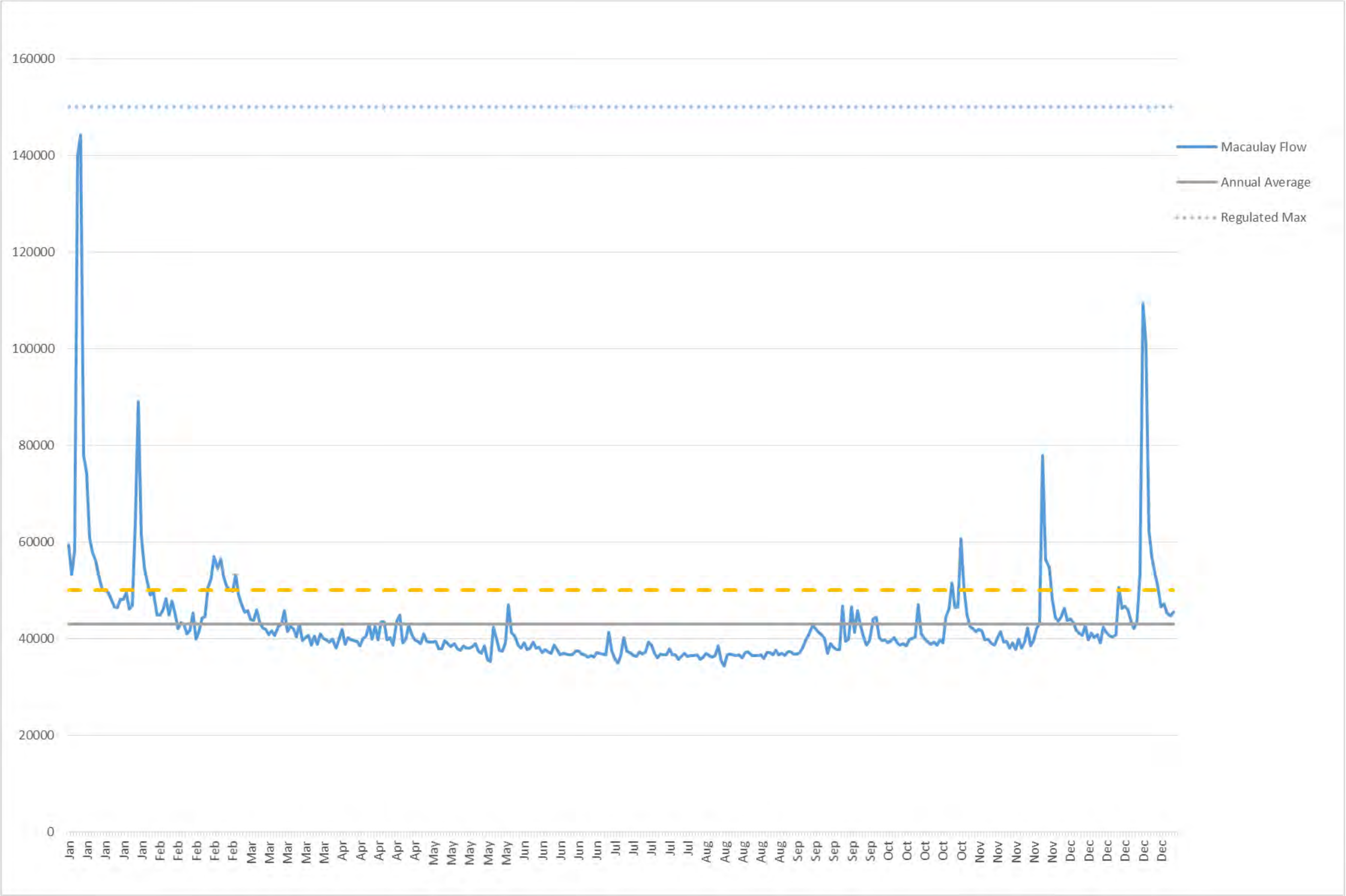


Figure 2.1 Macaulay Flows in 2019

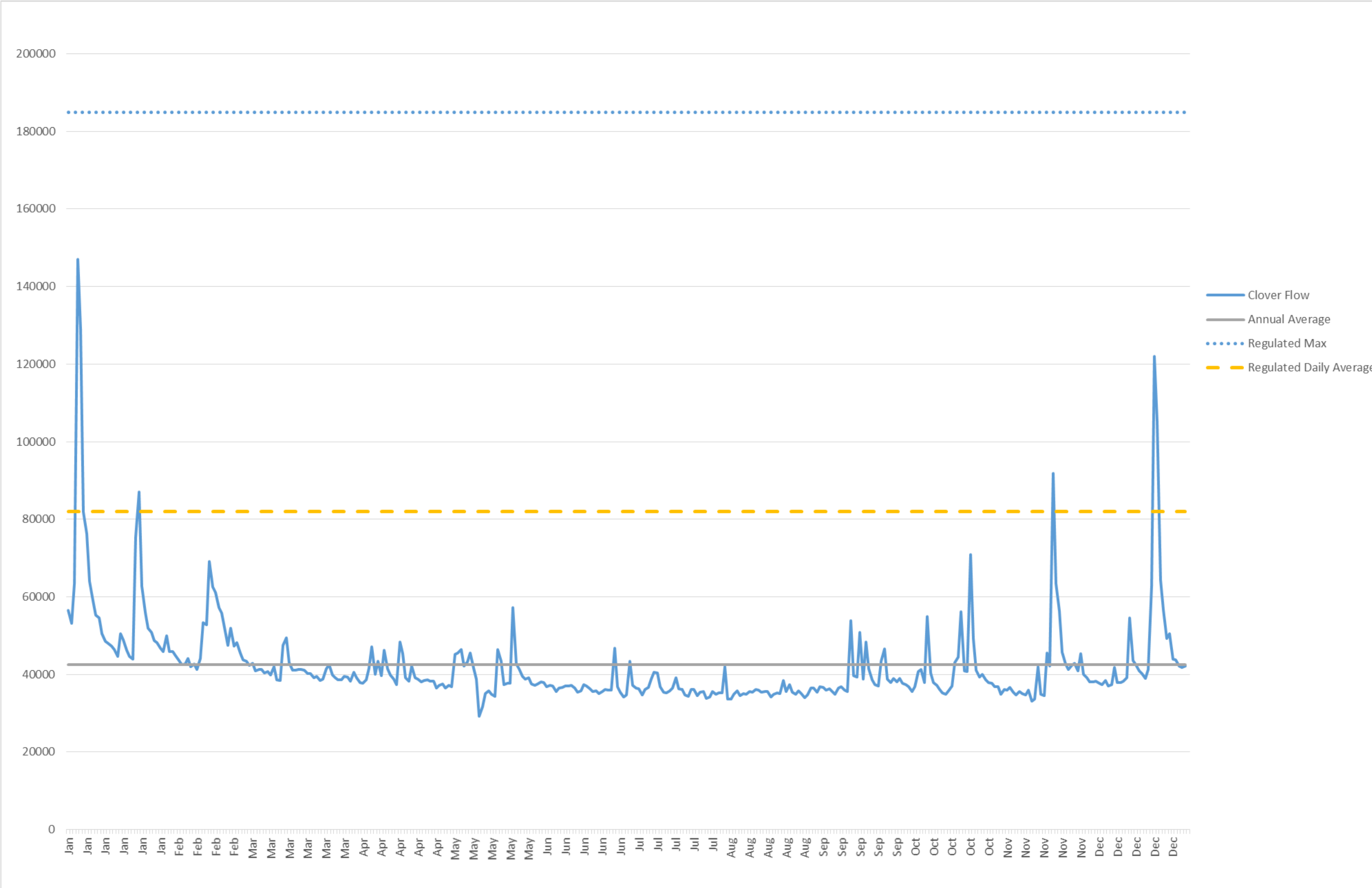


Figure 2.2 Clover Flows in 2019

Table 2.2 Macaulay Federal and Provincial Wastewater Compliance Results for 2019

	Macaulay				
	CBOD	BOD	TSS	Unionized NH_3	pH @ 15°C
	TOT	TOT	TOT	TOT	TOT
	mg/L	mg/L	mg/L	mg/L	pH
Provincial Limit* (compared to individual results)		110-350	120-400		
Federal Transitional Authorization limit (CBOD and TSS compared to monthly averages; NH_3 compared to maximum)	**334**		**342**	**1.250**	
02/01/2019	200	---	190	0.014	6.26
08/01/2019	160	---	189	0.130	7.07
15/01/2019	217	270	167	0.147	6.98
23/01/2019	150	---	218	0.043	6.69
31/01/2019	210	---	260	0.071	6.70
January Average	**187**	---	**205**	**0.081**	**6.74**
04/02/2019	240	---	256	0.073	6.81
14/02/2019	270	---	256	0.083	6.79
20/02/2019	190	284	174	0.029	6.64
28/02/2019	270	---	258	0.057	6.70
February Average	**243**	---	**236**	**0.061**	**6.74**
05/03/2019	260	---	280	0.057	6.63
12/03/2019	310	398	326	0.041	6.56
20/03/2019	250	---	288	0.067	6.76
26/03/2019	250	---	268	0.065	6.76
March Average	**268**	---	**291**	**0.058**	**6.68**
03/04/2019	260	---	304	0.073	6.78
09/04/2019	240	384	354	0.093	6.84
16/04/2019	320	---	314	0.063	6.73
23/04/2019	330	---	258	0.062	6.71
April Average	**288**	---	**308**	**0.073**	**6.77**
01/05/2019	270	---	290	0.110	6.91
07/05/2019	260	---	268	0.130	6.95
14/05/2019	290	320	290	0.072	6.78
21/05/2019	310	---	376	0.058	6.71
28/05/2019	270	---	302	0.088	6.83
May Average	**280**	---	**305**	**0.092**	**6.84**

Table 2.2, cont'd

	Macaulay				
	CBOD	**BOD**	**TSS**	**Unionized NH_3**	**pH @ 15°C**
	TOT	**TOT**	**TOT**	**TOT**	**TOT**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**pH**
Provincial Limit* (compared to individual results)		110-350	120-400		
Federal Transitional Authorization limit (CBOD and TSS compared to monthly averages; NH_3 compared to maximum)	**334**		**342**	**1.250**	
04/06/2019	310	---	358	0.190	6.93
11/06/2019	260	320	302	0.120	7.00
18/06/2019	430	---	330	0.089	6.87
25/06/2019	270	---	324	0.083	6.84
June Average	**318**	---	**329**	**0.121**	**6.91**
03/07/2019	270	---	338	0.097	6.89
10/07/2019	270	---	260	0.077	6.85
16/07/2019	280	---	248	0.058	6.67
24/07/2019	290	---	278	0.094	6.90
31/07/2019	310	---	274	0.076	6.81
July Average	**284**	---	**280**	**0.080**	**6.82**
06/08/2019	260	---	270	0.082	6.85
13/08/2019	330	300	298	0.048	6.64
21/08/2019	260	---	290	0.077	6.91
27/08/2019	290	---	300	0.054	6.66
August Average	**285**	---	**290**	**0.065**	**6.77**
03/09/2019	230	---	230	0.700	7.58
10/09/2019	250	---	300	0.062	6.74
18/09/2019	230	260	260	0.140	7.03
25/09/2019	220	---	300	0.037	6.53
September Average	**233**	---	**273**	**0.235**	**6.97**
01/10/2019	280	---	350	0.052	6.68
09/10/2019	260	---	280	0.065	6.80
16/10/2019	250	---	320	0.190	7.14
22/10/2019	250	270	307	0.070	6.77
29/10/2019	270	---	280	0.065	6.70
October Average	**262**	---	**307**	**0.088**	**6.82**

Table 2.2, cont'd

	Macaulay				
	CBOD	**BOD**	**TSS**	**Unionized NH_3**	**pH @ 15°C**
	TOT	**TOT**	**TOT**	**TOT**	**TOT**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**pH**
Provincial Limit* (compared to individual results)		110-350	120-400		
Federal Transitional Authorization limit (CBOD and TSS compared to monthly averages; NH_3 compared to maximum)	**334**		**342**	**1.250**	
06/11/2019	290	---	250	0.052	6.60
13/11/2019	240	---	248	0.064	6.79
21/11/2019	180	260	304	0.056	6.64
27/11/2019	230	---	186	0.088	6.81
November Average	**235**	---	**247**	**0.065**	**6.71**
04/12/2019	300	---	252	0.066	6.77
11/12/2019	270	---	220	0.057	6.69
17/12/2019	130	130	260	0.073	6.78
26/12/2019	200	---	260	0.074	6.80
December Average	**225**	---	**248**	**0.068**	**6.76**

Notes:
* Equivalent to or better than screened municipal wastewater. Metcalf and Eddy (2013)
Shaded results indicate exceedance

Table 2.3 Clover Federal and Provincial Wastewater Compliance Results for 2019

	Clover				
	CBOD	BOD	TSS	Unionized NH_3	pH @ 15° C
	TOT	TOT	TOT	TOT	TOT
	mg/L	mg/L	mg/L	mg/L	pH
Provincial Limit (compared to individual results)*		110-350	120-400		
Federal Transitional Authorization limit (CBOD and TSS compared to monthly averages; NH_3 compared to maximum)	**327**		**396**	**1.25**	
02/01/2019	120	---	146	0.007	6.26
08/01/2019	120	---	155	0.069	7.06
15/01/2019	250	292	194	0.052	6.80
23/01/2019	110	---	161	0.056	7.09
31/01/2019	190	---	210	0.022	6.47
January Average	**158**	**---**	**173**	**0.041**	**6.74**
04/02/2019	200	---	234	0.041	6.72
14/02/2019	170	---	235	0.040	6.77
20/02/2019	230	278	212	0.041	6.65
28/02/2019	230	---	232	0.028	6.53
February Average	**208**	**---**	**228**	**0.038**	**6.67**
05/03/2019	220	---	318	0.229	6.55
12/03/2019	210	262	216	0.022	6.44
20/03/2019	220	---	306	0.012	6.77
26/03/2019	210	---	320	0.045	6.70
March Average	**215**	**---**	**290**	**0.077**	**6.62**
03/04/2019	210	---	316	0.046	6.70
09/04/2019	160	225	188	0.083	6.95
16/04/2019	300	---	334	0.054	6.76
23/04/2019	340	---	288	0.054	6.82
April Average	**253**	**---**	**282**	**0.059**	**6.81**
01/05/2019	230	---	280	0.068	6.84
07/05/2019	180	---	210	0.036	6.73
14/05/2019	270	225	240	0.055	6.75
21/05/2019	320	---	296	0.032	6.57
28/05/2019	260	---	236	0.050	6.72
May Average	**252**	**---**	**252**	**0.048**	**6.72**

Table 2.3, cont'd

	Clover				
	CBOD	BOD	TSS	Unionized NH_3	pH @ 15° C
	TOT	TOT	TOT	TOT	TOT
	mg/L	mg/L	mg/L	mg/L	pH
Provincial Limit (compared to individual results)*		110-350	120-400		
Federal Transitional Authorization limit (CBOD and TSS compared to monthly averages; NH_3 compared to maximum)	**327**		**396**	**1.25**	
04/06/2019	260	---	406	0.072	6.81
11/06/2019	250	320	260	0.046	6.70
18/06/2019	360	---	352	0.060	6.76
25/06/2019	310	---	402	0.045	6.69
June Average	**295**	**---**	**355**	**0.056**	**6.74**
03/07/2019	240	---	296	0.069	6.86
10/07/2019	210	---	260	0.085	6.98
16/07/2019	200	---	188	0.053	6.75
24/07/2019	300	---	284	0.073	6.86
31/07/2019	390	---	304	0.037	6.59
July Average	**268**	**---**	**266**	**0.063**	**6.81**
06/08/2019	240	---	290	0.062	6.82
13/08/2019	270	280	306	0.043	6.65
21/08/2019	190	---	270	0.100	6.94
27/08/2019	240	---	220	0.042	6.64
August Average	**235**	**---**	**272**	**0.062**	**6.76**
03/09/2019	210	---	280	0.079	6.93
10/09/2019	200	---	270	0.059	6.81
18/09/2019	190	220	300	0.065	6.88
25/09/2019	190	---	270	0.038	6.65
September Average	**198**	**---**	**280**	**0.060**	**6.82**
01/10/2019	280	---	270	0.043	6.67
09/10/2019	160	---	250	0.044	6.70
16/10/2019	200	---	310	0.050	6.83
22/10/2019	190	210	242	0.090	7.04
29/10/2019	240	---	272	0.083	6.85
October Average	**214**	**---**	**269**	**0.062**	**6.82**

Table 2.3, cont'd

	Clover				
	CBOD	**BOD**	**TSS**	**Unionized NH_3**	**pH @ 15° C**
	TOT	**TOT**	**TOT**	**TOT**	**TOT**
	mg/L	**mg/L**	**mg/L**	**mg/L**	**pH**
Provincial Limit (compared to individual results)*		110-350	120-400		
Federal Transitional Authorization limit (CBOD and TSS compared to monthly averages; NH_3 compared to maximum)	**327**		**396**	**1.25**	
06/11/2019	280	---	332	0.039	6.56
13/11/2019	180	---	136	0.046	6.73
21/11/2019	240	220	288	0.047	6.61
27/11/2019	230	---	191	0.048	6.71
November Average	**233**	**---**	**237**	**0.045**	**6.65**
04/12/2019	290	---	298	0.050	6.78
11/12/2019	150	---	270	0.046	6.71
17/12/2019	200	190	250	0.043	6.68
26/12/2019	210	---	290	0.046	6.79
December Average	**213**	**---**	**277**	**0.046**	**6.74**

Notes:
* Equivalent to or better than screened municipal wastewater. Metcalf and Eddy (2013)
Shaded results indicate exceedance

2.3.3 Priority Substances

Wastewater samples were analyzed for the priority substances listed in Table 2.1 and Appendix B1.

The frequencies of detection of all substances analyzed in wastewater are included in Appendix B4 (Macaulay) and B5 (Clover). There were more than 170 routine resolution substances analyzed in both discharges and more than half of these substances were never detected in 2019 (at routine detection limits chosen for comparison to the applicable water quality guidelines). Routine resolution substances frequently detected in wastewater (greater than 50% of the time) in 2019 were similar to previous years and included a number of conventional parameters, total and dissolved metals, speciated metals, two phenolic compounds, PAH, phthalates, and a few miscellaneous organics. 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.

The concentrations of substances that were frequently detected (greater than 50% of sampling events) in Macaulay and Clover wastewaters are presented in Table 2.4 (Macaulay) and Table 2.5 (Clover). Annual loadings to the marine environment are presented in Appendix B4. Both concentrations and loadings in 2019 were qualitatively similar to previous years and the observed variation was typical of municipal wastewater discharges.

To determine the potential for effects of the wastewater discharges on the receiving environment, average and maximum wastewater concentrations of frequently detected substances (Table 2.4 and Table 2.7) were compared to the BC (BCMoE 2017 and 2019), Warrington (1988) and CCME water quality guidelines (CCME, 2003) developed to protect aquatic life and human health, and Health Canada guidelines for human health protection (Health Canada, 2012). Conservative estimates of the minimum initial dilution of the wastewaters in receiving waters off the outfalls (245:1 for Macaulay and 175:1 for Clover) (Hodgins, 2006) were applied to maximum wastewater substance concentrations from both discharges 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 (area that extends 100 m around the outfall diffusers) of each outfall.

Before application of minimum dilution factors, there were several substances (at both outfalls) that exceeded applicable guidelines in undiluted wastewater prior to discharge. These substances included both bacteriological indicators, NH_3 (ammonia), weak acid dissociable cyanide, cadmium, copper, mercury, zinc, benzo(a)pyrene and total PCBs at both Macaulay and Clover. In addition, PCB 105 exceeded at Clover only and nonylphenols, chrysene and napthalene exceeded at Macaulay only (Table 2.4 and Table 2.6). These exceedances were similar in frequency and magnitude to those observed in 2018 and 2017 (CRD, 2018; CRD, 2019). The CRD will continue to monitor these substances to determine whether the exceedances of provincial and federal guidelines are changing in frequency over time, or whether concentrations of these substances are increasing over time.

After application of minimum dilution factors, there were no substances exceeding applicable guidelines in wastewater, except for bacteriological indicators, indicating that receiving environment concentrations were unlikely to exceed guidelines beyond the initial dilution zone, and the potential for effects on aquatic life were likely limited to within the outfall initial dilution zone.

Table 2.4 Concentrations of Frequently Detected Substances (>50% of the time) in Macaulay Wastewater 2019

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Conventionals										
pH @ 15°C	TOT	pH	100%	6.8	54	7.58	6.26	0.03		
TSS	TOT	mg/L	100%	272.2	54	376	92	1.53		
CBOD	TOT	mg/L as O2	100%	257	54	430	130	1.76		
N - NH_3 (As N)- Unionized	TOT	mg/L	100%	0.09213	54	0.7	0.014	0.003		
Temperature	TOT	°C	100%	16.9	52	21.7	11.9	0.09		
pH	TOT	pH	100%	7.26	43	7.7	6.6	0.03		
TOC	TOT	mg/L	100%	56.4	14	81	35	0.33		
COD	TOT	mg/L as O2	100%	698.4	12	947	567	3.87		
BOD	TOT	mg/L as O2	100%	288.2	13	398	130	1.62		
N - TKN (As N)	TOT	mg/L	100%	63.64	9	77.1	45.2	0.31		
N - NH_3 (As N)	TOT	mg/L	100%	44.71	52	82	24	0.33	19.7e	
Fecal Coliforms	TOT	CFU/100 mL	100%	8962000	13	20,000,000	3,500,000	81633	200j	
Enterococci	TOT	CFU/100 mL	1	1294000	14	2400000	570000	9796	20j	35/70n
pH	TOT	pH	100%	7.47	14	7.71	7.03	0.03		
Specific Conductivity - 25°C.	TOT	µS/cm	100%	797	13	933	595	3.81		
Alkalinity	TOT	mg/L asCaCO3	100%	243.1	12	306	164	1.25		
Hardness (As $CaCO_3$)	DIS	mg/L	100%	71.84	14	92.4	50.5	0.38		
Hardness (As $CaCO_3$)	TOT	mg/L	100%	81.51	14	96.5	62.4	0.39		
PO_4 - Ortho (As P)	DIS	mg/L	100%	3.598	11	4.1	2.54	0.02		
PO_4 - Total (As P)	DIS	µg/L	100%	4420	3	4530	4260	18		
PO_4 - Total (As P)	TOT	µg/L	100%	6060	11	7430	4880	30		
Sulfide	TOT	mg/L	100%	0.2592	13	0.76	0.05	0.0031		
Weak Acid Dissociable Cyanide	TOT	mg/L	100%	0.001297	14	0.0034	0.0007	0.000014	0.001b	
Strong Acid Dissociable Cyanide	TOT	mg/L	100%	0.003089	14	0.0065	0.00093	0.00003		
Oil & Grease, mineral	TOT	mg/L	93%	4.38	14	12	2	0.05		
Oil & grease, total	TOT	mg/L	100%	13.89	14	30	2.3	0.12		
Metals - Total										
Aluminum	TOT	µg/L	100%	205	14	291	148	1.19		
Antimony	TOT	µg/L	100%	0.3111	14	0.4	0.247	0.002		
Arsenic	TOT	µg/L	100%	0.5961	14	1.01	0.351	0.004	12.5bg	12.5
Barium	TOT	µg/L	100%	20.33	14	22.6	15.7	0.09		
Cadmium	TOT	µg/L	100%	0.1589	14	0.253	0.109	0.0010	0.12c	0.12
Calcium	TOT	mg/L	100%	20.66	14	24.8	15	0.10		
Chromium	TOT	µg/L	100%	2.306	14	4.55	0.7	0.019		
Chromium Iii	TOT	mg/L	82%	0.00175	11	0.0025	0.001	0.000010		
Cobalt	TOT	µg/L	100%	0.894	14	1.33	0.309	0.005		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Copper	TOT	µg/L	100%	80.59	14	131	34.8	0.53	3b	
Iron	TOT	µg/L	100%	543.2	14	666	404	2.72		
Lead	TOT	µg/L	100%	3.111	14	7.41	2.14	0.03	140b	
Magnesium	TOT	mg/L	100%	7.272	14	8.42	5.15	0.03		
Manganese	TOT	µg/L	100%	64.57	13	92.9	42	0.38	100c	
Mercury	TOT	µg/L	64%	0.02396	14	0.0585	0.0028	0.0002	0.02b	
Molybdenum	TOT	µg/L	100%	1.314	14	3.06	0.745	0.012		
Nickel	TOT	µg/L	100%	4.474	14	6.97	2.22	0.03		
Potassium	TOT	mg/L	100%	18.34	14	21.4	10.2	0.09		
Selenium	TOT	µg/L	100%	0.3059	14	0.391	0.261	0.002	2b	
Silver	TOT	µg/L	100%	0.0423	13	0.122	0.02	0.0005	3bh	
Sodium	TOT	mg/L	100%	51.8	11	58.8	39.3	0.24		
Thallium	TOT	µg/L	100%	0.00558	14	0.0085	0.0036	0.00003		
Tin	TOT	µg/L	100%	1.158	13	1.4	0.54	0.006		
Zinc	TOT	µg/L	100%	105.9	14	126	69.2	0.51	10bj/55bh	
Metals - Dissolved										
Aluminum	DIS	µg/L	100%	29.93	14	37.3	22.6	0.15		
Antimony	DIS	µg/L	100%	0.2771	14	0.34	0.189	0.0014		
Arsenic	DIS	µg/L	100%	0.5003	14	0.787	0.32	0.0032		
Barium	DIS	µg/L	100%	10.26	14	15	6.18	0.06		
Cadmium	DIS	µg/L	100%	0.03744	14	0.124	0.0127	0.0005		
Calcium	DIS	mg/L	100%	17.59	14	23.3	12.7	0.10		
Chromium	DIS	µg/L	100%	1.847	14	4.27	0.4	0.02		
Cobalt	DIS	µg/L	100%	0.7136	14	1.21	0.203	0.005		
Copper	DIS	µg/L	100%	40.26	14	60.1	20.5	0.25		
Iron	DIS	µg/L	100%	309.9	14	439	207	1.79		
Lead	DIS	µg/L	100%	0.6939	14	1	0.436	0.00		
Magnesium	DIS	mg/L	100%	6.791	14	8.31	4.58	0.03		
Manganese	DIS	µg/L	100%	49.21	14	78.6	27.4	0.32		
Mercury	DIS	µg/L	79%	0.00403	14	0.0108	0.002	0.00004		
Molybdenum	DIS	µg/L	100%	1.596	14	5.83	0.506	0.02		
Nickel	DIS	µg/L	100%	3.958	14	6.3	2.35	0.03		
Potassium	DIS	mg/L	100%	17.89	14	21.1	10.2	0.09		
Selenium	DIS	µg/L	100%	0.2195	14	0.312	0.172	0.0013		
Silver	DIS	µg/L	100%	0.04424	14	0.12	0.0199	0.0005		
Tin	DIS	µg/L	100%	1.029	14	1.6	0.57	0.01		
Zinc	DIS	µg/L	100%	22.62	14	37.8	6.62	0.15		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Metals - Speciated										
Methyl Mercury	TOT	ng/L	100%	0.445	6	0.555	0.363	0.0023		
Dibutyltin	TOT	µg/L	83%	0.00357	6	0.007	0.001	0.00003		
Dibutyltin Dichloride	TOT	µg/L	83%	0.00517	6	0.009	0.001	0.00004		
Monobutyltin	TOT	µg/L	100%	0.00683	6	0.014	0.002	0.0001		
Tributyltin	TOT	µg/L	67%	0.00417	6	0.018	0.001	0.0001		
Monobutyltin Trichloride	TOT	µg/L	100%	0.01067	6	0.022	0.003	0.0001		
Phenolics										
Total Phenols	TOT	mg/L	100%	0.07926	14	0.12	0.0029	0.0005		
2-Methyl-4,6-Dinitrophenol	TOT	µg/L	100%	2.5	3	2.5	2.5	0.01		
Phenol	TOT	µg/L	100%	14.89	14	28.4	6.3	0.12		
PAHs										
2-Methylnaphthalene	TOT	µg/L	100%	0.1497	14	0.36	0.025	0.001		
Acenaphthene	TOT	µg/L	100%	0.2026	8	0.44	0.024	0.002	6b	
Acenaphthylene	TOT	µg/L	86%	0.0896	14	0.26	0.01	0.001		
Anthracene	TOT	µg/L	86%	0.0431	14	0.22	0.01	0.001		
Benzo(A)Anthracene	TOT	µg/L	93%	0.0417	14	0.28	0.01	0.001		
Benzo(A)Pyrene	TOT	µg/L	86%	0.04386	14	0.3	0.005	0.001	0.01b	
Benzo(B)Fluoranthene	TOT	µg/L	86%	0.0224	14	0.093	0.01	0.000		
Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	TOT	µg/L	86%	0.0306	14	0.15	0.01	0.001		
Chrysene	TOT	µg/L	100%	0.053	14	0.24	0.012	0.001	0.1b	
Fluoranthene	TOT	µg/L	100%	0.1299	14	0.64	0.014	0.003		
Fluorene	TOT	µg/L	100%	0.1305	14	0.39	0.029	0.002	12b	
Naphthalene	TOT	µg/L	100%	0.3719	14	1.4	0.01	0.006	1b	1.4
Phenanthrene	TOT	µg/L	100%	0.2212	14	0.89	0.043	0.004		
Pyrene	TOT	µg/L	100%	0.1064	14	0.46	0.013	0.002		
Total Hmw-PAHs	TOT	µg/L	100%	0.4232	14	2.3	0.049	0.01		
Total Lmw-PAHs	TOT	µg/L	100%	1.256	14	3.2	0.28	0.013		
Total PAHs	TOT	µg/L	100%	1.683	14	5.1	0.33	0.02		
Phthalates										
Bis(2-Ethylhexyl)Phthalate	TOT	µg/L	86%	8.79	14	29	5	0.12		
Butylbenzyl Phthalate	TOT	µg/L	100%	2.5	3	2.5	2.5	0.010		
Diethyl Phthalate	TOT	µg/L	100%	1.66	14	4.12	0.25	0.02		
Organics										
Toluene	TOT	µg/L	100%	1.239	14	1.8	0.64	0.007		215
Chloroethene	TOT	µg/L	100%	0.5	3	0.5	0.5	0.002		
Tetrabromomethane	TOT	µg/L	100%	50	3	50	50	0.20		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Tetrachloromethane	TOT	µg/L	100%	0.5	3	0.5	0.5	0.002		
Trichloromethane	TOT	µg/L	100%	2.83	3	2.9	2.8	0.012		
Chloroform	TOT	µg/L	100%	3.31	11	4.9	2.1	0.02		
Dimethyl Ketone	TOT	µg/L	100%	215.6	14	680	53	2.78		
Alpha-Terpineol	TOT	µg/L	100%	7.6	14	11	5.5	0.04		
1,4-Dioxane	TOT	µg/L	100%	3.238	6	5.5	0.83	0.02		
High Resolution										
PAHs										
1-methylphenanthrene	TOT	ng/L	100%	15.63	6	19.3	11.4	0.08		
2,3,5-trimethylnaphthalene	TOT	ng/L	100%	22.38	6	51.3	10.2	0.21		
2,6-dimethylnaphthalene	TOT	ng/L	100%	34.93	6	80.3	11.9	0.33		
2-Methylnaphthalene	TOT	ng/L	100%	22.86	8	96.8	0.07	0.40		
Acenaphthene	TOT	ng/L	100%	37.44	8	138	0.1	0.56	6000b	
Acenaphthylene	TOT	ng/L	100%	1.213	8	4.01	0.01	0.02		
Anthracene	TOT	ng/L	100%	5.76	7	25.5	0.01	0.10		
Benz[a]anthracene	TOT	ng/L	100%	39.98	6	57.3	21.8	0.23		
Benzo[a]pyrene	TOT	ng/L	100%	31.2	6	45.1	19.8	0.18	10b	
Benzo[b]fluoranthene	TOT	ng/L	100%	26.97	6	36.7	17.5	0.15		
Benzo[e]pyrene	TOT	ng/L	100%	23.85	6	32	15	0.13		
Benzo[ghi]perylene	TOT	ng/L	100%	20.43	6	26.6	15	0.11		
Benzo[J,K]Fluoranthenes	TOT	ng/L	100%	28.12	6	37.9	17.7	0.15	100b	
Chrysene	TOT	ng/L	100%	14	8	44.2	0.01	0.18		
Dibenz[a,h]anthracene	TOT	ng/L	100%	5.16	6	6.82	3.76	0.03		
Dibenzothiophene	TOT	ng/L	100%	32.77	6	45.9	19.1	0.19		
Fluoranthene	TOT	ng/L	100%	42.19	8	143	0.1	0.58		
Fluorene	TOT	ng/L	100%	22.75	8	85.2	0.03	0.35	12000b	
Indeno[1,2,3-cd]pyrene	TOT	ng/L	100%	20.67	6	26.6	14.5	0.11		
Naphthalene	TOT	ng/L	100%	43.25	8	164	0.1	0.67	1000b	
Octachlorostyrene	TOT	ng/L	80%	0.1908	5	0.478	0.013	0.002		
Pentachlorobenzene	TOT	ng/L	100%	0.0742	5	0.086	0.06	0.0004		
Perylene	TOT	ng/L	100%	7.358	6	10.7	5.11	0.04		
Phenanthrene	TOT	ng/L	100%	54.33	7	238	0.1	0.97		1,400
Pyrene	TOT	ng/L	100%	24.67	7	114	0.1	0.47		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Nonyl Phenols										
4-n-Octylphenol	TOT	ng/L	80%	12.43	5	43.1	1.55	0.18		
4-Nonylphenol Diethoxylates	TOT	ng/L	100%	565.6	5	962	135	3.9		
4-Nonylphenol Monoethoxylates	TOT	ng/L	100%	2304	5	2920	1320	12		
NP	TOT	ng/L	100%	914.2	5	1090	765	4.4	700c	
Organochlorine Pesticides										
1,2,3,4-tetrachlorobenzene	TOT	ng/L	60%	0.302	5	0.641	0.211	0.003		
1,2,3-trichlorobenzene	TOT	ng/L	60%	0.302	5	0.641	0.211	0.003		
1,2,4,5-/1,2,3,5-tetrachlorobenzene	TOT	ng/L	60%	0.302	5	0.641	0.211	0.003		
1,2,4-trichlorobenzene	TOT	ng/L	71%	0.266	7	0.641	0.2	0.003		
1,2-dichlorobenzene	TOT	ng/L	100%	1.12	6	4.22	0.5	0.017		
1,3,5-trichlorobenzene	TOT	ng/L	60%	0.302	5	0.641	0.211	0.003		
1,3-dichlorobenzene	TOT	ng/L	83%	0.524	6	0.641	0.5	0.003		
1,4-dichlorobenzene	TOT	ng/L	100%	31.25	6	185	0.5	0.76		
2,4-DDD	TOT	ng/L	100%	29.1	5	76.2	3.96	0.31		
2,4-DDE	TOT	ng/L	60%	0.0665	5	0.156	0.0423	0.001		
2,4-DDT	TOT	ng/L	60%	0.389	5	1.38	0.081	0.006		
44DDD	TOT	ng/L	80%	0.389	5	1.4	0.082	0.0057		
4,4-DDE	TOT	ng/L	100%	0.6868	5	0.878	0.5	0.00		
4,4-DDT	TOT	ng/L	80%	0.52	5	1.65	0.189	0.007		
Aldrin	TOT	ng/L	60%	0.1698	5	0.352	0.0423	0.001		
Alpha Chlordane	TOT	ng/L	100%	0.2152	5	0.436	0.094	0.002		
Alpha-Endosulfan	TOT	ng/L	100%	0.369	4	0.575	0.146	0.002		
Alpha-Hch Or Alpha-Bhc	TOT	ng/L	80%	0.1085	5	0.181	0.0423	0.001		
Beta-Endosulfan	TOT	ng/L	100%	0.46	4	0.561	0.352	0.002		
Beta-Hch Or Beta-Bhc	TOT	ng/L	100%	0.228	5	0.299	0.17	0.001		
Cis-Nonachlor	TOT	ng/L	80%	0.3732	5	0.8	0.112	0.003		
Delta-Hch Or Delta-Bhc	TOT	ng/L	75%	0.324	4	0.55	0.106	0.002		
Dieldrin	TOT	ng/L	100%	0.599	4	0.771	0.499	0.003		
Endosulfan Sulfate	TOT	ng/L	75%	0.324	4	0.55	0.106	0.002		
Endrin	TOT	ng/L	75%	0.324	4	0.55	0.106	0.002		
Endrin Aldehyde	TOT	ng/L	75%	0.327	4	0.55	0.112	0.002		
Endrin Ketone	TOT	ng/L	75%	0.519	4	1.26	0.112	0.005		
Hch, Gamma	TOT	ng/L	100%	0.161	5	0.222	0.11	0.001		
Heptachlor	TOT	ng/L	60%	0.2649	5	0.517	0.0449	0.002		
Heptachlor Epoxide	TOT	ng/L	75%	0.334	4	0.55	0.112	0.002		
Hexachlorobenzene	TOT	ng/L	100%	0.1894	5	0.242	0.153	0.001		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Hexachlorobutadiene	TOT	ng/L	100%	0.3249	7	0.8	0.224	0.003		
Hydrochlorothiazide	TOT	ng/L	100%	535.5	6	778	296	3.18		
Methoxyclor	TOT	ng/L	100%	0.97	4	1.1	0.82	0.004		
Mirex	TOT	ng/L	60%	0.1019	5	0.196	0.0423	0.001		
Oxy-Chlordane	TOT	ng/L	80%	0.562	5	1.23	0.119	0.01		
Trans-Chlordane	TOT	ng/L	100%	0.2664	5	0.409	0.16	0.002		
Trans-Nonachlor	TOT	ng/L	100%	0.2692	5	0.52	0.113	0.002		
PPCPs										
2-hydroxy-Ibuprofen	TOT	ng/L	100%	60870	6	74500	47400	304		
Bisphenol A	TOT	ng/L	83%	36530	6	61900	500	253		
Furosemide	TOT	ng/L	100%	1860	5	2340	1100	9.6		
Gemfibrozil	TOT	ng/L	100%	149.3	6	264	89.1	1.1		
Glyburide	TOT	ng/L	83%	4.99	6	7.16	3.02	0.03		
Ibuprofen	TOT	ng/L	100%	25530	6	37000	12400	151		
Naproxen	TOT	ng/L	100%	12860	6	17300	8950	71		
Triclocarban	TOT	ng/L	83%	13.17	6	21.7	3.02	0.09		
Triclosan	TOT	ng/L	100%	640.2	5	1090	238	4.45		
Warfarin	TOT	ng/L	83%	6.19	6	6.96	5.44	0.03		
PBDEs										
Pbde 100	TOT	pg/L	100%	3770	6	4190	2980	17		
Pbde 119/120	TOT	pg/L	100%	61.28	6	79.7	46.5	0.33		
Pbde 12/13	TOT	pg/L	100%	20.18	6	28.5	4.78	0.12		
Pbde 126	TOT	pg/L	83%	20.5	6	29.2	14.5	0.12		
Pbde 138/166	TOT	pg/L	100%	147.4	6	212	64.4	0.87		
Pbde 140	TOT	pg/L	100%	65.33	6	70.9	57.6	0.3		
Pbde 15	TOT	pg/L	100%	60.22	6	79.3	17.5	0.3		
Pbde 153	TOT	pg/L	100%	1893	6	2230	1660	9.1		
Pbde 154	TOT	pg/L	100%	1452	6	1760	1310	7.2		
Pbde 155	TOT	pg/L	100%	133.8	6	169	117	0.7		
Pbde 17/25	TOT	pg/L	100%	195.8	6	225	139	0.9		
Pbde 183	TOT	pg/L	100%	400.8	6	717	304	2.9		
Pbde 203	TOT	pg/L	100%	353.2	6	590	180	2.4		
Pbde 206	TOT	pg/L	100%	5245	6	16400	1480	67		
Pbde 207	TOT	pg/L	100%	5335	6	16400	1840	67		
Pbde 208	TOT	pg/L	100%	2826	6	8820	951	36		
Pbde 209	TOT	pg/L	100%	76720	6	158000	35800	645		
Pbde 28/33	TOT	pg/L	100%	358.3	6	413	281	1.69		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Pbde 30	TOT	pg/L	67%	1.962	6	4.02	1.26	0.02		
Pbde 32	TOT	pg/L	83%	5.248	6	8.31	1.43	0.03		
Pbde 35	TOT	pg/L	100%	5.113	6	7.64	3.19	0.03		
Pbde 37	TOT	pg/L	100%	10.14	6	13.1	7.31	0.05		
Pbde 47	TOT	pg/L	100%	18420	6	22500	13400	92		
Pbde 49	TOT	pg/L	100%	964.8	6	1220	471	4.98		
Pbde 51	TOT	pg/L	100%	76.93	6	95.3	60.9	0.39		
Pbde 66	TOT	pg/L	100%	300.7	6	432	226	1.8		
Pbde 7	TOT	pg/L	100%	17.99	6	26.3	3.35	0.11		
Pbde 71	TOT	pg/L	100%	60.38	6	69.4	50.4	0.28		
Pbde 75	TOT	pg/L	100%	28	6	34.1	23.4	0.14		
Pbde 77	TOT	pg/L	83%	2.053	6	5.04	1.33	0.02		
Pbde 79	TOT	pg/L	100%	46.36	6	116	8.7	0.47		
Pbde 8/11	TOT	pg/L	100%	15.38	6	20.9	4.06	0.09		
Pbde 85	TOT	pg/L	100%	687.3	6	899	498	3.7		
Pbde 99	TOT	pg/L	100%	18070	6	20900	14000	85		
PCBs										
Pcb 1	TOT	pg/L	100%	102.5	6	159	8.9	0.65		
Pcb 10	TOT	pg/L	83%	11.49	6	17.5	1.42	0.07		
Pcb 103	TOT	pg/L	83%	6.707	6	9.61	2.83	0.04		
Pcb 104	TOT	pg/L	83%	1.556	6	2.38	0.934	0.01		
Pcb 105	TOT	pg/L	100%	72.05	6	84.9	59.8	0.35	90h	
Pcb 107/124	TOT	pg/L	100%	8.31	6	10.5	6.1	0.04		
Pcb 109	TOT	pg/L	100%	16.57	6	19.4	12.6	0.08		
Pcb 11	TOT	pg/L	100%	315.2	6	438	208	1.79		
Pcb 110/115	TOT	pg/L	100%	312.5	6	347	244	1.42		
Pcb 114	TOT	pg/L	83%	5.5	6	7.89	3.9	0.03		
Pcb 118	TOT	pg/L	100%	221.3	6	249	175	1.02		
Pcb 12/13	TOT	pg/L	100%	18.22	6	20.6	14.1	0.08		
Pcb 121	TOT	pg/L	67%	2.177	6	3.84	1.06	0.02		
Pcb 122	TOT	pg/L	67%	3.08	6	5.62	2.11	0.02		
Pcb 123	TOT	pg/L	100%	7.09	6	8.13	5.88	0.03		
Pcb 128/166	TOT	pg/L	100%	38.25	6	42.5	30.7	0.17		
Pcb 129/138/160/163	TOT	pg/L	100%	270.3	6	326	231	1.33		
Pcb 130	TOT	pg/L	83%	14.85	6	16.8	12.1	0.07		
Pcb 131	TOT	pg/L	67%	5.52	6	13.2	3.23	0.05		
Pcb 132	TOT	pg/L	100%	80.17	6	92.7	64.9	0.38		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Pcb 133	TOT	pg/L	83%	5.78	6	12.7	3.58	0.05		
Pcb 134/143	TOT	pg/L	100%	16.7	6	19.7	9.39	0.08		
Pcb 135/151/154	TOT	pg/L	100%	93.43	6	120	55.7	0.49		
Pcb 136	TOT	pg/L	100%	34.78	6	53.7	19.9	0.22		
Pcb 137	TOT	pg/L	100%	15.35	6	19.9	10.4	0.08		
Pcb 139/140	TOT	pg/L	83%	7.67	6	11.9	5.33	0.05		
Pcb 141	TOT	pg/L	100%	43.45	6	63	33	0.26		
Pcb 144	TOT	pg/L	100%	13.49	6	17.7	8.73	0.07		
Pcb 145	TOT	pg/L	67%	1.745	6	6.95	0.657	0.03		
Pcb 146	TOT	pg/L	100%	41.55	6	55.6	28.3	0.23		
Pcb 147/149	TOT	pg/L	100%	223.5	6	313	130	1.28		
Pcb 148	TOT	pg/L	67%	2.643	6	8.85	0.657	0.04		
Pcb 15	TOT	pg/L	100%	59.88	6	70.3	29.3	0.29		
Pcb 150	TOT	pg/L	83%	2.468	6	6.69	1.19	0.03		
Pcb 153/168	TOT	pg/L	100%	230.8	6	308	190	1.26		
Pcb 155	TOT	pg/L	100%	16.8	6	29.2	10	0.12		
Pcb 156157	TOT	pg/L	100%	36.55	6	43.9	31.1	0.18		
Pcb 158	TOT	pg/L	100%	24.85	6	29.5	19.2	0.12		
Pcb 159	TOT	pg/L	83%	3.03	6	9.78	1.28	0.04		
Pcb 16	TOT	pg/L	100%	61.75	6	78.1	38.4	0.32		
Pcb 164	TOT	pg/L	100%	15.9	6	21.5	13.5	0.09		
Pcb 167	TOT	pg/L	83%	10.26	6	11.5	8.56	0.05		
Pcb 17	TOT	pg/L	100%	105.9	6	155	39.4	0.63		
Pcb 170	TOT	pg/L	100%	48.32	6	73.9	34.8	0.30		
Pcb 171/173	TOT	pg/L	100%	15.7	6	24.3	12.7	0.10		
Pcb 172	TOT	pg/L	100%	9.515	6	12.2	6.27	0.05		
Pcb 174	TOT	pg/L	100%	44.05	6	77.5	31.2	0.32		
Pcb 175	TOT	pg/L	67%	3.068	6	7.2	1.39	0.03		
Pcb 176	TOT	pg/L	100%	6.995	6	11.6	4.98	0.05		
Pcb 177	TOT	pg/L	100%	26.4	6	44.4	21.6	0.18		
Pcb 178	TOT	pg/L	100%	14.73	6	31.4	9.49	0.13		
Pcb 179	TOT	pg/L	100%	25.48	6	47.4	17.8	0.19		
Pcb 18/30	TOT	pg/L	100%	189	6	288	84.1	1.18		
Pcb 180/193	TOT	pg/L	100%	134.4	6	220	91.4	0.90		
Pcb 183/185	TOT	pg/L	100%	39.13	6	63.5	26.4	0.26		
Pcb 184	TOT	pg/L	100%	39.35	6	70.6	26.5	0.29		
Pcb 187	TOT	pg/L	100%	72.9	6	122	37.1	0.50		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Pcb 188	TOT	pg/L	67%	1.573	6	5.3	0.667	0.02		
Pcb 189	TOT	pg/L	83%	3.73	6	11.8	1.38	0.05		
Pcb 19	TOT	pg/L	100%	81.53	6	118	11	0.48		
Pcb 190	TOT	pg/L	100%	10.16	6	14.3	8.18	0.06		
Pcb 191	TOT	pg/L	67%	2.417	6	6.14	1.07	0.03		
Pcb 194	TOT	pg/L	100%	26.87	6	39.8	15.4	0.16		
Pcb 195	TOT	pg/L	100%	8.032	6	11.6	4.54	0.05		
Pcb 196	TOT	pg/L	100%	12.51	6	18.9	8.57	0.08		
Pcb 197/200	TOT	pg/L	100%	6.25	6	12.2	3.73	0.05		
Pcb 198/199	TOT	pg/L	100%	34.65	6	58.9	21	0.24		
Pcb 2	TOT	pg/L	100%	7.053	6	8.1	5.94	0.03		
Pcb 20/28	TOT	pg/L	100%	160.5	6	186	133	0.76		
Pcb 201	TOT	pg/L	83%	3.752	6	8.2	1.56	0.03		
Pcb 202	TOT	pg/L	100%	10.87	6	16.7	7.5	0.07		
Pcb 203	TOT	pg/L	100%	21.88	6	32	13.4	0.13		
Pcb 204	TOT	pg/L	83%	1.443	6	2.84	0.741	0.01		
Pcb 205	TOT	pg/L	83%	1.954	6	5.91	0.693	0.02		
Pcb 206	TOT	pg/L	100%	28.93	6	47.5	15.9	0.19		
Pcb 207	TOT	pg/L	83%	5.41	6	14.1	2.01	0.06		
Pcb 208	TOT	pg/L	100%	10.31	6	15.7	5.47	0.06		
Pcb 209	TOT	pg/L	100%	26.07	6	45.6	12.7	0.19		
Pcb 21/33	TOT	pg/L	100%	87.38	6	97.4	76.7	0.40		
Pcb 22	TOT	pg/L	100%	63.65	6	68.2	58	0.28		
Pcb 23	TOT	pg/L	67%	0.835	6	1.63	0.657	0.01		
Pcb 24	TOT	pg/L	100%	2.362	6	3.13	1.97	0.01		
Pcb 25	TOT	pg/L	100%	86.85	6	133	12	0.54		
Pcb 26/29	TOT	pg/L	100%	91.57	6	129	23.6	0.53		
Pcb 27	TOT	pg/L	100%	108.9	6	169	6.2	0.69		
Pcb 3	TOT	pg/L	100%	28.63	6	37.6	15.1	0.15		
Pcb 31	TOT	pg/L	100%	162.5	6	192	121	0.78		
Pcb 32	TOT	pg/L	100%	79.13	6	118	28	0.48		
Pcb 34	TOT	pg/L	83%	1.605	6	1.84	1.3	0.01		
Pcb 35	TOT	pg/L	100%	12.26	6	17.6	8.75	0.07		
Pcb 36	TOT	pg/L	100%	2.193	6	3.3	1.16	0.01		
Pcb 37	TOT	pg/L	100%	31.77	6	41.4	27.1	0.17		
Pcb 39	TOT	pg/L	83%	1.303	6	1.7	0.837	0.01		
Pcb 4	TOT	pg/L	100%	328.9	6	471	16.1	1.92		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Pcb 40/41/71	TOT	pg/L	100%	101.1	6	116	76.7	0.47		
Pcb 42	TOT	pg/L	100%	62.22	6	78	35	0.32		
Pcb 43	TOT	pg/L	100%	7.957	6	9.99	4.98	0.04		
Pcb 44/47/65	TOT	pg/L	100%	305.3	6	349	228	1.42		
Pcb 45/51	TOT	pg/L	100%	78.77	6	97.1	42.4	0.40		
Pcb 46	TOT	pg/L	100%	29.47	6	40.7	9.3	0.17		
Pcb 48	TOT	pg/L	100%	27.67	6	31	26.1	0.13		
Pcb 49/69	TOT	pg/L	100%	251.8	6	338	83.5	1.38		
Pcb 5	TOT	pg/L	83%	3.075	6	3.69	1.66	0.02		
Pcb 50/53	TOT	pg/L	100%	146.2	6	234	19.3	0.96		
Pcb 52	TOT	pg/L	100%	353.2	6	426	247	1.74		
Pcb 54	TOT	pg/L	83%	9.458	6	13.6	0.95	0.06		
Pcb 55	TOT	pg/L	83%	2.18	6	3.34	1.58	0.01		
Pcb 56	TOT	pg/L	100%	46.68	6	55.8	37.7	0.23		
Pcb 57	TOT	pg/L	83%	4.18	6	6.12	1.78	0.02		
Pcb 58	TOT	pg/L	67%	1.285	6	2.77	0.681	0.01		
Pcb 59/62/75	TOT	pg/L	100%	19.93	6	23.9	12.7	0.10		
Pcb 6	TOT	pg/L	100%	55.83	6	78	23.5	0.32		
Pcb 60	TOT	pg/L	100%	23.53	6	33.8	16.4	0.14		
Pcb 61/70/74/76	TOT	pg/L	100%	243.8	6	283	210	1.16		
Pcb 63	TOT	pg/L	100%	7.507	6	9.03	4.7	0.04		
Pcb 64	TOT	pg/L	100%	61.37	6	69.4	54	0.28		
Pcb 66	TOT	pg/L	100%	112.3	6	127	105	0.52		
Pcb 67	TOT	pg/L	100%	7.16	6	9.45	3.85	0.04		
Pcb 68	TOT	pg/L	100%	16.6	6	19.1	14	0.08		
Pcb 7	TOT	pg/L	100%	9.127	6	12.8	4.53	0.05		
Pcb 72	TOT	pg/L	83%	4.63	6	6.17	2.03	0.03		
Pcb 73	TOT	pg/L	83%	2.665	6	3.49	0.982	0.01		
Pcb 77	TOT	pg/L	100%	8.13	6	10.8	5.96	0.04	40h	
Pcb 79	TOT	pg/L	100%	3.072	6	4.11	2.49	0.02		
Pcb 8	TOT	pg/L	100%	103.4	3	131	63.3	0.53		
Pcb 81	TOT	pg/L	67%	1.08	6	2.25	0.67	0.01		
Pcb 82	TOT	pg/L	100%	27.38	6	33.1	24.4	0.14		
Pcb 83/99	TOT	pg/L	100%	182	6	207	130	0.84		
Pcb 84	TOT	pg/L	100%	77.42	6	88.4	60.8	0.36		
Pcb 85/116/117	TOT	pg/L	100%	47.12	6	52.6	35.7	0.21		
Pcb 86/87/97/108/119/125	TOT	pg/L	100%	175.3	6	198	148	0.81		

Table 2.4, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max1:245 Dilution	BCWQG	CCME WQG
Pcb 88/91	TOT	pg/L	100%	51.23	6	66.9	33.9	0.27		
Pcb 89	TOT	pg/L	67%	3.15	6	5.25	1.97	0.02		
Pcb 9	TOT	pg/L	100%	9.63	6	13.2	4.98	0.05		
Pcb 90/101/113	TOT	pg/L	100%	300.7	6	341	226	1.39		
Pcb 92	TOT	pg/L	100%	67.75	6	81.9	45.9	0.33		
Pcb 93/95/98/100/102	TOT	pg/L	100%	261.8	6	290	190	1.18		
Pcb 94	TOT	pg/L	83%	6.29	6	7.99	2.92	0.03		
Pcb 96	TOT	pg/L	83%	3.742	6	5.75	1.77	0.02		
PCBs Total	TOT	pg/L	100%	7968	6	9200	6390	37.55	100a	
Total Dichloro Biphenyls	TOT	pg/L	100%	975	6	1240	590	5.06		
Decachloro Biphenyl	TOT	pg/L	100%	24.53	4	38.5	14.7	0.16		
Total Heptachloro Biphenyls	TOT	pg/L	100%	454	6	765	314	3.12		
Total Hexachloro Biphenyls	TOT	pg/L	100%	1210	3	1400	929	5.71		
Total Monochloro Biphenyls	TOT	pg/L	100%	140.8	5	202	21.8	0.82		
Total Nonachloro Biphenyls	TOT	pg/L	100%	39	6	63	25	0.26		
Total Octachloro Biphenyls	TOT	pg/L	100%	96	6	121	66	0.49		
Total Pentachloro Biphenyls	TOT	pg/L	100%	1838	4	2020	1410	8.24		
Total Tetrachloro Biphenyls	TOT	pg/L	100%	1915	6	2210	1340	9.02		
Total Trichloro Biphenyls	TOT	pg/L	100%	1381	5	1770	666	7.22		
PFASs										
PFBA	TOT	ng/L	100%	24.41	3	45.1	6.43	0.18		
PFBS	TOT	ng/L	67%	11.23	3	20	1.98	0.08		
PFDA	TOT	ng/L	67%	1.823	3	2.91	0.988	0.01		
PFHpA	TOT	ng/L	100%	7.09	3	13.4	1.21	0.05		
PFHxA	TOT	ng/L	100%	32.36	3	62.1	4.77	0.25		
PFHxS	TOT	ng/L	100%	16.33	3	24.8	3.2	0.10		
PFNA	TOT	ng/L	67%	1.609	3	2.14	0.988	0.01		
PFOA	TOT	ng/L	100%	18.87	3	31.5	3.2	0.13		
PFOS	TOT	ng/L	67%	9.23	3	14.1	1.98	0.06		
PFPeA	TOT	ng/L	100%	18.33	3	37.8	5.39	0.15		

Table 2.4, cont'd

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,
HC = Health Canada WQG

a. these are "minimum risk" guidelines. There are also "hazard" guidelines for these substances (which are higher concentrations)
b. approved
c. working
d. inorganic
e. maximum concentration at 7.0 pH and 15˚C
f. as H_2S
g. interim
h. maximum
i. chronic, --- not detected $\geq$50%, n/a not analyzed or not applicable
j. assumes a geometric mean of five samples in 30 days
k. guideline expressed as a TEQ basis using NP TEF
l. The criteria recommended above are more restrictive than the CCREM (1987) and CCME (1991) guidelines of 10,000 pg PCB/L for the protection of aquatic life. The CCREM and CCME guidelines were designed to protect aquatic biota from toxic effects of PCB, rather than to protect consumers of PCB contaminated foods; hence, CCME guidelines are less restrictive than the BC water quality guidelines
m. recalled guideline; n. Health Canada 2012, geomean of five samples not to exceed 35 CFU/100 mL and single results not to exceed 70 CFU/100 mL.
(Shaded values indicate exceedances of water quality guidelines)

Table 2.5 Concentration of Frequently Detected Substances (>50% of the time) in Clover Wastewater 2019

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
Conventionals										
pH @ 15°C	TOT	pH	100%	6.74	71	7.09	6.26	0.04		
TSS	TOT	mg/L	100%	254.7	71	406	136	2.32		
CBOD	TOT	mg/L as O2	100%	223	71	390	110	2		
N - NH_3 (As N)- Unionized	TOT	mg/L	100%	0.05161	69	0.1	0.0068	0.00057		
Temperature	TOT	°C	100%	17.2	51	22.8	10.2	0.1		
pH	TOT	pH	100%	7.3	52	7.9	6.1	0.05		
TOC	TOT	mg/L	100%	44.5	31	60	21	0.3		
COD	TOT	mg/L as O2	100%	573.2	25	725	370	4.14		
BOD	TOT	mg/L as O2	100%	247	28	320	130	1.83		
N - TKN (As N)	TOT	mg/L	100%	45.44	28	55.7	33.7	0.3183		
N - NH_3 (As N)	TOT	mg/L	100%	32.12	60	43	14	0.246	19.7e	
Fecal Coliforms	TOT	CFU/100 mL	100%	9,123,000	26	27,000,000	4,700,000	154,300	200j	
Enterococci	TOT	CFU/100 mL	100%	2,532,000	31	29,000,000	190,000	165,700	20j	35/70n
pH	TOT	pH	100%	7.49	31	7.87	7.02	0.04		
Specific Conductivity - 25°C.	TOT	µS/cm	100%	613	25	726	573	4		
Alkalinity	TOT	mg/L asCaCO3	100%	186.6	23	197	168	1.13		
Hardness (As $CaCO_3$)	DIS	mg/L	100%	69.85	31	88	46.2	0.503		
Hardness (As $CaCO_3$)	TOT	mg/L	100%	77.36	31	92.7	63.4	0.53		
PO_4 - Ortho (As P)	DIS	mg/L	100%	3.003	31	3.8	2.42	0.0217		
PO_4 - Total (As P)	DIS	µg/L	100%	3837	3	3840	3830	22		
PO_4 - Total (As P)	TOT	µg/L	100%	4891	22	5680	4400	32		
Sulfide	TOT	mg/L	93%	0.1309	29	0.27	0.043	0.00154		
Weak Acid Dissociable Cyanide	TOT	mg/L	74%	0.001154	31	0.0038	0.0005	0.000022	0.001b	
Strong Acid Dissociable Cyanide	TOT	mg/L	88%	0.03774	25	1	0.001	0.005714		
Oil & Grease, Mineral	TOT	mg/L	97%	5.03	31	14	2	0.08		
Oil & grease, total	TOT	mg/L	100%	15.9	31	26	6.4	0.15		
Metals - Total										
Aluminum	TOT	µg/L	100%	240.2	31	374	143	2.14		
Antimony	TOT	µg/L	100%	0.2676	31	0.332	0.162	0.0019		
Arsenic	TOT	µg/L	100%	0.5647	31	0.897	0.419	0.0051	12.5bg	12.5
Barium	TOT	µg/L	100%	19.19	31	24.1	14.8	0.1377		
Cadmium	TOT	µg/L	100%	0.1243	31	0.169	0.089	0.00097	0.12c	0.12
Calcium	TOT	mg/L	100%	19.39	31	24	15.5	0.137		
Chromium	TOT	µg/L	100%	0.864	31	1.23	0.71	0.007		
Cobalt	TOT	µg/L	100%	0.3932	31	0.621	0.281	0.0035		
Copper	TOT	µg/L	100%	97.37	31	138	48.8	0.789	3b	

Table 2.5, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
Iron	TOT	µg/L	100%	505.1	31	652	296	3.73		
Lead	TOT	µg/L	100%	4.165	31	7.42	2.34	0.0424	140b	
Magnesium	TOT	mg/L	100%	7.032	31	9.98	5.4	0.057		
Manganese	TOT	µg/L	100%	46.26	31	56	38.6	0.32	100c	
Mercury	TOT	µg/L	71%	0.02693	31	0.08	0.0033	0.00046	0.02b	
Molybdenum	TOT	µg/L	100%	1.045	31	1.94	0.64	0.0111		
Nickel	TOT	µg/L	100%	2.519	31	3.53	2.09	0.02		
Potassium	TOT	mg/L	100%	12.85	31	15.3	10.7	0.087		
Selenium	TOT	µg/L	100%	0.2845	30	0.336	0.237	0.0019	2b	
Silver	TOT	µg/L	100%	0.1003	30	0.184	0.013	0.0011	3bh	
Sodium	TOT	mg/L	100%	38.87	23	47.9	32.2	0.274		
Thallium	TOT	µg/L	100%	0.0058	31	0.013	0.003	0.00007		
Tin	TOT	µg/L	100%	0.8	29	0.98	0.58	0.006		
Zinc	TOT	µg/L	100%	87.98	31	119	68.1	0.68	10bj/55bh	
Metals - Dissolved										
Aluminum	DIS	µg/L	100%	27.1	31	51.6	19.4	0.295		
Antimony	DIS	µg/L	100%	0.2294	31	0.322	0.082	0.0018		
Arsenic	DIS	µg/L	100%	0.4342	31	0.626	0.331	0.0036		
Barium	DIS	µg/L	100%	8.537	31	12.6	5.16	0.072		
Cadmium	DIS	µg/L	94%	0.01566	31	0.0335	0.005	0.00019		
Calcium	DIS	mg/L	100%	16.97	31	22.4	11.5	0.128		
Chromium	DIS	µg/L	100%	0.442	31	1.01	0.32	0.006		
Cobalt	DIS	µg/L	100%	0.2277	31	0.459	0.151	0.00262		
Copper	DIS	µg/L	100%	43.89	31	63.2	22.2	0.3611		
Iron	DIS	µg/L	100%	263.7	31	385	153	2.2		
Lead	DIS	µg/L	100%	0.7568	31	1.46	0.452	0.00834		
Magnesium	DIS	mg/L	100%	6.673	31	9.53	4.23	0.0545		
Manganese	DIS	µg/L	100%	33.95	31	43.9	21.2	0.2509		
Mercury	DIS	µg/L	58%	0.00437	31	0.0073	0.002	0.00004		
Molybdenum	DIS	µg/L	100%	1.046	31	5.36	0.335	0.0306		
Nickel	DIS	µg/L	100%	1.868	31	2.48	1.46	0.0142		
Potassium	DIS	mg/L	100%	12.36	31	14.9	10.2	0.0851		
Selenium	DIS	µg/L	100%	0.1932	31	0.271	0.137	0.0015		
Silver	DIS	µg/L	100%	0.0719	31	0.139	0.0269	0.00079		
Tin	DIS	µg/L	100%	0.56	31	0.81	0.45	0.005		
Zinc	DIS	µg/L	100%	21.96	31	38.7	5.83	0.221		

Table 2.5, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
Metals - Speciated										
Methyl Mercury	TOT	ng/L	100%	0.6729	11	0.789	0.581	0.0045		
Dibutyltin	TOT	µg/L	82%	0.00264	11	0.004	0.001	0.00002		
Dibutyltin Dichloride	TOT	µg/L	75%	0.00338	8	0.005	0.001	0.00003		
Monobutyltin	TOT	µg/L	100%	0.00582	11	0.017	0.002	0.0001		
Monobutyltin Trichloride	TOT	µg/L	100%	0.00918	11	0.028	0.003	0.00016		
Phenolics										
Total Phenols	TOT	mg/L	100%	0.05719	31	0.091	0.036	0.00052		
Phenol	TOT	µg/L	97%	8.14	31	12.5	2.5	0.07		
PAHs										
2-Methylnaphthalene	TOT	µg/L	100%	0.0775	31	0.15	0.024	0.0009		
Acenaphthene	TOT	µg/L	100%	0.0544	31	0.13	0.018	0.0007	6b	
Acenaphthylene	TOT	µg/L	90%	0.0978	31	0.26	0.01	0.0015		
Anthracene	TOT	µg/L	71%	0.0199	31	0.076	0.01	0.0004		
Benzo(A)Anthracene	TOT	µg/L	71%	0.0211	31	0.091	0.01	0.0005		
Benzo(A)Pyrene	TOT	µg/L	94%	0.02595	31	0.13	0.005	0.00074	0.01b	
Benzo(B)Fluoranthene	TOT	µg/L	61%	0.0219	31	0.085	0.01	0.0005		
Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	TOT	µg/L	61%	0.0266	31	0.095	0.01	0.0005		
Chrysene	TOT	µg/L	87%	0.0353	31	0.086	0.01	0.0005	0.1b	
Fluoranthene	TOT	µg/L	100%	0.0643	31	0.25	0.019	0.0014		
Fluorene	TOT	µg/L	100%	0.0477	31	0.2	0.014	0.0011	12b	
Naphthalene	TOT	µg/L	94%	0.0734	31	0.21	0.01	0.0012	1b	
Phenanthrene	TOT	µg/L	100%	0.1215	31	0.52	0.057	0.003		
Pyrene	TOT	µg/L	100%	0.0555	31	0.17	0.015	0.001		
Total Hmw-PAHs	TOT	µg/L	100%	0.2455	31	0.92	0.052	0.0053		
Total Lmw-PAHs	TOT	µg/L	100%	0.5168	31	1.3	0.29	0.0074		
Total PAHs	TOT	µg/L	100%	0.7763	30	2.2	0.45	0.0126		
Phthalates										
Diethyl Phthalate	TOT	µg/L	84%	1.362	31	2.86	0.25	0.016		
Organics										
Toluene	TOT	µg/L	100%	0.894	31	1.4	0.44	0.008		
Trichloromethane	TOT	µg/L	100%	4.57	3	4.7	4.5	0.03		
Chloroform	TOT	µg/L	100%	4.95	28	8.5	2.8	0.05		
Dimethyl Ketone	TOT	µg/L	100%	183.7	31	670	44	3.8		
Alpha-Terpineol	TOT	µg/L	74%	6.2	31	9	5	0.05		

Table 2.5, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
High Resolution										
PAHs										
1-methylphenanthrene	TOT	ng/L	100%	16.56	11	29	10.1	0.166		
2,3,5-trimethylnaphthalene	TOT	ng/L	100%	20.88	11	35.4	11.8	0.202		
2,6-dimethylnaphthalene	TOT	ng/L	100%	25.85	11	44.7	9.78	0.255		
2-Methylnaphthalene	TOT	ng/L	100%	49.57	11	94.3	19	0.539		
Acenaphthene	TOT	ng/L	100%	64.19	11	77.3	45.5	0.442	6000b	
Acenaphthylene	TOT	ng/L	100%	10.17	11	21.3	4.09	0.122		
Anthracene	TOT	ng/L	100%	31.25	11	84.3	15.2	0.48		
Benz[a]anthracene	TOT	ng/L	100%	52.05	11	164	28.3	0.937		
Benzo[a]pyrene	TOT	ng/L	100%	63.89	11	175	28.6	1.0	10b	
Benzo[b]fluoranthene	TOT	ng/L	100%	49.41	11	131	23.7	0.749		
Benzo[e]pyrene	TOT	ng/L	100%	49.77	11	116	22.6	0.663		
Benzo[ghi]perylene	TOT	ng/L	100%	53.05	11	107	23	0.61		
Benzo[J,K]Fluoranthenes	TOT	ng/L	100%	58.45	11	154	27.1	0.88		
Chrysene	TOT	ng/L	100%	58.95	11	154	31.5	0.88	100b	
Dibenz[a,h]anthracene	TOT	ng/L	100%	12.25	11	35.8	5.56	0.2		
Dibenzothiophene	TOT	ng/L	100%	22.22	11	29.6	16	0.169		
Fluoranthene	TOT	ng/L	100%	130.1	11	324	80.4	1.851		
Fluorene	TOT	ng/L	100%	39.97	11	57.9	29.1	0.331	12000b	
Indeno[1,2,3-cd]pyrene	TOT	ng/L	100%	53.34	11	127	22	0.73		
Naphthalene	TOT	ng/L	100%	79.78	11	119	55.9	0.68	1000b	
Octachlorostyrene	TOT	ng/L	56%	0.02942	9	0.09	0.005	0.00051		
Pentachlorobenzene	TOT	ng/L	100%	0.0742	9	0.127	0.061	0.0007		
Perylene	TOT	ng/L	100%	16.67	11	41.5	7.22	0.237		
Phenanthrene	TOT	ng/L	100%	200.5	11	368	146	2.1		
Pyrene	TOT	ng/L	100%	88.01	14	247	0	1.411		
Nonyl Phenols										
4-n-Octylphenol	TOT	ng/L	75%	9.53	8	13.7	3.66	0.08		
4-Nonylphenol Diethoxylates	TOT	ng/L	100%	400.1	8	540	335	3.1		
4-Nonylphenol Monoethoxylates	TOT	ng/L	100%	1497	8	1830	916	10.5		
Np	TOT	ng/L	100%	407.3	8	586	254	3.3	700c	
Organochlorine Pesticides										
1,2-dichlorobenzene	TOT	ng/L	100%	4.713	6	9.64	0.577	0.055		
1,3-dichlorobenzene	TOT	ng/L	67%	2.563	6	4.16	0.221	0.024		
1,4-dichlorobenzene	TOT	ng/L	100%	63.63	6	69	56.7	0.394		
2,4-DDD	TOT	ng/L	89%	0.6889	9	1.82	0.119	0.0104		
2,4-DDT	TOT	ng/L	78%	0.151	9	0.207	0.096	0.001		

Table 2.5, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
44DDD	TOT	ng/L	67%	0.123	9	0.212	0.085	0.001		
4,4-DDE	TOT	ng/L	100%	0.7681	9	0.88	0.705	0.005		
4,4-DDT	TOT	ng/L	89%	0.371	9	0.521	0.228	0.003		
Alpha Chlordane	TOT	ng/L	89%	0.1701	9	0.229	0.128	0.0013		
Beta-Endosulfan	TOT	ng/L	83%	0.693	6	1.2	0.42	0.007		
Beta-Hch Or Beta-Bhc	TOT	ng/L	67%	0.185	9	0.263	0.13	0.002		
Cis-Nonachlor	TOT	ng/L	67%	0.1959	9	0.907	0.054	0.0052		
Dieldrin	TOT	ng/L	83%	0.718	6	1.2	0.495	0.007		
Hch, Gamma	TOT	ng/L	67%	0.421	9	1.08	0.098	0.006		
Heptachlor	TOT	ng/L	56%	0.0657	9	0.117	0.042	0.0007		
Hexachlorobenzene	TOT	ng/L	100%	0.1651	9	0.213	0.135	0.0012		
Hexachlorobutadiene	TOT	ng/L	100%	0.2369	8	0.308	0.14	0.0018		
Hydrochlorothiazide	TOT	ng/L	100%	387.1	11	694	212	4		
Oxy-Chlordane	TOT	ng/L	56%	0.1008	9	0.209	0.0433	0.0012		
Trans-Chlordane	TOT	ng/L	89%	0.2071	9	0.284	0.167	0.0016		
Trans-Nonachlor	TOT	ng/L	89%	0.1833	9	0.32	0.118	0.0018		
PPCPs										
2-hydroxy-Ibuprofen	TOT	ng/L	100%	54050	11	73900	40100	422.3		
Furosemide	TOT	ng/L	100%	1590	11	1980	1260	11.3		
Gemfibrozil	TOT	ng/L	100%	123.3	11	220	64.9	1.26		
Ibuprofen	TOT	ng/L	100%	18750	11	24300	14000	138.9		
Naproxen	TOT	ng/L	100%	9309	11	12100	6010	69.1		
Triclocarban	TOT	ng/L	91%	12.65	11	18.7	4.23	0.11		
Triclosan	TOT	ng/L	100%	421.5	11	714	193	4.1		
Warfarin	TOT	ng/L	100%	4.66	9	5.28	4.03	0.03		
PBDEs										
Pbde 100	TOT	pg/L	100%	2547	11	3110	1780	17.77		
Pbde 119/120	TOT	pg/L	91%	41	11	53.3	29	0.3		
Pbde 12/13	TOT	pg/L	91%	2.901	11	6.07	1.4	0.035		
Pbde 138/166	TOT	pg/L	100%	107.2	11	166	42.8	0.95		
Pbde 140	TOT	pg/L	100%	43.33	11	56.3	27.5	0.32		
Pbde 15	TOT	pg/L	100%	12.58	11	15.3	11	0.087		
Pbde 153	TOT	pg/L	100%	1151	11	1450	807	8.29		
Pbde 154	TOT	pg/L	100%	834.7	11	1010	564	5.77		
Pbde 155	TOT	pg/L	100%	80.24	11	107	53	0.61		
Pbde 17/25	TOT	pg/L	100%	98.88	11	121	78.4	0.691		
Pbde 183	TOT	pg/L	100%	214	11	274	178	1.57		

Table 2.5, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
Pbde 203	TOT	pg/L	100%	224.5	11	305	142	1.7		
Pbde 206	TOT	pg/L	100%	3944	11	11800	1100	67.43		
Pbde 207	TOT	pg/L	100%	4783	11	15600	1540	89.14		
Pbde 208	TOT	pg/L	100%	2737	11	8100	768	46.29		
Pbde 209	TOT	pg/L	100%	61850	11	219000	20700	1251		
Pbde 28/33	TOT	pg/L	100%	255.9	11	333	206	1.9		
Pbde 35	TOT	pg/L	100%	4.517	11	7.4	1.74	0.042		
Pbde 37	TOT	pg/L	100%	8.169	11	11.7	5.22	0.067		
Pbde 47	TOT	pg/L	100%	12910	11	15800	9980	90.29		
Pbde 49	TOT	pg/L	100%	299.6	11	349	214	1.994		
Pbde 51	TOT	pg/L	100%	38.16	11	45.9	26	0.262		
Pbde 66	TOT	pg/L	100%	216.7	10	291	144	1.663		
Pbde 7	TOT	pg/L	91%	2.348	11	4.3	1.4	0.025		
Pbde 71	TOT	pg/L	100%	36.73	11	51.9	20.6	0.297		
Pbde 75	TOT	pg/L	100%	17.39	11	21.3	11.2	0.122		
Pbde 79	TOT	pg/L	100%	42.33	11	76.8	11.2	0.439		
Pbde 8/11	TOT	pg/L	100%	3.251	11	6.41	2.23	0.037		
Pbde 85	TOT	pg/L	100%	524.7	11	660	343	3.77		
Pbde 99	TOT	pg/L	100%	12530	11	15800	8740	90.29		
PCBs										
Pcb 1	TOT	pg/L	100%	19.24	11	33.8	9.03	0.193		
Pcb 103	TOT	pg/L	64%	2.554	11	4.42	1.49	0.025		
Pcb 105	TOT	pg/L	100%	59.18	11	137	36.2	0.78	90h	
Pcb 107/124	TOT	pg/L	100%	7.43	11	16.8	3.48	0.1		
Pcb 109	TOT	pg/L	100%	10.05	11	23.6	5.15	0.13		
Pcb 11	TOT	pg/L	100%	309.4	11	399	218	2.28		
Pcb 110/115	TOT	pg/L	100%	274.2	6	438	165	2.503		
Pcb 114	TOT	pg/L	100%	5.53	6	7.25	3.58	0.04		
Pcb 118	TOT	pg/L	100%	185.7	6	354	106	2.02		
Pcb 12/13	TOT	pg/L	100%	11.65	7	15.1	6.25	0.086		
Pcb 121	TOT	pg/L	55%	2.105	11	3.8	1.12	0.022		
Pcb 123	TOT	pg/L	100%	4.73	11	7.3	3.33	0.04		
Pcb 128/166	TOT	pg/L	100%	28.78	11	81.4	13.9	0.47		
Pcb 129/138/160/163	TOT	pg/L	100%	220.8	11	474	108	2.71		
Pcb 130	TOT	pg/L	100%	12.92	11	31	6.09	0.18		
Pcb 131	TOT	pg/L	55%	5	11	12.3	1.43	0.07		
Pcb 132	TOT	pg/L	100%	74.09	10	163	34.4	0.93		
Pcb 133	TOT	pg/L	73%	4.9	11	11.8	2	0.07		

Table 2.5, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
Pcb 134/143	TOT	pg/L	100%	12.96	11	24.6	6.31	0.14		
Pcb 135/151/154	TOT	pg/L	100%	79.55	11	132	42.4	0.754		
Pcb 136	TOT	pg/L	100%	31.15	11	53.5	16.4	0.306		
Pcb 137	TOT	pg/L	91%	11.16	11	27	4.82	0.15		
Pcb 139/140	TOT	pg/L	64%	5.87	11	11	2.59	0.06		
Pcb 141	TOT	pg/L	100%	40.37	11	72	19.2	0.41		
Pcb 144	TOT	pg/L	100%	13.42	10	19.9	6.31	0.114		
Pcb 146	TOT	pg/L	100%	31.32	11	50	17.8	0.29		
Pcb 147/149	TOT	pg/L	100%	187.5	10	296	93.1	1.69		
Pcb 148	TOT	pg/L	64%	2.434	11	6.79	0.718	0.039		
Pcb 15	TOT	pg/L	100%	28.51	11	32.1	25.1	0.183		
Pcb 150	TOT	pg/L	55%	1.912	11	5.13	0.693	0.029		
Pcb 153/168	TOT	pg/L	100%	202.7	11	323	108	1.85		
Pcb 155	TOT	pg/L	100%	13.03	11	17.6	8.6	0.101		
Pcb 156157	TOT	pg/L	100%	29.3	11	69.4	17.7	0.4		
Pcb 158	TOT	pg/L	100%	20.35	11	48.6	8.67	0.28		
Pcb 16	TOT	pg/L	100%	31.5	11	42.6	24.2	0.243		
Pcb 164	TOT	pg/L	100%	11.86	11	26.4	5.74	0.15		
Pcb 167	TOT	pg/L	100%	8.65	11	19.9	4.95	0.11		
Pcb 17	TOT	pg/L	100%	31.22	11	41.1	23.9	0.235		
Pcb 170	TOT	pg/L	100%	45.81	11	76.7	29.9	0.438		
Pcb 171/173	TOT	pg/L	100%	14.47	11	27.7	7.57	0.158		
Pcb 172	TOT	pg/L	100%	9.268	11	15.6	5.17	0.089		
Pcb 174	TOT	pg/L	100%	41.69	11	76	22.2	0.434		
Pcb 175	TOT	pg/L	82%	2.938	11	7.54	1.17	0.043		
Pcb 176	TOT	pg/L	100%	7.604	11	15.1	4.35	0.086		
Pcb 177	TOT	pg/L	100%	22.93	11	44.1	12.6	0.252		
Pcb 178	TOT	pg/L	100%	12.22	11	22.5	6.3	0.129		
Pcb 179	TOT	pg/L	100%	24.57	11	43.1	12.4	0.246		
Pcb 18/30	TOT	pg/L	100%	70.92	11	92.3	46.2	0.527		
Pcb 180/193	TOT	pg/L	100%	128.8	11	206	87.1	1.177		
Pcb 183/185	TOT	pg/L	100%	42.57	6	60.8	17.6	0.347		
Pcb 184	TOT	pg/L	100%	29.29	8	41.7	14.7	0.238		
Pcb 187	TOT	pg/L	100%	68.83	8	117	27.8	0.669		
Pcb 19	TOT	pg/L	100%	7.881	11	11.1	6.09	0.063		
Pcb 190	TOT	pg/L	100%	9.242	11	15.7	5.98	0.09		
Pcb 191	TOT	pg/L	73%	2.671	11	6.43	1.07	0.037		

Table 2.5, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
Pcb 194	TOT	pg/L	100%	23.55	11	41.6	15.4	0.238		
Pcb 195	TOT	pg/L	100%	8.444	11	17.4	3.8	0.099		
Pcb 196	TOT	pg/L	100%	11.93	11	21	6.47	0.12		
Pcb 197/200	TOT	pg/L	100%	5.047	11	10.1	2.99	0.058		
Pcb 198/199	TOT	pg/L	100%	31.56	11	57	17.3	0.326		
Pcb 2	TOT	pg/L	100%	5.69	11	10.7	3.83	0.061		
Pcb 20/28	TOT	pg/L	100%	91.84	11	129	72.5	0.737		
Pcb 201	TOT	pg/L	100%	3.437	11	6.99	1.66	0.04		
Pcb 202	TOT	pg/L	100%	10.47	11	19.7	6.42	0.113		
Pcb 203	TOT	pg/L	100%	17.7	11	32.8	10.5	0.187		
Pcb 204	TOT	pg/L	55%	1.3	11	2.62	0.693	0.015		
Pcb 205	TOT	pg/L	73%	1.72	11	4.1	0.712	0.023		
Pcb 206	TOT	pg/L	100%	18.57	11	28	12	0.16		
Pcb 207	TOT	pg/L	64%	3.85	11	8.53	1.31	0.05		
Pcb 208	TOT	pg/L	100%	7.57	11	12.8	3.95	0.07		
Pcb 209	TOT	pg/L	100%	14.78	11	22.6	9.27	0.129		
Pcb 21/33	TOT	pg/L	100%	57.04	11	79.5	45	0.454		
Pcb 22	TOT	pg/L	100%	38.25	11	51.9	30.7	0.297		
Pcb 24	TOT	pg/L	91%	1.1	11	1.61	0.708	0.009		
Pcb 25	TOT	pg/L	100%	7.077	11	10.1	5.13	0.058		
Pcb 26/29	TOT	pg/L	100%	15.05	11	19.8	11.9	0.113		
Pcb 27	TOT	pg/L	100%	4.44	11	5.86	3.28	0.033		
Pcb 3	TOT	pg/L	100%	15.32	11	21.2	11.3	0.121		
Pcb 31	TOT	pg/L	100%	85.85	11	117	70.2	0.669		
Pcb 32	TOT	pg/L	100%	21.64	11	28.1	15.7	0.161		
Pcb 35	TOT	pg/L	100%	13.82	11	21.6	7.71	0.123		
Pcb 36	TOT	pg/L	100%	3.487	11	5.61	1.4	0.032		
Pcb 37	TOT	pg/L	100%	24.12	11	29.6	20.5	0.169		
Pcb 39	TOT	pg/L	55%	0.891	11	1.51	0.656	0.009		
Pcb 4	TOT	pg/L	100%	15.13	11	17.5	13.3	0.1		
Pcb 40/41/71	TOT	pg/L	100%	45.45	11	65.7	32.5	0.375		
Pcb 42	TOT	pg/L	100%	20.87	11	32.6	13.6	0.186		
Pcb 43	TOT	pg/L	100%	3.413	11	5.31	2.16	0.03		
Pcb 44/47/65	TOT	pg/L	100%	143.8	11	212	104	1.211		
Pcb 45/51	TOT	pg/L	100%	22.78	11	33.8	15.2	0.193		
Pcb 46	TOT	pg/L	100%	4.792	11	8.82	3.53	0.05		
Pcb 48	TOT	pg/L	100%	17.97	11	27.8	11.9	0.159		
Pcb 49/69	TOT	pg/L	100%	52.57	11	84.2	33.1	0.481		

Table 2.5, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
Pcb 5	TOT	pg/L	55%	1.89	11	3.43	1.14	0.02		
Pcb 50/53	TOT	pg/L	100%	11.58	11	15.7	8.63	0.09		
Pcb 52	TOT	pg/L	100%	200.7	11	281	134	1.606		
Pcb 55	TOT	pg/L	64%	1.54	11	2.13	1.12	0.01		
Pcb 56	TOT	pg/L	100%	39.56	11	55.5	27.5	0.32		
Pcb 59/62/75	TOT	pg/L	100%	7.127	11	11.2	4.75	0.064		
Pcb 6	TOT	pg/L	100%	15.7	11	24.1	12.1	0.138		
Pcb 60	TOT	pg/L	100%	23.15	11	32.1	15.5	0.18		
Pcb 61/70/74/76	TOT	pg/L	100%	193.5	11	287	119	1.64		
Pcb 63	TOT	pg/L	100%	3.471	11	6.17	2.15	0.035		
Pcb 64	TOT	pg/L	100%	39.21	11	60	26.5	0.343		
Pcb 66	TOT	pg/L	100%	73.95	11	115	47.8	0.66		
Pcb 67	TOT	pg/L	100%	2.1	11	3.49	1.39	0.02		
Pcb 68	TOT	pg/L	100%	10.73	11	16.7	6.28	0.1		
Pcb 7	TOT	pg/L	100%	4.47	11	6.85	2.55	0.039		
Pcb 77	TOT	pg/L	100%	7.3	11	9.58	5.75	0.05	40h	
Pcb 79	TOT	pg/L	100%	2.646	11	4.71	1.23	0.027		
Pcb 8	TOT	pg/L	100%	54	11	68.8	42.8	0.393		
Pcb 82	TOT	pg/L	100%	21.32	11	41.1	13.8	0.23		
Pcb 83/99	TOT	pg/L	100%	109.2	11	185	68.6	1.06		
Pcb 84	TOT	pg/L	100%	54.64	11	97.8	33.9	0.56		
Pcb 85/116/117	TOT	pg/L	100%	34.42	11	58.9	21.4	0.337		
Pcb 86/87/97/108/119/125	TOT	pg/L	100%	144.2	11	277	92.2	1.58		
Pcb 88/91	TOT	pg/L	100%	26.85	11	41.1	17.9	0.23		
Pcb 9	TOT	pg/L	100%	3.822	11	4.57	2.84	0.026		
Pcb 90/101/113	TOT	pg/L	100%	227.5	11	397	156	2.27		
Pcb 92	TOT	pg/L	100%	41.75	11	69.3	28	0.4		
Pcb 93/95/98/100/102	TOT	pg/L	100%	193.4	11	292	126	1.67		
Pcb 96	TOT	pg/L	73%	1.3	11	2.03	0.755	0.012		
PCBs Total	TOT	pg/L	100%	4643	11	6760	3340	38.63	100a	
Total Dichloro Biphenyls	TOT	pg/L	100%	435	11	563	345	3		
Decachloro Biphenyl	TOT	pg/L	100%	14.61	9	22.6	9.27	0.129		
Total Heptachloro Biphenyls	TOT	pg/L	100%	401	11	705	249	4		
Total Hexachloro Biphenyls	TOT	pg/L	100%	965	11	1870	508	11		
Total Monochloro Biphenyls	TOT	pg/L	100%	35.2	11	59.9	11.6	0.3		
Total Nonachloro Biphenyls	TOT	pg/L	100%	24	9	41	10	0		
Total Octachloro Biphenyls	TOT	pg/L	100%	78	11	162	23	1		

Table 2.5, cont'd

Parameter	State	Unit	Frequency of Detection	Average Concentration	n	Max Concentration	Min Concentration	Max 1:175 Dilution	BC WQG	CCME WQG
Total Pentachloro Biphenyls	TOT	pg/L	100%	1169	10	1740	877	9.9		
Total Tetrachloro Biphenyls	TOT	pg/L	100%	915	11	1340	646	7.7		
Total Trichloro Biphenyls	TOT	pg/L	100%	494.8	11	652	418	3.7		
PFASs										
PFBA	TOT	ng/L	100%	14.64	8	20.1	9.5	0.115		
PFHpA	TOT	ng/L	100%	2.33	8	3.63	1.44	0.02		
PFHxA	TOT	ng/L	100%	7.63	8	12.4	5.68	0.07		
PFHxS	TOT	ng/L	63%	2.56	8	3.67	1.97	0.02		
PFOA	TOT	ng/L	100%	3.78	8	5.92	2.61	0.034		
PFOS	TOT	ng/L	100%	5.15	8	7.25	2.22	0.04		
PFPeA	TOT	ng/L	100%	6.88	8	12.5	3.67	0.07		

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. these are "minimum risk" guidelines. There are also "hazard" guidelines for these substances (which are higher concentrations)
b. approved
c. working
d. inorganic
e. maximum concentration at 7.0 pH and 15ºC
f. as H_2S
g. interim
h. maximum
i. chronic, --- not detected ≥50%, n/a not analyzed or not applicable
j. assumes a geometric mean of five samples in 30 days
k. guideline expressed as a TEQ basis using NP TEF
l. The criteria recommended above are more restrictive than the CCREM (1987) and CCME (1991) guidelines of 10,000 pg PCB/L for the protection of aquatic life. The CCREM and CCME guidelines were designed to protect aquatic biota from toxic effects of PCB, rather than to protect consumers of PCB contaminated foods; hence, CCME guidelines are less restrictive than the BC water quality guidelines
m. recalled guideline; n. Health Canada 2012, geomean of five samples not to exceed 35 CFU/100 mL and single results not to exceed 70 CFU/100 mL.
(Shaded values indicate exceedances of water quality guidelines)

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 Clover and Macaulay wastewaters are reported as the LC50, which is the wastewater concentration that will cause mortality in 50% of the organisms within the specified test period. Refer to Appendix B6 for acute toxicity reports.

Table 2.6 presents the results from the quarterly acute toxicity testing of Clover and Macaulay wastewaters. Results indicated that undiluted (100%) wastewater continued to be acutely lethal to rainbow trout (*Oncorhynchus mykiss*), similar to historical results. Undiluted wastewater was also acutely toxic to *Daphnia magna* in April at Clover and January and October at Macaulay. The severity of toxicity is typically linked to flow volumes, as the lower the wastewater flow, the lower the concentration of wastewater needed to achieve a toxic effect. This is potentially because wastewaters are typically less dilute when flows are low (usually from late spring to mid-autumn). The low flow period did not correspond to the observed toxicity in Daphnia testing.

Clover wastewater was toxic to trout at concentrations ranging from 33.0% to 70.7% wastewater and toxic to Daphnia at 73.5% or greater. The estimated minimum initial dilution factor for the Clover outfall is 175:1, resulting in a predicted wastewater concentration of 0.6% at the edge of the initial dilution zone (Hodgins, 2006). The trout LC50 at Clover occurs, therefore, at wastewater concentrations that are two to three orders of magnitude greater than expected to occur at the edge of the initial dilution zone.

Macaulay wastewater was toxic to trout at concentrations ranging from 35.4% to 57.4% wastewater, and to Daphnia at 70.7% or greater. The estimated minimum initial dilution factor for the Macaulay outfall is 245:1, resulting in a predicted wastewater concentration of 0.4% at the edge of the initial dilution zone (Hodgins, 2006). The trout LC50 at Macaulay occurs, therefore, at wastewater concentrations that are also two to three orders of magnitude greater than expected to occur at the edge of the initial dilution zone.

Estimated minimum dilution factors provide conservative estimates of the concentrations of wastewaters in the receiving waters off the outfalls at the edge of the initial dilution zone. Since the observed LC50 effects concentrations in 2019 were well above predicted concentrations of wastewater at the edge of the initial dilution zone, it is not likely that marine life is exposed to acute concentrations of effluent unless exposure occurs close to the diffusers within the initial dilution zone.

Table 2.6 Clover and Macaulay Acute Toxicity Test Results – 2019

Clover	**Predicted Concentration of Effluent at the Edge of the initial dilution zone**	**Rainbow Trout LC50 (CI) (96-hour) (%)**	**Daphnia magna LC50 (48-hour) (CI) (%)**
January	0.6%	70.7 (50.0-100.0)	>100
April		37.9 (33.2-43.2)	73.5 (67.8-79.7)
July		33.0 (28.9-37.6)	>100
October		70.7 (50.0-100.0)	>100
Macaulay	**Predicted Concentration of Effluent at the Edge of the initial dilution zone**	**Rainbow Trout LC50 (CI) (96-hour) (%)**	**Daphnia magna LC50 (48-hour) (CI) (%)**
January	0.4%	35.4 (25.0-50.0)	70.7 (50.0-100.0)
April		35.4 (25.0-50.0)	>100
July		57.4 (47.0-70.2)	>100
October		35.4 (25.0-50.0)	70.7 (50.0-100.0)

Notes: Test pass = >100%, Results are presented as v/v%, CI = ± 95% Confidence limits intervals

2.3.5 Chronic Toxicity Testing

Chronic toxicity is described as adverse health effects from repeated exposures to a substance, often at lower levels over a longer time period (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 or EC25, which are the concentrations that will have a 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 in October 2019 using several species, including Topsmelt (*Atherinops affinis*), *Ceriodaphnia,* Echinoids and a 30-day rainbow trout 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 in a timely and normal manner, 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 2.7 presents the results from chronic toxicity testing of Clover wastewater. Chronic lethal toxicity (survival) ranged from 33.7% to 37.8% wastewater (LC50), with sub-lethal effects, such as growth, reproduction and fertilization impairment occurring at wastewater concentrations ranging from 2.6% to 31.8% (EC50 and lC50) and 2.2% to 23.1% (EC25 and lC25).

Table 2.8 presents the results from the chronic toxicity testing of Macaulay wastewater. Chronic lethal toxicity (survival) ranged from 32.5% to 53.6% wastewater (LC50), with sub-lethal effects, such as growth, reproduction and fertilization impairment occurring at wastewater concentrations ranging from 5.4% to 34.3% (EC50 and IC50) and 4.1% to 28.3% (EC25 and IC25).

Similar to the acute toxicity test results, the wastewater concentrations at which most chronic effects were observed were substantially higher than the minimum initial dilution predicted wastewater concentrations in the marine receiving environment at the edge of the initial dilution zone (0.6% at Clover and 0.4% at Macaulay). Marine life is not likely 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 2.7 Clover Chronic Toxicity Test Results – 2019

Chronic Toxicity Test	Clover %v/v
Six-day Topsmelt	
Survival -LC50	33.7 (31.5-36.2)
Dry Biomass - IC25	19.0 (1.2-30.6)
Dry Biomass - IC50	30.8 (26.3-34.1)
Dry Weight - IC25	20.7 (n/a-n/a)
Dry Weight - IC50	>25
Seven-day Ceriodaphnia	
Survival -LC50	37.8 (27.0-49.6)
Reproduction-IC25	23.1 (17.5-28.4)
Reproduction-IC50	31.0 (25.4-34.4)
Echinoid Fertilization-IC25	2.2 (2.0-2.3)
Echinoid Fertilization-IC50	2.6 (2.5-2.8)
Rainbow Trout Embryo-Alevin	
Embryo Survival-EC25	10.0 (4.6-13.5)
Embryo Survival-EC50	14.0 (8.9-18.1)
Embryo Viability-EC25	8.9 (4.7-11.3)
Embryo Viability-EC50	11.7 (8.0-14.3)

Notes: Cl = 95% confidence limits

Table 2.8 Macaulay Chronic Toxicity Test Results – 2019

Chronic Toxicity Test	Macaulay %v/v
Seven-day Topsmelt	
Survival -LC50	32.5 (29.7-35.6)
Dry Biomass - IC25	26.9 (18.6-30.5)
Dry Biomass - IC50	33.1 (28.7-36.0)
Dry Weight - IC25	>25
Dry Weight - IC50	>25
Six-day Ceriodaphnia	
Survival -LC50	53.6 (42.0-68.3)
Reproduction-IC25	28.3 (26.7-29.3)
Reproduction-IC50	34.3 (33.0-35.0)
Echinoid Fertilization-IC25	4.1 (3.9-4.3)
Echinoid Fertilization-IC50	5.4 (5.0-5.8)
Rainbow Trout Embryo-Alevin	
Embryo Survival-EC25	17.2 (3.4-21.1)
Embryo Survival-EC50	21.8 (12.1-26.7)
Embryo Viability-EC25	14.9 (10.9-16.6)
Embryo Viability-EC50	18.6 (14.8-21.0)

Notes: CI = 95% confidence limits

OVERALL ASSESSMENT

The 2019 wastewater monitoring results were generally consistent with previous years, indicating that from an operational and regulatory compliance perspective, wastewater quality was as expected. Most flow, BOD and TSS requirements stipulated under Macaulay and Clover provincial permits were met, except for two BOD and two TSS measurements that exceeded effluent quality expectations for fine-screened effluent.

Federal transitional authorization wastewater regulation limits were not exceeded for TSS, CBOD or unionized ammonia. These transitional authorizations stipulate a December 31, 2020 deadline for the installation of treatment equivalent to secondary or better. The CRD and participating municipalities are currently building a new treatment plant to meet this deadline.

Some substances in the Macaulay and Clover wastewaters exceeded water quality guidelines in undiluted wastewater, but all except the bacteriological indicators were predicted to meet guidelines in the marine receiving environment, following the application of estimated minimum initial dilution factors. The 2019 wastewaters from both outfalls were acutely lethal and chronically toxic to aquatic life. However, the observed effects concentrations in the laboratory were, for the most part, well above the predicted environmental wastewater concentrations in the marine receiving environment at the edge of the initial dilution zone.

The use of estimated minimum initial dilution factors allows for a conservative (highly protective) estimation of potential effects, because the predicted average (mean) initial dilution factors are actually much higher in the marine receiving environments around each outfall (647:1 and 894:1 for the Macaulay and Clover outfalls, respectively; Hodgins, 2006). However, it should be noted that the above dilution factors assume fully functioning outfall diffusers. An outfall inspection was conducted in 2017 and found no deficiencies in the diffusers that could cause water quality issues in the receiving environment. The overall operation of the outfall diffusers is assessed via the surface water and water column monitoring described in Section 2.1.

The Clover and Macaulay wastewaters will continue to be acutely and chronically toxic until the installation of further treatment. The bacteriological indicator guideline exceedances will continue even after the installation of treatment, as disinfection will not be installed as part of the new McLoughlin treatment process and is not feasible at Macaulay or Clover during rain events. However, with additional treatment at McLoughlin, but without disinfection, the magnitude of these exceedances will be much reduced.

3.0 SURFACE WATER MONITORING

3.1 Introduction

CRD staff have been monitoring receiving waters around the Macaulay and Clover outfalls for fecal coliform 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 environment. Potential effects at the shoreline have been attributed to stormwater discharges, which are currently monitored by the CRD's Stormwater Quality Program.

In 2006, the SETAC panel recommended a review of the monitoring program's surface water monitoring component (SETAC, 2006). One of their recommendations included an evaluation of enterococci as an additional human health indicator near the outfalls and a review of the monitoring frequency and station spatial distribution. A review of this program component was also suggested in the 2007 advisory group report to the ministry.

As part of the five-year monitoring cycle design, CRD and ministry staff substantially revised the surface water monitoring component of the program. Most notably, revisions included the replacement of the monthly sampling with quarterly (January, April, July, October) surface water sampling that consists of five bacteriology samples in a 30-day period ("5-in-30") for each quarter and the addition of enterococci. In addition, the program added water column sampling for stations around the initial dilution zone of each outfall. The water column sampling (at depth) includes automated instrument measurements and water sampling for the analysis of various nutrients, conventional parameters, metals, oil and grease, and the two bacteriological indicators. The objective of the water column sampling is to determine whether provincial regulatory requirements are being met, specifically that applicable provincial and federal water quality guidelines are not exceeded at the edge of the initial dilution zone throughout the water column, and that the outfall diffusers are operating as expected.

Finally, in 2015, staff added a reference station at Constance Bank, 12 km from the Clover outfall, to provide background concentrations for comparison to any guideline exceedances observed adjacent to the two outfalls.

3.2 Methods

Staff collected "5 in 30" surface and initial dilution zone water column samples each quarter of 2019 in the vicinity of both outfalls (Figure 3.1). Sampling was undertaken using the University of Victoria's 16-metre science vessel, the MSV John Strickland. The Strickland is equipped with a hydraulic winch and an electric slip ring winch, an A-frame, bow thrusters and a differential global positioning system. Surface samples were collected at the surface of the water column at a depth of 1 m using a sampling pole, and the initial dilution zone water column stations were sampled with a Seabird conductivity-temperature-depth (CTD) instrument and automated rosette sampler. The CTD instrument was also equipped with a dissolved oxygen sensor. Water column instrument profiles were taken at each initial dilution zone station and water samples were taken at the top (at a depth of 5 m), middle (middle of predicted plume trapping depth; see below for how middle depths were determined) and bottom (5 m above the seafloor). Surface and initial dilution zone sampling parameters are presented in Appendix C1.

A surface drift drogue was released at the beginning of each surface water sampling event and retrieved at the end of the sampling event. Position and time were recorded at the beginning and the end of the release in order to track potential directional flow of sewage, should it be surfacing.

Surface sampling stations are presented in Figure 3.1 and Appendix C2. The surface sampling grid, consisting of a total of 13 stations per outfall, was used to ensure that there was 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 the drift drogue was retrieved. 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.

Potential initial dilution zone stations (surrounding the initial dilution zone) are also presented in Figure 3.1. Station selection varied from day to day with four stations sampled each day. For each sampling day, 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. The 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 day and time. Samples were collected with the automated rosette sampler and were decanted into appropriate sample bottles and preserved for analysis of metals, various conventional parameters and nutrients (Appendix C1). Bacteriological, ammonia, hardness, TSS and pH samples were collected for each of the "5-in-30" sampling days, while the analysis of metals, oil and grease, phosphorus, sulfide, total organic carbon and nutrients were conducted on samples collected from only one day per quarter (usually the first of the "5-in-30" sampling days).

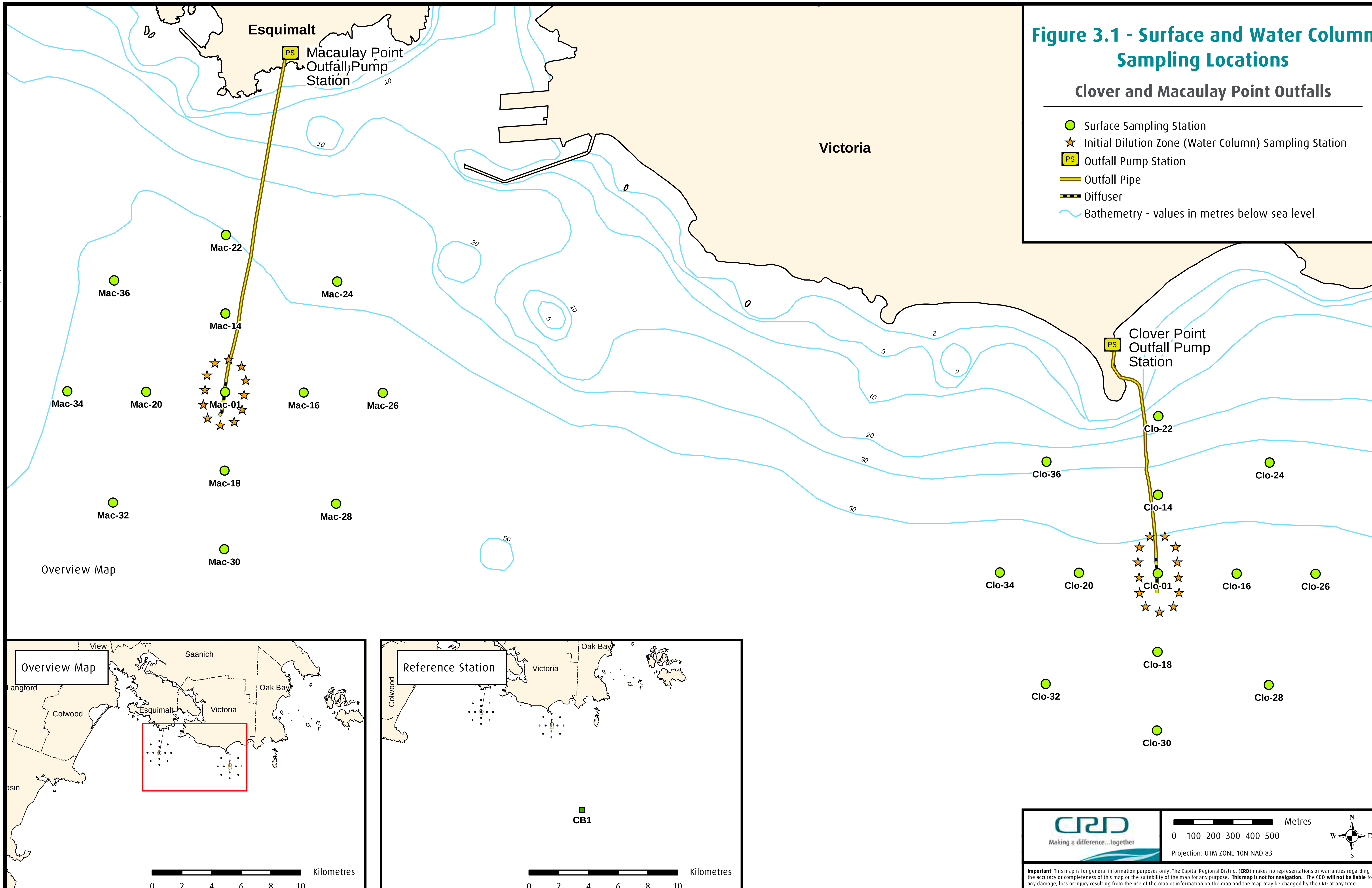
The surface and initial dilution zone water column samples were analyzed for two bacteriological indicators (fecal coliforms and enterococci) by BV Labs (Victoria, BC). Fecal coliforms were enumerated using 0.45 µm membrane filters on mFC medium at 44.5°C for 24 hours and enterococci were enumerated using 0.45 µm nitrocellulose membranes on mEI medium at 41°C for 22-26 hours.

Bacteriological results were evaluated against human health guidelines developed by Warrington (1988) for the ministry (BCMoE&CCS 2017; 2019) for recreational primary contact and to Health Canada (2012) guidelines for recreational water quality. These guidelines are:

- Provincial guidelines based on the geometric mean of five samples collected in 30 days not exceeding 200 CFU/100 mL (fecal coliforms) and 20 CFU/100 mL (enterococci)
    - Note: these guidelines no longer exist, but will be used in this report for comparison purposes
- Health Canada enterococci guidelines based on the geometric mean of five samples taken approximately weekly, not exceeding 35 CFU/100 mL
- Health Canada single enterococci values not exceeding 70 CFU/100 mL

All other initial dilution zone water column results were evaluated against available CCME (2002) and Approved BC Water Quality Guidelines for the Protection of Aquatic Life (BCMoE&CCS 2017; 2019) using the maximum concentration from each of the pooled sampling depths (of the four sample stations) from each of the sampling days within the season. It should be noted that metals results were compared to guidelines that stipulate a "5-in-30" sampling protocol. However, metals were only sampled once during a "5-in-30" sampling period and consequently, these comparisons to guidelines should be interpreted with caution.

CRD Environmental Sustainability - May 18, 2016 - Technologist: SR - Map Document: MacClov_SurfaceAndWaterColumnStations.mxd



3.3 Results and Discussion

3.3.1 Macaulay

Surface Water Stations

CRD staff collected 280 surface water samples at the Macaulay outfall receiving environment in 2019.

Fecal coliform results for each sampling event at Macaulay (including seasonal geometric means) are presented in Appendix C3. Station seasonal geometric means were one or two orders of magnitude below the provincial guideline of 200 CFU/100 mL (Table 3.1; Figure 3.2). No individual fecal coliform measurements out of 280 were above the value of 200 CFU/100 mL (Appendix C3). The maximum fecal coliform concentration measured in 2019 was 150 CFU/100 mL on day one in the spring.

Enterococci results for each sampling event at Macaulay (including seasonal station geometric means) are presented in Appendix C3. All seasonal geometric means were below federal guideline of 35 CFU/100 mL (Table 3.1; Figure 3.2). Two individual enterococci measurements out of 280 (representing 0.7% of the surface water samples) were above the federal single value guideline of 70 CFU/100 mL (Appendix C3), in the winter. The maximum enterococci concentration measured in 2019 was 110 CFU/100 mL occurring on day one in the winter.

There were no human health guideline exceedances for fecals in any quarter and no exceedances for enterococci in the spring, summer or autumn. The frequency and location of exceedances are similar to previous years indicating that the diffuser performance is consistent over time. The Macaulay outfall was inspected by a remotely operated vehicle in 2017, which found no deficiencies in the diffuser that could cause water quality issues in the receiving environment.

Elevated bacterial results in winter suggest that diluted effluent was surfacing during these sampling events and some risks to human health were present for anyone recreating at the ocean's surface during this time of year. Overall, however, results were within the concentrations predicted by hydrodynamic modelling (Hodgins, 2006). The model predicts a less than 5% chance that Macaulay effluent would reach the surface during slack tide in winter and an even lower probability at other times of the year. Although the plume is predicted to be highly diluted by the time it reaches the surface on these occasions (average dilution of 1580:1), fecal coliform and enterococci concentrations above 200 and 35 CFU/100 mL, respectively, are predicted to occur (Hodgins, 2006). Summer plume surfacing events are also predicted at both outfalls, associated with the morning flush in the wastewater system, weak water column stratification and slack tide (Lorax, 2009). These events are predicted to be less frequent than in winter. During summer, the core of the plume is predicted to be trapped at depth, but the diluted edge of the plume is predicted to surface occasionally.

Overall, the data indicate that the Macaulay effluent plume was predominantly trapped below the surface, as predicted by the 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 more regular plume surfacing was occurring, we would expect to see more fecal coliform concentrations of approximately 5,671 CFU/100 mL, based on applying the average dilution factor of 1,580:1 to the 2019 mean wastewater fecal coliform concentration of 8,961,538 CFU/100 mL (Table 2.4). As mentioned above, the maximum fecal coliform concentration was 150 CFU/100 mL, with most results below 100 CFU/100 mL.

Table 3.1 Macaulay Surface Water (1 m depth) Fecal Coliform and Enterococci Seasonal Geometric Means

Fecals	Winter	Spring	Summer	Autumn
Mac-01	14	2	2	16
Mac-14	18	2	1	13
Mac-16	18	7	5	12
Mac-18	21	2	4	5
Mac-20	20	3	1	11
Mac-22	16	2	1	20
Mac-24	18	6	2	23
Mac-26	29	9	4	24
Mac-28	24	2	1	9
Mac-30	13	1	1	8
Mac-32	21	1	4	4
Mac-34	23	2	1	23
Mac-36	12	2	1	14
Mac-D1	24	2*	2*	24*
CB-Reference	5	2	1	3
Enterococci	**Winter**	**Spring**	**Summer**	**Autumn**
Mac-01	4	1	1	3
Mac-14	6	1	1	5
Mac-16	10	4	2	3
Mac-18	5	1	3	1
Mac-20	4	2	1	4
Mac-22	4	1	1	5
Mac-24	8	1	1	6
Mac-26	11	3	2	4
Mac-28	9	2	1	2
Mac-30	5	1	1	2
Mac-32	5	1	2	2
Mac-34	5	1	1	3
Mac-36	5	1	1	4
Mac-D1	6	2*	1*	5*
CB-Reference	2	1	1	3

Notes:
Results exceeding the old BC water quality guideline (geometric mean of 200 CFU/100 mL for fecal coliforms) and Health Canada's (geometric mean of 35 CFU/100 mL for enterococci) are highlighted. Results are presented in geometric means of "5-in-30" day sampling (CFU/100 mL).
--- denotes sampling did not occur, due to adverse weather or drogue loss.
*not a complete set of five sampling events, due to weather

Figure 3.2 - Macaulay Point Surface Water Stations

Fecal Coliform and Enterococci Results - 2019 (5 in 30)

- Macaulay Point Surface Sampling Stations
  Geo mean fecal count / Geo mean enterococci count
- Initial Dilution Zone
  (100 metres from diffuser)
- Outfall Pipe
- Diffuser

Note: Geo mean count shown in red if fecal count exceeds 200 CFU/100mL or enterococci count exceeds 20 CFU/100mL.

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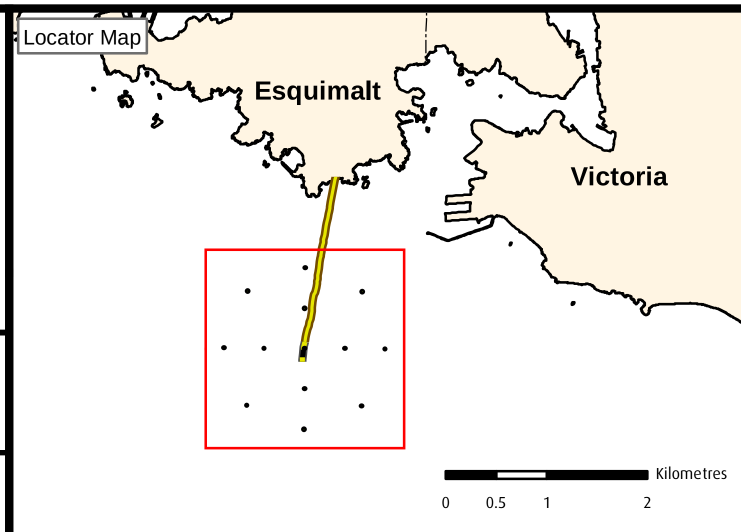
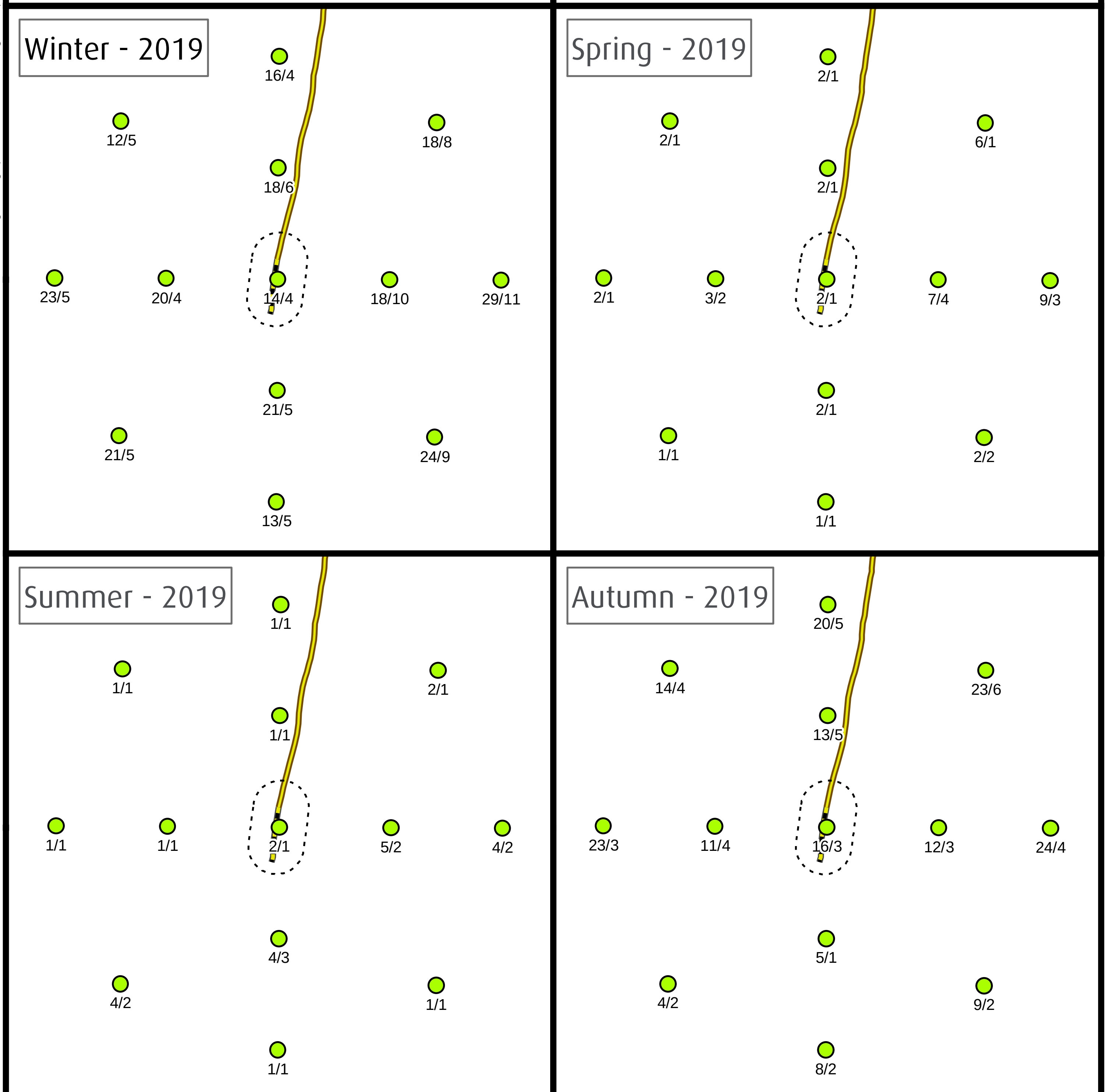
Metres
0 100 200 300 400 500

Projection: UTM ZONE 10N NAD 83

N W E S





Initial Dilution Zone Water Column

Analytical results for each initial dilution zone water column sampling event at Macaulay are presented in Appendix C4. CTD and dissolved oxygen plots for each sampling day are presented in Appendix C7.

Only samples for which results were above detection limits, and have either BC approved or CCME water quality guidelines, are presented (Appendix C4) (arsenic, boron, cadmium, copper, enterococci, fecal coliforms, lead, manganese, nickel, nitrate nitrogen, silver and zinc).

Figure 3.3 presents the geometric means of maximum (worst case from each day in the “5-in-30” round) enterococci and fecal coliforms concentrations for each of the seasons’ samples (winter, spring, summer and autumn).

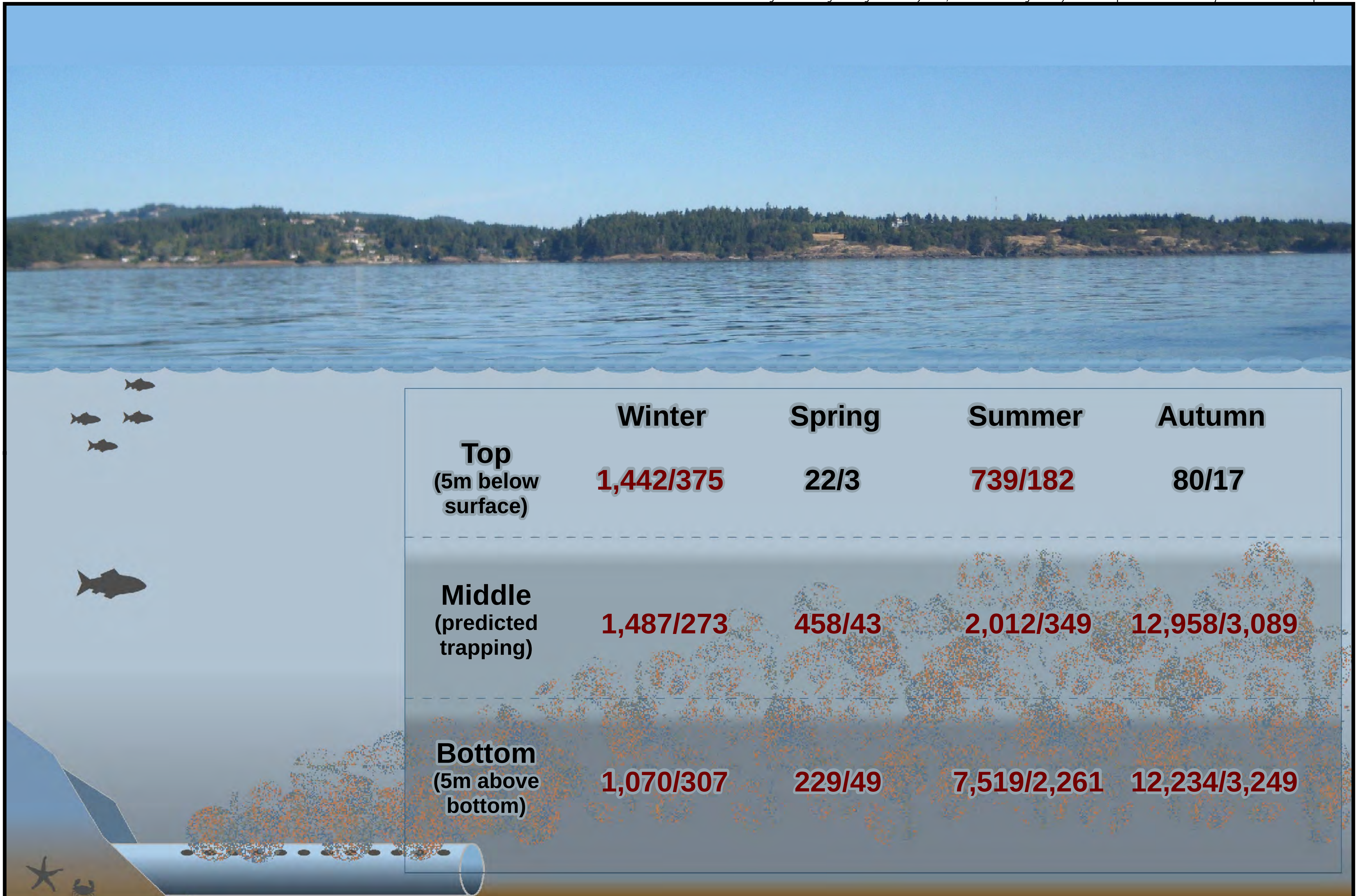
The geometric means of the “5-in-30” fecal coliform water column results exceeded guidelines the majority of the time, with exceedances at the middle or bottom sampling depths at each season (within the plume’s predicted trapping depth), with exceedances at the surface in the winter and summer only (Appendix C4).

The geometric means of the “5-in-30” enterococci water column results also exceeded guidelines with most exceedances at the middle or bottom sampling depths at each season (within the plume’s predicted trapping depth), with exceedances at the surface in the winter and summer only (Appendix C4). Single value exceedances to the federal enterococci guideline of 70 CFU/100 mL occurred 14% of the time (Appendix C4), with slightly fewer exceedances in autumn/winter than spring/summer.

There were no exceedances of provincial or federal guidelines for any of the metals that were analyzed in the water column initial dilution zone samples, except for boron. Concentrations of total boron almost invariably exceeded the provincial guideline of 1,200 µg/L, with values ranging from 3,800 to 4,300 µg/L and 4,070 to 4,510 µg/L at the reference station. However, ambient boron concentrations, as demonstrated at the reference station, are approximately 4,000 µg/L in southern Vancouver Island marine waters (BCMoE, 2006). Therefore, it is inevitable that guidelines are exceeded.

Water column profiles of temperature, salinity, dissolved oxygen and transmissivity (Appendix C7) 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 transmissivity 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 CTD data will supplement the continuous dissolved oxygen monitoring that is being collected in collaboration with Ocean Networks Canada (see Section 5.0).



	Winter	Spring	Summer	Autumn
Top (5m below surface)	1,442/375	22/3	739/182	80/17
Middle (predicted trapping)	1,487/273	458/43	2,012/349	12,958/3,089
Bottom (5m above bottom)	1,070/307	229/49	7,519/2,261	12,234/3,249

Fecal Coliform — **34/7** — Enterococci

Macaulay Point IDZ station geometric means of fecal coliform and enterococci counts CFU/100mL (maximum concentrations).

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Notes:

Each value is the geometric mean of each maximum value detected at each sampling event (i.e. n=5)
Sampled 5 times in 30 days during each season.

Geometric mean count shown in red if fecal count exceeds 200 CFU/100mL or enterococci count exceeds 20 CFU/100mL.

3.3.2 Clover

Surface Water Stations

CRD staff collected 280 surface water samples at the Clover outfall receiving environment and 20 samples at an associated reference station, Constance Bank in 2019.

Fecal coliform results for each sampling event at Clover (including seasonal geometric means) are presented in Appendix C5. All station fecal coliform geometric means were one or two orders of magnitude below 200 CFU/100 mL (Table 3.2; Figure 3.4). All individual stations had geometric means of 115 CFU/100 mL or less. Seven measurements out of 280 surface water samples were above the value of 200 CFU/100 mL (Appendix C5). The maximum fecal coliform concentration measured in 2019 was 1,600 CFU/100 mL on day three and five in winter.

Enterococci results for each sampling event at Clover (including seasonal geometric means) are presented in Appendix C5. One enterococci geometric mean was above the federal guideline of 35 CFU/100 mL (Table 3.2; Figure 3.4). Four individual measurements out of 280 (representing 1.4% of the surface water samples) were above the federal single value guideline of 70 CFU/100 mL, (Appendix C5) in winter and autumn. The maximum enterococci concentration measured in 2019 was 560 CFU/100 mL on day three in winter, concurrent with the highest fecal coliform concentration found in 2019.

In 2019, there were no human health guideline exceedances for fecals and only one exceedance for enterococci. The frequency and location of exceedances are similar to previous years indicating that the diffuser performance is consistent over time. The Clover outfall was inspected by remotely operated vehicle in 2017, which found no deficiencies in the diffuser that could cause water quality issues in the receiving environment.

Relatively elevated bacterial results in winter suggest that diluted effluent was surfacing during these sampling events and some risks to human health were present for anyone recreating at the ocean's surface during these times of year. Overall, however, results were within the expected concentrations predicted by hydrodynamic modelling (Hodgins, 2006). The C3 model predicts a less than 2% chance that the Clover effluent would reach the surface during slack tide in winter and an even lower chance during other times of the year (Hodgins, 2006). Although the plume is highly diluted by the time it reaches the surface (average dilution of 1500:1), fecal coliform and enterococci concentrations above 200 and 20 CFU/100 mL, respectively, are predicted to occur. Summer plume surfacing events are also predicted at both outfalls, associated with the morning flush in the wastewater system, weak water column stratification and slack tide (Lorax, 2009). These events are predicted to be less frequent than in winter. During summer, the core of the plume is predicted to be trapped at depth, but the diluted edge of the plume is predicted to occasionally surface. The modelling assumes a fully functioning outfall diffuser.

Overall, the data indicate that the Clover effluent plume was predominantly trapped below the surface, as predicted by the 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 more regular plume surfacing was occurring, we would expect to see fecal coliform concentrations of approximately 6,082 CFU/100 mL, based on applying the average dilution factor of 1,500:1 to the 2019 mean wastewater fecal coliform concentration of 9,123,076 CFU/100 mL (Table 2.5). As mentioned above, the maximum fecal coliform concentration was 1,600 CFU/100 mL.

Table 3.2 Clover Surface Water (1 m depth) Fecal Coliform and Enterococci Seasonal Geometric Means

Fecals	Winter	Spring	Summer	Autumn
Clo-01	36	12	2	20
Clo-14	69	7	9	40
Clo-16	73	9	2	26
Clo-18	28	5	1	17
Clo-20	37*	10	3	33
Clo-22	42	5	9	51
Clo-24	115*	12	14	34
Clo-26	52	6	4	22
Clo-28	57	9	1	17
Clo-30	31	5	1	16
Clo-32	28	6	2	21
Clo-34	35	5	6	30
Clo-36	40	6	9	31
Clo-D1	30	5*	7*	31*
CB-Reference	5	2	1	3
Enterococci	**Winter**	**Spring**	**Summer**	**Autumn**
Clo-01	9	3	1	6
Clo-14	11	1	3	10
Clo-16	20	3	1	7
Clo-18	8	1	1	5
Clo-20	12	2	1	6
Clo-22	11	2	4	9
Clo-24	43	2	1	7
Clo-26	17	3	1	4
Clo-28	13	2	1	3
Clo-30	9	1	1	2
Clo-32	10	2	1	4
Clo-34	12	1	1	6
Clo-36	13	1	2	7
Clo-D1	11	2*	3*	6*
CB-Reference	2	1	1	3

Notes:
Results exceeding the old BC water quality guidelines (geometric mean of 200 CFU/100 mL for fecal coliforms) and Health Canada's (geometric mean of 35 CFU/100 mL for enterococci) are highlighted. Results are presented in geometric means of "5-in-30" day sampling (CFU/100 mL).
--- denotes sampling did not occur, due to adverse weather or drogue loss.
* not a complete set of five sampling events, due to weather

Figure 3.4 - Clover Point Surface Water Stations

Fecal Coliform and Enterococci Results - 2019 (5 in 30)

- Clover Point Surface Sampling Stations
  Geo mean fecal count / Geo mean enterococci count
- Initial Dilution Zone
  (100 metres from diffuser)
- Outfall Pipe
- Diffuser

Note: Geo mean count shown in red if fecal count exceeds 200 CFU/100mL or enterococci count exceeds 20 CFU/100mL.

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Metres
0 100 200 300 400 500
Projection: UTM ZONE 10N NAD 83

N W E S

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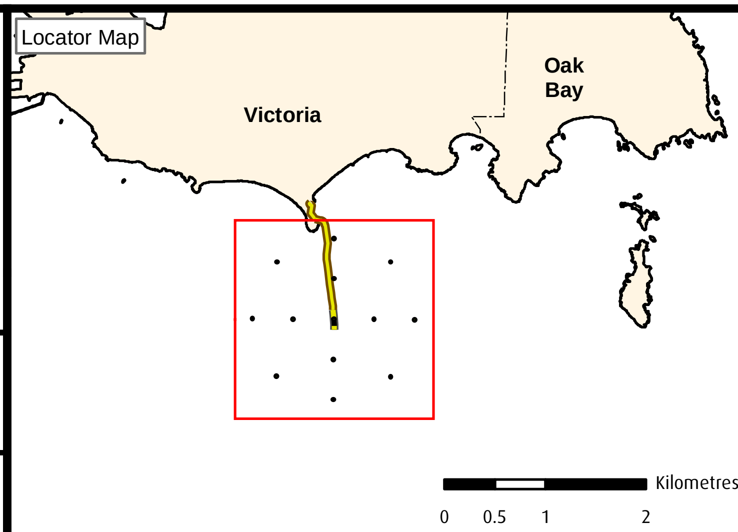

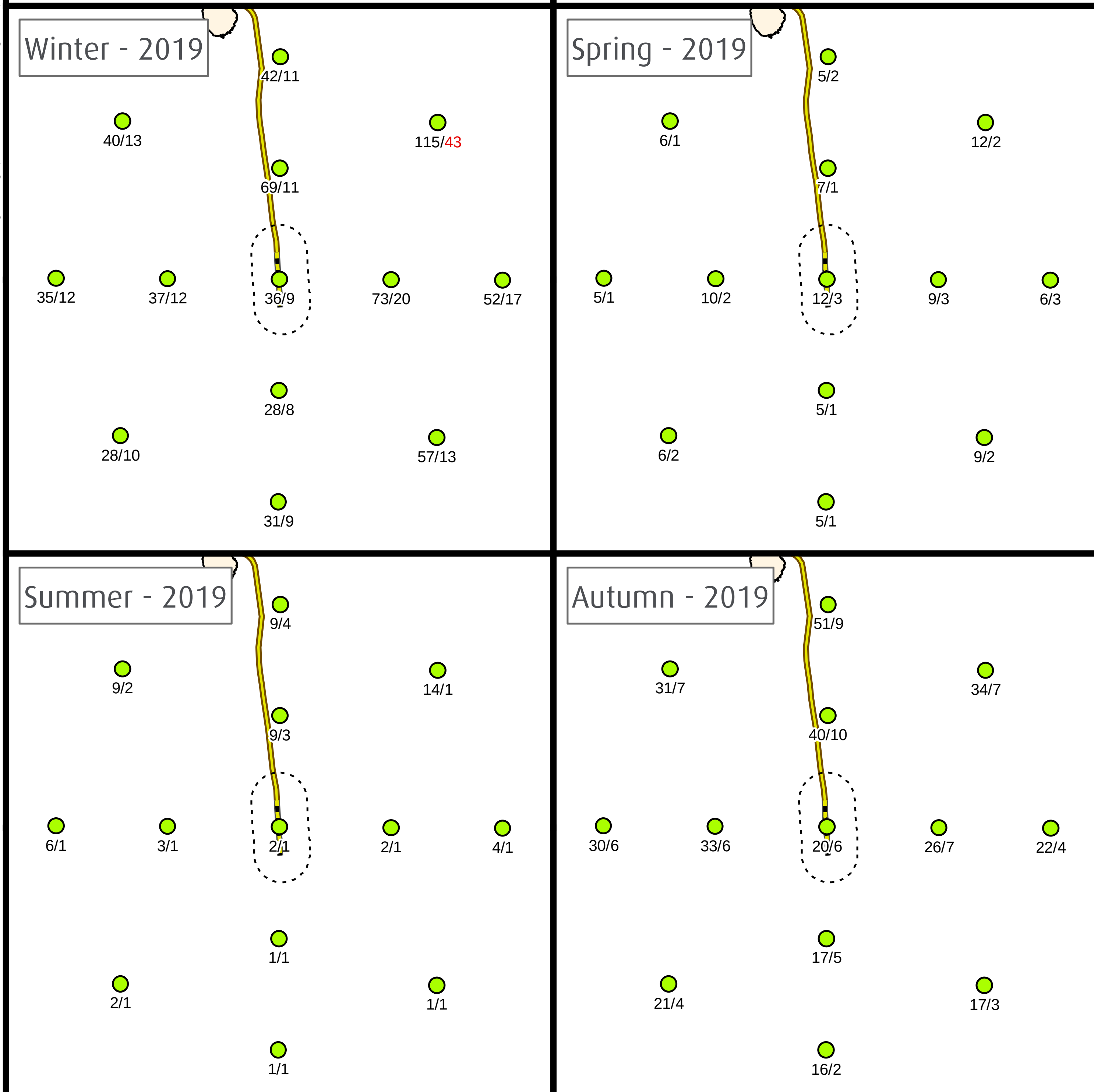

Initial Dilution Zone Water Column

Analytical results for each initial dilution zone water column sampling event at Clover are presented in Appendix C6. CTD, dissolved oxygen and transmissometer plots for each sampling day are presented in Appendix C7.

Only samples for which results were above detection limits, and have either BC Approved Water Quality or CCME guidelines, are presented (Appendix C6) (ammonia, arsenic, boron, cadmium, copper, enterococci, fecals, lead, nickel, nitrate nitrogen, silver and zinc).

Figure 3.5 presents the geometric means of maximum (worst case from each day in the “5-in-30” round) enterococci and fecal coliforms concentrations for each of the seasons’ samples (winter, spring, summer and autumn).

The geometric means of the “5-in-30” fecal coliform water column results exceeded guidelines consistently at the middle or bottom (within the plume’s predicted trapping depth) sampling depths with the winter season exceeding at the top depth (in the winter) (Appendix C4) aligning with surface water sampling results.

The geometric means of the “5-in-30” enterococci water column results exceeded guidelines at the middle or bottom depths. Enterococci exceeded guidelines at the surface (top of the water column) in the winter and autumn with a geomean of 353 CFU/100 mL and 39 CFU/100 mL, respectively. Single value exceedances to the federal enterococci guideline of 70 CFU/100 mL occurred 11% of the time (Appendix C4), with slightly fewer exceedances in summer and spring than winter and autumn.

There were no exceedances of provincial or federal guidelines for any of the metals that were analyzed in the water column initial dilution zone samples, except for boron in all samples and one cadmium measurement in the spring at a bottom depth. Concentrations of total boron almost invariably exceeded the provincial guideline of 1,200 µg/L, with values ranging from 3,890 to 4,690 µg/L and 4,070 to 4,510 µg/L at the reference station. However, ambient boron concentrations, as demonstrated by results found at the reference station, are approximately 4,000 µg/L in southern Vancouver Island marine waters (BCMoE, 2006). Therefore, it is inevitable that guidelines are exceeded, but not as a result of the outfall. Cadmium exceedances are rarely seen and are attributed to contamination from the sampling vessel.

Water column profiles of temperature, salinity and dissolved oxygen (Appendix C7) 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 transmissivity and increases in bacteriological indicators (fecal coliforms and enterococci). A master’s thesis (Krogh *et al*., 2018), examined vertical profiles of dissolved oxygen between 2011 and 2016, confirming that of the approximately 850 CTD casts conducted, only six profiles showed any evidence of a sewage plume layer, as indicated by decreases in dissolved oxygen.

CTD profiling will continue as part of the routine environmental monitoring program and the CTD data will supplement the continuous dissolved oxygen monitoring that is being collected in collaboration with Ocean Networks Canada (ONC) (see Section 5.0).

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	Winter	Spring	Summer	Autumn
Top (5m below surface)	905/353	85/21	47/3	171/39
Middle (predicted trapping)	752/322	590/378	642/762	273/146
Bottom (5m above bottom)	614/215	1,739/453	2,333/492	234/200

Fecal Coliform — **51/13** Clover Point IDZ station geometric means of fecal coliform and enterococci counts CFU/100mL (maximum concentrations).

Enterococci

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Notes:

Each value is the geometric mean of each maximum value detected at each sampling event (i.e. n=5)
Sampled 5 times in 30 days during each season.

Geometric mean count shown in red if fecal count exceeds 200 CFU/100mL or enterococci count exceeds 20 CFU/100mL.

<u>OVERALL ASSESSMENT</u>

The revised surface water and initial dilution zone water column monitoring program was implemented in April 2011.

Overall, the 2019 surface fecal coliform and enterococci results indicate that the outfall plumes were predominantly trapped below the ocean surface and the diffusers were working as expected for most of the year. In addition, the potential for human exposure to high fecal coliform and enterococci concentrations from the wastewater was moderate around the outfalls, as surface water “5-in-30” geometric mean results were all below thresholds used to assess risk to human health, with the exception of once at the surface of the initial dilution zone. No surface water water quality guideline exceedances were observed greater than 100 m from the outfall, but there were a number of single value enterococci results that exceeded the single sample criteria. These exceedances occurred in the winter sampling periods when plume surfacing events are more likely to occur. The seasonality of the high bacterial counts can be attributed to higher effluent flows in winter, coupled with the oceanography of this particular area during the winter months (relative lack of water column stratification, due to wind and cooler surface waters). Both Clover and Macaulay outfalls were inspected by remotely operated vehicle in 2017, which found no deficiencies in the diffuser that could cause water quality issues in the receiving environment.

The initial dilution zone water column sampling, however, indicated that many fecal and enterococci results were above guidelines at depth, with the highest magnitude bacteriological guideline exceedances observed at depths, generally below 40 m. Boron exceeded guidelines in all samples, even those at the reference station and cadmium exceeded in one sample, which is attributed to sampling vessel contamination.

Similar to wastewater observations, the bacteriological guideline exceedances are expected to continue even after the installation of additional wastewater treatment at McLoughlin. Disinfection is not installed at the new McLoughlin plant and is not feasible for Macaulay or Clover wet weather flows. However, the magnitude and frequency of the exceedances will be greatly reduced overall.

4.0 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.

2019 represents Year 4 of Cycle 2 and the seafloor monitoring component consisted of measurements associated with the Macaulay outfall for:

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

In addition, sampling started at five locations around the new McLoughlin outfall, as part of the pre-discharge monitoring program. This new outfall will undergo commissioning in the fall of 2020.

Data that was still outstanding from previous years, and is included in this report, are listed below:

- 2014 and 2017 sediment toxicity at both outfalls
- 2014 and 2017 sediment/benthic invertebrate bioaccumulation at the Macaulay outfall only
- 2018 delayed Cycle 1 finfish and crab survey at both outfalls

4.1 Methods

Seafloor sampling in 2019 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 4.1).

4.2 Sediment Sampling

Sediment samples were collected from 24 stations (Figure 4.1):

- 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 4.1 Seafloor Sampling Van Veen Grab

<u>SEDIMENT CHEMISTRY</u>

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), as listed in Appendix D1; target analytes included the enhanced Vancouver Aquarium Pollution Tracker and SSAMEx programs (Section 5.1.1). 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.

<u>BENTHIC INVERTEBRATE TAXONOMY</u>

Four replicates (five at M0) were collected for benthic invertebrate taxonomy at the sediment sampling stations listed above. Field methods were modified slightly to fit within 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

The 2019 toxicity and bioaccumulation tests for Macaulay were the 56-day bivalve survival and bioaccumulation, the 10-day Mysid survival and growth, the 48-hour bivalve larval development and survival, the 20-day polychaeta survival and growth, and 10-day amphipod survival (Table 4.1). 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), as listed in Appendix D1. Target analytes included an enhanced list to follow the Vancouver Aquarium Pollution Tracker and SSAMEx programs.

Table 4.1 2019 Toxicity and Bioaccumulation Test Selection and Endpoints

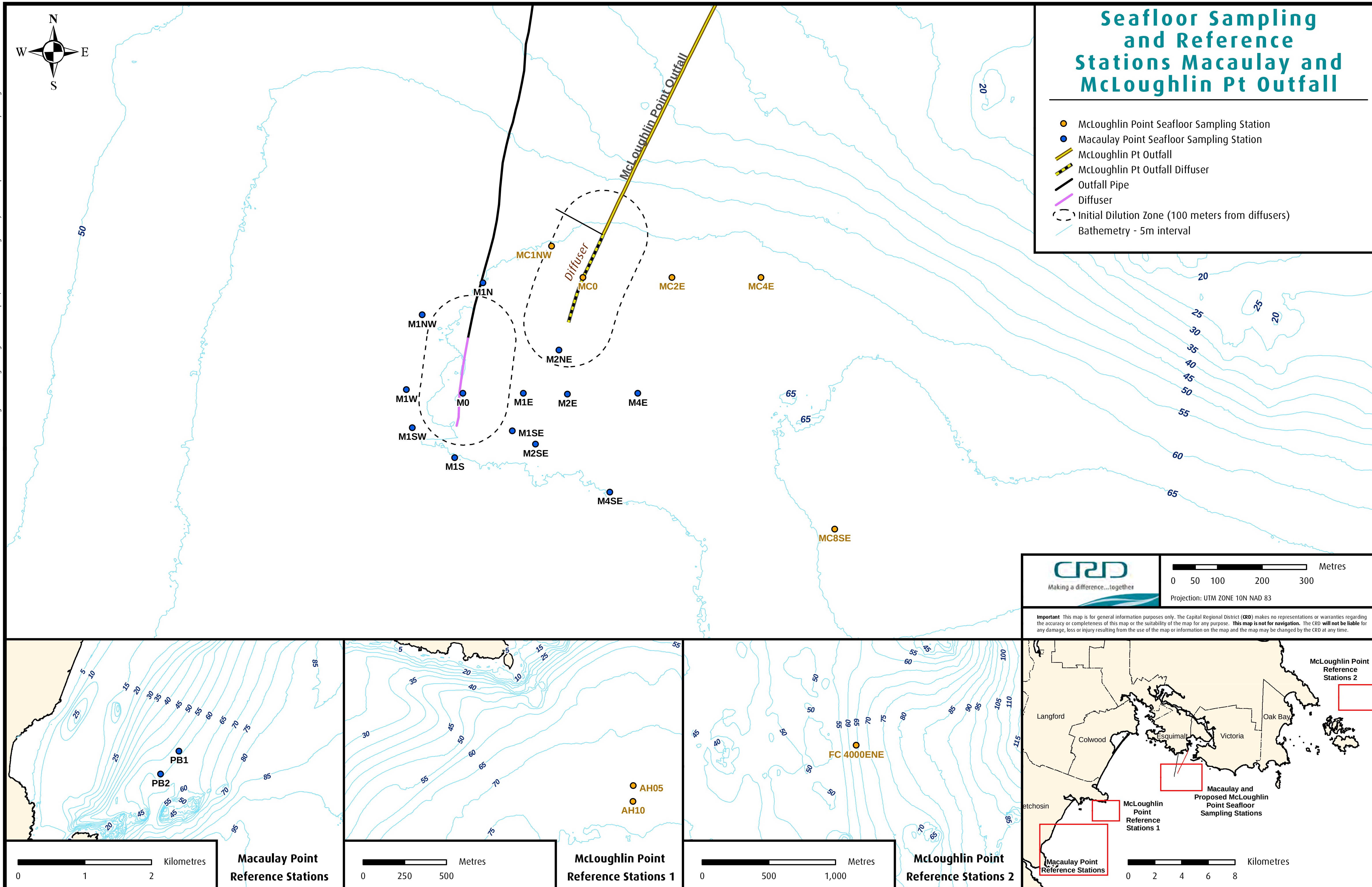
Test	Measure	Endpoint
10-day mysid shrimp (*Americamysis bahia*)	toxicity	Survival and growth
20-day polychaete (*Neanthes arenaceondentata*)	toxicity	Survival and growth
10-day amphipod (*Eohaustorius estuarius*)	toxicity	Survival
48-hour bivalve (*Mytilus galloprovincealis*)	toxicity	Larval development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

FISH AND CRAB STUDY

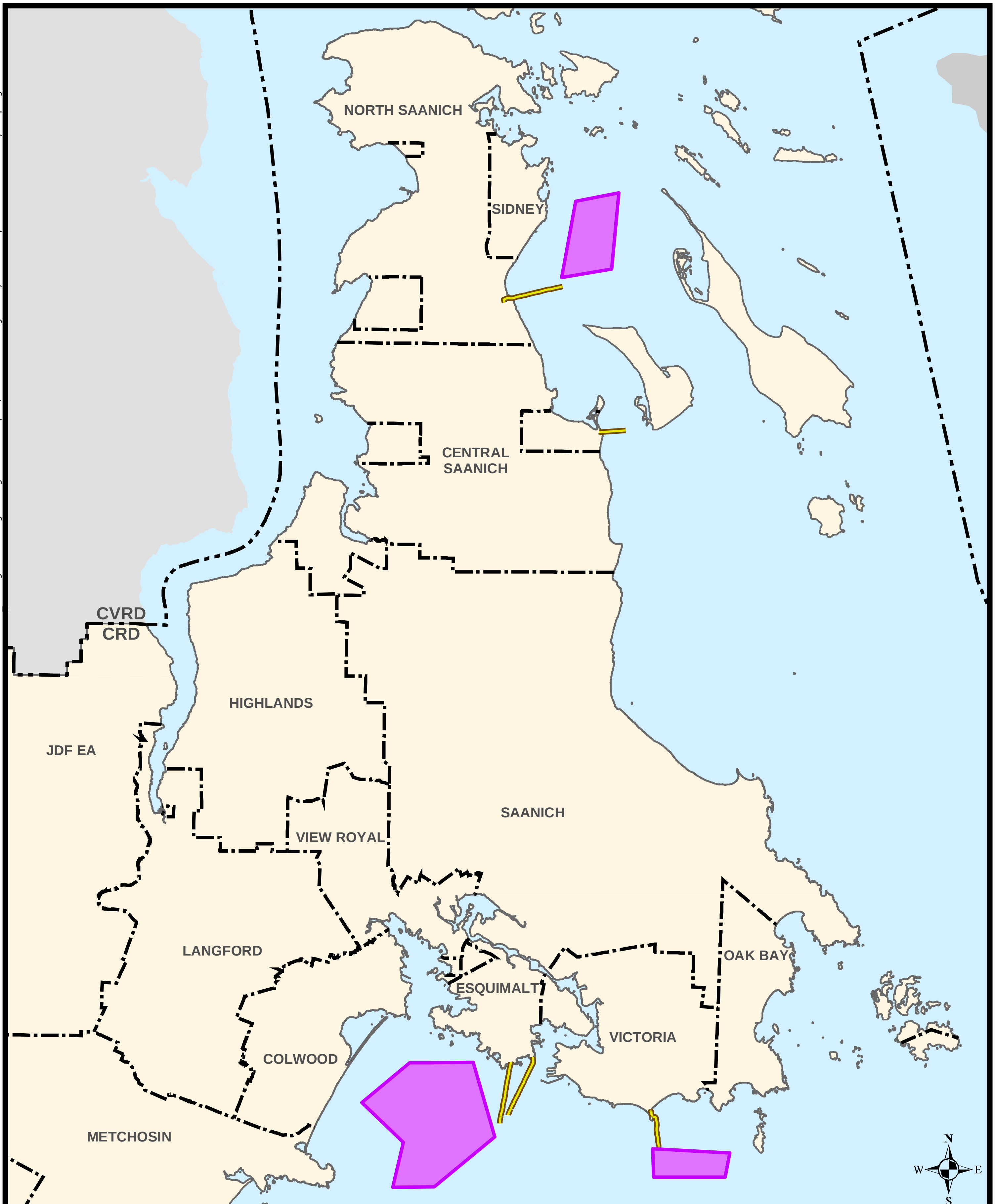
Hatfield Consultants (North Vancouver, BC) conducted a comprehensive fish and crab study in 2018. The study assessed differences between the outfalls and at a reference site, in the health and tissue chemical concentrations of fish (English sole and Irish Lords) and crabs (Dungeness). The study also assessed the risks of these contaminants to human and ecological health. Tissue chemistry analyses included metals, dioxins, PCB, pesticides, PBDE, PAH, PPCP, polyfluorinated compounds, alkylphenols, hormones and sterols. Analyses were conducted collectively by Caro Analytical Services (Burnaby, BC), BV Laboratories (Burnaby, BC) and SGS AXYs Analytical Services (Sidney, BC). Histological assessments were conducted by BC Animal Health (Abbotsford, BC), and fish health assessment were conducted by Hatfield Consultants.

Fish and crab were collected in the spring and summer of 2018, following a pilot study in November 2017 that assessed capture rates for the desired fish species, identified potential alternative target species, and confirmed comparability of fish and crab populations at exposure and reference sites using longlining, crab traps, black cod traps and otter trawl. This pilot survey confirmed that the feasibility of using a single finfish species to meet the objective of the survey at both outfalls would be challenging. As such, English sole, Irish Lords and Dungeness crab were targeted at both outfalls for the final survey.

Fish and crab were collected in the area around Macaulay and Clover outfalls and at station behind Sidney Island (as a reference/far-field station) (Figure 4.2).



CRD - Facilities Management & Engineering Services - Sep 09, 2020 - Technologist: sruljancich - Map Document: MacaulayMcLoughlinSeafloorStations2020.mxd



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Kilometres
0 1 2 4

Projection: UTM ZONE 10N NAD 83

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Municipal Boundary

Sanitary Outfall

Fish Study Sampling Locations

FISH STUDY SAMPLING LOCATIONS

4.3 Results and Discussion

SEDIMENT CHEMISTRY

The Cycle 1 Plus 2016-2019 sediment results are currently under comprehensive review and are expected to be complete in November 2020. The results and assessment below are preliminary, as they have not been put through the CRD's rigorous QA/QC protocol. Results and interpretation are subject to change after the comprehensive review has been completed.

The 2019 sediment chemistry results (Appendix D4) indicated that 5% of the detected results exceeded at least one sediment quality guideline. This is a higher percentage than has been reported in recent years (CRD, 2018), and is likely a result of several non-outfall-related factors, including not yet having completed a QA review of data outliers, undertaking a more fulsome comparison of high-resolution parameters to guidelines, and using new and more conservative BC Working and Approved guidelines, published in 2017 and 2018, respectively.

Parameters with results that exceeded guidelines include:

- cadmium (M4SE), copper (M0, M1SE), lead (M2SE, M2E), mercury (M0, M2E), nickel (M4SE) and silver (M0),
- PAHs (high resolution) (M0, M1E, M2E, M4E, M4SE, M1W, MC800SE and M2SE)
- PCBs total (M1E, M8E)
- 2,4-DDD (M0) AND 4,4-DDD (M1E)

Pharmaceutical and personal care products analyzed at high resolution resulted in a small number of detections, specifically: triamterene (diuretic), triclocarban (antibacterial), triclosan (antibacterial), metformin (diabetes drug), erythromycin-H2O (antibiotic), DEET (pesticide), caffeine (stimulant), carbamazepine (anticonvulsant), cimetidine (acid reducer), codeine (narcotic), amphetamine (methamphetamine) and atenolol (beta blocker). Per- and polyfluoroalkyl substances were not detected in any samples. Compounds of concern that were detected in samples, but do not have guidelines were, nonylphenols, PCBs, PBDEs, dioxins and furans, and organochlorine pesticides. These substances are all legacy bio-accumulative contaminants found in the environment, are not specifically sourced from the Macaulay outfall, and have been observed consistently in previous years.

The new McLoughlin outfall stations sediment chemistry results were qualitatively similar to the Macaulay stations. The only guideline exceedances at any McLoughlin stations occurred at MC800SE for some PAHs (acenaphthene, anthracene, fluorine, and phenanthrene). The above mentioned legacy contaminants were also detected at these stations.

BENTHIC INVERTEBRATE TAXONOMY

The 2019 benthic invertebrate taxonomy results have not yet been analyzed and interpreted. Results will be assessed in the upcoming Cycle 1 Plus 2016-2019 overall assessment, which will be completed in late 2020.

TOXICITY AND BIOACCUMULATION

2019 Results

The toxicity and bioaccumulation results reported by Nautilus (2020) can be found in Appendix D3. Figures 4.3 through 4.7 present results of individual toxicity tests, which have been adjusted to percent of control to correct for test effects.

Results for the 10-day mysid shrimp test are provided in Figure 4.3 and qualitatively indicate very little to no difference between stations. No samples exhibited a statistically significant difference in survival, compared to the control sediment (Appendix D3).

Results for the 20-day marine polychaete test are provided in Figure 4.4. No samples exhibited a statistically significant difference in survival compared to the control sediment. Eight out of the 21 samples tested (including a reference sample) exhibited statistically significant reduction in all growth endpoints relative to the control sediment. An additional four near-/mid-field samples were statistically significantly reduced in total dry weight endpoint (Appendix D3).

Results for the 48-hour bivalve larval development test (Figure 4.5), showed effects on survival in all samples tested as compared to control sediment; however, only one of these samples in the near field grouping (M1SE) had abnormal larvae rates. The reduced survival may have occurred as a result of physical effects of settling sediment particulate.

Results for the 10-day marine amphipod test (Figure 4.6) indicated samples M0 and MC0 were significantly different than the laboratory control for survival; however, the survival rate of organisms at the new McLoughlin outfall terminus (MC0) was high at 90%. The higher sulphide concentration in the Macaulay outfall terminus (M0) may have contributed to the lower survival in the sample. The surviving amphipods exhibited a high rate of reburial, indicating that they could successfully bury themselves (Appendix D3).

Results of the 56-day bioaccumulation test *(*Figure 4.7) exhibited a statistically significant difference in survival for all stations, compared to the control sediment. The bioaccumulation chemistry results are included in appendices D5 to D7, but have not been fully assessed and evaluated at the time of production of this report. The outstanding data will be presented in either a future summary report or the comprehensive assessment report of the Macaulay and Clover monitoring program.

Bioaccumulation sediment chemistry results will be assessed in the upcoming Cycle 1 Plus 2016-2019 overall assessment, which will be completed in the fall of 2020.

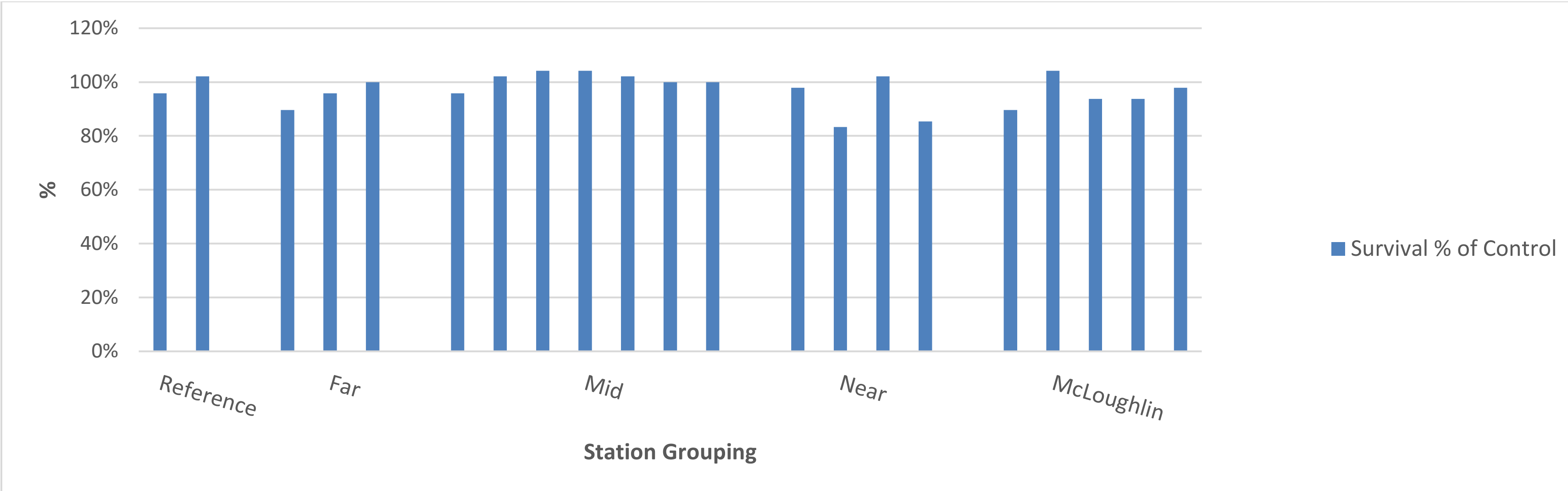

Figure 4.3 10-day Mysid Shrimp Survival

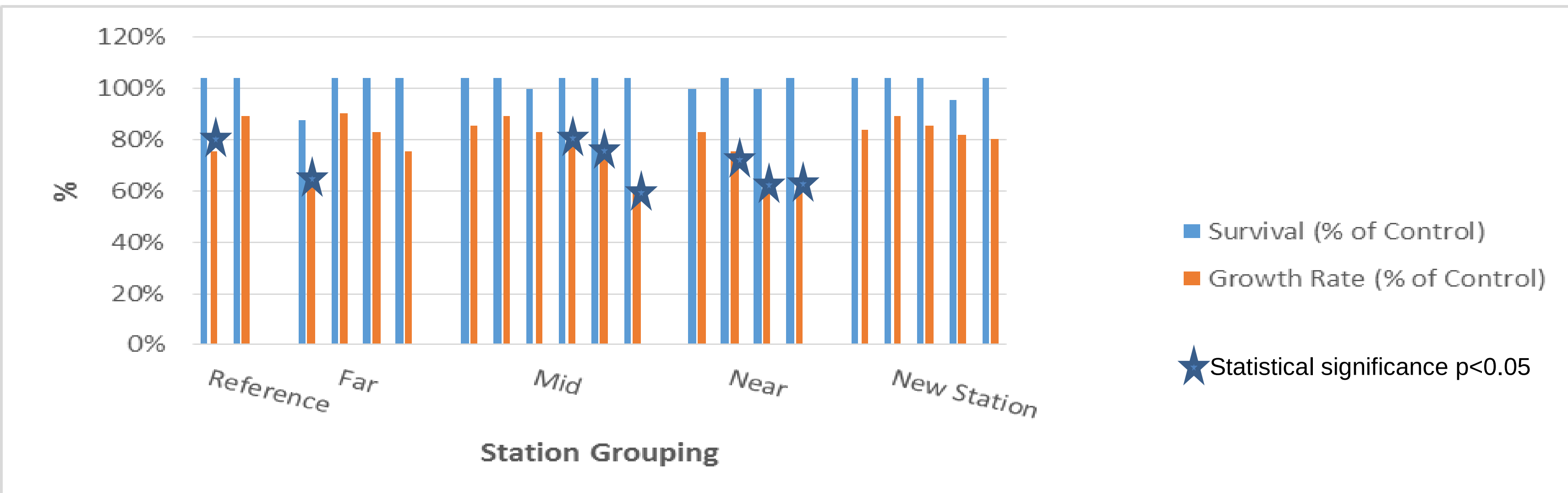

Figure 4.4 20-day Marine Polychaete Survival and Growth

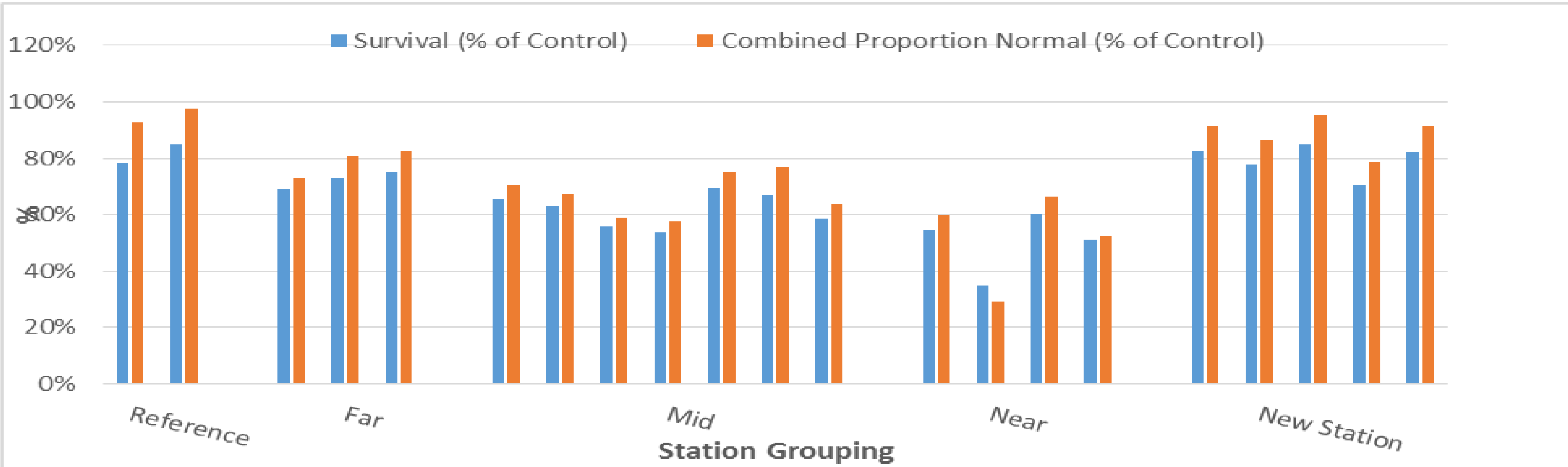

Figure 4.5 48-hour Bivalve Larval Survival and Development

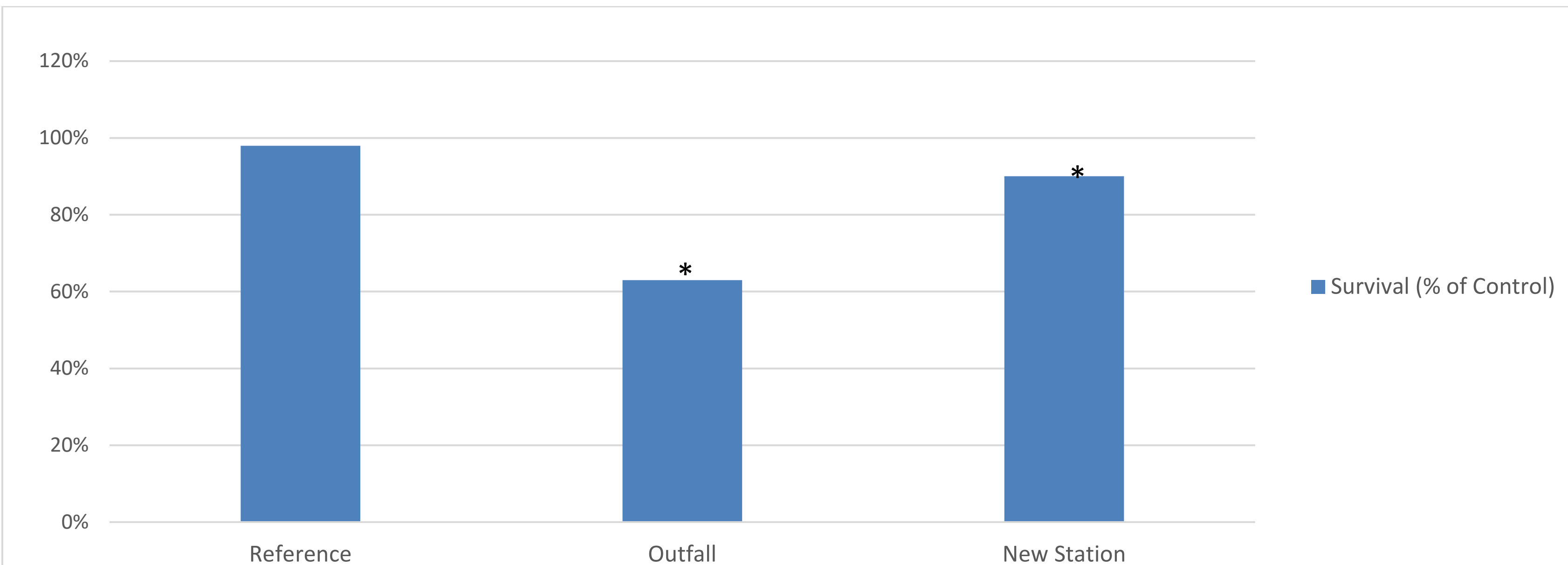

Figure 4.6 10-day Marine Amphipod Survival

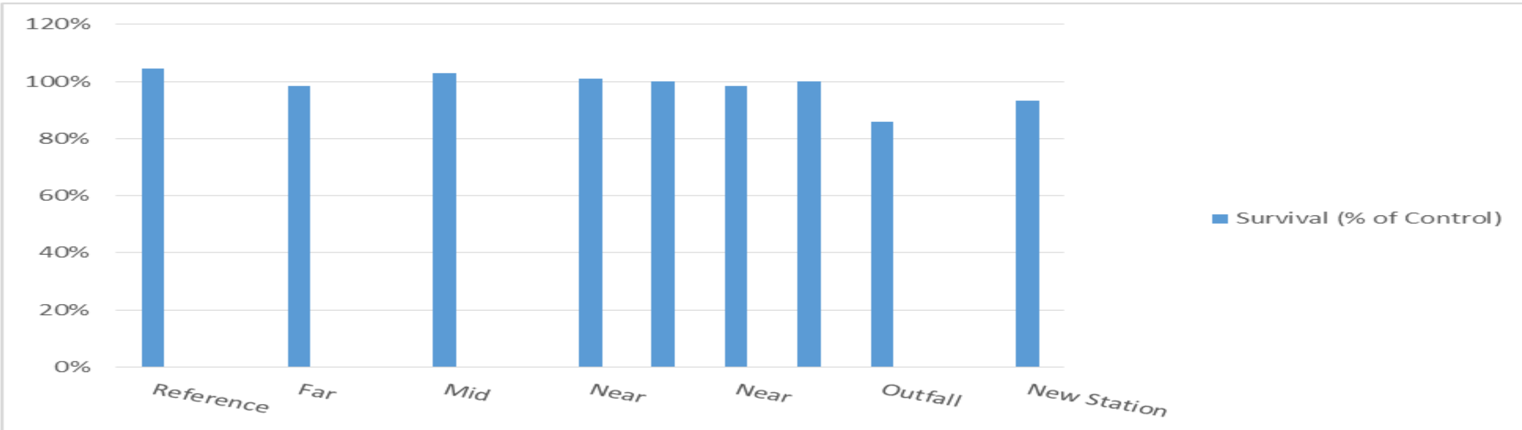

Figure 4.7 56-day Bivalve Bioaccumulation

2014, 2017 and 2019 Results

Figures 4.8 to 4.12 present grouped results of sediment toxicity tests conducted from 2014, 2017 and 2019. The only toxicity test endpoint presented graphically is survival. Tabulated results of all endpoints tested can be found in Appendix D3. Five new McLoughlin stations (named "New Outfall") were plotted alongside existing Macaulay stations.

Overall, plots 4.8 to 4.12 indicate tremendous variability between and within station groupings making interpretation difficult without advance statistical testing. This testing will be conducted as part of the Cycle 1 Plus 2016-2019 overall assessment, which will be completed in the fall of 2020. The plots also indicate that the new McLoughlin stations are within the same ranges of the Macaulay stations. This similarity was expected, considering the close proximity of the McLoughlin stations to the Macaulay stations (Figure 4.1).

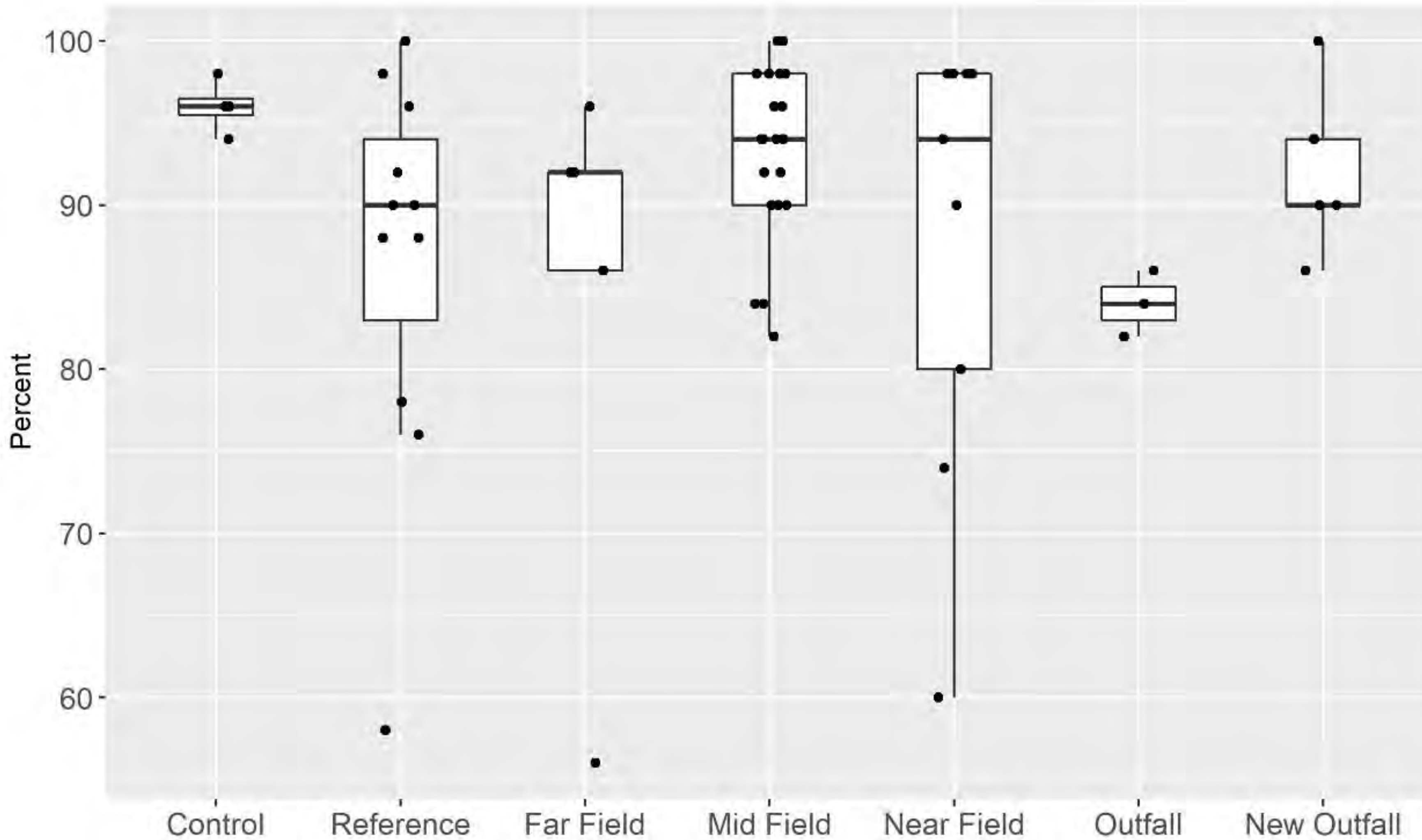

Figure 4.8 2014, 2017 and 2019 10-Day Mysid Shrimp Survival

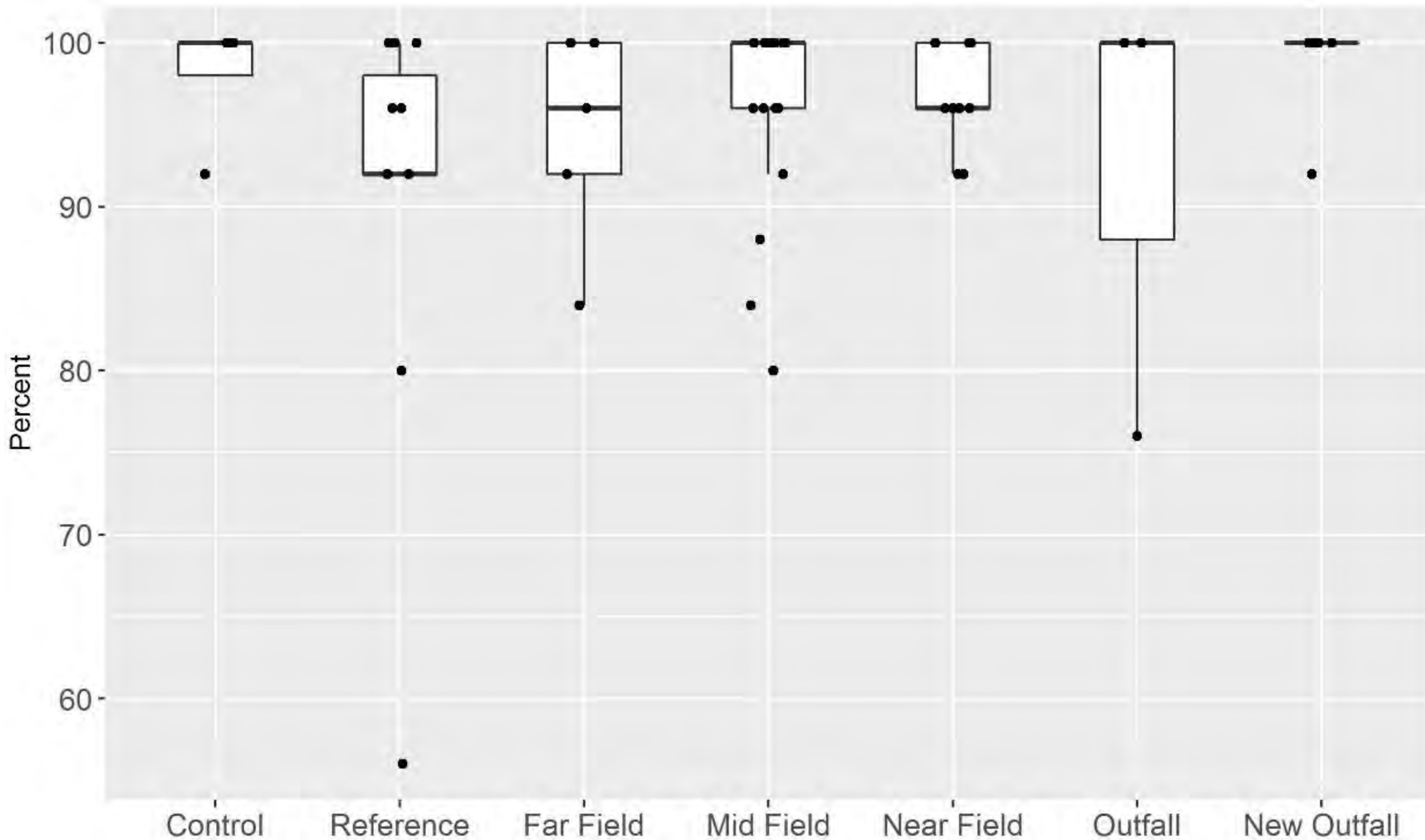

Figure 4.9 2014, 2017 and 2019 20-Day Marine Polychaete Survival

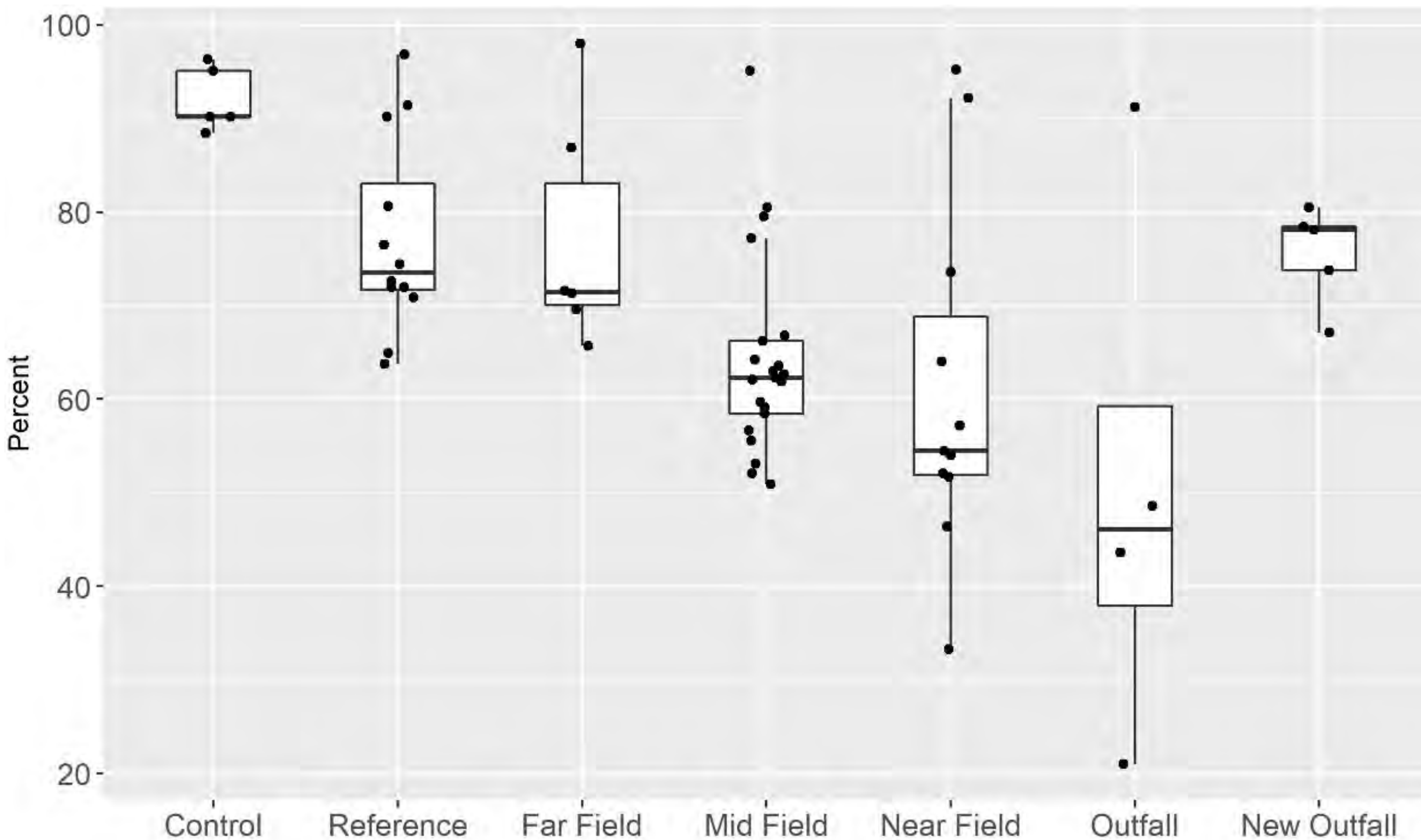

Figure 4.10 2014, 2017 and 2019 48-hour Bivalve Survival

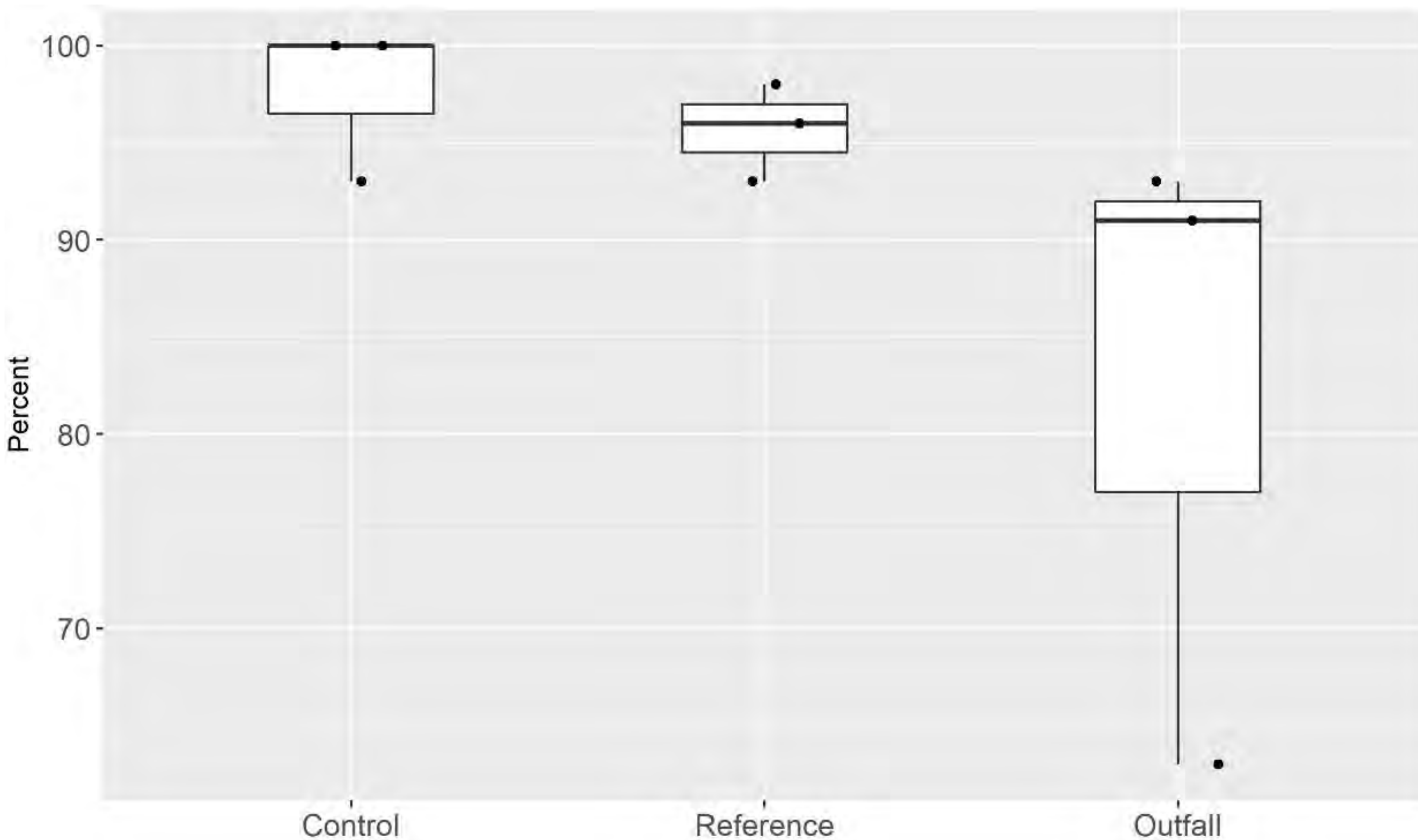

Figure 4.11 2014, 2017 and 2019 10-Day Estuarius Survival

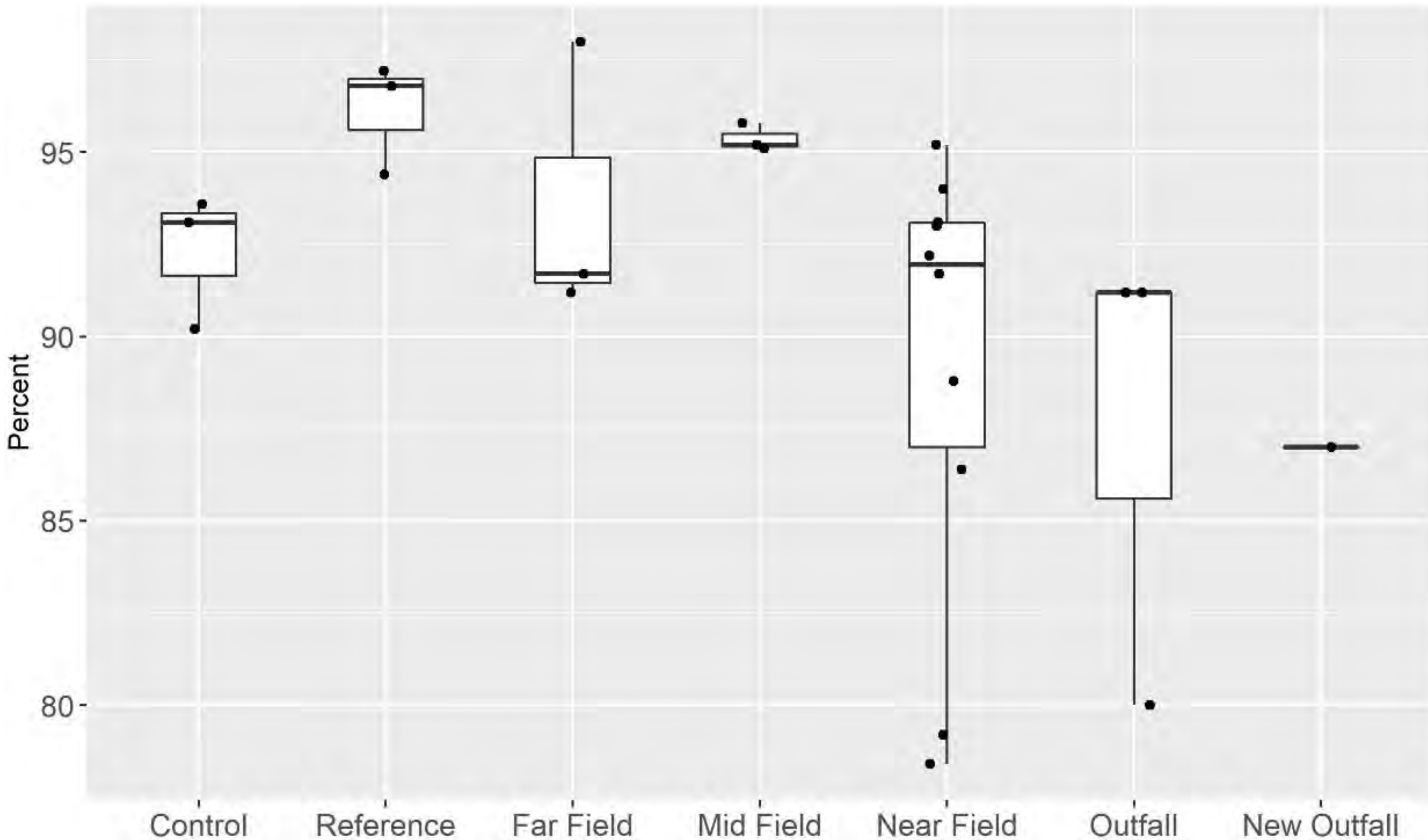

Figure 4.12 2014, 2017 and 2019 56-Day Bivlave Bioaccumulation Survival

4.4 Fish Survey

Fish health was similar in exposure areas (Macaulay and Clover) and background areas (Sidney Island). Comprehensive fish survey results can be found in Hatfield (2019). Female English sole from Sidney Island were larger and older than those from Macaulay, but most assessed indicators of fish health in both male and female English sole (condition, growth rates, and relative gonad sizes) were similar in both areas.

Histopathology studies of gill and liver tissues found no evidence of cancer in fish from either exposure or background areas, but nearly all fish from both areas carried various types of external and internal parasites. Although many fish showed external abnormalities, such as skin reddening or frayed fins or gills, the incidence of this was similar between existing areas. A biomarker of chemical exposure, ethoxyresorufin-O-deethylase (EROD) activity in liver tissues, indicating induction of detoxification enzymes in response to xenobiotic stressors, was slightly greater in fish from Sidney Channel (background area), although this difference was small. Minor seasonal differences between spring and summer were observed in some fish health variables, with English sole collected in summer showing greater relative liver size and overall lower mean age than sole in spring. Key fish health indicators that have the potential to be affected by effluents, such as relative gonad size or condition, were similar between seasons.

Of the over 600 chemical measurements taken in 90 samples of fish or crab tissues (including metals, organometallic compounds, PAH, PBDE, dioxins/furans, pesticides, PPCP, hormones, chlorinated phenolics, alkylphenols, perfluorinated organic compounds, phthalates, and semi-volatile organics), the majority were not consistently measured above analytical detection limits in fish from either exposure or background areas. Chemical groups that were consistently detected in fish or crab tissue include several metals, methyl mercury, PAH, PCB, pesticides (detected in over 50% of samples), and dioxins/furans (detected in 30% of samples). Pharmaceuticals and personal care products were not detected in analyzed tissues.

Of the 256 metals or organic chemicals that were consistently detected, 83 showed significant differences between study areas, with 75 of these exhibiting higher concentrations in exposure-area tissues (exceptions included dioxins/furans and cadmium, with higher concentrations in the background area). Largest differences in exposure-area fish tissues above background-area tissues were found in the pesticide 2,4-DDD, various PBDE and alkylated PAH species, and the organo-arsenic compound arsenobetaine. Almost no significant differences in tissue concentrations were observed between seasons and almost no relationships of concentrations with fish size were observed, although concentrations of several PAH species were lower in larger fish.

Generally, English sole were more likely to have higher tissue concentrations than Irish Lord or Dungeness crabs. For most analyte groups, concentrations were highest in English sole or similar between the sentinel species. This was not necessarily due to the age of the individuals sampled, given Irish Lords were generally older (aged between seven and 26) than English sole (aged between three and 15). Few measured tissue concentrations in any species exceeded relevant, available Canadian Food Inspection Agency (CFIA), Canadian Council of Ministers of the Environment (CCME), Environment and Climate Change Canada (ECCC), or provincial tissue quality guidelines for human or wildlife consumption, with the exception of total arsenic, selenium, and methyl mercury, some PBDE species or groups, PCB TEQ (toxic equivalency), and total DDT (dichlorodiphenyltrichloroethane). Guideline exceedances were similar in background and exposure areas for all of these chemicals, except PCB TEQ and total DDT, where concentrations above relevant guidelines were observed only in the Macaulay exposure area. It is important to note that this study did not examine the potential or likely causes or sources of any elevated tissue concentrations or observed spatial differences. Chemicals with consistently higher concentrations in the exposure area may originate from wastewater, other effluents or other urban and regional sources.

<u>OVERALL ASSESSMENT</u>

The Macaulay seafloor investigations indicate demonstrable impacts of the outfall on sediment and benthic communities. These alterations were consistent with previous years, and conditions around the outfall did not appear to be deteriorating over time. All seafloor results will be included in the upcoming Cycle 1 Plus 2016-2019 overall comprehensive assessment, which will be completed in the fall of 2020.

5.0 ADDITIONAL INVESTIGATIONS

Additional investigations are important elements of the monitoring program and are conducted to address focussed or emerging issues, clarify aspects of the program and provide concurrent data for the assessment of environmental effects. The SETAC review of the program agreed that one-time investigations are appropriate to fill in information gaps, as needed (SETAC, 2006). Studies undertaken as part of the additional investigations component of the monitoring program are usually recommended and reviewed by the advisory group. The advisory group periodically reviews the list of additional investigations based on program results, current scientific issues, and the need to supplement the existing knowledge on environmental effects of the Macaulay and Clover wastewater discharges. Other additional investigations are identified opportunistically through contacts in the local academic and scientific communities.

In 2005, the advisory group initiated a comprehensive review of the list of additional investigations. This review was completed in 2006 and Table 5.1 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 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 advisory group 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, but the implementation of other investigations was put on hold because their priority may change when new treatment is put in place. Following a meeting in early 2013, the advisory group has been tasked with reviewing and reprioritizing the list, as well as adding any additional potential new studies. This review is ongoing.

Investigations that deal with new emerging scientific issues are best undertaken under collaborative research programs. For example, the potential for environmental effects of PPCP has been identified as an emerging environmental concern in the scientific community and was identified as a high priority by the advisory group. 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. These substances are believed to be present in very low concentrations in wastewater discharges. However, routine laboratory analytical techniques for quantifying these substances have only been developed relatively recently and there are few commercial laboratories in Canada that can reliably analyze for these compounds. There are also limited standard methods currently available to assess their potential environmental effects. As such, these substances are best studied under a research program where collaborative resources from academia and government can be used to comprehensively answer environmental questions.

As mentioned previously, studies that were underway in 2006 have since been completed or are continuing, but new investigations from Table 5.1 have not been initiated. However, a number of opportunistic collaborative opportunities have come up in recent years. This section summarizes the additional investigations that were ongoing, completed or initiated in 2019 and early 2020.

Table 5.1 Macaulay and Clover Additional Investigations Prioritization (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 were 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	No dates (study will be re-evaluated in the advisory group additional investigation review)	
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 5.1, cont'd

Category	Investigation	Description and Characteristics	2006 Rating	Status/ Anticipated Initiation Date	Anticipated Completion Date
	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 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 A result summary is presented in Section 4.0 of this 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)	

5.1 Investigations Completed or Underway in 2018 and Early 2019

In 2019 and early 2020, the monitoring program participated in the following additional investigations:

- continued participation in the Vancouver Aquarium's SSAMEx and Pollution Tracker programs
- continuation of a collaborative project with the Vancouver Aquarium and Vancouver Island University 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., the University of Victoria, and Metro Vancouver to develop benthic invertebrate toxicogenomic monitoring tools
- initiation of a collaborative assessment of the uptake and trophic changes in PCBs in the benthic marine food chain around the Macaulay outfall
- participation in a University of Victoria and industry collaborative project to assess COVID-19 presence in regional wastewaters

5.1.1 Participation in the Vancouver Aquarium's SSAMEx and Pollution Tracker Programs

The Vancouver Aquarium'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 Vancouver Aquarium'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.

In 2019, the CRD continued to analyze an expanded contaminant list in Macaulay and Clover wastewaters and sediments that aligns with the Pollution Tracker target analyte list. The 2019 seafloor sampling was also harmonized with SSAMEx methodologies. In 2019, staff and external researchers also used monitoring program and Pollution Tracker data start to characterize and assess behaviour of PCB contaminants throughout the Salish Sea; additional details about these assessments can be found in Section 5.1.5.

5.1.2 Microplastic Analytical Methodology Development

The Vancouver Aquarium 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 results will be received, due to the program shutting down. In addition, the CRD provided the Vancouver Aquarium 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 Vancouver Aquarium has been using these samples to develop analytical methodologies that determine both quantity and type of plastics in wastewater and environmental samples. Results will also be added to the broader Pollution Tracker dataset. When available, results will be presented in a future report.

5.1.3 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 2005-2014 "live" Macaulay community data were pooled to establish average bivalve species composition per site and the 2014 debris samples were picked for "dead" individuals. The 2017 samples are still under assessment.

The preliminary 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 1 km 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 2019 Salish Sea Ecosystem Conference in Vancouver. Findings will also eventually be published in a relevant scientific journal.

5.1.4 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 program was approached by our contract taxonomist (Biologica Environmental Services Ltd.) and a University of Victoria 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 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 (Section 1.0), 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 University of Victoria researcher that developed the Clover mussel tools providing the scientific and technical lead. To date, the monitoring program has provided benthos samples collected during seafloor sampling in 2017 and 2019, 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 a 2017 University of Victoria co-op student for preliminary method development.

In 2018, Biologica and the University of Victoria 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 monitoring program 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. Results, as they come available, will be presented in relevant scientific journals.

5.1.5 Uptake and Trophic Changes of Polychlorinated Biphenyls

Following completion of last year's assessment of PBDE flame retardant contaminants (Burd et al., 2019), a similar assessment was initiated for PCBs, another group of contaminants that are persistent, bioaccumulative, and toxic. Because of these properties, their production has been banned and they are no longer in active use, but legacy sources to the environment exist. Understanding their environmental behaviour is important for determining why environmental concentrations are not decreasing in some locations, as expected. In 2019 and early 2020, staff worked with external researchers to compile monitoring program and Vancouver Aquarium Pollution Tracker data to assess uptake and trophic changes in PCBs in the benthic marine food chain in the Salish Sea relative to sediment physical and geochemical characteristics. Tissue data from the Cycle 1 Macaulay and Clover fish survey was also included. A draft manuscript is expected in late 2020.

5.1.6 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 COVD-19 in wastewater systems, sometimes as much as a week or two before patients started presenting with widespread symptoms in health care settings.

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 plant by a consortium of researchers from the University of Victoria and Pani Energy Inc. (Victoria, BC). The samples will be analyzed using similar methodologies to those used elsewhere on the BC Lower Mainland, across Canada and internationally, and the group plans to solicit samples from other Vancouver Island wastewater treatment plants, as their laboratory capacity scales up. McLoughlin samples will also eventually be provided once the new plant is commissioned, and these samples will be used to assess the effectiveness of various treatment components to reduce COVID concentrations. All results will be used to inform local health authority COVID-19 response plans.

5.1.7 Investigations Planned for 2020

No new additional investigations or studies are planned for 2020, unless novel opportunities arise.

6.0 CONCLUSIONS

The different routine monitoring components of the program and the additional investigations are effective tools to assess the effects of the Macaulay and Clover discharges on the marine receiving environment. The 2019 monitoring program results showed effects on the receiving environment that were limited spatially, relatively stable over time, and generally consistent with previous observations. A more comprehensive assessment of the 2019 seafloor dataset will be undertaken as part of Cycle 1 Plus 2016-2019 overall assessment, which will be completed late 2020.

6.1 Wastewater

Wastewater compliance monitoring results indicate that the quality of the wastewaters from Macaulay and Clover outfalls in 2019 was similar to previous years. Concentrations of all conventional parameters were generally within the expected range for fine-screened wastewater, with the exception of two BOD results at Macaulay and two TSS results at Clover. Federal Wastewater Systems Effluent Regulations limits for TSS and CBOD were not met, but the CRD has received transitional authorizations to discharge non-compliant effluent until December 31, 2020, by which time additional treatment must be installed. These transitional authorizations contain interim unionized ammonia, TSS and CBOD limits, which were met in 2019.

With the exception of bacteriological indicators, the estimated receiving environment concentrations (based on applying predicted minimum initial dilution factors to routine resolution wastewater concentrations) did not exceed applicable provincial and federal water quality guidelines for the protection of human health and aquatic life. Wastewater priority substance monitoring results were also similar to previous years and those substances with applicable guidelines showed receiving environment concentrations (based on the predicted minimum initial dilution) below guidelines, with most below guidelines in wastewater even before discharge to the marine environment.

Wastewaters from both outfalls were regularly acutely lethal to fish and sometimes to invertebrates, and chronic toxicity was observed for both fish and invertebrates. However, the effects concentrations observed in the acute and chronic tests were generally well above the predicted wastewater concentrations at the edge of the initial dilution zone of both outfalls. Since measured wastewater parameters were not predicted to exceed guidelines in the receiving environment, and toxicity effects levels were above the wastewater concentrations predicted in the marine environment, there is likely low potential for adverse effects to organisms in the environment around the outfalls, as a result of the wastewater discharge.

There are many newer and emerging substances that the CRD may or may not yet monitor and for which guidelines have yet to be developed. The potential influence of these chemicals on the environment is relatively unknown. The CRD attempts to assess risk of these newer chemicals through additional investigations. Such investigations are currently being identified or, for those in Table 5.1, will be reprioritized by the advisory group.

The CRD and participating municipalities are currently building a system which will treat core area wastewaters (Macaulay and Clover) at McLoughlin by December 31, 2020. Overall, the wastewater toxicity test failures will likely continue until the installation of further treatment for the core area wastewaters. The bacteriological guideline exceedances will continue even after the installation of treatment, but the magnitude and duration of the exceedances will decrease substantially overall. At this point in time, disinfection treatment processes will not be part of the new McLoughlin plant. Such processes would only eliminate bacteriological guideline exceedances during dry weather flows, as it is not feasible to disinfect all wet weather flows or upstream wet weather overflows. 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. Reduction of wet weather discharges will be advanced through the ongoing implementation of CRD and municipal inflow and infiltration reduction programs.

6.2 Surface Water

Overall, the 2019 surface fecal coliform and enterococci results indicate that the outfall plumes were predominantly trapped below the ocean surface. The potential for human exposure to high fecal coliform and enterococci concentrations around the outfalls was moderate, as fecal coliform and enterococci surface water geometric mean results were above thresholds used to assess risk to human health. These exceedances occurred mostly during the autumn and winter sampling periods when surfacing events are more likely to occur.

The 2019 water column monitoring (at depths of 5 m or greater) confirmed that bacteriological indicators regularly exceeded both provincial and federal guidelines at the edge of the initial dilution zone around each outfall. However, these results were expected, based on the wastewater concentrations of the bacteriological indicators (in the millions of bacteria per 100 mL) and the intended design of the outfall diffusers. 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 hydrodynamic modelling. The seasonality of the high bacterial counts can be attributed to higher wastewater flows in winter, coupled with the oceanography of this particular area during the winter months (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 less frequent in summer than in winter.

These bacteriological guideline exceedances are expected to continue even after the installation of additional wastewater treatment for these facilities, as disinfection processes are not included as part of the new McLoughlin plant. However, exceedances will be much reduced in magnitude and duration overall, as treated McLoughlin effluent bacterial levels will be an order of magnitude lower than current Macaulay and Clover concentrations. There will also be continued exceedances around the Macaulay and Clover outfalls, as they will be transitioned to wet weather overflow points when McLoughlin treatment capacity is reached. Disinfection is not feasible for Macaulay and Clover, though they are only predicted to overflow infrequently until fulsome implementation of CRD and municipal inflow and infiltration reduction programs.

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

While the plumes are predominantly trapped below the surface and there is, therefore, moderate risk to human health, there is higher potential risk to organisms that live in the water column. The 2019 water column monitoring results for metals were all at background levels (e.g., boron) indicating that risk to organisms is also likely low. However, the monitoring program is lacking assessments of organisms living in the water column, as these organisms are very challenging to monitor. They potentially move in and out of the plume and, therefore, potential effects cannot be easily attributed to the outfall itself. Such investigations were, therefore, considered lower priority when staff worked with the ministry to review and revise the monitoring program. The CRD committed to conducting a finfish survey to try to assess potential impacts on these organisms. The Cycle 1 finfish study was originally planned for 2015, but was delayed to 2018. Results from the finfish survey are provided below.

Overall, the bacteriological monitoring results indicated that the surface water effects of the outfalls were limited. The cores of the plumes were predominantly trapped at depth for most of the year and substantially diluted wastewater only occasionally reached the surface.

6.3 Seafloor Monitoring

Seafloor monitoring is required every two to three years as part of the monitoring program design. In 2019, seafloor monitoring was conducted, including benthic invertebrate taxonomy and sediment toxicity/bioaccumulation and chemistry at stations adjacent to the Macaulay outfall and associated reference stations. In addition, sediment chemistry and benthic invertebrate taxonomy was conducted at McLoughlin outfall stations, as part of the Environmental Impact Study for the new McLoughlin plant.

Overall, the 2019 sediment chemistry results indicated that 5% of the detected results exceeded at least one sediment quality guideline, which is higher than has been reported in recent years, and is likely a result of several non-outfall-related factors, including not yet having completed a QA review of data outliers, undertaking a more fulsome comparison of high-resolution parameters to guidelines, and using new and more conservative provincial guidelines published in 2017 and 2018, respectively. Typical guideline exceedances in 2019 included metals, PAHs, PCBs and organochlorine pesticides. The new McLoughlin outfall stations' sediment chemistry results were qualitatively similar to the Macaulay stations.

Results of the fish and crab study indicated that fish health was similar in exposure areas (Macaulay and Clover) and background areas (Sidney Island). Female English sole from Sidney Island were larger and older than those from Macaulay, but most assessed indicators of fish health in both male and female English sole (condition, growth rates, and relative gonad sizes) were similar in both areas.

The 2019 sediment toxicity and chemistry and benthic invertebrate taxonomy results have not yet been fulsomely analyzed and interpreted, but are being incorporated into the Cycle 1 Plus 2016-2019 overall comprehensive assessment, which will be completed late 2020.

6.4 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 two Vancouver Aquarium initiatives included ensuring the monitoring program's samples were collected using harmonized methodologies, thereby benefiting 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. Access to such datasets was integral during the preparation of an upcoming journal manuscript that will characterize trophic changes of PCBs in CRD biota samples. By providing various types of samples to the Vancouver Aquarium, the monitoring program has helped facilitate the development of new analytical methodologies for microplastics in wastewater and environmental samples. 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. By providing wastewater samples to UVic for COVID analyses, it is hoped that local health authorities will receive advanced notice of local COVID outbreaks prior to widespread increases in patient hospitalization.

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APPENDIX A

GUIDANCE MANUAL FOR THE ASSESSMENT OF WMEP ANALYTICAL DATA

21 July 2017

WASTEWATER AND MARINE ENVIRONMENT PROGRAMS

Updated Guidance Manual for Assessment and Analysis of WMEP Data

Submitted to:
Capital Regional District
Environmental Protection
625 Fisgard Street
Victoria, BC V8W 1R7

Attention: Mr. Chris Lowe

REPORT

Report Number: 1666988-001-R-RevA

Distribution:

1 Copy - Capital Regional District
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List of Acronyms

CRD	Capital Regional District
CRM	certified reference materials
DL	detection limit
DQO	data quality objective
EQG	environmental quality guideline
J	estimated value data qualifier
MDL	method detection limit
ND	Non-detect
NDR	lab qualifier indicating that a peak was detected, but did not meet quantification criteria; therefore, the result reported represents the estimated maximum possible concentration
QA/QC	quality assurance/quality control
R	rejected value data qualifier
RSD	relative standard deviation
SD	standard deviation
TEL	threshold effects level
TEQ	toxic equivalency
U	undetected value data qualifier
UN	undetected and uncertain value data qualifier
WMEP	Wastewater and Marine Environment Program

1.0 INTRODUCTION

This report provides an update to the Guidance Manual for Assessment and Analysis of Wastewater and Marine Environment Program (WMEP) Data (Appendix A of Golder 2007). The process for the assessment and analysis of WMEP data includes three main steps:

- **Step 1—Assess data quality and attributes**:
  - Screen data for suspect values
  - Assess laboratory compliance with requirements
  - Re-analyze suspect data if required
  - Assess re-analyzed data
  - Assign data qualifiers
  - Qualify associated data
- **Step 2—Prepare data for analysis**:
  - Omit or adjust qualified data where appropriate
  - Identify outliers
  - Condense replicates and re-analyses
- **Step 3—Conduct data analyses**:
  - Calculate detection frequency
  - Select appropriate statistical methods
  - Calculate summary statistics
  - Conduct trend analyses
  - Screen against benchmarks

Detailed guidance for completing each step in this process is presented in the following sections.

2.0 STEP 1: ASSESS DATA QUALITY AND ATTRIBUTES

The WMEP quality assurance/quality control (QA/QC) program involves screening data against the following three program-specific DQOs:

- **Precision**—Data precision, reflecting the degree of repeatability of measurements, is assessed with respect to the variability among laboratory and field replicate samples. Relative standard deviation (RSD) of replicate samples is generally used as the measurement of precision.
- **Bias**—Data bias, reflecting the consistent tendency, if any, of a measured value to deviate positively or negatively from a true value, is assessed with respect to the recovery of analytes in certified reference materials (CRMs), matrix spike samples, and internal surrogate standards. Bias is measured as percent recovery of analytes in CRMs and spiked samples.
- **Representativeness**—Data representativeness, reflecting how well data derived from a sampling program represent the actual state of the environment under study, is assessed with respect to the ratio of analyte concentrations in laboratory method blanks to associated samples.

In addition, the QA/QC program assesses the following elements:

- **Completeness**—Reflects how closely the actual numbers and types of acquired sample data match those proposed or expected for a sampling and analysis program is assessed for each sampling event (all matrices) with respect to completeness of analyses and analytical method and reporting requirements. Additional sampling volume is often archived for possible re-analysis if anomalous results are observed.
- **Comparability**—Consistency of sampling and analytical methods employed across repeated sampling events, and consistent QA/QC methods.

2.1 Screening Laboratory Results for Suspect Values

Upon receipt of analytical results, data should be screened to determine if they fall within the range of expected results. Extreme values at either tail of the sampling distribution may be legitimate, but such values should be explored to determine whether there is evidence of errors or analytical artefacts. Data that represent a substantial deviation from expected values may warrant a laboratory investigation of the raw analytical data or a re-analysis of archived sample volume. Any required re-analysis must be requested promptly, to minimize losses of labile contaminants and to avoid exceeding sample holding times.

The range of expected results for a given parameter should be based on a consideration of the distribution of values previously obtained for that parameter in the WMEP, and may also include a consideration of the distribution of values previously obtained for a particular site or group of sites. Golder (2008) presents a control-chart approach to deriving upper and lower warning and control limits for historical WMEP data. Warning limits are derived based on the 5th and 90th percentiles and control limits are derived based on the 0.5th and 99.5th percentiles. Control and warning limits are presented in Golder (2008) for each analyte in each applicable matrix, including sediment, mussel tissue, and wastewater, and limits are presented separately for various groups of stations (i.e., reference, near-field, far-field). The initial warning and control limits in Golder (2008) were based on data from 1996 to 2006, and should be updated periodically (e.g., every 3 years) to reflect the most current distribution of values. The recommended methodology for use of control limits in identifying extreme values is discussed in Section 2.3.

In conjunction with the use of control charts or other quantitative tools to identify suspect values, it is helpful to use graphical tools to evaluate the potential presence of suspect data. Scatterplots, boxplots, time series, and other graphical tools can be used effectively to inspect data sets for questionable findings, particularly where the frequency of data outside warning limits is high and/or where a potential confounding factor is present (e.g., change in analytical methods, change in sampling handling, etc.).

2.2 Assessment of Laboratory Compliance with Contract Requirements

Assessing whether the laboratory has complied with contract requirements entails answering the following questions:

- Were all submitted samples analyzed for all requested compounds?
- Did method detection limits (MDLs) meet or exceed quoted requirements, and if not, was an explanation provided?
- Were QA/QC samples analyzed with the required frequency (i.e., one reference material or matrix spike, and one method blank, per 10% of submitted samples)?
- Were QA/QC samples acceptable (e.g., matrix spikes ≥ 5×MDL and ≥ 2× sample concentrations; method blanks passed DQOs for surrogate recovery)?
- Were RSD and percent recovery formulae correct?

The investigator should also read the file documentation associated with the laboratory report, particularly in terms of annotations that indicate potential concerns with the reliability or uncertainty of data. Laboratories often document modifications to the sample processing (e.g., dilution of sample due to high concentrations, or raised detection limits associated with low sample volume or moisture content) or interpretation (e.g., documentation of matrix interference issues). This type of documentation provides important information regarding the reliability and consistency of the underlying data.

2.3 Reanalyze Samples if Required

When data fall substantially outside of the historical ranges (i.e., beyond control limits) or exhibit severe failure of DQOs (e.g., high variability of laboratory replicates), the sample should be re-analyzed if it is within analytical holding times and:

- The missing information is necessary to achieve the goals of the WMEP (i.e., key goals of the WMEP cannot be achieved with the existing data).

- There is a reasonable expectation that the re-analysis will produce higher-quality results (i.e., whatever caused the failed DQOs in the original analysis will not also affect re-analyses).
- The re-analysis can be conducted with a reasonable cost and expenditure of effort (e.g., re-sampling will not be required).

It is recommended that control limits be used as the basis for requesting re-analysis, as only one in 100 samples would be expected to fall beyond control limits due to chance alone. In contrast, one in 20 samples would be expected to fall beyond warning limits due to chance alone. A higher than one in 20 (5%) frequency of exceedance of warning limits may indicate a departure from historical conditions, but exceedance of warning limits for any given sample is not sufficient evidence to consider the value suspect.

As discussed in Section 2.2, an indication of an unusual pattern or bias in the underlying data (as observed in graphical summaries of the data) may warrant reanalysis even where no specific values exceed the control limits. However, such reanalysis should be considered on a case-specific basis, and with engagement of the CRD project manager, rather than through an automated and prescribed process.

Re-analysis due to high variability of field replicates is not recommended. Field replicate variability reflects both analytical variability (which is also reflected in laboratory replicates) and matrix heterogeneity (which is unlikely to be reduced by re-analysis). If laboratory replicate variability meets DQOs, high field replicate variability should not prompt re-analysis in an effort to reduce RSD. Re-analysis of field replicates might be undertaken for other purposes (e.g., to investigate the magnitude of matrix heterogeneity relative to analytical variability).

2.4 Assess Re-analyzed Data

When re-analysis is requested, the re-analyzed results should be compared to the original data and assessed using the guidance presented below and summarized in Tables 1 and 2. The appropriate decision rules for assessment of re-analyzed data depend on the reason for the re-analysis, as follows:

- **Original data were outside of control limits**—The re-analyzed result should be compared to the original result (Table 1), and the RSD should be calculated. If the RSD meets the applicable DQO for precision (Table 3), evidence exists to support the original result and both values should be retained for subsequent analyses. If the new result varies substantially from the original results (i.e., RSD exceeds precision DQO for severe failure), the following rules apply:
  - If the new result is within the control limits, the original result is rejected and the re-analyzed result is retained for subsequent analyses.
  - If the new result is also outside of the control limits, both results are rejected. This scenario would include cases where the original and new result were outside opposite control limits (i.e., one was lower than the lower control limit and the other higher than the upper control limit) and where both results were outside the same control limit, but sufficiently far apart that uncertainty in where the 'true' value lies remains unacceptably large.

- If the new result varies moderately from the original result (i.e., the RSD exceeds the precision DQO for marginal failure but is below the DQO for severe failure), both results are retained and assigned a J flag (detected values) or a UN flag (non-detected values).

- **Replicates failed precision DQOs**—When re-analysis of a replicated sample is requested, the new result should be compared to the original results (Table 2), and the original replicate that deviates farthest from the re-analyzed result should be discarded. A new RSD should be calculated using the re-analyzed result and the two retained original results (i.e., n = 3 replicates, as in the original sample)[1]. The new RSD should then be used to assess the precision of this and all associated samples (typically the batch in which the replicate was analyzed), as follows:
  - If the new RSD meets the precision DQO (Table 3), all associated samples (Table 4) should be assigned a marginal precision DQO failure, to acknowledge the increased uncertainty in the results of the original analysis.
  - If the new RSD exhibits a marginal failure of the precision DQO, all associated samples should be assigned a marginal precision DQO failure.
  - If the new RSD exhibits a severe failure of the precision DQO, all associated samples should be assigned a severe precision DQO failure.

2.5 Assigning Data Qualifiers

Proposed criteria for assessing the three DQOs of precision, bias, and representativeness are provided in Table 3. The methods for assessing the three DQOs are:

- **Precision**—Calculate the RSD for each parameter of the lab and/or field replicates and compare to RSD-based criteria in Table 3 to ascertain whether the data pass or fail the DQO criteria for precision. Precision is reduced for measurements near the DL, and therefore relaxed DQOs are appropriate. If any of the replicate values are <5× DL, then also calculate standard deviation (SD) divided by average DL and compare to the SD-based criteria in Table 3. For those parameters with replicate values <5× DL, the severity of the DQO failure is determined as the less stringent of the RSD-based and SD-based criteria. Failure of precision DQOs in field replicates should not result in identification as a severe failure.

- **Bias**—For each parameter in a batch, compare percent recoveries of all QA/QC spikes and reference materials (e.g., matrix spike, CRM, spiked blank) to the bias-based DQO criteria provided in Table 3. When more than one spike or reference material is analyzed in a batch for a given parameter, the "final" severity of the failure is assigned based on the most extreme observed failure.

- **Representativeness**—The method for assessing representativeness differs between low-resolution and high-resolution analysis, because the high-resolution analyses generally have method blank limits that are higher than the sample-specific MDL. Thus, detected concentrations can occur in high-resolution analysis of

[1] In cases where only two replicates are analyzed (*i.e.*, duplicates), the same procedure applies, and a new RSD is recalculated with the re-analyzed result and the original result closest to the re-analyzed results (*i.e.*, *n*=2).

method blanks that are below method blank limits and therefore are considered acceptable according to laboratory DQOs. These method blank limits were incorporated into the representativeness DQO criteria for high-resolution analytes in Table 3. For each parameter in a batch, the method blank concentration is compared to minimum and median concentrations of the associated samples to ascertain whether the data pass or fail the DQO criteria for representativeness. Minimum and median concentrations do not consider values flagged by the lab as "NDR"[2].

Table 5 presents a set of decision criteria for assigning data qualifiers to WMEP data. Decision points are based on the following information:

- *Whether the result is above or below the detection limit (DL)*—Some decision rules are pertinent only to detected values. For example, positive bias due to unacceptable surrogate recoveries or blank contamination may warrant qualification or rejection of detected values, but would have no effect on the assessment of non-detects, because the non-detect result occurred in spite of positive bias.
- *Whether the data pass, exhibit a marginal failure, or exhibit a severe failure of each of the three types of DQO (i.e., precision, accuracy and representativeness)*—Criteria for making these discriminations are presented in Table 3. DQO failures of increasing severity and/or frequency lead to increased chance of rejection using the QA framework.
- *Direction of bias*—For data that fail a bias-based DQO (i.e., where percent recovery of surrogates, laboratory control samples or matrix spikes is unacceptable), decision rules depend on whether the direction of observed bias is negative (i.e., percent recovery below lower limit), positive (i.e., percent recovery above upper limit) or inconsistent (i.e., one or more recoveries exhibit negative bias whereas one or more others exhibit positive bias).

Guidance for the assessment of data with respect to precision, bias or representativeness alone (i.e., considering only one type of DQO at a time) was adapted primarily from USACE (2005) and US EPA (1999, 2001, 2004) and is presented in Figures 1–3 of Golder (2007). This guidance was then synthesized to produce a single set of decision criteria for assigning data qualifiers to WMEP data based on the following rationale:

- A single severe DQO failure may warrant data rejection:
  - A severe failure of precision DQOs (replicate RSD) should result in data rejection. Unacceptably high imprecision in measurements, with no information about the direction of bias, renders data unusable.
  - A severe failure of representativeness DQOs (blank contamination) should result in data rejection only for detected values. Non-detected values represent upper bound thresholds to the plausible range of sample concentrations, and lack of detection in spite of blank contamination provides additional evidence that the substance is unlikely to be present at concentrations at or above the DL. In cases where the

[2] Lab definition of an NDR flag: peak detected, but did not meet quantification criteria, result reported represents the estimated maximum possible concentration

DL is relatively high (e.g., near or exceeding environmental quality guidelines [EQGs], or when an elevated DL was applied by the laboratory to account for QA/QC results), non-detect replacement (Section 4.2.1) should be employed with caution.

- A severe failure of bias-based DQOs (standard recovery) should result in data rejection for detected values and for non-detects when bias is negative. The implications of severe positive bias for non-detects are the same as those discussed above for representativeness.

- Combinations of severe and marginal DQO failures may warrant data rejection. That is, the various sources of uncertainty in data quality are considered to be compounded when multiple DQO failures are observed:
  - A marginal failure of representativeness-based DQOs (i.e., marginal blank contamination), combined with a severe failure of bias DQOs, should result in data rejection for all values when bias is negative, but for detected values only when bias is positive.
  - A marginal failure of precision-based DQOs, combined with a severe failure of bias-based DQOs, should result in data rejection. (Note that a severe failure of representativeness-based DQOs alone warrants rejection of detected values and has no effect on the assessment of non-detects.)
  - A marginal failure of bias-based DQOs, combined with a severe failure of precision-based DQOs, should result in data rejection (because a severe failure of precision-based DQOs alone warrants rejection). A marginal failure of bias-based DQOs, combined with a severe failure of representativeness-based DQOs, should result in data rejection for detected values only.

- Marginal DQO failures for all three DQO types (i.e., precision, bias and representativeness) should warrant data rejection for detected values. That is, the various sources of uncertainty in data quality are considered to be compounded when multiple DQO failures are observed. Failure of representativeness-based DQOs has no effect on the assessment of non-detects.

The decision criteria summarized in Table 5 provide the basis for determining if each result should be accepted, qualified, or rejected. This information determines how the data can be used in data summaries, statistical analyses, and comparisons to EQGs.

2.6 Qualify Associated Data

When individual data are qualified due to failure of one or more DQOs, the qualifications may extend beyond the individual datum, such that additional samples and/or additional analytes may be affected. This occurs because analyses are typically conducted in batches (samples and/or analytes) that are presumed to have some commonality in data quality attributes. In general, QA/QC samples such as blanks, CRMs, matrix spikes, and laboratory replicates are intended to reflect data quality for a particular analyte in a batch of samples processed/analyzed at the same time, and therefore DQO failures for these QA/QC samples apply to the analyte in all samples in the same batch. Table 4 specifies which additional samples and analytes should receive data qualifiers.

The determination of which additional analytes in the batch should receive data qualifiers must be based on a consideration of whether the failure is likely analyte-specific, or may be a systematic problem that affects the entire analyte group. For example, a failure of DQOs for matrix spike recoveries may indicate matrix interference, and the analytical laboratory may be able to provide guidance as to which other analytes are likely to be affected. If only a single analyte in an analyte group exhibits a DQO failure, and the analytical laboratory does not identify additional analytes that are likely to be affected, then only that single analyte should be qualified. For those parameter groups that yield total summed concentrations of individual parameters in the group (e.g., polycyclic aromatic hydrocarbons and polychlorinated biphenyls) or a toxic equivalency (TEQ) (e.g., dioxins and furans), the total concentration or TEQ may require a data qualifier based on a consideration of the flags on individual parameters. The qualifiers on individual parameters may sufficiently minor that the total concentration or TEQ may not need a qualifier. Alternatively, the qualifiers on individual parameters may be significantly consequential that the total concentration should be qualified as biased, or even rejected. Considerations for qualifying the total parameter group concentration or TEQ could include the percentage of individual parameters that are flagged with data qualifiers, the relative contribution of flagged individual parameters to the total concentration, and the environmental consequence of the parameters (i.e., high toxicity potential).

3.0 STEP 2: PREPARE DATA FOR ANALYSIS

3.1 Omit or Adjust Qualified Data Where Appropriate

The general procedure is to retain all unqualified data, remove data points with unacceptable quality (R-flagged data), and adjust and/or annotate data of marginal quality (J-flagged data). Data that have failed one or more DQOs and therefore have been assigned data qualifiers should be treated as follows:

- Rejected (R-flagged) data should not be entered in the database and should be omitted from all analyses (this is the approach taken by other agencies; e.g., US EPA 1989, 1998b, PSEP 1997, Environment Canada 2002, 2005; see section 3.5).
- If bias is well characterized, J-flagged data should be bias-corrected before conducting data summaries and statistical analyses (USACE 2005). If bias is suspected but not well characterized, an investigation may be warranted to resolve uncertainty for future programs. For example, a change in analytical methods could result in variance among sampling events before and after the change. This would require an investigation to ascertain whether the data need to be adjusted before conducting data summaries and statistical analyses.
- When the percentage of non-detects (U-flagged and UN-flagged data) in a dataset is low, non-detects should be replaced with one-half of the detection limit (US EPA 2000, Irwin 2004). US EPA (2000) recommends non-detect replacement only if the frequency of non-detects is ≤ 15%. However, on a case-specific basis, it may be acceptable to replace higher frequency non-detects (e.g., up to 50% non-detection frequency).

Although use of one-half of the detection limit to replace non-detected values will be satisfactory for most projects, and is the recommended default procedure, there are some situations where more advanced methods are recommended. These situations typically include a combination of the following conditions:

- The proportion of non-detected data is moderate (determination based on professional judgement, but generally in the range of 10–50%.

- The consequences of non-detect replacement method would be consequential in terms of environmental significance. For example, bounding analyses (i.e., replacement using zeroes versus replacement using full detection limits) indicate large differences in degree of environmental hazard, as indicated by comparisons to environmental quality benchmarks or other thresholds for significance.
- The data are intended for use in a spatial or temporal trend assessment for which relatively small changes in central tendency estimates (i.e., approximately 20%) may be of interest.

Helsel (2012) provides a summary of automated methods for dealing with these situations. Ultimately, the decision to apply a higher threshold for non-detect frequency in the ND replacement process should be based on a comparison of the increase in uncertainty from ND replacement versus the benefits of simplicity and consistency of analysis. The decision should also consider the degree of consistency of the parameter detection limits (over space and time) and the consequences for resulting statistical analyses. For example, if all stations within a group (e.g., far-field stations) exhibit non-detect results with identical detection limits, there will be zero intra-group variance and therefore no ability to apply parametric statistics. Conversely, if all stations within a group exhibit non-detect results but with different (sample-specific) detection limits, there will be intra-group variance related entirely to analytical methods, such that tests of statistical significance may not reflect the underlying hypotheses of interest. Changes in detection limits over time are of particular interest for trend analyses; high frequencies of ND values combined with changes in laboratory precision can yield spurious statistical trends. The investigator should carefully consider the purpose of the quantitative analyses prior to applying default substitution methods. Where analyses are sensitive to DL replacement technique, a recommended approach is to conduct a bounding analysis (e.g., with zero and full DL as substitution assumptions). Investigators may explore more advanced methods that take into consideration the data distribution of censored data (e.g., maximum likelihood estimators), but such should only be contemplated where bounding analyses suggest that advanced techniques are warranted (see Section 4.2).

3.2 Identify Outliers

Outliers are measured values that are extremely large or small relative to the rest of the data, and that are therefore suspected of misrepresenting the population from which they were collected (US EPA 2000). The general principles for outlier treatment are analogous to DQO processing: retain all acceptable data; correct or eliminate data known to be unrepresentative; and document questionable values that cannot be ascribed to the above two categories. The general guidance presented below for identifying and dealing with outliers when calculating summary statistics is adapted from US EPA (2000):

- Potential outliers can often be efficiently identified by using graphical representations such as box and whisker plots, ranked data plots, normal probability plots (quantile-quantile plots), temporal plots (or control charts) or bivariate scatterplots. Potential outliers are flagged for additional QA/QC review (e.g., comparison of the values with raw laboratory reports to ensure they are correct), and if necessary and feasible re-analysis of archived sample volume may be warranted. Graphical plots are recommended even where formal statistical metrics are applied; graphical methods are effective in the identification of coding/transcription errors (e.g., unit conversion errors), preliminary identification of extreme values that require additional analysis, and inspecting data sets for questionable findings (e.g., due to a change in analytical method).

- Statistical tests can be used to determine if potential outliers are true statistical outliers. These include Dixon's Extreme Value test, the Discordance test, Rosner's test, or Walsh's test. Selection of a specific test depends largely on sample size and normality of data.
- Although a statistical test may indicate that a particular value is a statistical outlier (according to a formal test of statistical significance with fixed probability of Type I error), it does not necessarily provide justification for removal of a value from the data set. Outliers may be erroneous values or they may be accurate measurements that occur by chance in the 'tails' of the distribution of values for a statistical population.
- An outlier should only be discarded if there is a good scientific reason to do so. Such a decision may be based on the scientific plausibility of the value in question (e.g., negative water temperature, substance concentration greater than 10^6 parts per million, tissue moisture or lipid content below natural tolerance ranges for organisms), or on the degree to which retaining the anomalous value would violate statistical assumptions. Both scientific and statistical assessments entail some degree of professional judgement; the goals of objective and comprehensive analysis may conflict with strict conformance to statistical assumptions.
- If an outlier can be identified as an erroneous value, it should be corrected (e.g., if a transcription or conversion error) or rejected (e.g., if collected while the analytical instrument was malfunctioning).
- If scientific reasoning cannot explain the outlier, then it should not be excluded from the data analysis (Section 4.4 in US EPA 2000). However, the leverage of the outlier (i.e., the degree to which this single value influences summary statistics and other calculations) should be assessed. Where outliers have excessive leverage or cause violations of statistical assumptions, data analyses should be conducted with and without the statistical outlier(s) included, to assess the sensitivity of the result on the inclusion/exclusion of these values. Alternatively, a data analysis method that does not rely on adherence to the statistical assumptions (e.g., non-parametric or graphical methods) may be applied.
- Investigators should consider whether an outlier may represent a legitimate value from a different statistical population. Where possible and appropriate, normalization of data should be considered to remove underlying sources of variation that are not related to the hypothesis of interest. For example, fluctuations in organic carbon or lipid content can result in substantial differences in concentration-based measurements for hydrophobic substances. Normalization using carbon, lipid, particle-size, or other factors can aid in the discrimination of erroneous values from field variability.
- If outliers are common, 'trimming' procedures or statistical approaches that are relatively robust to outliers may be adopted. Alternatively, recurring high outliers may indicate a statistical population with a long right tail (e.g., the lognormal distribution), and a data transformation (in this case, log transformation) may be appropriate. Investigators should carefully consider the intended use of data prior to application of trimming procedures; for example, trimming of "hot spots" of localized contamination may be inappropriate for assessing weighted-average exposures to organisms that integrate their exposures over large areas.
- The process of identifying and evaluating outliers should always be documented for future review.

3.3 Condense Replicates and Reanalyzed Samples

When multiple values are available for a single sample, these values should be condensed into a single value prior to analysis. The objective is to best apply the available information to estimate a single value (sample mean) that represents the parameter of interest. The appropriate method for condensing multiple values will depend on whether values were above DL and whether any of the values failed DQOs.

3.3.1 Replicates

The most appropriate way to estimate a sample mean from replicate measurements depends on how many of the replicates produced values above DL, and whether any failed one or more DQOs. Confidence is reduced in replicates that fail replicate-specific DQOs (e.g., surrogate recovery).

- If all replicates are above the DL and meet DQOs, the sample mean concentration should be calculated as the arithmetic mean (average) of the replicate measurements.
- If one or two of the replicates are non-detected but meet DQOs, a sample-mean should be estimated by replacing non-detect(s) with one-half of the sample DL.
- If all replicates are non-detected, the sample-mean is considered to be non-detected, and the value set to the greatest individual detection limit reported for the replicates (U flag). If the sample failed certain DQOs, this may warrant a UN flag.
- If any replicate exhibits severe failures of sample specific DQOs (i.e., surrogate recoveries), that replicate should be excluded from the calculation of the sample mean.

3.3.2 Reanalyzed Samples

As discussed in Section 2.4, determination of how re-analyses are applied requires: (1) comparison of the measurements obtained from the original analysis and the re-analysis; and (2) comparison of both measurements to the expected (historical) range of values. In general, if the original data are confirmed by the results of re-analysis, the values should be averaged, provided that both analyses met the applicable DQOs. If the results of re-analysis deviate substantially from the original data, the decision rules described in Section 2.4 should be used to determine which, if any, of the data should be retained for analysis.

4.0 STEP 3: CONDUCT DATA ANALYSIS

4.1 Calculate Detection Frequency

Detection frequency (i.e., the proportion of results that are quantified above DL) helps to determine which statistical analyses may appropriately be employed. The detection frequency will inform the decision on non-detect substitution method.

Depending on the purpose of the investigation, it may be informative to calculate detection frequencies using subsets of data (e.g., influent versus effluent, near-field versus far-field versus reference, grab sample versus composite sample, sampling year). These comparisons can assist in the identification of analytical factors that may affect the testing of statistical hypotheses.

4.2 Select Appropriate Descriptive Statistics

4.2.1 Detection Frequency Considerations

The degree of censoring in a data set determines the appropriate summary statistical calculations that may be conducted with those data. Different summary statistical calculations should be used for substances that are detected with ≥ 50% frequency versus those that are detected with < 50% frequency.

Detection Frequency ≥ 50%—When detection frequency is ≥ 50%, the mean and standard deviation can be estimated using normal methods (with non-detect replacement), trimmed mean, Cohen's method, Aitchison's method, or Winsorizing. These parameters can then be used in the normal manner to estimate a 95% confidence interval. US EPA (2000, Section 4.7) provides detailed guidance on when and how to conduct these procedures. Briefly:

- Non-detect replacement involves replacing all ND results with a value (typically one-half of the DL) and then calculating summary statistics in the normal manner (Section 3.1). US EPA (2000) recommends employing non-detect replacement only if the frequency of non-detects is ≤ 15%. However, on a case-specific basis, it may be acceptable to replace higher frequency non-detects (e.g., up to 50% non-detection frequency). Bounding analysis should also be considered; this involves calculating two sets of summary statistics, e.g., once replacing ND results with zero and once with the full DL, with true values considered to fall between these bounding values.
- Trimming involves symmetrically discarding data in the tails of the data set to eliminate censored values. If data are approximately symmetrical, a 25% trimmed mean (i.e., the mean of the central 50% of the data, also known as the mid-mean) is a good estimator of the population mean. If data are skewed and cannot be transformed to approximate symmetry, a 15% trimmed mean (i.e., the mean of the central 70% of the data) may be a good estimator of the population mean. It is also possible to trim only to replace non-detects (e.g., if there are 5% non-detects, use a 5% trimmed mean). It is appropriate to calculate a mean from trimmed data, but it is not appropriate to calculate a standard deviation.
- Winsorizing replaces data in the tails of a data set with the next most extreme value, such that all censored left-tail values are replaced with the DL, and an equal number of right tail values are replaced with the value that is the 'mirror image' to the DL in the data set. For example, if the data set is 5% censored (the lowest 5% of values are non-detects), Winsorizing would replace the lowest 5% of values with the 6th percentile value (i.e., the DL), and the highest 5% of values with the 94th percentile value. Both mean and standard deviation can be calculated using Winsorized data. If data are skewed, normalizing transformations should be considered.
- Cohen's method and Aitchison's method are based on maximum-likelihood estimates. Cohen's method uses tabulated values to adjust the sample mean and standard deviation to account for data below the DL. Aitchison's method adjusts the mean and standard deviation to account for the possibility that some non-detects may actually be zero values (i.e., the substance is truly not present). Cohen's method requires that the data distribution excluding non-detects is normally distributed and that the DL is constant. Both methods require a relatively large data set (n > 20).
- Advanced methods based on extrapolating the distribution of the measured values (i.e., those above the DL) to the censored region are also available (Helsel 1990; Helsel 2012; Parkin et al. 1988), which can be considered where bounding analyses suggest that advanced techniques are warranted.

Detection Frequency < 50%—When detection frequency is < 50%, it is not appropriate to calculate summary statistics such as means, medians, or standard deviations. The median of a data set with detection frequency < 50% will always be equal to the DL. For non-frequently detected substances, US EPA (2000) recommends switching the parameter of interest to some percentile other than the 50th percentile (median), such as the 75th or 95th percentile of the data set.

4.2.2 Data Quality Objective Considerations

The appropriate method for dealing with results that fail DQOs when calculating summary statistics or conducting trend analyses will be a function of the nature and magnitude of the DQO failure(s), as reflected in the data qualifiers that have been assigned to the data. In particular:

- **R flag**: Omit. Rejected data should not be entered in the database and should be deleted from all working statistical analysis files (this is the approach taken by other agencies; e.g., US EPA 1989, 1998b, PSEP 1997, Environment Canada 2002, 2005; see section 3.5).
- **J flag**: Include.
- **J(-) flag**: Include. If the bias is well characterized, employ (and document) bias correction.
- **J(+) flag**: Include. If the bias is well characterized, employ (and document) bias correction.
- **U flag**: If the frequency of non-detects is low[3], include a value equal to one-half the DL. If the frequency of non-detects is high, alternative methods (i.e., non-parametric statistics, alternative ND replacement methods, etc.) should be applied.
- **UN flag**: If the frequency of non-detects is low, include a value equal to one-half the DL. If the frequency of non-detects is high, alternative methods should be applied.

4.3 Trend Analyses

The appropriate method for dealing with results that fail DQOs when conducting trend analyses will be a function of the nature and magnitude of the DQO failure(s), as reflected in the data qualifiers that have been assigned to the data. In particular:

- **R flag**: Omit. Rejected data should not be entered in the database and should be deleted from all working statistical analysis files (this is the approach taken by other agencies; e.g., US EPA 1989, 1998b, PSEP 1997, Environment Canada 2002, 2005; see section 3.5).
- **J flag**: Include.
- **J(-) flag**: Include. If the bias is well characterized, employ (and document) bias correction.
- **J(+) flag**: Include. If the bias is well characterized, employ (and document) bias correction.

[3] US EPA (2000) recommends non-detect replacement only if the frequency of non-detects is ≤ 15%. However, it may be acceptable to replace higher frequency non-detects (*e.g.*, up to 50%) if the resulting increase in uncertainty is acceptable within the objectives of the program, and is outweighed by the benefits of simplicity and consistency of analysis. See sections 3.1 and 4.2.1 for more detailed discussion regarding the treatment of NDs.

- **U flag**: If the frequency of non-detects is low, include a value equal to one-half the DL. If the frequency of non-detects is high, non-parametric trend analysis methods should be employed.
- **UN flag**: If the frequency of non-detects is low, include a value equal to one-half the DL. If the frequency of non-detects is high, non-parametric trend analysis methods should be employed.

4.4 Comparison to Environmental Quality Guidelines

The appropriate method for dealing with results that fail DQOs when comparing measured concentrations to EQGs will be a function of the nature and magnitude of the DQO failure(s), as reflected in the data qualifiers that have been assigned to the data. Qualified data should be compared to EQGs with caution, and with an explicit consideration of the uncertainty in the resulting conclusions. In particular:

- **R flag**: Omit. Rejected data should not be entered in the database and should be deleted from all working statistical analysis files (this is the approach taken by other agencies; e.g., US EPA 1989, 1998b, PSEP 1997, Environment Canada 2002, 2005; see section 3.5). Therefore, no comparisons to EQGs will be conducted.
- **J flag**: Include. Any observed exceedance should be characterized as a potential exceedance, with uncertainty resolvable through additional analysis. If the estimated value and the applicable benchmark for decision-making are both < 5×MDL, potential exceedances should be characterized as a possible false positive. Additional investigations, or increased precision in future monitoring events, may be required depending on the objectives of the study and/or the information obtained from other lines of evidence.
- **J(-) flag**: Omit[4].
- **J(+) flag**: Tentatively include. Any observed exceedance would be conservatively evaluated as a possible exceedance; however, the exceedance should be applied for screening purposes only, and not used to make conclusions regarding probability or magnitude of environmental harm.
- **U flag**: Include a value equal to the DL.
- **UN flag**: Include a value equal to the DL. Consider further study if a possible false negative is considered to affect study conclusions.

The narratives used to describe EQG exceedances may also take into account the uncertainty and conservatism in the EQGs themselves. Generic EQGs are not site-specific, tend to be conservative (high proportion of false positives) and have generally not been developed with a mechanistic linkage between exposure and effect. Accordingly, a datum flagged as J(+) that is only marginally elevated relative to a lower-bound EQG (such as a threshold effects level [TEL] sediment quality guideline developed using a co-occurrence statistical method) may be used to retain a substance as a potential concern, but should not be construed as evidence of harm.

[4] It may be appropriate to retain certain values flagged as J(-) for comparison with EQGs if the magnitude of potential negative bias is small relative to the difference between the reported value and the EQG. For example, if the negative bias is on the order of 50% (*i.e.*, the true value is expected to be approximately twice as large) but the reported value is orders of magnitude lower than the EQG, it may be appropriate to conclude that there is no exceedance.

Report Signature Page

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Table 1: Decision Rules for Re-analyzed Samples: Original Datum Outside of Control Limits

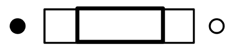
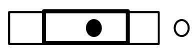
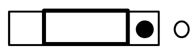
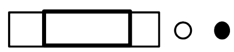
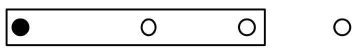
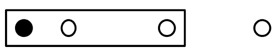
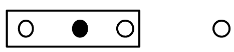
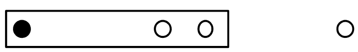
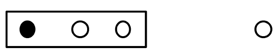
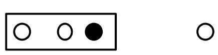
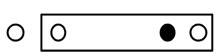
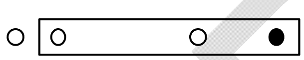
Position of original (○) and re-run (●) data relative to control (light box) and warning (bold box) limits	Interpretation	Action
	Neither value reliable, high uncertainty	Discard both
	Re-run possibly valid, original not supported	Discard original
	Re-run likely valid, original not supported	Discard original
	Original data likely 'tail' value, supported	Retain both
	Original data likely 'tail' value, supported	Retain both

Table 2: Decision Rules for Re-analyzed Samples: Original Lab Replicates with High Relative Standard Deviation (RSD)

Position of original (○) and re-run (●) data [a]	Interpretation	Effect on RSD [a]	Likely Outcome [b]
	High variability confirmed	Worse	Precision failure
	Support for one end of range	Better	Possibly pass
	Strong support for one end of range	Better	Likely pass
	High variability confirmed	Worse	Precision failure
	Strong support for one end of range	Better	Likely pass
	Strong support for one end of range	Better	Likely pass
	Strong support for one end of range	Better	Likely pass
	High variability confirmed	Slightly better	Likely fail
	High variability confirmed	Worse	Precision failure

[a] Re-calculate RSD using re-run result and the two original results closest to the re-run result (values within rectangle).
[b] Actual outcome to be determined by comparing new RSD to precision DQO for that analyte.

Table 3: Criteria for Distinguishing Between Marginal and Severe Data Quality Objective (DQO) Failures

Objective/DQO	Analyte Group	Proposed Criteria[a]		
		Pass	**Marginal Failure**	**Severe Failure**
Precision: Laboratory or Field[b] Replicate RSD [or SD][c]	Oil & Grease	RSD<20% [SD<DL]	RSD=20–30% [SD=DL–1.5×DL]	RSD>30% [SD>1.5×DL]
	Metals (except silver)	RSD<20% [SD<DL]	RSD=20–40% [SD=DL–2×DL]	RSD>40% [SD>2×DL]
	Silver	RSD<20% [SD<DL]	RSD=20–70% [SD=DL–3.5×DL]	RSD>70% [SD>3.5×DL]
	Low- and high-resolution organics[d], organotins	RSD<50% [SD<2.5×DL]	RSD=50-75% [SD=2.5×DL–5×DL]	RSD>75% [SD>5×DL]
	TN, NH_3, TKN, NO_2^-, NO_3^-, MeHg	RSD<10% [SD<0.5×DL]	RSD=10–15% [SD=0.5×DL–DL]	RSD>15% [SD>DL]
	TSS, BOD, COD, SO_4^{2-}, hardness	RSD<15% [SD<DL]	RSD=15-25% [SD=DL–1.5×DL]	RSD>25% [SD>1.5×DL]
	AVS, S^{2-}, CN^-, total phenols, TOC, lipid	RSD<25% [SD<DL]	RSD=25–40% [SD=DL–1.5×DL]	RSD>40% [SD>1.5×DL]
Bias: Matrix Spike, Reference Sample or Surrogate Recovery	Metals, AVS/SEM, S^{2-}, CN^-, total phenols, carbon, organic carbon, MeHg	75–125%	60–75% or 125–140%	<60% or >140%
	Low-resolution organics[d], high-resolution PBDEs, high-resolution PPCPs (List 3, 4, 5, and 6 compounds), organotins	50–150%	25–50% or 150–175%	<25% or >175%
	High-resolution OC Pests, NPs, PCBs, PAHs, and dioxins and furans	70–130%	50–70% or 130–150%	<50% or >150%
	High resolution PPCPs (List 1 and 2 compounds)	25–200%	10–25% or 200–250%	<10% or >250%
	Nitrogen, SO_4^{2-}, hardness, oil & grease, % lipid, % particle size (sand, silt, clay)	80–120%	70–80% or 120–130%	<70% or >130%
	BOD, COD	85–115%	75–85% or 115–125%	<75% or >125%
Representativeness Lab or Field/Trip Blank Contamination (Low-resolution analysis)	All (Sample-based)	MB concentration <10% of minimum concentration	MB concentration = 10-20% of minimum concentration	MB concentration >20% of minimum concentration[f]

Objective/DQO	Analyte Group	Proposed Criteria[a]		
		Pass	Marginal Failure	Severe Failure
Representativeness Lab or Field/Trip Blank Contamination (High-resolution analysis)	All (Sample-based)	MB concentration < MB limit[e] AND MB concentration < minimum concentration	MB concentration > minimum concentration OR MB concentration > 20% of median concentration	MB concentration > MB limit OR MB concentration > median concentration[f]

[a] It is recommended that the proposed criteria be reviewed once every three years due to changes in laboratory analytical methods that can affect DQOs.

[b] Separate precision criteria given for results ≥5× DL (RSD-based) and results <5× DL (SD-based; see bracketed criteria).

[c] Failure of precision DQOs in field replicates should result in either a pass or a marginal failure, never a severe failure.

[d] Low-resolution organics includes polycyclic aromatic hydrocarbons, volatile organics, semi-volatile organics, chlorinated hydrocarbons, and phenolic compounds (except total phenols). High-resolution organics includes polybrominated diphenyl ethers (PBDEs), polychlorinated biphenyls (PCBs), nonylphenols (NPs), organochlorine pesticides (OC Pests), polycyclic aromatic hydrocarbons (PAHs), pharmaceuticals and personal care products (PPCPs), and dioxins and furans.

[e] Method blank (MB) concentrations only compared to MB limits where they exist. For parameters with no MB limits (e.g., PCB homologues), criteria based on comparison of MB concentration with minimum and median concentrations of the associated samples only.

[f] Blank contamination flagged as "NDR" by laboratory should be compared to DQOs, but should not result in a severe failure.

Table 4: Guidance for Assigning Data Qualifiers to Data Associated With Data Quality Objective (DQO) Failure

Objective/ DQO	Interpretation	Associated Samples	Associated Analytes [a]	Action Upon Marginal Failure [b]	Action Upon Severe Failure [b]
Precision					
Laboratory RSD	Analytical imprecision	Sample preparation & analysis batch	Analyte or analyte group	Qualify detects (J) and non-detects (UN).	Reject data. Re-analyze if essential.
Field RSD	Sampling and/or environmental and/or analytical imprecision	Sample collection group (same matrix, same sampling event)	Analyte or analyte group	Qualify detects (J) and non-detects (UN).	Qualify detects (J) and non-detects (UN). Review adequacy of sampling program. [c]
Bias					
Matrix Spike Recovery	Analytical bias (possibly matrix effects)	Sample preparation & analysis batch	Analyte or analyte group (consult lab)	Qualify data (J+, J- or J for detects, U or UN for non-detects).	Reject detect and non-detects with low or inconsistent bias. Accept biased-high non-detects.
LCS Recovery	Analytical bias	Sample preparation & analysis batch	Analyte or analyte group.	Qualify data (J+, J- or J for detects, U or UN for non-detects).	Reject detect and non-detects with low or inconsistent bias. Accept biased-high non-detects.
Surrogate Recovery	Analytical bias	Sample	All or subset represented by surrogate compound	Qualify data (J+, J- or J for detects, U or UN for non-detects).	Reject detect and non-detects with low or inconsistent bias. Accept biased-high non-detects.
Representativeness					
Laboratory Blank Contamination	Contamination from laboratory sources	Sample preparation & analysis batch (same matrix)	Substances detected in blanks	Qualify detects (J+).	Reject and re-analyze detects if data essential. Qualify detects (UN) if non-essential.
Field/Trip Blank Contamination	Contamination from field and/or laboratory sources	Sample collection group (same matrix, same sampling event)	Substances detected in blanks	Qualify detects (J+).	Reject and re-analyze detects if data essential. Qualify detects (UN) if non-essential.

[a] If DQO failures are observed for multiple analytes in an analyte group, consider assigning data qualifier(s) to entire analyte group

[b] Recommended actions upon failing DQOs assume that no other DQOs are failed for the sample

[c] High variability of field replicates (but acceptable variability of lab replicates) indicates high environmental heterogeneity. Additional sampling may be required to obtain reliable estimates of sediment chemistry, but data should not be rejected nor sample re-analyzed based only on high field replicate precision RSD.

Table 5: Decision Criteria for Assigning Data Qualifiers to WMEP Data

Applicable DQO Failure(s)			Resulting Data Qualifier	
Representativeness (Blanks)	Precision (Replicates)	Bias (Standards)	Detects	Non-detects
—	—	M-	J-	UN
—	—	M+	J+	U
—	—	S-	R	R
—	—	S+	R	U
—	M	—	J	UN
—	M	M-	J-	UN
—	M	M+	J+	U
—	M	S+ or S-	R	R
—	S	—	R	R
—	S	M+ or M-	R	R
—	S	S+ or S-	R	R
M	—	—	J+	U
M	—	M-	J	UN
M	—	M+	J+	U
M	—	S-	R	R
M	—	S+	R	U
S	—	—	R	U
S	—	M-	R	UN
S	—	M+	R	U
S	—	S-	R	R
S	—	S+	R	U
M	M	—	J+	UN
M	M	M-	R	UN
M	M	M+	R	U
M	M	S+ or S-	R	R
M	S	—	R	R
M	S	M+ or M-	R	R
S	M	—	R	UN
S	M	M-	R	UN
S	M	M+	R	U
S	S	—	R	R
S	S	S+ or S-	R	R

M = Marginal Data Quality Objective (DQO) failure; S = Severe DQO failure; — = no DQO failure
Bias DQO failures indicate direction of bias (+ or -).
If multiple QA/QC samples are used to assess a DQO, use most severe failure to determine applicable data qualifier.

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APPENDIX B
2019 WASTEWATER MONITORING

Appendix B1 Priority Substance List and Sampling Frequency

Substance	Wastewater Macaulay and Clover Points Outfalls	
	(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	√	√

Appendix B1, continued

Substance	Wastewater Macaulay and Clover Points Outfalls	
	(full list)	(modified list)
	Quarterly	Monthly
silver	√	√
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		

Appendix B1, continued

Substance	Wastewater Macaulay and Clover Points Outfalls	
	(full list)	(modified list)
	Quarterly	Monthly
2,4-dimethylphenol	√	√
2,4-dinitrophenol	√	√
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	√*	

Appendix B1, continued

Substance	Wastewater Macaulay and Clover Points Outfalls	
	(full list)	(modified list)
	Quarterly	Monthly
PCB-52/73	√*	
PCB-54	√*	
PCB-56/60	√*	
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	√	

Appendix B1, continued

Substance	Wastewater Macaulay and Clover Points Outfalls (full list) Quarterly	(modified list) Monthly
isophorone	√	√
nitrobenzene	√	√
N-nitrosodimethylamine	√	√
N-nitrosodi-n-propylamine	√	√
N-nitrosodiphenylamine	√	√
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	√	√

Appendix B1, continued

Substance	Wastewater Macaulay and Clover Points Outfalls	
	(full list)	(modified list)
	Quarterly	Monthly
chlorodibromomethane	√	√
tribromomethane	√	√
trichloromethane	√	√
Ketones		
dimethyl ketone	√	√
methyl ethyl ketone	√	√
methyl isobutyl ketone	√	√
alpha-terpineol	√	√
NONYLPHENOLS		
4-nonylphenols	√*	
4-nonylphenol monoethoxylates	√*	
4-nonylphenol diethoxylates	√*	
POLYBROMINATED DIPHENYL ETHERS (PBDE)		
PBDE-7	√*	
PBDE-8/11	√*	
PBDE-10	√*	
PBDE-12/13	√*	
PBDE-15	√*	
PBDE-17/25	√*	
PBDE-28/33	√*	
PBDE-30	√*	
PBDE-32	√*	
PBDE-35	√*	
PBDE-37	√*	
PBDE-47	√*	
PBDE-49	√*	
PBDE-51	√*	
PBDE-66	√*	
PBDE-71	√*	
PBDE-75	√*	
PBDE-77	√*	
PBDE-79	√*	
PBDE-85	√*	
PBDE-99	√*	
PBDE-100	√*	
PBDE-105	√*	
PBDE-116	√*	
PBDE-119/120	√*	
PBDE-126	√*	
PBDE-128	√*	
PBDE-138/166	√*	
PBDE-140	√*	
PBDE-153	√*	
PBDE-154	√*	
PBDE-155	√*	
PBDE-181	√*	
PBDE-183	√*	
PBDE-190	√*	

Appendix B1, continued

Substance	Wastewater Macaulay and Clover Points Outfalls	
	(full list)	(modified list)
	Quarterly	Monthly
PBDE-203	√*	
PBDE-206	√*	
PBDE-207	√*	
PBDE-208	√*	
PBDE-209	√*	
POLYCYCLIC AROMATIC HYDROCARBONS		
1-methylphenanthrene	√* and √	
2,3,5-trimethylnaphthalene	√* and √	
2,6-dimethylnaphthalene	√* and √	
Benzo[j,k]fluoranthenes	√* and √	
dibenzothiophene	√* and √	
2-methylnaphthalene	√* and √	
acenaphthene	√* and √	
acenaphthylene	√* and √	
anthracene	√* and √	
benzo(b)fluoranthene	√* and √	
benzo(e)pyrene	√* and √	
benzo(a)pyrene	√* and √	
benzo(a)anthracene	√* and √	
benzo(g,h,i)perylene	√* and √	
chrysene	√* and √	
dibenzo(a,h)anthracene	√* and √	
fluoranthene	√* and √	
fluorene	√* and √	
hexachlorobutadiene	√* and √	
indeno(1,2,3-c,d)pyrene	√* and √	
naphthalene	√* and √	
phenanthrene	√* and √	
pyrene	√* and √	
PER- AND POLYFLUOROALKYL SUBSTANCES		
PFBA	√*	
PFBS	√*	
PFDA	√*	
PFDoA	√*	
PFHpA	√*	
PFHxA	√*	
PFHxS	√*	
PFNA	√*	
PFOA	√*	
PFOS	√*	
PFOSA	√*	
PFPeA	√*	
PFUnA	√*	
PHARMACEUTICALS AND PERSONAL CARE PRODUCTS		
2-Hydroxy-ibuprofen	√*	
Bisphenol A	√*	
Furosemide	√*	
Gemfibrozil	√*	

Appendix B1, continued

Substance	Wastewater Macaulay and Clover Points Outfalls	
	(full list)	(modified list)
	Quarterly	Monthly
Glipizide	√*	
Glyburide	√*	
Hydrochlorothiazide	√*	
Ibuprofen	√*	
Naproxen	√*	
Triclocarban	√*	
Triclosan	√*	
Warfarin	√*	
TOXICITY-ACUTE		
96-hr Rainbow Trout	√	
48-hr Daphnia magna	√	
TOXICITY-CHRONIC (Annual)		
Rainbow Trout Avelin and Egg Test (EA)	√ (annually)	
Ceriodaphnia 7-day	√	
Top smelt 7-day	√	
Echinoderm fertilization	√	

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

Appendix B2 Macaulay Point Effluent Flow

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	59,340	45,860	45,720	41,940	39,220	37,660	34,980	36,080	39,760	39080	39,020	40,580
2	53,200	48,320	43,840	38,820	39,440	37,980	36,460	36,500	40,820	38700	38,580	42,680
3	58,140	44,780	43,700	40,260	37,880	39,320	40,180	38,460	42,640	38960	40,140	39,760
4	139,820	47,760	46,000	39,740	37,880	37,960	37,400	35,320	42,000	38520	41,480	41,080
5	144,240	45,160	43,420	39,540	39,540	38,120	37,060	34,280	41,320	39680	39,260	40,200
6	77,840	42,040	42,220	39,380	38,960	37,100	36,460	36,620	40,760	40000	39,360	40,800
7	74,300	43,260	41,860	38,500	38,260	37,660	36,360	36,840	40,020	40380	38,080	39,040
8	60,840	42,760	40,860	40,000	38,940	37,180	37,220	36,580	36,960	47080	39,160	42,300
9	57,740	40,980	41,620	40,500	37,880	36,940	36,760	36,480	38,900	41000	37,680	41,260
10	56,200	41,720	40,600	43,040	37,520	38,620	37,280	36,680	38,180	40080	39,800	40,540
11	52,460	45,300	42,460	39,920	38,500	37,640	39,320	36,000	37,680	39340	37,940	40,400
12	50,040	39,820	43,020	42,520	37,940	36,600	38,640	37,120	37,680	38760	39,280	40,740
13	49,880	41,380	45,780	39,720	38,060	36,940	36,940	37,200	46,640	39200	42,240	50,620
14	49,520	44,280	41,400	43,500	38,320	36,760	36,020	36,400	39,400	38660	38,460	46,200
15	48,060	44,520	42,500	43,480	38,940	36,560	36,800	36,500	39,800	39740	39,540	46,720
16	46,600	50,500	42,000	39,700	37,460	36,620	36,620	36,500	46,580	39040	42,040	45,960
17	46,340	52,320	40,360	40,120	36,980	37,360	36,560	36,560	41,300	44480	43,080	43,580
18	48,120	56,980	42,940	38,560	38,440	37,320	37,840	35,840	45,740	46060	77,880	42,040
19	48,160	54,440	39,620	43,640	35,720	36,840	36,640	37,140	42,720	51540	56,320	43,540
20	49,540	56,440	40,220	44,900	35,240	36,640	36,660	37,020	40,360	46320	54,740	53,340
21	46,080	52,740	40,680	39,120	42,280	36,200	35,640	36,560	38,620	46620	48,020	109,360
22	46,800	50,700	38,620	39,880	39,960	36,400	36,340	37,480	39,500	60640	44,360	100,820
23	63,980	50,140	40,520	42,740	37,600	36,100	36,980	36,600	44,000	50520	43,560	62,380
24	89,100	49,760	38,860	40,880	37,460	37,100	36,360	36,940	44,320	44960	44,580	56,560
25	61,480	53,280	40,920	39,720	39,140	36,980	36,420	36,500	40,180	42580	46,280	53,580
26	54,760	48,880	39,980	39,440	47,040	36,820	36,400	37,180	39,620	42060	43,700	50,600
27	51,720	47,020	39,680	38,980	41,240	36,580	36,560	37,280	39,680	41420	44,140	46,540
28	49,100	45,520	39,200	40,920	40,340	41,300	35,660	36,700	39,160	41880	43,320	47,220
29	49,720		39,880	39,480	38,680	37,340	36,200	36,800	39,620	41520	41,720	45,340
30	44,780		38,040	39,260	38,020	35,840	36,900	37,020	40,140	39680	41,060	44,760
31	44,860		39,800		39,100		36,460	38,120		39940		45,460
TOTAL Flow (m3/day)	1,872,760	1,326,660	1,286,320	1,218,200	1,201,980	1,118,480	1,142,120	1,137,300	1,224,100	1,318,440	1,304,820	1,524,000
Average	60,412	47,381	41,494	40,607	38,774	37,283	36,843	36,687	40,803	42,530	43,494	49,161
Maximum	144,240	56,980	46,000	44,900	47,040	41,300	40,180	38,460	46,640	60,640	77,880	109,360
Minimum	44,780	39,820	38,040	38,500	35,240	35,840	34,980	34,280	36,960	38,520	37,680	39,040
n	31	28	31	30	31	30	31	31	30	31	30	31
											Annual Average	**42,946**

Notes: Shaded cells indicate exceedance to maximum daily flow = 150,000 m^3/day and/or annual mean daily flow = 50,000 m^3/day

Appendix B3 Clover Point Effluent Flow

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	56,538	45,801	42,340	39,550	36,435	37,461	34,190	35,271	36,431	37,317	34,955	38,129
2	53,201	49,998	42,808	39,368	37,174	37,115	34,773	35,200	35,325	36,756	36,122	38,233
3	63,371	45,821	40,966	38,246	37,448	37,540	43,465	41,880	36,862	35,667	35,878	37,709
4	147,031	45,911	41,234	40,495	36,513	38,132	37,100	33,565	36,694	36,748	36,716	37,277
5	129,084	44,786	41,218	39,124	37,187	37,960	36,507	33,585	35,883	40,813	35,478	38,464
6	81,929	43,521	40,453	37,964	36,871	36,835	36,318	34,813	36,203	41,267	34,704	37,082
7	76,151	42,463	40,714	37,717	45,174	37,231	34,752	35,741	35,535	37,908	35,647	37,404
8	63,913	42,604	39,873	38,556	45,492	37,027	36,177	34,470	34,940	54,967	34,989	41,789
9	58,952	44,038	42,029	41,639	46,432	35,609	36,708	34,994	36,425	40,415	34,736	37,903
10	55,214	41,927	38,566	47,125	42,072	36,433	38,779	34,904	36,882	37,878	35,963	37,946
11	54,502	42,710	38,413	39,966	43,234	36,709	40,522	35,513	35,967	37,243	33,065	38,203
12	50,555	41,317	47,528	43,317	45,483	37,076	40,456	35,325	35,641	36,106	33,612	39,167
13	48,553	44,141	49,493	39,740	41,661	36,987	36,766	36,190	53,795	35,157	42,002	54,653
14	47,965	53,339	42,977	46,293	38,837	37,239	35,314	35,908	39,657	34,807	34,808	43,551
15	47,242	52,827	41,066	41,377	29,129	36,533	35,143	35,381	39,262	35,807	34,539	42,484
16	46,319	69,207	41,084	39,886	31,620	35,462	35,695	35,655	50,771	36,992	45,461	40,949
17	44,622	62,588	41,270	38,819	34,995	35,721	36,398	35,530	38,699	43,027	42,108	40,176
18	50,422	61,111	41,282	37,300	35,725	37,333	39,068	34,128	48,330	44,398	91,849	38,995
19	48,943	57,179	41,063	48,343	34,788	36,915	36,240	34,782	41,413	56,159	63,381	41,292
20	46,221	55,752	40,248	45,280	34,346	36,256	36,074	35,259	38,585	40,963	56,376	62,667
21	44,719	51,203	40,125	39,148	46,456	35,556	34,773	35,020	37,403	40,650	45,633	121,968
22	43,953	47,426	39,130	38,182	43,342	35,704	34,352	38,486	36,997	70,966	42,629	105,275
23	75,322	51,847	39,566	42,058	37,274	35,113	36,050	35,546	43,334	49,224	41,298	64,378
24	86,962	47,226	38,336	39,108	37,637	35,499	36,152	37,287	46,612	41,160	42,372	56,662
25	62,747	48,136	38,765	38,811	37,664	36,060	34,526	35,439	38,785	39,346	42,780	49,205
26	56,070	45,589	41,522	38,081	57,221	35,879	35,388	34,793	37,892	40,006	40,948	50,417
27	51,930	43,794	42,436	38,440	42,674	36,000	35,493	35,684	38,927	38,597	45,277	43,959
28	50,866	43,352	39,859	38,529	41,434	46,700	33,813	35,092	38,057	37,975	40,063	43,712
29	48,763		39,215	38,200	39,469	36,884	34,192	34,011	38,922	37,648	39,158	42,173
30	48,122		38,630	38,236	38,753	35,479	35,525	34,758	37,752	36,738	38,088	41,736
31	46,764		38,545		39,048		34,945	36,487		36,766		42,121
TOTAL Flow (m^3/day)	1,886,946	1,365,614	1,270,754	1,208,898	1,231,588	1,106,448	1,125,654	1,100,697	1,177,981	1,269,471	1,250,635	1,485,679
Average	60,869	48,772	40,992	40,297	39,729	36,882	36,311	35,506	39,266	40,951	41,688	47,925
Maximum	147,031	69,207	49,493	48,343	57,221	46,700	43,465	41,880	53,795	70,966	91,849	121,968
Minimum	43,953	41,317	38,336	37,300	29,129	35,113	33,813	33,565	34,940	34,807	33,065	37,082
n	31	28	31	30	31	30	31	31	30	31	30	31
										Annual Average		**42,212**

Notes: Shaded cells indicate exceedance to maximum daily flow = 185,000 m^3/day and/or annual mean daily flow = 82,000 m^3/day

Appendix B4 Frequency of Detection and Loadings of Substances in Macaulay Point Wastewaters

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Conventionals						
pH @ 15°C	TOT	pH	6.8	54	100%	----
TSS	TOT	mg/L	272.2	54	100%	4327037
CBOD	TOT	mg/L as O2	257	54	100%	---
N - NH3 (As N)- Unionized	TOT	mg/L	0.09213	54	100%	1461
Temperature	TOT	°C	16.9	52	100%	----
pH	TOT	pH	7.26	43	100%	---
TOC	TOT	mg/L	56.4	14	100%	914536
COD	TOT	mg/L as O2	698.4	12	100%	---
BOD	TOT	mg/L as O2	288.2	13	100%	---
N - NO2 (As N)	DIS	mg/L as N	ND>50%	14	36%	---
N - NO3 (As N)	DIS	mg/L as N	ND>50%	14	36%	---
N - TKN (As N)	TOT	mg/L	63.64	9	100%	1026443
N - NH3 (As N)	TOT	mg/L	44.71	52	100%	713530
N - NO3 + No2 (As N)	TOT	mg/L	ND>50%	12	25%	---
Fecal Coliforms	TOT	CFU/100 mL	8962000	13	100%	154624245797
Enterococci	TOT	CFU/100 mL	1294000	14	100%	21229602109
pH	TOT	pH	7.47	14	100%	---
Specific Conductivity - 25°C	TOT	µS/cm	797	13	100%	---
Alkalinity	TOT	mg/L asCaCO3	243.1	12	100%	3785924
Hardness (As Caco3)	DIS	mg/L	71.84	14	100%	1131437
Hardness (As Caco3)	TOT	mg/L	81.51	14	100%	1292687
P - PO4 - Ortho (As P)	DIS	mg/L	3.598	11	100%	55133
P - PO4 - Total (As P)	DIS	µg/L	4420	3	100%	99331
P - PO4 - Total (As P)	TOT	µg/L	6060	11	100%	99235
Sulfide	TOT	mg/L	0.2592	13	100%	4458
WAD Cyanide	TOT	mg/L	0.001297	14	100%	21
SAD Cyanide	TOT	mg/L	0.003089	14	100%	46
Oil & Grease, Mineral	TOT	mg/L	4.38	14	93%	72851
Oil & grease, total	TOT	mg/L	13.89	14	100%	234929
Total Metals						
Aluminum	TOT	µg/L	205	14	100%	3393
Antimony	TOT	µg/L	0.3111	14	100%	5.0
Arsenic	TOT	µg/L	0.5961	14	100%	8.9
Barium	TOT	µg/L	20.33	14	100%	322
Beryllium	TOT	µg/L	ND>50%	14	36%	---

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Cadmium	TOT	µg/L	0.1589	14	100%	2.5
Calcium	TOT	mg/L	20.66	14	100%	327123
Chromium	TOT	µg/L	2.306	14	100%	33
Chromium Iii	TOT	mg/L	0.00175	11	82%	27
Chromium Vi	TOT	mg/L	ND>50%	11	27%	---
Cobalt	TOT	µg/L	0.894	14	100%	13.5
Copper	TOT	µg/L	80.59	14	100%	1266
Iron	TOT	µg/L	543.2	14	100%	8604
Lead	TOT	µg/L	3.111	14	100%	52
Magnesium	TOT	mg/L	7.272	14	100%	115560
Manganese	TOT	µg/L	64.57	13	100%	983
Mercury	TOT	µg/L	0.02396	14	64%	0.4
Molybdenum	TOT	µg/L	1.314	14	100%	22
Nickel	TOT	µg/L	4.474	14	100%	68
Potassium	TOT	mg/L	18.34	14	100%	286286
Selenium	TOT	µg/L	0.3059	14	100%	4.9
Silver	TOT	µg/L	0.0423	13	100%	0.7
Sodium	TOT	mg/L	51.8	11	100%	833155
Thallium	TOT	µg/L	0.00558	14	100%	0.1
Tin	TOT	µg/L	1.158	13	100%	18
Zinc	TOT	µg/L	105.9	14	100%	1727
Dissolved Metals						
Aluminum	DIS	µg/L	29.93	14	100%	472
Antimony	DIS	µg/L	0.2771	14	100%	4.5
Arsenic	DIS	µg/L	0.5003	14	100%	7.5
Barium	DIS	µg/L	10.26	14	100%	156
Beryllium	DIS	µg/L	ND>50%	14	43%	---
Cadmium	DIS	µg/L	0.03744	14	100%	0.6
Calcium	DIS	mg/L	17.59	14	100%	276501
Chromium	DIS	µg/L	1.847	14	100%	25.0
Cobalt	DIS	µg/L	0.7136	14	100%	10.5
Copper	DIS	µg/L	40.26	14	100%	650
Iron	DIS	µg/L	309.9	14	100%	4745
Lead	DIS	µg/L	0.6939	14	100%	11
Magnesium	DIS	mg/L	6.791	14	100%	107250
Manganese	DIS	µg/L	49.21	14	100%	736
Mercury	DIS	µg/L	0.00403	14	79%	0.07

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Molybdenum	DIS	µg/L	1.596	14	100%	27
Nickel	DIS	µg/L	3.958	14	100%	61
Potassium	DIS	mg/L	17.89	14	100%	277982
Selenium	DIS	µg/L	0.2195	14	100%	3.6
Silver	DIS	µg/L	0.04424	14	100%	0.7
Thallium	DIS	µg/L	ND>50%	14	50%	---
Tin	DIS	µg/L	1.029	14	100%	15.4
Zinc	DIS	µg/L	22.62	14	100%	390
Speciated Metals						
Methyl Mercury	TOT	ng/L	0.445	6	100%	0.003
Dibutyltin	TOT	µg/L	0.00357	6	83%	0.02
Dibutyltin Dichloride	TOT	µg/L	0.00517	6	83%	0.03
Monobutyltin	TOT	µg/L	0.00683	6	100%	0.04
Tributyltin Chloride	TOT	µg/L	ND>50%	3	33%	---
Tributyltin	TOT	µg/L	0.00417	6	67%	0
Monobutyltin Trichloride	TOT	µg/L	0.01067	6	100%	0.06
Acrolein	TOT	µg/L	ND>50%	14	36%	---
Phenolics						
2,4 + 2,5-Dichlorophenol	TOT	µg/L	ND>50%	14	36%	---
2,4,6-trichlorophenol	TOT	µg/L	ND>50%	14	36%	---
2-Chlorophenol	TOT	µg/L	ND>50%	14	36%	---
4-Chloro-3-Methylphenol	TOT	µg/L	ND>50%	9	0%	---
Pentachlorophenol	TOT	µg/L	ND>50%	14	36%	---
Total Phenols	TOT	mg/L	0.07926	14	100%	1167
2,4-dimethylphenol	TOT	µg/L	ND>50%	14	36%	---
2,4-dinitrophenol	TOT	µg/L	ND>50%	14	36%	---
2-Methyl-4,6-Dinitrophenol	TOT	µg/L	2.5	3	100%	56
2-Nitrophenol	TOT	µg/L	ND>50%	14	36%	---
4-Nitrophenol	TOT	µg/L	ND>50%	14	36%	---
Phenol	TOT	µg/L	14.89	14	100%	242
4,6-dinitro-2-methylphenol	TOT	µg/L	ND>50%	11	18%	---
PAHs						
2-Chloronaphthalene	TOT	µg/L	ND>50%	14	36%	---
2-Methylnaphthalene	TOT	µg/L	0.1497	14	100%	2.0
Acenaphthene	TOT	µg/L	0.2026	8	100%	2.5
Acenaphthylene	TOT	µg/L	0.0896	14	86%	1.5

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Anthracene	TOT	µg/L	0.0431	14	86%	0.7
Benzo(A)Anthracene	TOT	µg/L	0.0417	14	93%	0.7
Benzo(A)Pyrene	TOT	µg/L	0.04386	14	86%	0.8
Benzo(B)Fluoranthene	TOT	µg/L	0.0224	14	86%	0.4
Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	TOT	µg/L	0.0306	14	86%	0.5
Benzo(G,H,I)Perylene	TOT	µg/L	ND>50%	14	50%	---
Benzo(K)Fluoranthene	TOT	µg/L	ND>50%	14	50%	---
Chrysene	TOT	µg/L	0.053	14	100%	0.8
Dibenzo(A,H)Anthracene	TOT	µg/L	ND>50%	14	50%	---
Fluoranthene	TOT	µg/L	0.1299	14	100%	1.9
Fluorene	TOT	µg/L	0.1305	14	100%	1.7
Indeno(1,2,3-C,D)Pyrene	TOT	µg/L	ND>50%	14	43%	---
Naphthalene	TOT	µg/L	0.3719	14	100%	4.0
Phenanthrene	TOT	µg/L	0.2212	14	100%	3.3
Pyrene	TOT	µg/L	0.1064	14	100%	1.7
Total Hmw-PAHs	TOT	µg/L	0.4232	14	100%	6.7
Total Lmw-PAHs	TOT	µg/L	1.256	14	100%	16.5
Total PAHs	TOT	µg/L	1.683	14	100%	23
Phthalates						
Bis(2-Ethylhexyl)Phthalate	TOT	µg/L	8.79	14	86%	146
Butylbenzyl Phthalate	TOT	µg/L	2.5	3	100%	56
N-Butylbenzyl Phthalate	TOT	µg/L	ND>50%	11	18%	---
Diethyl Phthalate	TOT	µg/L	1.66	14	100%	29
Dimethyl Phthalate	TOT	µg/L	ND>50%	14	36%	---
Di-N-Butyl Phthalate	TOT	µg/L	ND>50%	14	43%	---
Di-N-Octyl Phthalate	TOT	µg/L	ND>50%	14	36%	---
Organics						
Bis(2-Chloroethoxy)Methane	TOT	µg/L	ND>50%	14	36%	---
Bis(2-Chloroethyl)Ether	TOT	µg/L	ND>50%	14	36%	---
Bis(2-Chloroisopropyl)Ether	TOT	µg/L	ND>50%	14	36%	---
Hexachlorobutadiene	TOT	µg/L	ND>50%	14	36%	---
Hexachlorocyclopentadiene	TOT	µg/L	ND>50%	14	36%	---
Hexachloroethane	TOT	µg/L	ND>50%	14	36%	---
Isophorone	TOT	µg/L	ND>50%	14	50%	---
Nitrobenzene	TOT	µg/L	ND>50%	14	36%	---
N-Nitrosodiphenylamine	TOT	µg/L	ND>50%	14	36%	---

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
N-Nitrosodimethylamine	TOT	µg/L	ND>50%	14	36%	---
N-Nitrosodi-N-Propylamine	TOT	µg/L	ND>50%	13	38%	---
1,2,4-trichlorobenzene	TOT	µg/L	ND>50%	14	36%	---
1,2-dichlorobenzene	TOT	µg/L	ND>50%	14	36%	---
1,3-dichlorobenzene	TOT	µg/L	ND>50%	14	36%	---
1,4-dichlorobenzene	TOT	µg/L	ND>50%	14	36%	---
1,2-dichloropropane	TOT	µg/L	ND>50%	14	36%	---
1,2-diphenylhydrazine	TOT	µg/L	ND>50%	14	36%	---
2,4-dinitrotoluene	TOT	µg/L	ND>50%	14	36%	---
3,3-dichlorobenzidine	TOT	µg/L	ND>50%	14	36%	---
2,6-dinitrotoluene	TOT	µg/L	ND>50%	14	36%	---
4-Bromophenyl Phenyl Ether	TOT	µg/L	ND>50%	14	36%	---
4-Chlorophenyl Phenyl Ether	TOT	µg/L	ND>50%	14	36%	---
Chlorobenzene	TOT	µg/L	ND>50%	14	36%	---
Benzene	TOT	µg/L	ND>50%	14	36%	---
Ethylbenzene	TOT	µg/L	ND>50%	14	36%	---
Xylenes	TOT	µg/L	ND>50%	14	36%	---
m & p Xylenes	TOT	µg/L	ND>50%	14	36%	---
Styrene	TOT	µg/L	ND>50%	14	43%	---
Toluene	TOT	µg/L	1.239	14	100%	20
1,1,1,2-Tetrachloroethane	TOT	µg/L	ND>50%	14	36%	---
1,1,1-trichloroethane	TOT	µg/L	ND>50%	13	38%	---
1,1,2,2-tetrachloroethane	TOT	µg/L	ND>50%	14	36%	---
1,1,2-trichloroethane	TOT	µg/L	ND>50%	14	36%	---
1,1-dichloroethane	TOT	µg/L	ND>50%	14	36%	---
1,1-dichloroethene	TOT	µg/L	ND>50%	14	36%	---
1,2-dibromoethane	TOT	µg/L	ND>50%	13	38%	---
1,2-dichloroethane	TOT	µg/L	ND>50%	14	36%	---
Carbon Tetrachloride	TOT	µg/L	ND>50%	11	18%	---
Chloroethane	TOT	µg/L	ND>50%	14	36%	---
Chloroethene	TOT	µg/L	0.5	3	100%	11
Chloromethane	TOT	µg/L	ND>50%	14	36%	---
Acrylonitrile	TOT	µg/L	ND>50%	14	36%	---
Methyl Tertiary Butyl Ether	TOT	µg/L	ND>50%	14	36%	---
Cis-1,2-Dichloroethene	TOT	µg/L	ND>50%	14	36%	---
cis-1,3-dichloropropene	TOT	µg/L	ND>50%	14	36%	---

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Dibromomethane	TOT	µg/L	ND>50%	14	36%	---
Dichloromethane	TOT	µg/L	ND>50%	14	36%	---
Dichlorodifluoromethane	TOT	µg/L	ND>50%	14	36%	---
Tetrabromomethane	TOT	µg/L	50	3	100%	1124
Tetrabromomethane	TOT	µg/L	ND>50%	12	25%	---
Tetrachloroethene	TOT	µg/L	ND>50%	14	36%	---
Tetrachloromethane	TOT	µg/L	0.5	3	100%	11
Trans-1,2-Dichloroethene	TOT	µg/L	ND>50%	14	36%	---
trans-1,3-dichloropropene	TOT	µg/L	ND>50%	14	36%	---
Trichloroethene	TOT	µg/L	ND>50%	14	36%	---
Trichlorofluoromethane	TOT	µg/L	ND>50%	14	36%	---
Vinyl Chloride	TOT	µg/L	ND>50%	11	18%	---
Bromodichloromethane	TOT	µg/L	ND>50%	14	36%	---
Bromoform	TOT	µg/L	ND>50%	1	0%	---
Bromomethane	TOT	µg/L	ND>50%	14	50%	---
Chlorodibromomethane	TOT	µg/L	ND>50%	14	36%	---
Tribromomethane	TOT	µg/L	ND>50%	13	38%	---
Trichloromethane	TOT	µg/L	2.83	3	100%	64
Chloroform	TOT	µg/L	3.31	11	100%	51
Dimethyl Ketone	TOT	µg/L	215.6	14	100%	3660
Methyl Ethyl Ketone	TOT	µg/L	ND>50%	14	50%	---
4-Methyl-2-Pentanone	TOT	µg/L	ND>50%	14	36%	---
Alpha-Terpineol	TOT	µg/L	7.6	14	100%	123
Oxy-Chlordane	TOT	µg/L	ND>50%	12	25%	---
1,4-Dioxane	TOT	µg/L	3.238	6	100%	42
High Resolution						
PAH						
1-methylphenanthrene	TOT	ng/L	15.63	6	100%	0.26
2,3,5-trimethylnaphthalene	TOT	ng/L	22.38	6	100%	0.40
2,6-dimethylnaphthalene	TOT	ng/L	34.93	6	100%	0.62
2-Methylnaphthalene	TOT	ng/L	22.86	8	100%	0.46
Acenaphthene	TOT	ng/L	37.44	8	100%	0.76
Acenaphthylene	TOT	ng/L	1.213	8	100%	0.02
Anthracene	TOT	ng/L	5.76	7	100%	0.12
Benz[a]anthracene	TOT	ng/L	39.98	6	100%	0.64
Benzo[a]pyrene	TOT	ng/L	31.2	6	100%	0.52

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Benzo[b]fluoranthene	TOT	ng/L	26.97	6	100%	0.45
Benzo[e]pyrene	TOT	ng/L	23.85	6	100%	0.40
Benzo[ghi]perylene	TOT	ng/L	20.43	6	100%	0.35
Benzo[J,K]Fluoranthenes	TOT	ng/L	28.12	6	100%	0.47
Chrysene	TOT	ng/L	14	8	100%	0.28
Dibenz[a,h]anthracene	TOT	ng/L	5.16	6	100%	0.09
Dibenzothiophene	TOT	ng/L	32.77	6	100%	0.49
Fluoranthene	TOT	ng/L	42.19	8	100%	0.85
Fluorene	TOT	ng/L	22.75	8	100%	0.46
Indeno[1,2,3-cd]pyrene	TOT	ng/L	20.67	6	100%	0.36
Naphthalene	TOT	ng/L	43.25	8	100%	0.87
Octachlorostyrene	TOT	ng/L	0.1908	5	80%	0.0028
Pentachlorobenzene	TOT	ng/L	0.0742	5	100%	0.0013
Perylene	TOT	ng/L	7.358	6	100%	0.12
Phenanthrene	TOT	ng/L	54.33	7	100%	1.14
Pyrene	TOT	ng/L	24.67	7	100%	0.52
Nonylphenols						
4-n-Octylphenol	TOT	ng/L	12.43	5	80%	0.26
4-Nonylphenol Diethoxylates	TOT	ng/L	565.6	5	100%	10.0
4-Nonylphenol Monoethoxylates	TOT	ng/L	2304	5	100%	42.4
NP	TOT	ng/L	914.2	5	100%	16.0
OC Pesticides						
1,2,3,4-tetrachlorobenzene	TOT	ng/L	0.302	5	60%	0.00586
1,2,3-trichlorobenzene	TOT	ng/L	0.302	5	60%	0.00586
1,2,4,5-/1,2,3,5-tetrachlorobenzene	TOT	ng/L	0.302	5	60%	0.00586
1,2,4-trichlorobenzene	TOT	ng/L	0.266	7	71%	0.00477
1,2-dichlorobenzene	TOT	ng/L	1.12	6	100%	0.023
1,3,5-trichlorobenzene	TOT	ng/L	0.302	5	60%	0.006
1,3-dichlorobenzene	TOT	ng/L	0.524	6	83%	0.009
1,4-dichlorobenzene	TOT	ng/L	31.25	6	100%	0.71
2,4-DDD	TOT	ng/L	29.1	5	100%	0.673
2,4-DDE	TOT	ng/L	0.0665	5	60%	0.001
2,4-DDT	TOT	ng/L	0.389	5	60%	0.0085
44DDD	TOT	ng/L	0.389	5	80%	0.0086
4,4-DDE	TOT	ng/L	0.6868	5	100%	0.013
4,4-DDT	TOT	ng/L	0.52	5	80%	0.011
Aldrin	TOT	ng/L	0.1698	5	60%	0.003

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Alpha Chlordane	TOT	ng/L	0.2152	5	100%	0.003
Alpha-Endosulfan	TOT	ng/L	0.369	4	100%	0.006
Alpha-HCH Or Alpha-BHC	TOT	ng/L	0.1085	5	80%	0.0018834
Beta-Endosulfan	TOT	ng/L	0.46	4	100%	0.0081
Beta-HCH Or Beta-BHC	TOT	ng/L	0.228	5	100%	0.0040
Cis-Nonachlor	TOT	ng/L	0.3732	5	80%	0.0056
Delta-HCHOr Delta-BHC	TOT	ng/L	0.324	4	75%	0.0052
Dieldrin	TOT	ng/L	0.599	4	100%	0.0105
Endosulfan Sulfate	TOT	ng/L	0.324	4	75%	0.0052059
Endrin	TOT	ng/L	0.324	4	75%	0.0052059
Endrin Aldehyde	TOT	ng/L	0.327	4	75%	0.0052397
Endrin Ketone	TOT	ng/L	0.519	4	75%	0.0081200
HCH, Gamma	TOT	ng/L	0.161	5	100%	0.0028
Heptachlor	TOT	ng/L	0.2649	5	60%	0.0044
Heptachlor Epoxide	TOT	ng/L	0.334	4	75%	0.0053
Hexachlorobenzene	TOT	ng/L	0.1894	5	100%	0.0034
Hexachlorobutadiene	TOT	ng/L	0.3249	7	100%	0.0058
Hydrochlorothiazide	TOT	ng/L	535.5	6	100%	8.4
Methoxyclor	TOT	ng/L	0.97	4	100%	0.0174487
MIREX	TOT	ng/L	0.1019	5	60%	0.0016904
Oxy-Chlordane	TOT	ng/L	0.562	5	80%	0.0085
Trans-Chlordane	TOT	ng/L	0.2664	5	100%	0.0046
Trans-Nonachlor	TOT	ng/L	0.2692	5	100%	0.0042
PPCP						
2-hydroxy-Ibuprofen	TOT	ng/L	60870	6	100%	1051
Bisphenol A	TOT	ng/L	36530	6	83%	535.0896049
Furosemide	TOT	ng/L	1860	5	100%	30.3
Gemfibrozil	TOT	ng/L	149.3	6	100%	2.8
Glipizide	TOT	ng/L	ND>50%	6	50%	---
Glyburide	TOT	ng/L	4.99	6	83%	0
Ibuprofen	TOT	ng/L	25530	6	100%	388
Naproxen	TOT	ng/L	12860	6	100%	229
Triclocarban	TOT	ng/L	13.17	6	83%	0.23
Triclosan	TOT	ng/L	640.2	5	100%	9.5
Warfarin	TOT	ng/L	6.19	6	83%	0.10
PBDE						

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Pbde 10	TOT	pg/L	#DIV/0!	0	#DIV/0!	#DIV/0!
Pbde 100	TOT	pg/L	3770	6	100%	0.065
Pbde 105	TOT	pg/L	ND>50%	6	50%	---
Pbde 116	TOT	pg/L	ND>50%	6	50%	---
Pbde 119/120	TOT	pg/L	61.28	6	100%	0.00102
Pbde 12/13	TOT	pg/L	20.18	6	100%	0.00030
Pbde 126	TOT	pg/L	20.5	6	83%	0.000
Pbde 128	TOT	pg/L	ND>50%	6	50%	---
Pbde 138/166	TOT	pg/L	147.4	6	100%	0.0024
Pbde 140	TOT	pg/L	65.33	6	100%	0.0011
Pbde 15	TOT	pg/L	60.22	6	100%	0.0009
Pbde 153	TOT	pg/L	1893	6	100%	0.0317
Pbde 154	TOT	pg/L	1452	6	100%	0.0240
Pbde 155	TOT	pg/L	133.8	6	100%	0.0022
Pbde 17/25	TOT	pg/L	195.8	6	100%	0.0032
Pbde 181	TOT	pg/L	ND>50%	6	50%	---
Pbde 183	TOT	pg/L	400.8	6	100%	0.0063
Pbde 190	TOT	pg/L	ND>50%	6	50%	---
Pbde 203	TOT	pg/L	353.2	6	100%	0.006
Pbde 206	TOT	pg/L	5245	6	100%	0.102
Pbde 207	TOT	pg/L	5335	6	100%	0.102
Pbde 208	TOT	pg/L	2826	6	100%	0.054
Pbde 209	TOT	pg/L	76720	6	100%	1.438
Pbde 28/33	TOT	pg/L	358.3	6	100%	0.006
Pbde 30	TOT	pg/L	1.962	6	67%	0.000035
Pbde 32	TOT	pg/L	5.248	6	83%	0.000076
Pbde 35	TOT	pg/L	5.113	6	100%	0.00009
Pbde 37	TOT	pg/L	10.14	6	100%	0.00017
Pbde 47	TOT	pg/L	18420	6	100%	0.33
Pbde 49	TOT	pg/L	964.8	6	100%	0.0149
Pbde 51	TOT	pg/L	76.93	6	100%	0.0012
Pbde 66	TOT	pg/L	300.7	6	100%	0.0052
Pbde 7	TOT	pg/L	17.99	6	100%	0.000269
Pbde 71	TOT	pg/L	60.38	6	100%	0.0010
Pbde 75	TOT	pg/L	28	6	100%	0.00047
Pbde 77	TOT	pg/L	2.053	6	83%	0.000037
Pbde 79	TOT	pg/L	46.36	6	100%	0.00095

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
PCB						
Pbde 8/11	TOT	pg/L	15.38	6	100%	0.000233
Pbde 85	TOT	pg/L	687.3	6	100%	0.0121
Pbde 99	TOT	pg/L	18070	6	100%	0.31
Pcb 1	TOT	pg/L	102.5	6	100%	0.00144
Pcb 10	TOT	pg/L	11.49	6	83%	0.00016479
Pcb 103	TOT	pg/L	6.707	6	83%	0.000101
Pcb 104	TOT	pg/L	1.556	6	83%	0.00002761
Pcb 105	TOT	pg/L	72.05	6	100%	0.00120
Pcb 106	TOT	pg/L	ND>50%	6	50%	---
Pcb 107/124	TOT	pg/L	8.31	6	100%	0.00013
Pcb 109	TOT	pg/L	16.57	6	100%	0.00027
Pcb 11	TOT	pg/L	315.2	6	100%	0.0056
Pcb 110/115	TOT	pg/L	312.5	6	100%	0.0051
Pcb 111	TOT	pg/L	ND>50%	6	50%	---
Pcb 112	TOT	pg/L	ND>50%	6	50%	---
Pcb 114	TOT	pg/L	5.5	6	83%	0.00009
Pcb 118	TOT	pg/L	221.3	6	100%	0.00359
Pcb 12/13	TOT	pg/L	18.22	6	100%	0.00030
Pcb 120	TOT	pg/L	ND>50%	6	50%	---
Pcb 121	TOT	pg/L	2.177	6	67%	0.000040
Pcb 122	TOT	pg/L	3.08	6	67%	0.0000541
Pcb 123	TOT	pg/L	7.09	6	100%	0.00012
Pcb 126	TOT	pg/L	ND>50%	6	50%	---
Pcb 127	TOT	pg/L	ND>50%	6	50%	---
Pcb 128/166	TOT	pg/L	38.25	6	100%	0.00062
Pcb 129/138/160/163	TOT	pg/L	270.3	6	100%	0.00459
Pcb 130	TOT	pg/L	14.85	6	83%	0.00025
Pcb 131	TOT	pg/L	5.52	6	67%	0.00010
Pcb 132	TOT	pg/L	80.17	6	100%	0.00133
Pcb 133	TOT	pg/L	5.78	6	83%	0.00010
Pcb 134/143	TOT	pg/L	16.7	6	100%	0.00027
Pcb 135/151/154	TOT	pg/L	93.43	6	100%	0.00155
Pcb 136	TOT	pg/L	34.78	6	100%	0.00059
Pcb 137	TOT	pg/L	15.35	6	100%	0.00025
Pcb 139/140	TOT	pg/L	7.67	6	83%	0.00013
Pcb 14	TOT	pg/L	ND>50%	6	50%	---

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Pcb 141	TOT	pg/L	43.45	6	100%	0.00076
Pcb 142	TOT	pg/L	ND>50%	6	50%	---
Pcb 144	TOT	pg/L	13.49	6	100%	0.00022
Pcb 145	TOT	pg/L	1.745	6	67%	0.00003
Pcb 146	TOT	pg/L	41.55	6	100%	0.00071
Pcb 147/149	TOT	pg/L	223.5	6	100%	0.00371
Pcb 148	TOT	pg/L	2.643	6	67%	0.00005
Pcb 15	TOT	pg/L	59.88	6	100%	0.00097
Pcb 150	TOT	pg/L	2.468	6	83%	0.00005
Pcb 152	TOT	pg/L	ND>50%	6	50%	---
Pcb 153/168	TOT	pg/L	230.8	6	100%	0.00400
Pcb 155	TOT	pg/L	16.8	6	100%	0.00031
Pcb 156157	TOT	pg/L	36.55	6	100%	0.00062
Pcb 158	TOT	pg/L	24.85	6	100%	0.00042
Pcb 159	TOT	pg/L	3.03	6	83%	0.00006
Pcb 16	TOT	pg/L	61.75	6	100%	0.00098
Pcb 161	TOT	pg/L	ND>50%	6	50%	---
Pcb 162	TOT	pg/L	ND>50%	6	50%	---
Pcb 164	TOT	pg/L	15.9	6	100%	0.00027
Pcb 165	TOT	pg/L	ND>50%	6	50%	---
Pcb 167	TOT	pg/L	10.26	6	83%	0.00017
Pcb 169	TOT	pg/L	ND>50%	6	50%	---
Pcb 17	TOT	pg/L	105.9	6	100%	0.00160
Pcb 170	TOT	pg/L	48.32	6	100%	0.00086
Pcb 171/173	TOT	pg/L	15.7	6	100%	0.00027
Pcb 172	TOT	pg/L	9.515	6	100%	0.00017
Pcb 174	TOT	pg/L	44.05	6	100%	0.00078
Pcb 175	TOT	pg/L	3.068	6	67%	0.000053
Pcb 176	TOT	pg/L	6.995	6	100%	0.00012
Pcb 177	TOT	pg/L	26.4	6	100%	0.00045
Pcb 178	TOT	pg/L	14.73	6	100%	0.00026
Pcb 179	TOT	pg/L	25.48	6	100%	0.00045
Pcb 18/30	TOT	pg/L	189	6	100%	0.00278
Pcb 180/193	TOT	pg/L	134.4	6	100%	0.00242
Pcb 181	TOT	pg/L	ND>50%	6	50%	---
Pcb 182	TOT	pg/L	ND>50%	6	50%	---
Pcb 183/185	TOT	pg/L	39.13	6	100%	0.00070

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Pcb 184	TOT	pg/L	39.35	6	100%	0.00070
Pcb 186	TOT	pg/L	ND>50%	6	50%	---
Pcb 187	TOT	pg/L	72.9	6	100%	0.00123
Pcb 188	TOT	pg/L	1.573	6	67%	0.00003
Pcb 189	TOT	pg/L	3.73	6	83%	0.00007
Pcb 19	TOT	pg/L	81.53	6	100%	0.00119
Pcb 190	TOT	pg/L	10.16	6	100%	0.00017
Pcb 191	TOT	pg/L	2.417	6	67%	0.00004
Pcb 192	TOT	pg/L	ND>50%	6	50%	---
Pcb 194	TOT	pg/L	26.87	6	100%	0.00050
Pcb 195	TOT	pg/L	8.032	6	100%	0.00015
Pcb 196	TOT	pg/L	12.51	6	100%	0.00022
Pcb 197/200	TOT	pg/L	6.25	6	100%	0.00011
Pcb 198/199	TOT	pg/L	34.65	6	100%	0.00062
Pcb 2	TOT	pg/L	7.053	6	100%	0.00012
Pcb 20/28	TOT	pg/L	160.5	6	100%	0.00267
Pcb 201	TOT	pg/L	3.752	6	83%	0.00006
Pcb 202	TOT	pg/L	10.87	6	100%	0.00019
Pcb 203	TOT	pg/L	21.88	6	100%	0.00040
Pcb 204	TOT	pg/L	1.443	6	83%	0.00003
Pcb 205	TOT	pg/L	1.954	6	83%	0.00004
Pcb 206	TOT	pg/L	28.93	6	100%	0.00051
Pcb 207	TOT	pg/L	5.41	6	83%	0.00010
Pcb 208	TOT	pg/L	10.31	6	100%	0.00018
Pcb 209	TOT	pg/L	26.07	6	100%	0.00045
Pcb 21/33	TOT	pg/L	87.38	6	100%	0.00149
Pcb 22	TOT	pg/L	63.65	6	100%	0.00107
Pcb 23	TOT	pg/L	0.835	6	67%	0.00001
Pcb 24	TOT	pg/L	2.362	6	100%	0.00004
Pcb 25	TOT	pg/L	86.85	6	100%	0.00126
Pcb 26/29	TOT	pg/L	91.57	6	100%	0.00139
Pcb 27	TOT	pg/L	108.9	6	100%	0.00154
Pcb 3	TOT	pg/L	28.63	6	100%	0.00044
Pcb 31	TOT	pg/L	162.5	6	100%	0.00266
Pcb 32	TOT	pg/L	79.13	6	100%	0.00116
Pcb 34	TOT	pg/L	1.605	6	83%	0.00003
Pcb 35	TOT	pg/L	12.26	6	100%	0.00022

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Pcb 36	TOT	pg/L	2.193	6	100%	0.00004
Pcb 37	TOT	pg/L	31.77	6	100%	0.00055
Pcb 38	TOT	pg/L	ND>50%	6	50%	---
Pcb 39	TOT	pg/L	1.303	6	83%	0.00002
Pcb 4	TOT	pg/L	328.9	6	100%	0.00481
Pcb 40/41/71	TOT	pg/L	101.1	6	100%	0.00163
Pcb 42	TOT	pg/L	62.22	6	100%	0.00098
Pcb 43	TOT	pg/L	7.957	6	100%	0.00013
Pcb 44/47/65	TOT	pg/L	305.3	6	100%	0.00493
Pcb 45/51	TOT	pg/L	78.77	6	100%	0.00123
Pcb 46	TOT	pg/L	29.47	6	100%	0.00045
Pcb 48	TOT	pg/L	27.67	6	100%	0.00047
Pcb 49/69	TOT	pg/L	251.8	6	100%	0.00381
Pcb 5	TOT	pg/L	3.075	6	83%	0.00005
Pcb 50/53	TOT	pg/L	146.2	6	100%	0.00210
Pcb 52	TOT	pg/L	353.2	6	100%	0.00564
Pcb 54	TOT	pg/L	9.458	6	83%	0.00014
Pcb 55	TOT	pg/L	2.18	6	83%	0.00004
Pcb 56	TOT	pg/L	46.68	6	100%	0.00082
Pcb 57	TOT	pg/L	4.18	6	83%	0.00006
Pcb 58	TOT	pg/L	1.285	6	67%	0.00002
Pcb 59/62/75	TOT	pg/L	19.93	6	100%	0.00032
Pcb 6	TOT	pg/L	55.83	6	100%	0.00083
Pcb 60	TOT	pg/L	23.53	6	100%	0.00043
Pcb 61/70/74/76	TOT	pg/L	243.8	6	100%	0.00422
Pcb 63	TOT	pg/L	7.507	6	100%	0.00012
Pcb 64	TOT	pg/L	61.37	6	100%	0.00103
Pcb 66	TOT	pg/L	112.3	6	100%	0.00191
Pcb 67	TOT	pg/L	7.16	6	100%	0.00011
Pcb 68	TOT	pg/L	16.6	6	100%	0.00028
Pcb 7	TOT	pg/L	9.127	6	100%	0.00014
Pcb 72	TOT	pg/L	4.63	6	83%	0.00007
Pcb 73	TOT	pg/L	2.665	6	83%	0.00004
Pcb 77	TOT	pg/L	8.13	6	100%	0.00015
Pcb 78	TOT	pg/L	ND>50%	2	0%	---
Pcb 79	TOT	pg/L	3.072	6	100%	0.00005
Pcb 8	TOT	pg/L	103.4	3	100%	0.00156

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
Pcb 80	TOT	pg/L	ND>50%	6	50%	---
Pcb 81	TOT	pg/L	1.08	6	67%	0.00002
Pcb 82	TOT	pg/L	27.38	6	100%	0.00046
Pcb 83/99	TOT	pg/L	182	6	100%	0.00294
Pcb 84	TOT	pg/L	77.42	6	100%	0.00127
Pcb 85/116/117	TOT	pg/L	47.12	6	100%	0.00076
Pcb 86/87/97/108/119/125	TOT	pg/L	175.3	6	100%	0.00295
Pcb 88/91	TOT	pg/L	51.23	6	100%	0.00081
Pcb 89	TOT	pg/L	3.15	6	67%	0.00006
Pcb 9	TOT	pg/L	9.63	6	100%	0.00015
Pcb 90/101/113	TOT	pg/L	300.7	6	100%	0.0049
Pcb 92	TOT	pg/L	67.75	6	100%	0.00108
Pcb 93/95/98/100/102	TOT	pg/L	261.8	6	100%	0.0043
Pcb 94	TOT	pg/L	6.29	6	83%	0.00010
Pcb 96	TOT	pg/L	3.742	6	83%	0.00006
PCBs Total	TOT	pg/L	7968	6	100%	0.129
Total Dichloro Biphenyls	TOT	pg/L	975	6	100%	0.0154
Decachloro Biphenyl	TOT	pg/L	24.53	4	100%	0.00043
Total Heptachloro Biphenyls	TOT	pg/L	454	6	100%	0.0080
Total Hexachloro Biphenyls	TOT	pg/L	1210	3	100%	0.0178
Total Monochloro Biphenyls	TOT	pg/L	140.8	5	100%	0.0020
Total Nonachloro Biphenyls	TOT	pg/L	39	6	100%	0.0007
Total Octachloro Biphenyls	TOT	pg/L	96	6	100%	0.0017
Total Pentachloro Biphenyls	TOT	pg/L	1838	4	100%	0.0334
Total Tetrachloro Biphenyls	TOT	pg/L	1915	6	100%	0.0307
Total Trichloro Biphenyls	TOT	pg/L	1381	5	100%	0.0219
PFAS						
PFBA	TOT	ng/L	24.41	3	100%	0.376
PFBS	TOT	ng/L	11.23	3	67%	0.1734
PFDA	TOT	ng/L	1.823	3	67%	0.0278
PFDoA	TOT	ng/L	ND>50%	3	0%	---
PFHpA	TOT	ng/L	7.09	3	100%	0.110
PFHxA	TOT	ng/L	32.36	3	100%	0.501
PFHxS	TOT	ng/L	16.33	3	100%	0.251
PFNA	TOT	ng/L	1.609	3	67%	0.0244
PFOA	TOT	ng/L	18.87	3	100%	0.291
PFOS	TOT	ng/L	9.23	3	67%	0.141

Appendix B4, continued

Parameter	State Code	Unit Code	Average Concentration	Macaulay		Loading
				n	% Freq	kg/year
PFOSA	TOT	ng/L	ND>50%	3	0%	---
PFPeA	TOT	ng/L	18.33	3	100%	0.283
PFUnA	TOT	ng/L	ND>50%	3	0%	---

--- not detected >50% of the time

Appendix B5 Frequency of Detection and Loadings of Substances in Clover Point Wastewaters

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Conventionals						
pH @ 15°C	TOT	pH	6.74	54	100%	---
TSS	TOT	mg/L	254.7	54	100%	3991071
CBOD	TOT	mg/L as O2	223	54	100%	---
N - Nh3 (As N)- Unionized	TOT	mg/L	0.05161	54	100%	800
Temperature	TOT	°C	17.2	52	100%	---
pH	TOT	pH	7.3	43	100%	---
TOC	TOT	mg/L	44.5	14	100%	677189
COD	TOT	mg/L as O2	573.2	12	100%	---
BOD	TOT	mg/L as O2	247	13	100%	---
N - NO2 (As N)	DIS	mg/L as N	ND>50%	14	10%	---
N - NO (As N)	DIS	mg/L as N	ND>50%	14	10%	---
N - TKN (As N)	TOT	mg/L	45.44	9	100%	722001
N - NH3 (As N)	TOT	mg/L	32.12	52	100%	515185
N - NO3 + NO2 (As N)	TOT	mg/L	ND>50%	12	0%	---
Fecal Coliforms	TOT	CFU/100 mL	9123000	13	100%	146408393808
Enterococci	TOT	CFU/100 mL	2532000	14	100%	54243524949
pH	TOT	pH	7.49	14	100%	---
Specific Conductivity - 25°C	TOT	µS/cm	613	13	100%	---
Alkalinity	TOT	mg/L asCaCO3	186.6	12	100%	3089036
Hardness (As Caco3)	DIS	mg/L	69.85	14	100%	1093846
Hardness (As Caco3)	TOT	mg/L	77.36	14	100%	1211802
P - PO4 - Ortho (As P)	DIS	mg/L	3.003	11	100%	46975
P – PO4 - Total (As P)	DIS	µg/L	3837	3	100%	86875
P - PO4 - Total (As P)	TOT	µg/L	4891	11	100%	76577
Sulfide	TOT	mg/L	0.1309	13	93%	2101
WAD Cyanide	TOT	mg/L	0.001154	14	74%	17
SAD Cyanide	TOT	mg/L	0.03774	14	88%	718
Oil & Grease, Mineral	TOT	mg/L	5.03	14	97%	75321
Oil & grease, total	TOT	mg/L	15.9	14	100%	255614
Total Metals						
Aluminum	TOT	µg/L	240.2	14	100%	3840
Antimony	TOT	µg/L	0.2676	14	100%	4.3
Arsenic	TOT	µg/L	0.5647	14	100%	9.0
Barium	TOT	µg/L	19.19	14	100%	303
Beryllium	TOT	µg/L	ND>50%	14	10%	---

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Cadmium	TOT	µg/L	0.1243	14	100%	2.0
Calcium	TOT	mg/L	19.39	14	100%	305687
Chromium	TOT	µg/L	0.864	14	100%	14
Chromium Iii	TOT	mg/L	ND>50%	11	7%	---
Chromium Vi	TOT	mg/L	ND>50%	11	18%	---
Cobalt	TOT	µg/L	0.3932	14	100%	6.3
Copper	TOT	µg/L	97.37	14	100%	1496
Iron	TOT	µg/L	505.1	14	100%	8139
Lead	TOT	µg/L	4.165	14	100%	65
Magnesium	TOT	mg/L	7.032	14	100%	108980
Manganese	TOT	µg/L	46.26	13	100%	737
Mercury	TOT	µg/L	0.02693	14	71%	0.4
Molybdenum	TOT	µg/L	1.045	14	100%	17
Nickel	TOT	µg/L	2.519	14	100%	40
Potassium	TOT	mg/L	12.85	14	100%	202495
Selenium	TOT	µg/L	0.2845	14	100%	4.5
Silver	TOT	µg/L	0.1003	13	100%	1.5
Sodium	TOT	mg/L	38.87	11	100%	625754
Thallium	TOT	µg/L	0.0058	14	100%	0.1
Tin	TOT	µg/L	0.8	13	100%	13
Zinc	TOT	µg/L	87.98	14	100%	1391
Dissolved Metals						
Aluminum	DIS	µg/L	27.1	14	100%	447
Antimony	DIS	µg/L	0.2294	14	100%	3.8
Arsenic	DIS	µg/L	0.4342	14	100%	7.0
Barium	DIS	µg/L	8.537	14	100%	133
Beryllium	DIS	µg/L	ND>50%	14	0%	---
Cadmium	DIS	µg/L	0.01566	14	94%	0.3
Calcium	DIS	mg/L	16.97	14	100%	267646
Chromium	DIS	µg/L	0.442	14	100%	7.0
Cobalt	DIS	µg/L	0.2277	14	100%	3.7
Copper	DIS	µg/L	43.89	14	100%	686
Iron	DIS	µg/L	263.7	14	100%	4163
Lead	DIS	µg/L	0.7568	14	100%	12
Magnesium	DIS	mg/L	6.673	14	100%	103419
Manganese	DIS	µg/L	33.95	14	100%	538
Mercury	DIS	µg/L	0.00437	14	58%	0.07

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Molybdenum	DIS	µg/L	1.046	14	100%	20
Nickel	DIS	µg/L	1.868	14	100%	30
Potassium	DIS	mg/L	12.36	14	100%	195984
Selenium	DIS	µg/L	0.1932	14	100%	3.1
Silver	DIS	µg/L	0.0719	14	100%	1.2
Thallium	DIS	µg/L	ND>50%	14	23%	---
Tin	DIS	µg/L	0.56	14	100%	9.0
Zinc	DIS	µg/L	21.96	14	100%	359
Speciated Metals						
Methyl Mercury	TOT	ng/L	0.6729	6	100%	0.004
Dibutyltin	TOT	µg/L	0.00264	6	82%	0.02
Dibutyltin Dichloride	TOT	µg/L	0.00338	6	75%	0.02
Monobutyltin	TOT	µg/L	0.00582	6	100%	0.04
Tributyltin Chloride	TOT	µg/L	ND>50%	3	36%	---
Tributyltin	TOT	µg/L	ND>50%	6	36%	---
Monobutyltin Trichloride	TOT	µg/L	0.00918	6	100%	0.06
Acrolein	TOT	µg/L	ND>50%	14	3%	---
Phenolics						
2,4 + 2,5-Dichlorophenol	TOT	µg/L	ND>50%	14	0%	---
2,4,6-trichlorophenol	TOT	µg/L	ND>50%	14	0%	---
2-Chlorophenol	TOT	µg/L	ND>50%	14	0%	---
4-Chloro-3-Methylphenol	TOT	µg/L	ND>50%	9	0%	---
Pentachlorophenol	TOT	µg/L	ND>50%	14	0%	---
Total Phenols	TOT	mg/L	0.05719	14	100%	896
2,4-dimethylphenol	TOT	µg/L	ND>50%	14	0%	---
2,4-dinitrophenol	TOT	µg/L	ND>50%	14	0%	---
2-Methyl-4,6-Dinitrophenol	TOT	µg/L	ND>50%	3	0%	---
2-Nitrophenol	TOT	µg/L	ND>50%	14	0%	---
4-Nitrophenol	TOT	µg/L	ND>50%	14	0%	---
Phenol	TOT	µg/L	8.14	14	97%	127
4,6-dinitro-2-methylphenol	TOT	µg/L	ND>50%	11	0%	---
PAH						
2-Chloronaphthalene	TOT	µg/L	ND>50%	14	0%	---
2-Methylnaphthalene	TOT	µg/L	0.0775	14	100%	1.2
Acenaphthene	TOT	µg/L	0.0544	8	100%	0.9
Acenaphthylene	TOT	µg/L	0.0978	14	90%	1.4

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Anthracene	TOT	µg/L	0.0199	14	71%	0.4
Benzo(A)Anthracene	TOT	µg/L	0.0211	14	71%	0.4
Benzo(A)Pyrene	TOT	µg/L	0.02595	14	94%	0.5
Benzo(B)Fluoranthene	TOT	µg/L	0.0219	14	61%	0.4
Benzo(B)Fluoranthene + Benzo(J)Fluoranthene	TOT	µg/L	0.0266	14	61%	0.5
Benzo(G,H,I)Perylene	TOT	µg/L	ND>50%	14	35%	---
Benzo(K)Fluoranthene	TOT	µg/L	ND>50%	14	29%	---
Chrysene	TOT	µg/L	0.0353	14	87%	0.6
Dibenzo(A,H)Anthracene	TOT	µg/L	ND>50%	14	3%	---
Fluoranthene	TOT	µg/L	0.0643	14	100%	1.2
Fluorene	TOT	µg/L	0.0477	14	100%	0.9
Indeno(1,2,3-C,D)Pyrene	TOT	µg/L	ND>50%	14	29%	---
Naphthalene	TOT	µg/L	0.0734	14	94%	1.3
Phenanthrene	TOT	µg/L	0.1215	14	100%	2.2
Pyrene	TOT	µg/L	0.0555	14	100%	1.0
Total Hmw-PAHs	TOT	µg/L	0.2455	14	100%	4.4
Total Lmw-PAHs	TOT	µg/L	0.5168	14	100%	8.7
Total PAHs	TOT	µg/L	0.7763	14	100%	13
Phthalates						
Bis(2-Ethylhexyl)Phthalate	TOT	µg/L	ND>50%	14	48%	---
Butylbenzyl Phthalate	TOT	µg/L	ND>50%	3	0%	---
N-Butylbenzyl Phthalate	TOT	µg/L	ND>50%	11	4%	---
Diethyl Phthalate	TOT	µg/L	1.362	14	84%	22
Dimethyl Phthalate	TOT	µg/L	ND>50%	14	0%	---
Di-N-Butyl Phthalate	TOT	µg/L	ND>50%	14	3%	---
Di-N-Octyl Phthalate	TOT	µg/L	ND>50%	14	0%	---
Organics						
Bis(2-Chloroethoxy)Methane	TOT	µg/L	ND>50%	14	0%	---
Bis(2-Chloroethyl)Ether	TOT	µg/L	ND>50%	14	0%	---
Bis(2-Chloroisopropyl)Ether	TOT	µg/L	ND>50%	14	0%	---
Hexachlorobutadiene	TOT	µg/L	ND>50%	14	0%	---
Hexachlorocyclopentadiene	TOT	µg/L	ND>50%	14	0%	---
Hexachloroethane	TOT	µg/L	ND>50%	14	0%	---
Isophorone	TOT	µg/L	ND>50%	14	35%	---
Nitrobenzene	TOT	µg/L	ND>50%	14	0%	---
N-Nitrosodiphenylamine	TOT	µg/L	ND>50%	14	0%	---
N-Nitrosodimethylamine	TOT	µg/L	ND>50%	14	0%	---

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
N-Nitrosodi-N-Propylamine	TOT	µg/L	ND>50%	13	0%	---
1,2,4-trichlorobenzene	TOT	µg/L	ND>50%	14	0%	---
1,2-dichlorobenzene	TOT	µg/L	ND>50%	14	0%	---
1,3-dichlorobenzene	TOT	µg/L	ND>50%	14	0%	---
1,4-dichlorobenzene	TOT	µg/L	ND>50%	14	0%	---
1,2-dichloropropane	TOT	µg/L	ND>50%	14	0%	---
1,2-diphenylhydrazine	TOT	µg/L	ND>50%	14	0%	---
2,4-dinitrotoluene	TOT	µg/L	ND>50%	14	0%	---
3,3-dichlorobenzidine	TOT	µg/L	ND>50%	14	0%	---
2,6-dinitrotoluene	TOT	µg/L	ND>50%	14	0%	---
4-Bromophenyl Phenyl Ether	TOT	µg/L	ND>50%	14	0%	---
4-Chlorophenyl Phenyl Ether	TOT	µg/L	ND>50%	14	0%	---
Chlorobenzene	TOT	µg/L	ND>50%	14	0%	---
Benzene	TOT	µg/L	ND>50%	14	0%	---
Ethylbenzene	TOT	µg/L	ND>50%	14	3%	---
Xylenes	TOT	µg/L	ND>50%	14	13%	---
m & p Xylenes	TOT	µg/L	ND>50%	14	13%	---
Styrene	TOT	µg/L	ND>50%	14	10%	---
Toluene	TOT	µg/L	0.894	14	100%	14
1,1,1,2-Tetrachloroethane	TOT	µg/L	ND>50%	14	0%	---
1,1,1-trichloroethane	TOT	µg/L	ND>50%	13	0%	---
1,1,2,2-tetrachloroethane	TOT	µg/L	ND>50%	14	0%	---
1,1,2-trichloroethane	TOT	µg/L	ND>50%	14	0%	---
1,1-dichloroethane	TOT	µg/L	ND>50%	14	0%	---
1,1-dichloroethene	TOT	µg/L	ND>50%	14	0%	---
1,2-dibromoethane	TOT	µg/L	ND>50%	13	0%	---
1,2-dichloroethane	TOT	µg/L	ND>50%	14	0%	---
Carbon Tetrachloride	TOT	µg/L	ND>50%	11	0%	---
Chloroethane	TOT	µg/L	ND>50%	14	0%	---
Chloroethene	TOT	µg/L	ND>50%	3	0%	---
Chloromethane	TOT	µg/L	ND>50%	14	0%	---
Acrylonitrile	TOT	µg/L	ND>50%	14	0%	---
Methyl Tertiary Butyl Ether	TOT	µg/L	ND>50%	14	0%	---
Cis-1,2-Dichloroethene	TOT	µg/L	ND>50%	14	0%	---
cis-1,3-dichloropropene	TOT	µg/L	ND>50%	14	0%	---
Dibromomethane	TOT	µg/L	ND>50%	14	0%	---

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Dichloromethane	TOT	µg/L	ND>50%	14	0%	---
Dichlorodifluoromethane	TOT	µg/L	ND>50%	14	0%	---
Tetrabromomethane	TOT	µg/L	ND>50%	3	0%	---
Tetrabromomethane	TOT	µg/L	ND>50%	12	0%	---
Tetrachloroethene	TOT	µg/L	ND>50%	14	8%	---
Tetrachloromethane	TOT	µg/L	ND>50%	3	0%	---
Trans-1,2-Dichloroethene	TOT	µg/L	ND>50%	14	0%	---
trans-1,3-dichloropropene	TOT	µg/L	ND>50%	14	0%	---
Trichloroethene	TOT	µg/L	ND>50%	14	0%	---
Trichlorofluoromethane	TOT	µg/L	ND>50%	14	0%	---
Vinyl Chloride	TOT	µg/L	ND>50%	11	0%	---
Bromodichloromethane	TOT	µg/L	ND>50%	14	0%	---
Bromoform	TOT	µg/L	ND>50%	1	0%	---
Bromomethane	TOT	µg/L	ND>50%	14	0%	---
Chlorodibromomethane	TOT	µg/L	ND>50%	14	0%	---
Tribromomethane	TOT	µg/L	ND>50%	13	0%	---
Trichloromethane	TOT	µg/L	4.57	3	100%	103
Chloroform	TOT	µg/L	4.95	11	100%	74
Dimethyl Ketone	TOT	µg/L	183.7	14	100%	2980
Methyl Ethyl Ketone	TOT	µg/L	ND>50%	14	0%	---
4-Methyl-2-Pentanone	TOT	µg/L	ND>50%	14	0%	---
Alpha-Terpineol	TOT	µg/L	6.2	14	74%	100
Oxy-Chlordane	TOT	µg/L	ND>50%	12	3%	---
1,4-Dioxane	TOT	µg/L	ND>50%	6	27%	---
OC Pesticides						
1-methylphenanthrene	TOT	ng/L	16.56	6	100%	0.26
2,3,5-trimethylnaphthalene	TOT	ng/L	20.88	6	100%	0.32
2,6-dimethylnaphthalene	TOT	ng/L	25.85	6	100%	0.40
2-Methylnaphthalene	TOT	ng/L	49.57	8	100%	0.77
Acenaphthene	TOT	ng/L	64.19	8	100%	1.09
Acenaphthylene	TOT	ng/L	10.17	8	100%	0.16
Anthracene	TOT	ng/L	31.25	7	100%	0.48
Benz[a]anthracene	TOT	ng/L	52.05	6	100%	0.80
Benzo[a]pyrene	TOT	ng/L	63.89	6	100%	0.97
Benzo[b]fluoranthene	TOT	ng/L	49.41	6	100%	0.75
Benzo[e]pyrene	TOT	ng/L	49.77	6	100%	0.76

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Benzo[ghi]perylene	TOT	ng/L	53.05	6	100%	0.80
Benzo[J,K]Fluoranthenes	TOT	ng/L	58.45	6	100%	0.89
Chrysene	TOT	ng/L	58.95	8	100%	0.90
Dibenz[a,h]anthracene	TOT	ng/L	12.25	6	100%	0.18
Dibenzothiophene	TOT	ng/L	22.22	6	100%	0.36
Fluoranthene	TOT	ng/L	130.1	8	100%	2.07
Fluorene	TOT	ng/L	39.97	8	100%	0.67
Indeno[1,2,3-cd]pyrene	TOT	ng/L	53.34	6	100%	0.80
Naphthalene	TOT	ng/L	79.78	8	100%	1.30
Octachlorostyrene	TOT	ng/L	0.02942	5	56%	0.0006
Pentachlorobenzene	TOT	ng/L	0.0742	5	100%	0.0012
Perylene	TOT	ng/L	16.67	6	100%	0.25
Phenanthrene	TOT	ng/L	200.5	7	100%	3.28
Pyrene	TOT	ng/L	88.01	7	100%	1.41
Nonylphenol						
4-n-Octylphenol	TOT	ng/L	9.53	5	75%	0.15
4-Nonylphenol Diethoxylates	TOT	ng/L	400.1	5	100%	7.0
4-Nonylphenol Monoethoxylates	TOT	ng/L	1497	5	100%	25.3
NP	TOT	ng/L	407.3	5	100%	7.1
OC Pesticides						
1,2,3,4-tetrachlorobenzene	TOT	ng/L	ND>50%	5	0%	---
1,2,3-trichlorobenzene	TOT	ng/L	ND>50%	5	0%	---
1,2,4,5-/1,2,3,5-tetrachlorobenzene	TOT	ng/L	ND>50%	5	0%	---
1,2,4-trichlorobenzene	TOT	ng/L	ND>50%	7	0%	---
1,2-dichlorobenzene	TOT	ng/L	4.713	6	100%	0.073
1,3,5-trichlorobenzene	TOT	ng/L	ND>50%	5	0%	---
1,3-dichlorobenzene	TOT	ng/L	2.563	6	67%	0.053
1,4-dichlorobenzene	TOT	ng/L	63.63	6	100%	1.19
2,4-DDD	TOT	ng/L	0.6889	5	89%	0.010
2,4-DDE	TOT	ng/L	ND>50%	5	33%	---
2,4-DDT	TOT	ng/L	0.151	5	78%	0.0025
44DDD	TOT	ng/L	0.123	5	67%	0.0021
4,4-DDE	TOT	ng/L	0.7681	5	100%	0.013
4,4-DDT	TOT	ng/L	0.371	5	89%	0.006
Aldrin	TOT	ng/L	ND>50%	5	11%	---
Alpha Chlordane	TOT	ng/L	0.1701	5	89%	0.003

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Alpha-Endosulfan	TOT	ng/L	ND>50%	4	50%	---
Alpha-HCH Or Alpha-BHC	TOT	ng/L	ND>50%	5	11%	---
Beta-Endosulfan	TOT	ng/L	0.693	4	83%	0.0132
Beta-HCH Or Beta-BHC	TOT	ng/L	0.185	5	67%	0.0031
Cis-Nonachlor	TOT	ng/L	0.1959	5	67%	0.0038
Delta-HCH Or Delta-BHC	TOT	ng/L	ND>50%	4	0%	---
Dieldrin	TOT	ng/L	0.718	4	83%	0.0137
Endosulfan Sulfate	TOT	ng/L	ND>50%	4	0%	---
Endrin	TOT	ng/L	ND>50%	4	0%	---
Endrin Aldehyde	TOT	ng/L	ND>50%	4	0%	---
Endrin Ketone	TOT	ng/L	ND>50%	4	0%	---
Hch, Gamma	TOT	ng/L	0.421	5	67%	0.0065
Heptachlor	TOT	ng/L	0.0657	5	56%	0.0011
Heptachlor Epoxide	TOT	ng/L	ND>50%	4	0%	---
Hexachlorobenzene	TOT	ng/L	0.1651	5	100%	0.0028
Hexachlorobutadiene	TOT	ng/L	0.2369	7	100%	0.0039
Hydrochlorothiazide	TOT	ng/L	387.1	6	100%	6.6
Methoxyclor	TOT	ng/L	ND>50%	4	17%	---
Mirex	TOT	ng/L	ND>50%	5	0%	---
Oxy-Chlordane	TOT	ng/L	0.1008	5	56%	0.0018
Trans-Chlordane	TOT	ng/L	0.2071	5	89%	0.0035
Trans-Nonachlor	TOT	ng/L	0.1833	5	89%	0.0032
PPCP						
2-hydroxy-Ibuprofen	TOT	ng/L	54050	6	100%	914
Bisphenol A	TOT	ng/L	ND>50%	6	0%	---
Furosemide	TOT	ng/L	1590	5	100%	27.0
Gemfibrozil	TOT	ng/L	123.3	6	100%	1.8
Glipizide	TOT	ng/L	ND>50%	6	0%	---
Glyburide	TOT	ng/L	ND>50%	6	30%	---
Ibuprofen	TOT	ng/L	18750	6	100%	317
Naproxen	TOT	ng/L	9309	6	100%	152
Triclocarban	TOT	ng/L	12.65	6	91%	0.20
Triclosan	TOT	ng/L	421.5	5	100%	6.7
Warfarin	TOT	ng/L	4.66	6	100%	0.08
PBDE						
Pbde 10	TOT	pg/L	ND>50%	0	9%	---
Pbde 100	TOT	pg/L	2547	6	100%	0.041

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Pbde 105	TOT	pg/L	ND>50%	6	0%	---
Pbde 116	TOT	pg/L	ND>50%	6	0%	---
Pbde 119/120	TOT	pg/L	41	6	91%	0.00066
Pbde 12/13	TOT	pg/L	2.901	6	91%	0.00005
Pbde 126	TOT	pg/L	ND>50%	6	10%	---
Pbde 128	TOT	pg/L	ND>50%	6	10%	---
Pbde 138/166	TOT	pg/L	107.2	6	100%	0.0017
Pbde 140	TOT	pg/L	43.33	6	100%	0.0007
Pbde 15	TOT	pg/L	12.58	6	100%	0.0002
Pbde 153	TOT	pg/L	1151	6	100%	0.0185
Pbde 154	TOT	pg/L	834.7	6	100%	0.0134
Pbde 155	TOT	pg/L	80.24	6	100%	0.0013
Pbde 17/25	TOT	pg/L	98.88	6	100%	0.0016
Pbde 181	TOT	pg/L	ND>50%	6	9%	---
Pbde 183	TOT	pg/L	214	6	100%	0.0036
Pbde 190	TOT	pg/L	ND>50%	6	9%	---
Pbde 203	TOT	pg/L	224.5	6	100%	0.004
Pbde 206	TOT	pg/L	3944	6	100%	0.059
Pbde 207	TOT	pg/L	4783	6	100%	0.070
Pbde 208	TOT	pg/L	2737	6	100%	0.040
Pbde 209	TOT	pg/L	61850	6	100%	0.953
Pbde 28/33	TOT	pg/L	255.9	6	100%	0.004
Pbde 30	TOT	pg/L	ND>50%	6	9%	---
Pbde 32	TOT	pg/L	ND>50%	6	36%	---
Pbde 35	TOT	pg/L	4.517	6	100%	0.00007
Pbde 37	TOT	pg/L	8.169	6	100%	0.00013
Pbde 47	TOT	pg/L	12910	6	100%	0.21
Pbde 49	TOT	pg/L	299.6	6	100%	0.0049
Pbde 51	TOT	pg/L	38.16	6	100%	0.0006
Pbde 66	TOT	pg/L	216.7	6	100%	0.0035
Pbde 7	TOT	pg/L	2.348	6	91%	0.000041
Pbde 71	TOT	pg/L	36.73	6	100%	0.0006
Pbde 75	TOT	pg/L	17.39	6	100%	0.00028
Pbde 77	TOT	pg/L	ND>50%	6	27%	---
Pbde 79	TOT	pg/L	42.33	6	100%	0.00063
Pbde 8/11	TOT	pg/L	3.251	6	100%	0.000054
Pbde 85	TOT	pg/L	524.7	6	100%	0.0083

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Pbde 99	TOT	pg/L	12530	6	100%	0.20
PCB						
Pcb 1	TOT	pg/L	19.24	6	100%	0.00035
Pcb 10	TOT	pg/L	ND>50%	6	9%	---
Pcb 103	TOT	pg/L	2.554	6	64%	0.000039
Pcb 104	TOT	pg/L	ND>50%	6	45%	---
Pcb 105	TOT	pg/L	59.18	6	100%	0.00098
Pcb 106	TOT	pg/L	ND>50%	6	0%	---
Pcb 107/124	TOT	pg/L	7.43	6	100%	0.00012
Pcb 109	TOT	pg/L	10.05	6	100%	0.00017
Pcb 11	TOT	pg/L	309.4	6	100%	0.0050
Pcb 110/115	TOT	pg/L	274.2	6	100%	0.0041
Pcb 111	TOT	pg/L	ND>50%	6	0%	---
Pcb 112	TOT	pg/L	ND>50%	6	0%	---
Pcb 114	TOT	pg/L	5.53	6	100%	0.00008
Pcb 118	TOT	pg/L	185.7	6	100%	0.00280
Pcb 12/13	TOT	pg/L	11.65	6	100%	0.00016
Pcb 120	TOT	pg/L	ND>50%	6	0%	---
Pcb 121	TOT	pg/L	2.105	6	55%	0.000032
Pcb 122	TOT	pg/L	ND>50%	6	36%	---
Pcb 123	TOT	pg/L	4.73	6	100%	0.00008
Pcb 126	TOT	pg/L	ND>50%	6	10%	---
Pcb 127	TOT	pg/L	ND>50%	6	0%	---
Pcb 128/166	TOT	pg/L	28.78	6	100%	0.00048
Pcb 129/138/160/163	TOT	pg/L	220.8	6	100%	0.00356
Pcb 130	TOT	pg/L	12.92	6	100%	0.00021
Pcb 131	TOT	pg/L	5	6	55%	0.00007
Pcb 132	TOT	pg/L	74.09	6	100%	0.00117
Pcb 133	TOT	pg/L	4.9	6	73%	0.00007
Pcb 134/143	TOT	pg/L	12.96	6	100%	0.00021
Pcb 135/151/154	TOT	pg/L	79.55	6	100%	0.00126
Pcb 136	TOT	pg/L	31.15	6	100%	0.00049
Pcb 137	TOT	pg/L	11.16	6	91%	0.00018
Pcb 139/140	TOT	pg/L	5.87	6	64%	0.00009
Pcb 14	TOT	pg/L	ND>50%	6	9%	---
Pcb 141	TOT	pg/L	40.37	6	100%	0.00064
Pcb 142	TOT	pg/L	ND>50%	6	0%	---

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Pcb 144	TOT	pg/L	13.42	6	100%	0.00023
Pcb 145	TOT	pg/L	ND>50%	6	0%	---
Pcb 146	TOT	pg/L	31.32	6	100%	0.00051
Pcb 147/149	TOT	pg/L	187.5	6	100%	0.00290
Pcb 148	TOT	pg/L	2.434	6	64%	0.00004
Pcb 15	TOT	pg/L	28.51	6	100%	0.00047
Pcb 150	TOT	pg/L	1.912	6	55%	0.00003
Pcb 152	TOT	pg/L	ND>50%	6	0%	---
Pcb 153/168	TOT	pg/L	202.7	6	100%	0.00321
Pcb 155	TOT	pg/L	13.03	6	100%	0.00021
Pcb 156157	TOT	pg/L	29.3	6	100%	0.00049
Pcb 158	TOT	pg/L	20.35	6	100%	0.00033
Pcb 159	TOT	pg/L	ND>50%	6	45%	---
Pcb 16	TOT	pg/L	31.5	6	100%	0.00051
Pcb 161	TOT	pg/L	ND>50%	6	0%	---
Pcb 162	TOT	pg/L	ND>50%	6	18%	---
Pcb 164	TOT	pg/L	11.86	6	100%	0.00019
Pcb 165	TOT	pg/L	ND>50%	6	0%	---
Pcb 167	TOT	pg/L	8.65	6	100%	0.00014
Pcb 169	TOT	pg/L	ND>50%	6	0%	---
Pcb 17	TOT	pg/L	31.22	6	100%	0.00051
Pcb 170	TOT	pg/L	45.81	6	100%	0.00072
Pcb 171/173	TOT	pg/L	14.47	6	100%	0.00023
Pcb 172	TOT	pg/L	9.268	6	100%	0.00015
Pcb 174	TOT	pg/L	41.69	6	100%	0.00065
Pcb 175	TOT	pg/L	2.938	6	82%	0.000044
Pcb 176	TOT	pg/L	7.604	6	100%	0.00012
Pcb 177	TOT	pg/L	22.93	6	100%	0.00036
Pcb 178	TOT	pg/L	12.22	6	100%	0.00019
Pcb 179	TOT	pg/L	24.57	6	100%	0.00037
Pcb 18/30	TOT	pg/L	70.92	6	100%	0.00116
Pcb 180/193	TOT	pg/L	128.8	6	100%	0.00204
Pcb 181	TOT	pg/L	ND>50%	6	9%	---
Pcb 182	TOT	pg/L	ND>50%	6	0%	---
Pcb 183/185	TOT	pg/L	42.57	6	100%	0.00060
Pcb 184	TOT	pg/L	29.29	6	100%	0.00047
Pcb 186	TOT	pg/L	ND>50%	6	0%	---

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Pcb 187	TOT	pg/L	68.83	6	100%	0.00098
Pcb 188	TOT	pg/L	ND>50%	6	13%	---
Pcb 189	TOT	pg/L	ND>50%	6	36%	---
Pcb 19	TOT	pg/L	7.881	6	100%	0.00013
Pcb 190	TOT	pg/L	9.242	6	100%	0.00015
Pcb 191	TOT	pg/L	2.671	6	73%	0.00004
Pcb 192	TOT	pg/L	ND>50%	6	0%	---
Pcb 194	TOT	pg/L	23.55	6	100%	0.00037
Pcb 195	TOT	pg/L	8.444	6	100%	0.00013
Pcb 196	TOT	pg/L	11.93	6	100%	0.00019
Pcb 197/200	TOT	pg/L	5.047	6	100%	0.00008
Pcb 198/199	TOT	pg/L	31.56	6	100%	0.00048
Pcb 2	TOT	pg/L	5.69	6	100%	0.00009
Pcb 20/28	TOT	pg/L	91.84	6	100%	0.00148
Pcb 201	TOT	pg/L	3.437	6	100%	0.00005
Pcb 202	TOT	pg/L	10.47	6	100%	0.00016
Pcb 203	TOT	pg/L	17.7	6	100%	0.00027
Pcb 204	TOT	pg/L	1.3	6	55%	0.00002
Pcb 205	TOT	pg/L	1.72	6	73%	0.00003
Pcb 206	TOT	pg/L	18.57	6	100%	0.00029
Pcb 207	TOT	pg/L	3.85	6	64%	0.00006
Pcb 208	TOT	pg/L	7.57	6	100%	0.00012
Pcb 209	TOT	pg/L	14.78	6	100%	0.00023
Pcb 21/33	TOT	pg/L	57.04	6	100%	0.00092
Pcb 22	TOT	pg/L	38.25	6	100%	0.00062
Pcb 23	TOT	pg/L	ND>50%	6	9%	---
Pcb 24	TOT	pg/L	1.1	6	91%	0.00002
Pcb 25	TOT	pg/L	7.077	6	100%	0.00012
Pcb 26/29	TOT	pg/L	15.05	6	100%	0.00024
Pcb 27	TOT	pg/L	4.44	6	100%	0.00007
Pcb 3	TOT	pg/L	15.32	6	100%	0.00025
Pcb 31	TOT	pg/L	85.85	6	100%	0.00139
Pcb 32	TOT	pg/L	21.64	6	100%	0.00035
Pcb 34	TOT	pg/L	ND>50%	6	9%	---
Pcb 35	TOT	pg/L	13.82	6	100%	0.00023
Pcb 36	TOT	pg/L	3.487	6	100%	0.00006
Pcb 37	TOT	pg/L	24.12	6	100%	0.00039

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Pcb 38	TOT	pg/L	ND>50%	6	0%	---
Pcb 39	TOT	pg/L	0.891	6	55%	0.00001
Pcb 4	TOT	pg/L	15.13	6	100%	0.00025
Pcb 40/41/71	TOT	pg/L	45.45	6	100%	0.00072
Pcb 42	TOT	pg/L	20.87	6	100%	0.00033
Pcb 43	TOT	pg/L	3.413	6	100%	0.00005
Pcb 44/47/65	TOT	pg/L	143.8	6	100%	0.00229
Pcb 45/51	TOT	pg/L	22.78	6	100%	0.00036
Pcb 46	TOT	pg/L	4.792	6	100%	0.00008
Pcb 48	TOT	pg/L	17.97	6	100%	0.00028
Pcb 49/69	TOT	pg/L	52.57	6	100%	0.00083
Pcb 5	TOT	pg/L	1.89	6	55%	0.00003
Pcb 50/53	TOT	pg/L	11.58	6	100%	0.00019
Pcb 52	TOT	pg/L	200.7	6	100%	0.00321
Pcb 54	TOT	pg/L	ND>50%	6	27%	---
Pcb 55	TOT	pg/L	1.54	6	64%	0.00003
Pcb 56	TOT	pg/L	39.56	6	100%	0.00064
Pcb 57	TOT	pg/L	ND>50%	6	0%	---
Pcb 58	TOT	pg/L	ND>50%	6	0%	---
Pcb 59/62/75	TOT	pg/L	7.127	6	100%	0.00011
Pcb 6	TOT	pg/L	15.7	6	100%	0.00025
Pcb 60	TOT	pg/L	23.15	6	100%	0.00037
Pcb 61/70/74/76	TOT	pg/L	193.5	6	100%	0.00309
Pcb 63	TOT	pg/L	3.471	6	100%	0.00006
Pcb 64	TOT	pg/L	39.21	6	100%	0.00062
Pcb 66	TOT	pg/L	73.95	6	100%	0.00118
Pcb 67	TOT	pg/L	2.1	6	100%	0.00003
Pcb 68	TOT	pg/L	10.73	6	100%	0.00017
Pcb 7	TOT	pg/L	4.47	6	100%	0.00008
Pcb 72	TOT	pg/L	ND>50%	6	0%	---
Pcb 73	TOT	pg/L	ND>50%	6	27%	---
Pcb 77	TOT	pg/L	7.3	6	100%	0.00012
Pcb 78	TOT	pg/L	ND>50%	2	0%	---
Pcb 79	TOT	pg/L	2.646	6	100%	0.00004
Pcb 8	TOT	pg/L	54	3	100%	0.00089
Pcb 80	TOT	pg/L	ND>50%	6	0%	---
Pcb 81	TOT	pg/L	ND>50%	6	9%	---

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
Pcb 82	TOT	pg/L	21.32	6	100%	0.00035
Pcb 83/99	TOT	pg/L	109.2	6	100%	0.00176
Pcb 84	TOT	pg/L	54.64	6	100%	0.00088
Pcb 85/116/117	TOT	pg/L	34.42	6	100%	0.00055
Pcb 86/87/97/108/119/125	TOT	pg/L	144.2	6	100%	0.00234
Pcb 88/91	TOT	pg/L	26.85	6	100%	0.00043
Pcb 89	TOT	pg/L	ND>50%	6	36%	---
Pcb 9	TOT	pg/L	3.822	6	100%	0.00006
Pcb 90/101/113	TOT	pg/L	227.5	6	100%	0.0037
Pcb 92	TOT	pg/L	41.75	6	100%	0.00067
Pcb 93/95/98/100/102	TOT	pg/L	193.4	6	100%	0.0031
Pcb 94	TOT	pg/L	ND>50%	6	0%	---
Pcb 96	TOT	pg/L	1.3	6	73%	0.00002
PCBs Total	TOT	pg/L	4643	6	100%	0.075
Total Dichloro Biphenyls	TOT	pg/L	435	6	100%	0.0071
Decachloro Biphenyl	TOT	pg/L	14.61	4	100%	0.00023
Total Heptachloro Biphenyls	TOT	pg/L	401	6	100%	0.0064
Total Hexachloro Biphenyls	TOT	pg/L	965	3	100%	0.0156
Total Monochloro Biphenyls	TOT	pg/L	35.2	5	100%	0.0006
Total Nonachloro Biphenyls	TOT	pg/L	24	6	100%	0.0004
Total Octachloro Biphenyls	TOT	pg/L	78	6	100%	0.0012
Total Pentachloro Biphenyls	TOT	pg/L	1169	4	100%	0.0181
Total Tetrachloro Biphenyls	TOT	pg/L	915	6	100%	0.0146
Total Trichloro Biphenyls	TOT	pg/L	494.8	5	100%	0.0080
PFAS						
PFBA	TOT	ng/L	14.64	3	100%	0.225
PFBS	TOT	ng/L	ND>50%	3	25%	---
PFDA	TOT	ng/L	ND>50%	3	25%	---
PFDoA	TOT	ng/L	ND>50%	3	0%	---
PFHpA	TOT	ng/L	2.33	3	100%	0.037
PFHxA	TOT	ng/L	7.63	3	100%	0.119
PFHxS	TOT	ng/L	2.56	3	63%	0.039
PFNA	TOT	ng/L	ND>50%	3	13%	---
PFOA	TOT	ng/L	3.78	3	100%	0.059
PFOS	TOT	ng/L	5.15	3	100%	0.079
PFOSA	TOT	ng/L	ND>50%	3	0%	---
PFPeA	TOT	ng/L	6.88	3	100%	0.109

Appendix B5, continued

Parameter	State Code	Unit Code	Average Concentration	Clover		Loading
				n	% Freq	kg/year
PFUnA	TOT	ng/L	ND>50%	3	0%	---

--- not detected >50% of the time

NAUTILUS ENVIRONMENTAL

Acute Toxicity Test Results

Samples 2019-020-000 (Clover), 2019-020-001 (Macaulay) and 2019-020-005 (SPWWTP), collected January 16, 2019

Final Report

January 31, 2019

Submitted to: **Capital Regional District**
Victoria, BC

SAMPLE INFORMATION

Sample ID	Dates				Receipt temp.
	Collected	Received	Rainbow trout test initiation	*Daphnia magna* test initiation	
2019-020-000 (Clover)	16-Jan-19 at 1100h	17-Jan-19 at 0857h	18-Jan-19 at 1800h	17-Jan-19 at 1500h	7.0°C
2019-020-001 (Macaulay)	16-Jan-19 at 1000h	17-Jan-19 at 0857h	18-Jan-19 at 1800h	17-Jan-19 at 1500h	7.0°C
2019-020-005 (SPWWTP)	16-Jan-19 at 0730h	17-Jan-19 at 0857h	18-Jan-19 at 1645h	17-Jan-19 at 1500h	7.0°C

TESTS

- Rainbow trout 96-h LC50 test
- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v) [95% CL]	
	Rainbow trout	*Daphnia magna*
2019-020-000 (Clover)	70.7 [50.0 – 100.0]	>100
2019-020-001 (Macaulay)	35.4 [25.0 – 50.0]	70.7 [50.0 – 100.0]
2019-020-005 (SPWWTP)	>100	>100

LC = Lethal Concentration, CL = Confidence Limits

NAUTILUS ENVIRONMENTAL

QA/QC

QA/QC summary	Rainbow trout	*Daphnia magna*
Reference toxicant LC50 (95% CL)	164.1 (133.7 – 201.4) µg/L Zn[1]	4.2 (3.7 – 4.8) g/L NaCl[2]
Reference toxicant historical mean (2 SD range)	84.3 (37.6 – 189.1) µg/L Zn	5.5 (3.8 – 8.0) g/L NaCl
Reference toxicant CV	42%	19%
Organism health history	Acceptable	Acceptable
Protocol deviations	None	None
Water quality range deviations	None	None
Control performance	Acceptable	Acceptable
Test performance	Valid	Valid

[1] Test Date: January 09, 2019; [2] Test Date: January 09, 2019, CL = Confidence Limits, LC = Lethal Concentration, SD = Standard Deviation, CV = Coefficient of Variation

Richard Chea

Report By:
Richard Chea, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P.Bio
Senior Analyst

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

NAUTILUS
ENVIRONMENTAL

Acute Toxicity Test Results

Samples 2019-0076667 (Clover), 2019-0076666 (Macaulay) and 2019-0076665 (SPWWTP), collected April 10, 2019

Final Report

April 26, 2019

Submitted to: **Capital Regional District**
Victoria, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates				Receipt temp.
	Collected	Received	Rainbow trout test initiation	*Daphnia magna* test initiation	
2019-0076667 (Clover)	10-Apr-19 at N/A	11-Apr-19 at 0936h	11-Apr-19 at 1520h	11-Apr-19 at 1755h	5.4°C
2019-0076666 (Macaulay)	10-Apr-19 at N/A	11-Apr-19 at 0936h	11-Apr-19 at 1520h	12-Apr-19 at 1220h	3.4°C
2019-0076665 (SPWWTP)	10-Apr-19 at N/A	11-Apr-19 at 0936h	11-Apr-19 at 1350h	12-Apr-19 at 1220h	4.6°C

N/A = Not Available

TESTS

- Rainbow trout 96-h LC50 test
- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v) [95% CL]	
	Rainbow trout	*Daphnia magna*
2019-0076667 (Clover)	37.9 [33.2 – 43.2]	73.5 [67.8 – 79.7]
2019-0076666 (Macaulay)	35.4 [25.0 – 50.0]	89.1 [66.1 – 100.0]
2019-0076665 (SPWWTP)	>100	>100

LC = Lethal Concentration, CL = Confidence Limits

QA/QC

QA/QC summary	Rainbow trout	*Daphnia magna*
Reference toxicant LC50 (95% CL)	109.6 (80.2 – 149.8) µg/L Zn[1]	4.8 (4.0 – 5.9) g/L NaCl[2]
Reference toxicant historical mean (2 SD range)	118.2 (34.6 – 404.1) µg/L Zn	5.3 (3.7 – 7.5) g/L NaCl
Reference toxicant CV	68%	18%
Organism health history	Acceptable	Acceptable
Protocol deviations	None	None
Water quality range deviations	None	None
Control performance	Acceptable	Acceptable
Test performance	Valid	Valid

[1] Test Date: April 11, 2019; [2] Test Date: April 03, 2019, CL = Confidence Limits, LC = Lethal Concentration, SD = Standard Deviation, CV = Coefficient of Variation

Report By:
Richard Chea, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P.Bio
Senior Analyst

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Acute Toxicity Test Results

Samples 2019-9076067 (CLO-FEF), 2019-9076066 (MAC-FEF), 2019-9076065 (SPWWTP-EFF) and 2019-9076068 (Ganges-EFF),
collected July 17, 2019

Final Report

August 1, 2019

Submitted to: **Capital Regional District**
Victoria, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates				Receipt temp.
	Collected	Received	Rainbow trout test initiation	*Daphnia magna* test initiation	
2019-9076067 (CLO-FEF)	17-Jul-19 at 0645h	18-Jul-19 at 1004h	19-Jul-19 at 1600h	18-Jul-19 at 1350h	1.8°C-2.2°C
2019-9076066 (MAC-FEF)	17-Jul-19 at 0600h	18-Jul-19 at 1004h	19-Jul-19 at 1600h	18-Jul-19 at 1345h	6.0°C-7.2°C
2019-9076065 (SPWWTP-EFF)	17-Jul-19 at 0645h	18-Jul-19 at 1004h	19-Jul-19 at 1445h	18-Jul-19 at 1310h	1.1°C-2.1°C
2019-9076068 (Ganges-EFF)	17-Jul-19 at 0900h	18-Jul-19 at 1004h	19-Jul-19 at 1600h	18-Jul-19 at 1350h	0.0°C-0.5°C

N/A = Not Available

TESTS

- Rainbow trout 96-h LC50 test
- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v) [95% CL]	
	Rainbow trout	*Daphnia magna*
2019-9076067 (CLO-FEF)	33.0 [28.9 – 37.6]	>100
2019-9076066 (MAC-FEF)	57.4 [47.0 – 70.2]	89.1 [66.1 – >100.0]
2019-9076065 (SPWWTP-EFF)	>100	>100
2019-9076068 (Ganges-EFF)	70.7 [50.0 – 100.0]	>100

LC = Lethal Concentration, CL = Confidence Limits

QA/QC

QA/QC summary	Rainbow trout	*Daphnia magna*
Reference toxicant LC50 (95% CL)	141.5 (104.1 – 192.7) µg/L Zn[1]	6.8 (5.7 – 8.1) g/L NaCl[2]
Reference toxicant historical mean (2 SD range)	87.9 (39.0 – 197.9) µg/L Zn	5.2 (3.7 – 7.5) g/L NaCl
Reference toxicant CV	42%	18%
Organism health history	Acceptable	Acceptable
Protocol deviations	None	None
Water quality range deviations	None	None
Control performance	Acceptable	Acceptable
Test performance	Valid	Valid

[1] Test Date: July 17, 2019; [2] Test Date: July 17, 2019, CL = Confidence Limits, LC = Lethal Concentration, SD = Standard Deviation, CV = Coefficient of Variation

Report By:
Ditty Kakkassery, R.P. Bio
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P.Bio
Senior Analyst

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

Acute Toxicity Test Results

Samples 2019-9088384 (CLO-FEF), 2019-9088383 (MAC-FEF), and 2019-9088382 (SPWWTP-EFF), collected October 23, 2019

Final Report

November 7, 2019

Submitted to: **Capital Regional District**
Victoria, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

SAMPLE INFORMATION

Sample ID	Dates				Receipt temp.
	Collected	Received	Rainbow trout test initiation	*Daphnia magna* test initiation	
2019-9088384 (CLO-FEF)	23-Oct-19 at 0900h	24-Oct-19 at 1110h	24-Oct-19 at 1900h	24-Oct-19 at 1420h	4.3°C
2019-9088383 (MAC-FEF)	23-Oct-19 at 1000h	24-Oct-19 at 1110h	24-Oct-19 at 1900h	24-Oct-19 at 1420h	3.4°C
2019-9088382 (SPWWTP-EFF)	23-Oct-19 at 1300h	24-Oct-19 at 1110h	24-Oct-19 at 1700h	24-Oct-19 at 1420h	6.2°C

TESTS

- Rainbow trout 96-h LC50 test
- *Daphnia magna* 48-h LC50 test

RESULTS

Toxicity test results

Sample ID	LC50 (% v/v) [95% CL]	
	Rainbow trout	*Daphnia magna*
2019-9088384 (CLO-FEF)	70.7 [50.0 – 100.0]	>100
2019-9088383 (MAC-FEF)	35.4 [25.0 – 50.0]	70.7 [50.0 – 100.0]
2019-9088382 (SPWWTP-EFF)	>100	>100

LC = Lethal Concentration, CL = Confidence Limits

QA/QC

QA/QC summary	Rainbow trout	*Daphnia magna*
Reference toxicant LC50 (95% CL)	113.0 (82.6 – 154.7) µg/L Zn[1]	6.3 (5.2 – 7.7) g/L NaCl[2]
Reference toxicant historical mean (2 SD range)	78.1 (30.8 – 198.1) µg/L Zn	5.6 (3.8 – 8.3) g/L NaCl
Reference toxicant CV	49%	20%
Organism health history	Acceptable	Acceptable
Protocol deviations	None	None
Water quality range deviations	None	None
Control performance	Acceptable	Acceptable
Test performance	Valid	Valid

[1] Test Date: October 15, 2019; [2] Test Date: October 30, 2019, CL = Confidence Limits, LC = Lethal Concentration, SD = Standard Deviation, CV = Coefficient of Variation

Richard Chea

Report By:
Richard Chea, B.Sc.
Laboratory Biologist

Reviewed By:
Edmund Canaria, R.P.Bio
Senior Analyst

Toxicity testing for samples Clover, Macaulay and SPWWTP

Samples collected November 12 – December 9, 2019

Final Report

February 27, 2020

Submitted to: **Capital Regional District**
Victoria, BC

8664 Commerce Court, Burnaby, BC V5A 4N7

Full report available upon request (192 pages)

APPENDIX C
2019 SURFACE WATER MONITORING

Appendix C1	Substance List
Appendix C2	Stations
Appendix C3	Macaulay Point Surface Fecal Coliform and Enterococci 5 Sampling Events in 30 Days Results
Appendix C4	Macaulay Point IDZ 5 Sampling Events in 30 Days Results
Appendix C5	Clover Point Surface Fecal Coliform and Enterococci 5 Sampling Events in 30 Days Results
Appendix C6	Clover Point IDZ 5 Sampling Events in 30 Days Results
Appendix C7	CTD Plots

Appendix C1 Substance List

Parameter	Surface Water (1 depth)/Edge of IDZ (3 depths)	
	1st day of 5 in 30	2nd to 5th day of 5 in 30
CONVENTIONAL VARIABLES		
conductivity	IDZ	IDZ
enterococci	SW and IDZ	SW and IDZ
fecal coliform	SW and IDZ	SW and IDZ
hardness (as $CaCO_3$)	IDZ	IDZ
ammonia (NH3)	IDZ	IDZ
total Kjeldahl nitrogen	IDZ	
nitrate	IDZ	IDZ
nitrite	IDZ	IDZ
nitrogen, total	IDZ	
oil & grease, mineral	IDZ	
oil & grease, total	IDZ	
organic carbon, total	IDZ	
pH	IDZ	IDZ
phosphate, dissolved	IDZ	
phosphate, total	IDZ	
salinity	IDZ	IDZ
sulphate	IDZ	
sulphide	IDZ	
suspended solids, total	IDZ	IDZ
temperature	IDZ	IDZ
CTD parameters	IDZ	IDZ
METALS TOTAL		
aluminum	IDZ	
antimony	IDZ	
arsenic	IDZ	
barium	IDZ	
beryllium	IDZ	
bismuth	IDZ	
cadmium	IDZ	
calcium	IDZ	
chromium	IDZ	
chromium VI	IDZ	
cobalt	IDZ	
copper	IDZ	
iron	IDZ	
lead	IDZ	
lithium	IDZ	
magnesium	IDZ	
manganese	IDZ	
mercury	IDZ	
molybdenum	IDZ	
nickel	IDZ	
phosphorus	IDZ	
potassium	IDZ	
selenium	IDZ	
silver	IDZ	
sodium	IDZ	

Appendix C1, continued

Parameter	Surface Water (1 depth)/Edge of IDZ (3 depths)	
	1st day of 5 in 30	2nd to 5th day of 5 in 30
strontium	IDZ	
thallium	IDZ	
tin	IDZ	
titanium	IDZ	
vanadium	IDZ	
zinc	IDZ	

Notes: SW -Surface Water Stations, IDZ – initial dilution zone

Appendix C2 Stations

Macaulay Point	Latitude 48˚	Longitude 123˚
Mac-D1	Variable	
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-D1	Variable	
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

Appendix C3 Macaulay Point Surface Fecal Coliform and Enterococci Results - 5 Sampling Events in 30 Days

Fecals	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
Mac-01	34	43	7	4	14	14	4	1	1	4	1	2	2	1	4	1	1	2	7	16	46	5	36	16
Mac-14	30	31	12	7	24	18	6	1	1	8	1	2	1	1	6	1	1	1	8	15	42	22	4	13
Mac-16	140	60	3	3	22	18	60	2	1	130	1	7	24	1	9	1	16	5	17	19	32	1	26	12
Mac-18	150	54	13	3	14	21	6	2	1	1	1	2	130	1	5	1	1	4	23	9	2	2	3	5
Mac-20	54	71	15	6	10	20	27	18	1	1	1	3	1	1	1	1	1	1	58	5	38	1	13	11
Mac-22	34	39	5	10	14	16	1	14	1	2	1	2	1	1	1	1	1	1	30	45	22	5	20	20
Mac-24	39	37	8	5	29	18	11	12	1	2	20	6	1	2	7	1	1	2	45	17	40	10	19	23
Mac-26	130	66	19	5	26	29	150	23	1	14	1	9	110	1	8	1	1	4	12	20	32	37	31	24
Mac-28	150	110	5	8	11	24	1	1	1	23	1	2	1	1	6	1	1	1	27	8	4	9	9	9
Mac-30	96	68	10	3	2	13	3	1	1	1	1	1	1	1	6	1	1	1	37	11	2	7	6	8
Mac-32	72	130	7	6	10	21	6	1	1	1	1	1	98	1	6	1	1	4	16	2	9	2	1	4
Mac-34	27	61	20	10	18	23	16	3	1	1	1	2	4	1	1	1	1	1	10	11	57	37	28	23
Mac-36	37	40	5	4	7	12	1	8	1	1	2	2	1	1	1	1	1	1	45	18	23	3	10	14
Mac-D1	50	91	23	6	13	24	1	2	1	12	---	2	1	5	4	---	1	2	---	11	60	33	15	24
CB-Ref	2	9	3	6	15	5	8	3	4	1	1	2	1	1	1	2	3	1	1	2	8	2	7	3

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

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
Mac-01	20	9	3	1	2	4	1	1	1	1	1	1	2	1	1	1	1	1	3	3	10	1	4	3
Mac-14	8	12	4	3	5	6	1	1	1	2	1	1	1	1	1	1	1	1	4	5	9	8	3	5
Mac-16	47	26	7	2	6	10	19	1	1	54	1	4	11	1	1	1	1	2	4	3	13	1	2	3
Mac-18	71	14	3	1	1	5	1	5	1	1	1	1	48	1	2	1	3	3	3	1	2	1	1	1
Mac-20	18	16	5	1	1	4	2	5	1	1	1	2	1	1	1	1	1	1	14	3	14	1	1	4
Mac-22	13	8	3	1	3	4	1	4	1	1	1	1	1	1	1	1	1	1	13	6	8	3	1	5
Mac-24	12	12	7	4	9	8	1	1	1	5	1	1	1	1	1	2	1	1	10	8	9	4	2	6
Mac-26	110	17	4	5	4	11	40	1	1	3	1	3	44	1	1	1	1	2	1	3	14	4	9	4
Mac-28	55	37	3	3	3	9	1	1	1	11	1	2	1	1	2	1	1	1	5	9	1	1	1	2
Mac-30	27	29	3	2	1	5	1	1	1	1	1	1	1	1	2	1	1	1	7	2	1	1	1	2
Mac-32	21	37	4	1	1	5	1	1	1	1	1	1	35	1	1	1	1	2	2	7	1	1	1	2
Mac-34	5	29	5	5	1	5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	13	6	4	3
Mac-36	4	17	5	2	3	5	1	1	1	1	1	1	1	1	1	1	1	1	3	7	10	2	3	4
Mac-D1	15	45	4	1	2	6	1	2	1	4	---	2	2	1	1	---	1	1	---	8	12	5	1	5
CB-Ref	3	1	3	2	5	2	1	1	1	1	1	1	1	1	1	1	3	1	1	1	5	1	31	3

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

Appendix C4 Macaulay Point IDZ Results - 5 Sampling Events in 30 Days

Fecals CFU/100 mL	BC Approved WQG = 200 CFU/100 mL (geometric mean over 5 samples)						
Winter							**GeoMean**
		Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	
CB Reference	Top	3	---	1	5	10	5
	Middle	4	3	2	20	2	11
	Bottom	5	4	1	---	1	38
Station 1	Top	97	71	430	17	260	106
	Middle	7000	1400	23	94	1300	488
	Bottom	70	6400	940	58	8100	723
Station 2	Top	65	95	5700	6	14	78
	Middle	6900	810	90	14	480	320
	Bottom	720	43	2700	830	9	229
Station 3	Top	---	85	4900	57	8	117
	Middle	220	71	22	49	19	50
	Bottom	88	68	300	60	11	65
Station 4	Top	64	360	54	9	120	67
	Middle	79	460	71	14	45	70
	Bottom	46	200	53	9	42	45
Spring							**GeoMean**
CB Reference	Top	17	5	4	---	4	6
	Middle	4	4	4	20	18	7
	Bottom	4	1	2	25	9	4
Station 1	Top	---	25	4	20	4	9
	Middle	2	44	27	3400	13	40
	Bottom	4	41	32	37	58	26
Station 2	Top	2	20	4	16	4	6
	Middle	4	6900	37	28	46	67
	Bottom	7	5900	38	1700	58	173
Station 3	Top	8	22	1	21	4	7
	Middle	11	---	35	24	48	26
	Bottom	10	30	35	26	94	30
Station 4	Top	5	22	2	20	5	7
	Middle	4	27	14	14	39	15
	Bottom	7	23	31	34	85	27
Summer							**GeoMean**
CB Reference	Top	4	2	1	3	4	2
	Middle	9	---	13	6	11	9
	Bottom	4	---	11	5	5	6
Station 1	Top	1600	1	6	4	9	13
	Middle	20	210	510	5	---	57
	Bottom	16	2100	18000	14	140	260
Station 2	Top	540	6	13	47	1	18
	Middle	6200	110	580	80	5600	707
	Bottom	2200	1500	16000	6000	3600	4087
Station 3	Top	480	5	9	6	6	15
	Middle	17	59	3700	---	94	137
	Bottom	18	20	3000	2400	350	246
Station 4	Top	720	1	4	3	4	8
	Middle	9	57	1400	4	89	48
	Bottom	16	3700	270	3100	280	425

Appendix C4, continued

Fecals CFU/100 mL	BC Approved WQG = 200 CFU/100 mL (geometric mean over 5 samples)						
Autumn							GeoMean
CB Reference	Top	75	65	23	7	44	210
	Middle	10	2	15	9	5	1
	Bottom	19	1	14	7	5	1
Station 1	Top	66	52	67	85	65	58
	Middle	9800	83	11000	71	1414	8900
	Bottom	11000	240	440	12000	1357	330
Station 2	Top	32	---	22	---	35	63
	Middle	110	19000	550	2900	2268	18000
	Bottom	80	13000	90	18000	1465	4000
Station 3	Top	34	65	120	66	69	89
	Middle	50	19000	210	100	719	9600
	Bottom	49	12000	140	51	519	9000
Station 4	Top	41	42	49	61	51	64
	Middle	140	130	5100	6800	1350	7100
	Bottom	190	540	5300	8900	854	94

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

Fecals CFU/100 mL – Macaulay – (maximum value presented from each depth for each day)				
	Station #	**Top**	**Middle**	**Bottom**
Winter	Station 1	430	7000	8100
	Station 2	5700	6900	2700
	Station 3	4900	220	300
	Station 4	360	460	200
GeoMean		**1442**	**1487**	**1070**
Spring	Station 1	25	3400	58
	Station 2	20	6900	5900
	Station 3	22	48	94
	Station 4	22	39	85
GeoMean		**22**	**458**	**229**
Summer	Station 1	1600	510	18000
	Station 2	540	6200	16000
	Station 3	480	3700	3000
	Station 4	720	1400	3700
GeoMean		**739**	**2012**	**7519**
Autumn	Station 1	85	11000	12000
	Station 2	35	19000	18000
	Station 3	120	19000	12000
	Station 4	61	7100	8900
GeoMean		**68**	**12958**	**12324**

Notes: Red Shaded cells indicate exceedance to BC WQG GeoMean of 200 CFU/100 mL, Geo Mean = Geometric Mean. *Figure 3.3 is derived from these tables by taking the maximum value from each sampling day and depth to provide a worst-case scenario

Appendix C4, continued

Enterococci		Health Canada WQG = 35 CFU/100 mL (geometric mean over 5 samples) & 70 CFU/100 mL for single samples					
Winter							GeoMean
		Day 1	Day 2	Day 3	Day 4	Day 5	
CB Reference	Top	1	---	1	1	4	1
	Middle	1	1	1	4	1	1
	Bottom	1	2	1	---	1	1
Station 1	Top	28	37	94	7	71	34
	Middle	1600	860	8	42	350	175
	Bottom	24	3400	200	18	2000	226
Station 2	Top	17	44	1400	2	4	24
	Middle	1300	330	41	6	110	103
	Bottom	260	22	630	400	1	68
Station 3	Top	---	25	1500	11	1	25
	Middle	34	34	9	19	3	14
	Bottom	24	34	86	24	2	20
Station 4	Top	12	100	17	2	37	17
	Middle	32	140	11	5	23	22
	Bottom	14	48	15	4	9	13
Spring							GeoMean
CB Reference	Top	3	2	1	---	1	2
	Middle	2	1	1	5	7	2
	Bottom	1	1	1	4	2	2
Station 1	Top	---	2	1	3	1	2
	Middle	2	5	13	930	1	10
	Bottom	1	5	4	11	6	4
Station 2	Top	1	3	1	5	2	2
	Middle	1	2300	7	4	10	15
	Bottom	1	1100	15	560	13	41
Station 3	Top	1	1	1	2	1	1
	Middle	3	---	10	5	11	6
	Bottom	1	5	6	6	16	5
Station 4	Top	1	3	1	3	2	2
	Middle	1	6	4	4	12	4
	Bottom	1	2	8	5	29	5
Summer							GeoMean
CB Reference	Top	1	1	1	1	1	1
	Middle	1	---	1	1	1	1
	Bottom	1	---	1	2	2	1
Station 1	Top	440	1	1	1	1	3
	Middle	3	42	62	1		9
	Bottom	5	640	7900	1	20	55
Station 2	Top	130	1	2	7	1	4
	Middle	1400	22	42	23	1100	127
	Bottom	690	310	7500	1400	650	1079
Station 3	Top	120	1	3	1	1	3
	Middle	4	10	570		13	23
	Bottom	3	7	760	700	35	52
Station 4	Top	160	1	2	1	1	3
	Middle	4	14	300	1	12	12
	Bottom	4	580	39	410	44	70

Appendix C4, continued

Enterococci	Health Canada WQG = 35 CFU/100 mL (geometric mean over 5 samples) & 70 CFU/100 mL for single samples						
Autumn							GeoMean
CB Reference	Top	1	1	7	2	1	2
	Middle	1	4	1	6	1	2
	Bottom	1	1	1	1	1	1
Station 1	Top	9	13	8	5	20	10
	Middle	570	890	18	1000	14	166
	Bottom	130	640	64	30	3400	222
Station 2	Top	14	2		1		3
	Middle	9200	45	3600	41	4100	758
	Bottom	330	37	2400	23	4200	309
Station 3	Top	12	2	15	9	11	8
	Middle	500	23	5500	39	25	144
	Bottom	500	21	2000	24	11	89
Station 4	Top	15	14	6	7	20	11
	Middle	610	65	30	500	1800	255
	Bottom	13	130	120	500	3900	209

Notes: Red 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, *Geo Mean = Geometric Mean,--- not sampled due to weather issues

Enterococci – Macaulay – (maximum value presented from each depth for each day) Health Canada WQG = 35 CFU/100 mL (geometric mean over 5 samples)				
	Station #	Top	Middle	Bottom
Winter	Station 1	94	1600	3400
	Station 2	1400	1300	630
	Station 3	1500	19	86
	Station 4	100	140	48
GeoMean		**375**	**273**	**307**
Spring	Station 1	3	11	11
	Station 2	5	2300	1100
	Station 3	2	11	16
	Station 4	3	12	29
GeoMean		**3**	**43**	**49**
Summer	Station 1	440	62	7900
	Station 2	130	1400	7500
	Station 3	120	570	760
	Station 4	160	300	580
GeoMean		**182**	**349**	**2261**
Autumn	Station 1	20	1000	3400
	Station 2	14	9200	4200
	Station 3	15	5500	2000
	Station 4	20	1800	3900
GeoMean		**17**	**3089**	**3249**

Notes: Red Shaded cells indicate exceedance to BC WQG GeoMean of 20 CFU/100 mL

Appendix C4, continued

NH$_3$ mg/L N – Macaulay							
BC Approved WQG = 22 mg/L N (average over 5 samples) or 148 mg/L N (maximum)							
Winter							Average
		Day 1	Day 2	Day 3	Day 4	Day 5	
CB Reference	Top	0.42	---	0.052	0.033	0.046	0.138
	Middle	0.42	0.034	0.067	---	0.036	0.139
	Bottom	0.42	0.043	0.047	0.035	0.038	0.117
Station 1	Top	0.41	0.07	0.032	0.034	0.03	0.115
	Middle	0.46	0.084	0.05	<0.025	0.07	0.166
	Bottom	0.41	0.11	0.096	<0.025	0.11	0.182
Station 2	Top	0.37	0.05	0.12	0.037	0.026	0.121
	Middle	0.47	0.1	0.049	<0.025	0.056	0.169
	Bottom	0.95	0.039	0.09	0.063	0.044	0.237
Station 3	Top	---	0.064	0.096	0.038	0.083	0.070
	Middle	0.42	0.074	0.043	0.031	0.044	0.122
	Bottom	0.41	0.1	0.059	0.053	0.036	0.132
Station 4	Top	0.26	0.078	0.08	0.046	0.039	0.101
	Middle	0.39	0.086	0.071	<0.025	0.036	0.146
	Bottom	0.47	0.048	0.079	<0.025	0.046	0.161
Spring							Average
CB Reference	Top	0.077	0.061	0.12	---	0.25	0.127
	Middle	0.03	0.075	0.13	0.11	0.27	0.123
	Bottom	0.062	0.065	0.38	0.047	0.13	0.137
Station 1	Top	---	0.041	0.14	0.082	0.064	0.082
	Middle	0.066	0.065	0.1	0.14	0.058	0.086
	Bottom	0.058	0.067	0.13	0.067	0.28	0.120
Station 2	Top	0.074	0.052	0.17	0.067	0.059	0.084
	Middle	0.046	0.11	0.072	0.16	0.099	0.097
	Bottom	0.059	0.12	0.06	0.22	0.076	0.107
Station 3	Top	0.06	0.063	0.095	<0.025	0.07	0.072
	Middle	0.083	---	0.11	0.077	0.077	0.087
	Bottom	0.071	0.078	0.094	0.07	0.1	0.083
Station 4	Top	0.052	0.061	0.14	0.049	0.055	0.071
	Middle	<0.025	0.064	0.37	0.29	0.063	0.197
	Bottom	0.05	0.054	0.073	0.089	0.1	0.073
Summer							Average
CB Reference	Top	0.045	<0.025	0.07	0.75	0.21	0.269
	Middle	0.071	---	<0.025	0.6	0.091	0.254
	Bottom	0.034	---	---	0.25	0.077	0.120
Station 1	Top	0.069	0.081	0.027	0.082	0.5	0.152
	Middle	0.056	0.17	0.029	0.18	<0.025	0.109
	Bottom	<0.025	0.2	0.1	0.33	<0.025	0.210
Station 2	Top	0.034	0.041	<0.025	0.25	0.057	0.096
	Middle	0.11	0.18	<0.025	0.35	0.087	0.182
	Bottom	0.057	0.046	0.14	0.37	<0.025	0.153
Station 3	Top	0.059	0.23	0.18	0.09	0.027	0.117
	Middle	0.077	0.3	0.58	---	<0.025	0.319
	Bottom	0.048	0.25	0.63	0.41	<0.025	0.335
Station 4	Top	0.06	0.3	0.26	0.099	---	0.180
	Middle	0.062	0.44	0.27	0.12	<0.025	0.223
	Bottom	<0.025	0.09	0.33	0.76	0.031	0.303

Appendix C4, continued

NH_3 mg/L N – Macaulay							
BC Approved WQG = 22 mg/L N (average over 5 samples) or 148 mg/L N (maximum)							
Autumn							Average
CB Reference	Top	0.12	0.12	0.077	0.11	0.071	0.100
	Middle	0.066	0.027	0.083	0.1	0.062	0.068
	Bottom	0.11	0.074	0.17	0.069	0.046	0.094
Station 1	Top	0.083	0.045	0.086	0.061	0.025	0.060
	Middle	0.18	0.16	0.12	0.19	0.042	0.138
	Bottom	0.11	0.21	0.95	0.071	0.16	0.300
Station 2	Top	0.051	0.087	---	0.046	---	0.061
	Middle	0.3	0.1	0.3	0.084	0.099	0.177
	Bottom	0.15	0.049	0.19	0.076	0.22	0.137
Station 3	Top	0.069	0.074	0.11	<0.025	0.086	0.085
	Middle	0.26	0.072	0.26	0.07	0.079	0.148
	Bottom	0.24	0.072	0.2	0.079	<0.025	0.148
Station 4	Top	0.1	0.12	0.13	0.057	0.067	0.095
	Middle	0.16	0.14	0.15	2.4	0.15	0.600
	Bottom	0.14	0.099	0.064	0.16	0.17	0.127

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

Arsenic ug/L-Macaulay					
BC Approved WQG = 12.5 ug/L (maximum)					
		Winter	Spring	Summer	Autumn
CB Reference	Top	---	1.92	2.05	1.93
	Middle	2.01	1.96	---	2.31
	Bottom	1.87	1.73	---	2.47
Station 1	Top	2	---	2.19	2.07
	Middle	2.02	1.73	2.36	2.37
	Bottom	1.91	1.94	2.06	2.28
Station 2	Top	1.74	1.78	1.78	2.11
	Middle	1.84	1.72	2.11	2.03
	Bottom	1.88	1.65	1.81	1.83
Station 3	Top	1.95	1.73	2.00	2.28
	Middle	1.85	1.69	1.97	2.28
	Bottom	1.81	1.69	1.68	2.18
Station 4	Top	1.92	1.75	1.59	2.26
	Middle	1.78	1.82	1.95	1.98
	Bottom	1.84	1.74	2.2	2.37

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

Appendix C4, continued

Copper ug/L-Macaulay					
BC Approved WQG= 2.0 ug/L (average over 5 samples) or 3.0 ug/L (maximum)					
		Winter	Spring	Summer	Autumn
CB Reference	Top	---	0.306	0.229	<0.5
	Middle	0.34	0.278	---	<0.5
	Bottom	0.369	0.386	---	<0.5
Station 1	Top	0.384	---	0.198	<0.5
	Middle	0.589	0.528	0.182	<0.5
	Bottom	0.473	0.401	0.258	<0.5
Station 2	Top	0.632	0.372	0.198	<0.5
	Middle	0.546	0.27	0.202	<0.5
	Bottom	0.492	0.284	0.236	<0.5
Station 3	Top	0.389	0.309	0.197	<0.5
	Middle	0.32	0.24	0.216	<0.5
	Bottom	0.418	0.462	0.216	<0.5
Station 4	Top	0.372	0.366	0.184	<0.5
	Middle	0.361	0.244	0.175	<0.5
	Bottom	0.397	0.315	0.256	<0.5

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

Zinc ug/L-Macaulay					
BC Working WQG = 10 ug/L (average of 5 samples)					
		Winter	Spring	Summer	Autumn
CB Reference	Top	---	0.758	0.984	<3
	Middle	0.931	10.2	---	<3
	Bottom	1.77	2.4	---	<3
Station 1	Top	0.679	---	0.564	<3
	Middle	1.07	1.03	0.465	<3
	Bottom	0.775	0.985	0.682	<3
Station 2	Top	0.874	1.75	0.515	<3
	Middle	1.07	0.964	0.608	<3
	Bottom	0.934	0.806	0.571	<3
Station 3	Top	0.793	1.1	0.677	<3
	Middle	0.633	0.801	1.03	<3
	Bottom	0.731	2.42	0.892	<3
Station 4	Top	0.993	1.37	0.512	<3
	Middle	0.741	1.39	0.487	<3
	Bottom	0.83	0.639	0.673	<3

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

Appendix C4, continued

Cadmium ug/L-Macaulay					
BC Working WQG = 0.12 ug/L (maximum)					
		Winter	**Spring**	**Summer**	**Autumn**
CB Reference	Top	---	0.072	0.078	0.089
	Middle	0.076	0.074	---	0.116
	Bottom	0.078	0.071	---	0.118
Station 1	Top	0.075	---	0.08	0.108
	Middle	0.073	0.073	0.081	0.107
	Bottom	0.074	0.069	0.081	0.106
Station 2	Top	0.074	0.073	0.085	0.094
	Middle	0.074	0.071	0.083	0.092
	Bottom	0.073	0.069	0.077	0.092
Station 3	Top	0.072	0.072	0.08	0.092
	Middle	0.072	0.068	0.086	0.097
	Bottom	0.073	0.068	0.079	0.094
Station 4	Top	0.076	0.072	0.075	0.101
	Middle	0.072	0.068	0.077	0.088
	Bottom	0.074	0.07	0.079	0.098

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

Lead ug/L-Macaulay					
BC Approved WQG = 2 ug/L (average of 5 samples) or 140 ug/L N (maximum)					
		Winter	**Spring**	**Summer**	**Autumn**
CB Reference	Top	---	0.072	0.078	0.089
	Middle	0.076	0.074	---	0.116
	Bottom	0.078	0.071	---	0.118
Station 1	Top	0.024	---	0.016	<0.05
	Middle	0.031	0.033	0.012	<0.05
	Bottom	0.032	0.023	0.028	0.051
Station 2	Top	0.025	0.028	0.014	<0.05
	Middle	0.034	0.021	0.019	<0.05
	Bottom	0.048	0.029	0.017	0.108
Station 3	Top	0.025	0.02	0.018	<0.05
	Middle	0.03	0.015	0.024	0.068
	Bottom	0.027	0.093	0.019	0.058
Station 4	Top	0.025	0.331	0.012	0.051
	Middle	0.026	0.021	0.014	0.076
	Bottom	0.03	0.026	0.026	0.066

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

Appendix C4, continued

Boron ug/L-Macaulay					
BC Approved WQG = 1200 ug/L (maximum)					
		Winter	**Spring**	**Summer**	**Autumn**
CB Reference	Top	---	4510	4070	4100
	Middle	4240	4450	---	4210
	Bottom	4320	4430	---	4390
Station 1	Top	4300	---	4040	3980
	Middle	4380	4400	4020	4040
	Bottom	4270	4460	3950	4070
Station 2	Top	4370	4230	3980	3950
	Middle	4140	4870	3870	3840
	Bottom	4420	4340	3890	3920
Station 3	Top	4140	4450	3870	3830
	Middle	4350	4360	4040	3930
	Bottom	4400	4310	4170	3950
Station 4	Top	4430	4560	3910	3800
	Middle	4440	4360	3940	3920
	Bottom	4510	4220	3930	3850

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

Nickel ug/L-Macaulay					
BC Working WQG = 8.3 ug/L (maximum)					
		Winter	**Spring**	**Summer**	**Autumn**
CB Reference	Top	---	0.358	0.374	1.54
	Middle	0.388	0.371	---	<0.5
	Bottom	0.393	0.373	---	<0.5
Station 1	Top	0.38	---	0.334	0.56
	Middle	0.385	0.37	0.336	0.55
	Bottom	0.402	0.373	0.363	<0.5
Station 2	Top	0.384	0.366	0.351	<0.5
	Middle	0.404	0.409	0.349	<0.5
	Bottom	0.411	0.383	0.351	<0.5
Station 3	Top	0.371	0.367	0.345	<0.5
	Middle	0.393	0.359	0.354	<0.5
	Bottom	0.376	0.374	0.358	0.55
Station 4	Top	0.402	0.358	0.347	<0.5
	Middle	0.394	0.354	0.34	<0.5
	Bottom	0.385	0.371	0.351	<0.5

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

Appendix C4, continued

Silver ug/L-Macaulay					
BC Approved WQG=3 ug/L (maximum) or 1.5 ug/L (average over 5 samples)					
		Winter	**Spring**	**Summer**	**Autumn**
CB Reference	Top	---	<0.00005	<0.00005	<0.00005
	Middle	<0.00005	<0.00005	---	<0.00005
	Bottom	<0.00005	<0.00005	---	<0.00005
Station 1	Top	<0.00005	---	<0.00005	<0.00005
	Middle	<0.00005	<0.00005	<0.00005	<0.00005
	Bottom	<0.00005	<0.00005	<0.00005	<0.00005
Station 2	Top	<0.00005	<0.00005	<0.00005	<0.00005
	Middle	<0.00005	<0.00005	<0.00005	<0.00005
	Bottom	<0.00005	<0.00005	<0.00005	<0.00005
Station 3	Top	<0.00005	<0.00005	<0.00005	<0.00005
	Middle	<0.00005	<0.00005	<0.00005	<0.00005
	Bottom	<0.00005	<0.00005	<0.00005	<0.00005
Station 4	Top	<0.00005	<0.00005	<0.00005	<0.00005
	Middle	<0.00005	<0.00005	<0.00005	<0.00005
	Bottom	<0.00005	<0.00005	<0.00005	<0.00005

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

Appendix C4, continued

Nitrate Nitrogen mg/L – Macaulay							
BC Approved WQG = 3.7 mg/L (average over 5 samples)							
Winter							**Average**
		Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	
CB Reference	Top	0.347	---	0.336	0.312	0.372	0.342
	Middle	0.342	0.361	0.331	---	0.336	0.343
	Bottom	0.341	0.354	0.331	0.313	0.321	0.332
Station 1	Top	0.358	0.364	0.349	0.323	0.368	0.351
	Middle	0.362	0.36	0.339	0.317	0.369	0.346
	Bottom	0.365	0.36	0.344	0.275	0.358	0.334
Station 2	Top	0.364	0.365	0.347	0.297	0.372	0.345
	Middle	0.361	0.362	0.342	0.304	0.361	0.342
	Bottom	0.364	0.36	0.342	0.282	0.361	0.336
Station 3	Top	0.372	0.356	0.348	0.311	0.368	0.346
	Middle	0.367	0.358	0.332	0.291	0.36	0.335
	Bottom	0.373	0.36	0.346	0.292	0.36	0.340
Station 4	Top	---	0.364	0.348	0.303	0.368	0.346
	Middle	0.367	0.366	0.32	0.325	0.363	0.344
	Bottom	0.366	0.353	0.337	0.251	0.363	0.326
Spring							**Average**
CB Reference	Top	0.245	0.25	0.247		0.238	0.245
	Middle	0.265	0.242	0.253	0.284	0.285	0.266
	Bottom	0.258	0.254	0.25	0.28	0.297	0.268
Station 1	Top	---	0.253	0.229	0.268	0.238	0.247
	Middle	0.243	0.253	0.255	0.253	0.239	0.249
	Bottom	0.22	0.256	0.25	0.248	0.274	0.250
Station 2	Top	0.281	0.255	0.199	0.261	0.196	0.238
	Middle	0.265	0.256	0.231	0.257	0.252	0.252
	Bottom	0.234	0.254	0.249	0.268	0.257	0.252
Station 3	Top	0.254	0.255	0.247	0.251	0.252	0.252
	Middle	0.267	---	0.25	0.258	0.249	0.256
	Bottom	0.259	0.249	0.239	0.264	0.23	0.248
Station 4	Top	0.25	0.258	0.256	0.259	0.222	0.249
	Middle	0.254	0.258	0.25	0.257	0.267	0.257
	Bottom	0.261	0.239	0.256	0.264	0.265	0.257
Summer							**Average**
CB Reference	Top	0.145	0.218	0.299	0.367	0.34	0.2738
	Middle	0.223	---	0.33	0.435	0.359	0.337
	Bottom	0.14	---	---	0.404	0.36	0.301
Station 1	Top	0.221	0.229	0.255	0.338	0.333	0.275
	Middle	0.176	0.244	0.284	0.396	---	0.275
	Bottom	0.155	0.23	0.289	0.423	0.357	0.291
Station 2	Top	0.192	0.222	0.259	0.291	0.323	0.257
	Middle	0.128	0.24	0.289	0.382	0.349	0.278
	Bottom	0.214	0.238	0.293	0.394	0.349	0.298
Station 3	Top	0.237	0.228	0.254	0.347	0.336	0.280
	Middle	0.207	0.231	0.288	---	0.344	0.268
	Bottom	0.223	0.19	0.288	0.384	0.353	0.288
Station 4	Top	0.169	0.193	0.247	0.299	0.332	0.248
	Middle	0.23	0.236	0.28	0.395	0.35	0.298
	Bottom	0.233	0.243	0.297	0.442	0.35	0.313

Appendix C4, continued

Nitrate Nitrogen mg/L – Macaulay							
BC Approved WQG = 3.7 mg/L (average over 5 samples)							
Autumn							**Average**
CB Reference	Top	0.339	0.314	0.339	0.359	0.373	0.345
	Middle	0.403	0.404	0.408	0.309	0.395	0.384
	Bottom	0.423	0.421	0.418	0.322	0.406	0.398
Station 1	Top	0.353	0.348	0.34	0.35	0.372	0.353
	Middle	0.376	0.359	---	0.38	0.386	0.375
	Bottom	0.379	0.354	0.374	0.313	0.392	0.358
Station 2	Top	0.356	0.343	0.381	0.377	---	0.367
	Middle	0.373	0.354	0.371	0.271	0.351	0.337
	Bottom	0.377	0.355	0.36	0.374	0.389	0.370
Station 3	Top	0.351	0.342	0.333	0.375	0.37	0.355
	Middle	0.378	0.341	0.359	0.384	0.392	0.369
	Bottom	0.377	0.35	0.365	0.38	0.388	0.371
Station 4	Top	0.335	0.349	0.337	0.378	0.361	0.356
	Middle	0.352	0.357	0.364	0.321	0.391	0.358
	Bottom	0.346	0.358	0.333	0.375	0.394	0.365

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

Appendix C5 Clover Point Surface Fecal Coliform and Enterococci Days Results- 5 Sampling Events in 30

Fecals	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
Clo-01	91	39	14	21	59	36	3	26	27	17	8	12	1	1	2	4	11	2	11	1	65	95	51	20
Clo-14	83	29	23	560	50	69	4	18	3	9	12	7	1	2	7	8	530	9	56	5	64	81	75	40
Clo-16	83	24	28	23	1600	73	4	12	21	1	58	9	1	2	2	3	1	2	30	2	40	98	50	26
Clo-18	40	26	26	20	31	28	3	7	23	1	5	5	1	2	1	3	1	1	23	5	8	80	17	17
Clo-20	76	---	26	28	34	37	7	8	17	15	7	10	1	2	2	11	6	3	21	6	72	120	35	33
Clo-22	55	40	89	26	25	42	1	37	1	14	8	5	10	3	16	2	63	9	19	80	60	53	71	51
Clo-24	100	---	1600	20	54	115	3	38	14	12	12	12	7	2	25	30	53	14	40	2	65	82	100	34
Clo-26	66	10	16	23	1600	52	1	17	26	1	15	6	1	1	8	14	5	4	17	1	61	110	49	22
Clo-28	35	22	25	32	980	57	16	24	17	1	8	9	1	1	1	2	1	1	21	5	6	86	28	17
Clo-30	46	19	28	29	38	31	4	6	12	3	3	5	1	1	1	1	3	1	25	4	5	100	19	16
Clo-32	24	44	22	25	28	28	4	13	29	1	4	6	1	2	1	18	1	2	15	6	13	220	15	21
Clo-34	64	43	21	28	33	35	4	9	15	1	8	5	1	15	4	11	15	6	19	9	97	86	17	30
Clo-36	87	45	29	22	40	40	14	2	12	1	15	6	9	1	4	47	30	9	20	2	55	190	71	31
Clo-D1	40	17	22	25	65	30	7	10	7	1	---	5	1	---	4	---	95	7	28	---	18	70	27	31
CB-Ref	2	9	3	6	15	5	8	3	4	1	1	2	1	1	1	2	3	1	1	2	8	2	7	3

Notes: * Red Shaded cells indicate exceedance to BC WQG Geomean of 200 CFU/100 mL, --- not sampled due to weather issues

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
Clo-01	23	10	1	12	23	9	1	4	6	2	4	3	1	1	1	1	2	1	1	1	45	25	5	6
Clo-14	35	12	2	11	14	11	1	3	1	1	1	1	1	1	2	1	54	3	11	1	20	31	14	10
Clo-16	24	5	8	8	440	20	1	2	7	1	7	3	1	1	1	1	3	1	4	1	12	21	14	7
Clo-18	8	14	5	7	8	8	1	2	3	1	1	1	1	1	1	1	1	1	6	4	4	12	4	5
Clo-20	25	---	7	9	13	12	1	1	4	5	2	2	1	1	1	1	1	1	5	3	11	16	4	6
Clo-22	12	20	25	11	3	11	1	8	1	1	1	2	1	1	38	1	18	4	1	39	20	10	6	9
Clo-24	35	---	560	10	17	43	1	9	2	1	5	2	1	1	1	1	5	1	12	1	14	12	6	7
Clo-26	21	5	4	9	370	17	2	5	7	1	2	3	1	1	1	1	1	1	1	1	13	13	7	4
Clo-28	11	2	13	6	250	13	1	6	1	1	2	2	1	1	1	1	1	1	2	3	2	15	1	3
Clo-30	18	3	9	9	11	9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	19	2	2
Clo-32	8	18	8	12	8	10	1	2	5	1	2	2	1	1	1	1	1	1	5	2	6	13	2	4
Clo-34	19	13	11	13	8	12	1	1	1	1	2	1	1	1	1	1	3	1	3	2	23	18	4	6
Clo-36	30	11	10	10	13	13	1	1	2	1	3	1	1	1	1	2	6	2	8	1	11	28	8	7
Clo-D1	12	10	4	14	25	11	1	4	2	1	---	2	1	---	1	---	19	3	3		9	6	6	6
CB-Ref	3	1	3	2	5	2	1	1	1	1	1	1	1	1	1	1	3	1	1	1	5	1	31	3

Notes: * Red shaded cells indicates exceedance to BC WQG GeoMean of 20 CFU/100 mL. Blue shaded cells indicate exceedances to Health Canada (2012) WQG of 70 CFU/100 mL, *GeoMean = Geometric Mean. --- not sampled due to weather issues

Appendix C6 Clover Point IDZ 5 Sampling Events in 30 Days Results

Fecals CFU/100 mL							
BC Approved WQG = 200 CFU/100 mL (geometric mean over 5 samples)							
Winter							GeoMean
		Day 1	Day 2	Day 3	Day 4	Day 5	
CB Reference	Top	3		1	5	10	5
	Middle	4	3	2	20	2	11
	Bottom	5	4	1		1	38
Station 1	Top	78	44	15	26	86	59
	Middle	24	57	6	34	780	15
	Bottom	30	63	9	30	42	19
Station 2	Top	83	54	6400	19	93	13
	Middle	68	51	200	900	630	24
	Bottom	4700	36	560	1500	2,000	97
Station 3	Top	51	49	16	16	870	37
	Middle	28	74	---	9700	95	193
	Bottom	5500	3000	7	7400	720	646
Station 4	Top	61	50	20	870	1400	28
	Middle	27	47	14	27	38	75
	Bottom	41	65	12	5	14	79
Spring							
CB Reference	Top	17	5	4		4	6
	Middle	4	4	4	20	18	7
	Bottom	4	1	2	25	9	4
Station 1	Top	8	23	8	19		13
	Middle	41	23	10	32	21	23
	Bottom	140	37	17	510	11	55
Station 2	Top	26	21	4	21	7	13
	Middle	67	35	13	35	220	47
	Bottom	62	42	27	200	320	85
Station 3	Top	68	26	7	25	13	21
	Middle	55	84	99	6700	270	242
	Bottom	240	3700	8000	2900	290	1430
Station 4	Top	31	23	7	1300	33	46
	Middle	2000	34	34	10	95	74
	Bottom	1400	3800	7000	660	85	1159
Summer							
CB Reference	Top	4	2	1	3	4	2
	Middle	9	---	13	6	11	9
	Bottom	4	---	11	5	5	6
Station 1	Top	9	10	---	21	250	26
	Middle	39	61	64	8	100	41
	Bottom	42	570	93	10	8	45
Station 2	Top	3	7	14	15	11	9
	Middle	22	6	140	20	7	19
	Bottom	26	10	4500	36	24	63
Station 3	Top	10	14	15	41	3	12
	Middle	11000	13	5700	10	30	190
	Bottom	4800	8	950	5500	18	325
Station 4	Top	4	17	8	31	6	10
	Middle	1100	10	770	230	32	144
	Bottom	2100	4	110	39	47	70

Appendix C6, continued

Fecals CFU/100 mL							
BC Approved WQG = 200 CFU/100 mL (geometric mean over 5 samples)							
		Autumn					GeoMean
CB Reference	Top	210	75	65	23	7	44
	Middle	1	10	2	15	9	5
	Bottom	1	19	1	14	7	5
Station 1	Top	160	2	160	170	45	52
	Middle	30	16	94	190	54	54
	Bottom	---	27	84	98	39	54
Station 2	Top	140	3	72	160	46	47
	Middle	29	15	88	150	49	49
	Bottom	40	44	98	160	58	69
Station 3	Top	150	1	120	64	45	35
	Middle	9000	11	76	55	13000	352
	Bottom	10000	2900	86	50	7700	992
Station 4	Top	200	2	89	---	66	39
	Middle	170	12	75	68	52	56
	Bottom	9200	7100	80	5900	36	1021

Notes: Red Shaded cells indicate exceedance of BC WQG GeoMean of 200 CFU/100 mL, GeoMean = Geometric Mean

Fecals – Clover – (maximum value presented from each depth for each day)				
	Station #	**Top**	**Middle**	**Bottom**
Winter	Station 1	86	780	63
	Station 2	6400	900	4700
	Station 3	870	9700	7400
	Station 4	1400	47	65
GeoMean		**905**	**752**	**614**
Spring	Station 1	23	41	510
	Station 2	26	220	320
	Station 3	68	6700	8000
	Station 4	1300	2000	7000
GeoMean		**85**	**590**	**1739**
Summer	Station 1	250	100	570
	Station 2	15	140	4500
	Station 3	41	11000	5500
	Station 4	31	1100	2100
GeoMean		**47**	**642**	**2333**
Autumn	Station 1	210	15	19
	Station 2	170	190	98
	Station 3	160	150	160
	Station 4	150	13000	9200
GeoMean		**171**	**273**	**229**

Notes: * Red Shaded cells indicate exceedance of BC WQG GeoMean of 200 CFU/100 mL. *Figure 3.3 is derived from these tables by taking the maximum value from each sampling day and depth to provide a worst-case scenario

Appendix C6, continued

Enterococci							
Health Canada WQG = 35 CFU/100 mL (geometric mean over 5 samples) & 70 CFU/100 mL for single samples							
Winter							GeoMean
		Day 1	Day 2	Day 3	Day 4	Day 5	
CB Reference	Top	1		1	1	4	1
	Middle	1	1	1	4	1	1
	Bottom	1	2	1		1	1
Station 1	Top	13	12	4	13	42	13
	Middle	8	21	2	11	420	17
	Bottom	14	18	1	10	20	9
Station 2	Top	16	15	670	8	34	34
	Middle	15	23	42	430	320	72
	Bottom	980	10	100	710	460	200
Station 3	Top	14	14	4	5	500	18
	Middle	3	24		2200	51	53
	Bottom	1000	740	3	3200	320	296
Station 4	Top	20	14	5	200	1100	50
	Middle	7	27	5	8	13	10
	Bottom	7	34	2	1	10	5
Spring							GeoMean
CB Reference	Top	3	2	1		1	2
	Middle	2	1	1	5	7	2
	Bottom	1	1	1	4	2	2
Station 1	Top	1	2	2	3		2
	Middle	8	14	6	6	2	6
	Bottom	24	11	4	120	3	13
Station 2	Top	1	2	3	6	4	3
	Middle	14	10	1	8	100	10
	Bottom	10	4	6	29	94	15
Station 3	Top	22	4	2	5	3	5
	Middle	15	17	43	2700	97	78
	Bottom	42	1200	1700	450	79	314
Station 4	Top	6	4	2	490	6	11
	Middle	630	4	14	4	42	23
	Bottom	310	1100	1200	2200	21	452
Summer							GeoMean
CB Reference	Top	1	1	1	1	1	1
	Middle	1		1	1	1	1
	Bottom	1		1	2	2	1
Station 1	Top	2	1		6	32	4
	Middle	5	14	14	4	13	9
	Bottom	4	96	38	2	1	8
Station 2	Top	1	1	1	3	1	1
	Middle	4	1	26	4	1	3
	Bottom	4	1	530	4	1	6
Station 3	Top	1	2	1	3	1	1
	Middle	2000	1	690	2	3	24
	Bottom	1100	1	160	1000	1	45
Station 4	Top	1	2	1	4	1	2
	Middle	290	1	230	23	5	24
	Bottom	220	1	18	6	4	10

Enterococci							
Health Canada WQG = 35 CFU/100 mL (geometric mean over 5 samples) & 70 CFU/100 mL for single samples							
Autumn							GeoMean
CB Reference	Top	1	1	7	2	1	2
	Middle	1	4	1	6	1	2
	Bottom	1	1	1	1	1	1
Station 1	Top	46	1	30	15	6	10
	Middle	9	2	14	26	12	10
	Bottom	---	13	22	12	6	12
Station 2	Top	38	1	40	14	5	10
	Middle	6	9	17	29	14	13
	Bottom	3	16	35	37	13	15
Station 3	Top	16	1	19	8	10	8
	Middle	540	7	20	7	8000	84
	Bottom	580	1100	21	5	2600	177
Station 4	Top	68	3	17		23	17
	Middle	76	3	23	10	6	13
	Bottom	570	760	15	670	8	128

Notes: Red 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, *Geo Mean = Geometric Mean,--- not sampled due to weather issues

Enterococci – Clover – (maximum value presented from each depth for each day) Health Canada WQG = 35 CFU/100 mL (geometric mean over 5 samples)				
	Station #	**Top**	**Middle**	**Bottom**
Winter	Station 1	42	420	20
	Station 2	670	430	980
	Station 3	500	2200	3200
	Station 4	1100	27	34
GeoMean		**353**	**322**	**215**
Spring	Station 1	3	120	120
	Station 2	6	100	94
	Station 3	22	2700	1700
	Station 4	490	630	2200
GeoMean		**21**	**378**	**453**
Summer	Station 1	32	14	96
	Station 2	3	26	530
	Station 3	3	2000	1100
	Station 4	4	290	220
GeoMean		**3**	**762**	**492**
Autumn	Station 1	46	26	22
	Station 2	40	29	37
	Station 3	19	8000	2600
	Station 4	68	76	760
GeoMean		**39**	**146**	**200**

Notes: Red Shaded cells indicate exceedance to BC WQG GeoMean of 20 CFU/100 mL, GeoMean = Geometric Mean

Appendix C6, continued

NH3 mg/L – Clover							
BC Approved WQG = 22 mg/L N (average over 5 samples) or 148 mg/L N (maximum)							
Winter							**Average**
		Day 1	**Day 2**	**Day 3**	**Day 4**	**Day 5**	
CB Reference	Top	0.42	---	0.052	0.033	0.046	0.138
	Middle	0.42	0.034	0.067	---	0.036	0.139
	Bottom	0.42	0.043	0.047	0.035	0.038	0.117
Station 1	Top	0.3	0.032	0.045	0.026	0.052	0.091
	Middle	0.38	0.063	0.055	0.048	0.06	0.121
	Bottom	0.4	0.053	0.054	0.039	0.054	0.120
Station 2	Top	0.43	0.11	0.093	0.049	0.059	0.148
	Middle	0.41	0.056	0.09	0.027	0.078	0.132
	Bottom	0.69	0.079	0.047	0.057	0.031	0.181
Station 3	Top	0.39	0.077	0.076	0.029	0.05	0.124
	Middle	0.41	0.074	0.05	0.098	0.031	0.133
	Bottom	0.44	0.093	0.054	0.065	0.043	0.139
Station 4	Top	0.4	0.034	0.041	0.033	0.057	0.113
	Middle	0.55	0.036	0.025	0.025	0.081	0.143
	Bottom	0.42	0.064	---	0.05	0.044	0.145
Spring							**Average**
CB Reference	Top	0.077	0.061	0.12	---	0.25	0.127
	Middle	0.03	0.075	0.13	0.11	0.27	0.123
	Bottom	0.062	0.065	0.38	0.047	0.13	0.137
Station 1	Top	0.074	0.085	0.18	0.09	---	0.107
	Middle	0.054	0.034	0.46	0.1	0.053	0.140
	Bottom	0.061	0.041	0.2	0.11	0.11	0.104
Station 2	Top	0.077	0.036	0.39	0.12	0.05	0.135
	Middle	0.071	0.054	0.14	0.11	0.24	0.123
	Bottom	0.072	0.069	0.19	0.17	0.066	0.113
Station 3	Top	0.089	0.046	0.13	0.15	0.096	0.102
	Middle	<0.025	0.057	0.16	0.24	0.13	0.147
	Bottom	0.069	0.061	0.18	0.19	0.086	0.117
Station 4	Top	0.067	0.065	0.12	0.24	0.13	0.124
	Middle	0.11	0.064	0.096	0.18	0.14	0.118
	Bottom	0.095	0.093	0.14	0.12	0.21	0.132
Summer							**Average**
CB Reference	Top	0.045	<0.025	0.07	0.75	0.21	0.269
	Middle	0.071	---	<0.025	0.6	0.091	0.254
	Bottom	0.034	---	---	0.25	0.077	0.120
Station 1	Top	0.054	0.036	0.056	0.12	0.03	<0.025
	Middle	<0.025	<0.025	0.066	0.1	<0.025	0.083
	Bottom	0.066	<0.025	0.059	0.54	<0.025	0.222
Station 2	Top	0.082	<0.025	0.21	0.31	<0.025	0.201
	Middle	0.068	<0.025	0.25	0.029	0.053	0.100
	Bottom	0.064	<0.025	0.16	0.15	<0.025	0.125
Station 3	Top	0.057	0.28	<0.025	0.056	<0.025	0.131
	Middle	0.087	0.16	0.051	0.22	<0.025	0.130
	Bottom	0.074	0.057	0.14	0.27	<0.025	0.135
Station 4	Top	0.057	0.035	0.049	0.56	<0.025	0.175
	Middle	0.081	0.28	0.1	0.17	0.032	0.133
	Bottom	0.041	0.39	0.078	0.5	<0.025	0.252

Appendix C6, continued

NH3 mg/L – Clover							
BC Approved WQG = 22 mg/L N (average over 5 samples) or 148 mg/L N (maximum)							
Autumn							Average
CB Reference	Top	0.12	0.12	0.077	0.11	0.071	0.100
	Middle	0.066	0.027	0.083	0.1	0.062	0.068
	Bottom	0.11	0.074	0.17	0.069	0.046	0.094
Station 1	Top	0.054	0.091	0.1	0.072	0.071	0.078
	Middle	0.079	0.11	0.079	0.12	0.025	0.083
	Bottom	---	0.058	0.52	0.079	0.069	0.182
Station 2	Top	0.11	0.075	0.12	0.061	0.078	0.089
	Middle	0.079	0.097	0.32	0.11	0.055	0.132
	Bottom	0.097	0.054	0.059	0.087	0.085	0.076
Station 3	Top	0.14	0.083	0.1	0.13	0.096	0.110
	Middle	0.13	0.069	0.09	0.075	0.14	0.101
	Bottom	0.18	0.07	0.1	0.051	0.12	0.104
Station 4	Top	0.085	0.071	0.14	---	0.067	0.091
	Middle	0.1	0.035	0.096	0.073	0.071	0.075
	Bottom	0.17	0.18	0.11	0.092	0.075	0.125

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

Arsenic ug/L-Clover					
BC Approved WQG = 12.5 ug/L (maximum)					
		Winter	Spring	Summer	Autumn
Reference	Top	---	1.92	2.05	1.93
	Middle	2.01	1.96	---	2.31
	Bottom	1.87	1.73	---	2.47
Station 1	Top	1.95	1.74	2.43	1.9
	Middle	1.88	1.79	2.29	1.87
	Bottom	1.85	1.89	2.14	2.11
Station 2	Top	1.76	1.83	2.45	2.04
	Middle	1.86	1.68	2.42	2.06
	Bottom	1.86	1.91	2.22	2.13
Station 3	Top	1.81	1.78	2.33	2.37
	Middle	1.87	1.63	2.47	2.33
	Bottom	1.71	1.93	2.75	1.95
Station 4	Top	1.69	1.66	2.35	1.96
	Middle	1.79	2.09	2.36	2.06
	Bottom	1.89	2.04	2.31	2.29

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

Appendix C6, continued

Copper ug/L-Clover					
BC Approved WQG= 2.0 ug/L (average over 5 samples) or 3.0 ug/L (maximum)					
		Winter	Spring	Summer	Autumn
Reference	Top	---	0.306	0.229	<0.5
	Middle	0.34	0.278	---	<0.5
	Bottom	0.369	0.386	---	<0.5
Station 1	Top	0.319	0.252	0.203	<0.5
	Middle	0.821	0.263	0.262	<0.5
	Bottom	0.408	0.41	0.221	<0.5
Station 2	Top	0.354	0.31	0.189	<0.5
	Middle	0.35	0.387	0.197	<0.5
	Bottom	0.403	0.316	0.234	<0.5
Station 3	Top	0.337	0.289	0.236	<0.5
	Middle	0.374	0.255	0.191	<0.5
	Bottom	0.509	0.562	0.272	<0.5
Station 4	Top	0.402	0.342	0.219	<0.5
	Middle	0.352	0.353	0.228	<0.5
	Bottom	0.333	0.387	0.209	<0.5

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

Zinc ug/L-Clover					
BC Approved WQG = 10 ug/L (average of 5 samples)					
		Winter	Spring	Summer	Autumn
Reference	Top	---	0.758	0.984	<3
	Middle	0.931	10.2	---	<3
	Bottom	1.77	2.4	---	<3
Station 1	Top	0.743	1.8	1.25	<3
	Middle	0.774	1.18	1.29	<3
	Bottom	0.824	0.589	0.842	<3
Station 2	Top	0.638	0.682	1.42	<3
	Middle	0.695	0.759	0.684	<3
	Bottom	2.05	0.702	0.801	<3
Station 3	Top	0.735	0.659	0.928	<3
	Middle	1.17	2.64	0.605	<3
	Bottom	3.91	1.43	1.04	<3
Station 4	Top	0.655	0.692	0.63	<3
	Middle	0.962	3.53	0.941	<3
	Bottom	0.861	1.12	0.678	<3

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

Appendix C6, continued

Cadmium ug/L-Clover					
BC Working WQG = 0.12 ug/L (maximum)					
		Winter	Spring	Summer	Autumn
Reference	Top	---	0.072	0.078	0.089
	Middle	0.076	0.074	---	0.116
	Bottom	0.078	0.071	---	0.118
Station 1	Top	0.075	0.069	0.08	0.112
	Middle	0.073	0.067	0.084	0.079
	Bottom	0.074	0.168	0.082	0.103
Station 2	Top	0.072	0.074	0.084	0.092
	Middle	0.078	0.068	0.085	0.093
	Bottom	0.074	0.068	0.082	0.095
Station 3	Top	0.072	0.07	0.083	0.1
	Middle	0.075	0.07	0.085	0.1
	Bottom	0.07	0.073	0.082	0.088
Station 4	Top	0.086	0.071	0.081	0.084
	Middle	0.078	0.072	0.084	0.102
	Bottom	0.073	0.07	0.087	0.098

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

Lead ug/L-Clover					
BC Approved WQG = 2 ug/L (average of 5 samples) or 140 ug/L N (maximum)					
		Winter	Spring	Summer	Autumn
Reference	Top	---	0.017	0.021	<0.05
	Middle	0.019	0.017	---	0.053
	Bottom	0.026	0.02	---	<0.05
Station 1	Top	0.023	0.015	0.017	0.069
	Middle	0.027	0.02	0.051	<0.05
	Bottom	0.025	0.018	0.018	<0.05
Station 2	Top	0.021	0.015	0.015	0.055
	Middle	0.028	0.016	0.017	<0.05
	Bottom	0.039	0.02	0.016	<0.05
Station 3	Top	0.023	0.015	0.017	<0.05
	Middle	0.031	0.016	0.021	<0.05
	Bottom	0.046	0.019	0.018	0.056
Station 4	Top	0.024	0.018	0.018	<0.05
	Middle	0.031	0.024	0.021	<0.05
	Bottom	0.03	0.022	0.02	0.051

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

Appendix C6, continued

Boron ug/L-Clover					
BC Approved WQG = 1200 ug/L (maximum)					
		Winter	**Spring**	**Summer**	**Autumn**
Reference	Top	---	4510	---	4100
	Middle	4240	4450	---	4210
	Bottom	4320	4430	4070	4390
Station 1	Top	4450	4520	4130	3890
	Middle	4510	4310	4150	4150
	Bottom	4450	4690	4050	4060
Station 2	Top	4430	4430	4130	4180
	Middle	4360	4390	4170	4190
	Bottom	4420	4570	4120	4070
Station 3	Top	4400	4550	4060	3990
	Middle	4270	4480	4080	4180
	Bottom	4320	4520	4150	4080
Station 4	Top	4470	4090	3910	4090
	Middle	4430	4670	4070	4070
	Bottom	4400	4570	4130	4080

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

Silver ug/L-Clover					
BC Approved WQG=3.0 ug/L (average over 5 samples) or 1.5 ug/L (maximum)					
		Winter	**Spring**	**Summer**	**Autumn**
Reference	Top	---	<0.00005	---	<0.00005
	Middle	<0.00005	<0.00005	---	<0.00005
	Bottom	<0.00005	<0.00005	<0.00005	<0.00005
Station 1	Top	<0.00005	<0.00005	<0.00005	<0.00005
	Middle	<0.00005	<0.00005	<0.00005	<0.00005
	Bottom	<0.00005	<0.00005	<0.00005	<0.00005
Station 2	Top	<0.00005	<0.00005	<0.00005	<0.00005
	Middle	<0.00005	<0.00005	<0.00005	<0.00005
	Bottom	<0.00005	<0.00005	<0.00005	<0.00005
Station 3	Top	<0.00005	<0.00005	<0.00005	<0.00005
	Middle	<0.00005	<0.00005	<0.00005	<0.00005
	Bottom	<0.00005	<0.00005	<0.00005	<0.00005
Station 4	Top	<0.00005	<0.00005	<0.00005	<0.00005
	Middle	<0.00005	<0.00005	<0.00005	<0.00005
	Bottom	<0.00005	<0.00005	<0.00005	<0.00005

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

Appendix C6, continued

Nickel ug/L-Clover					
BC Working WQG = 8.3 ug/L (maximum)					
		Winter	**Spring**	**Summer**	**Autumn**
Reference	Top	---	0.358	0.374	1.54
	Middle	0.388	0.371	---	<0.5
	Bottom	0.393	0.373	---	<0.5
Station 1	Top	0.379	0.363	0.371	<0.5
	Middle	0.395	0.383	0.387	<0.5
	Bottom	0.383	0.563	0.356	<0.5
Station 2	Top	0.377	0.376	0.363	<0.5
	Middle	0.412	0.36	0.363	<0.5
	Bottom	0.387	0.365	0.377	0.57
Station 3	Top	0.374	0.36	0.381	<0.5
	Middle	0.389	0.361	0.372	<0.5
	Bottom	0.391	0.363	0.371	<0.5
Station 4	Top	0.428	0.383	0.371	<0.5
	Middle	0.451	0.368	0.373	<0.5
	Bottom	0.394	0.362	0.376	<0.5

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

Appendix C6, continued

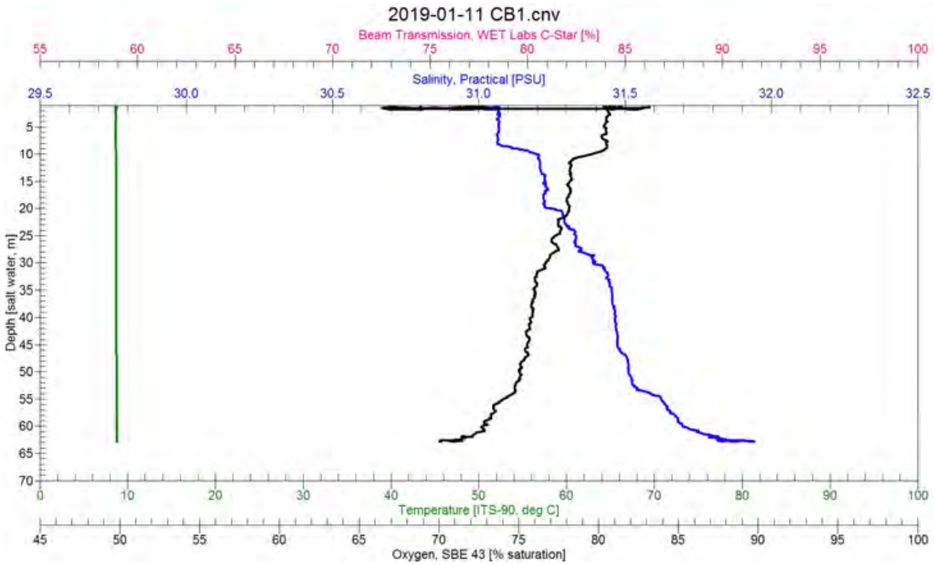
Nitrate Nitrogen mg/L – Clover							
BC Approved WQG = 3.7 mg/L (average over 5 samples)							
Winter							**Average**
CB Reference	Top	0.347	---	0.336	0.312	0.372	0.342
	Middle	0.342	0.361	0.331	---	0.336	0.343
	Bottom	0.341	0.354	0.331	0.313	0.321	0.332
Station 1	Top	0.368	0.366	0.343	0.287	0.375	0.348
	Middle	0.356	0.359	0.341	0.269	0.367	0.338
	Bottom	0.357	0.362	0.341	0.302	0.371	0.347
Station 2	Top	0.368	0.363	0.333	0.309	0.371	0.349
	Middle	0.368	0.363	0.336	0.292	0.367	0.345
	Bottom	0.359	0.353	0.338	0.299	0.367	0.343
Station 3	Top	0.361	0.363	0.334	0.31	0.37	0.348
	Middle	0.363	0.361	---	0.308	0.37	0.351
	Bottom	0.354	0.355	0.34	0.297	0.367	0.343
Station 4	Top	0.362	0.359	0.341	0.328	0.37	0.352
	Middle	0.363	0.363	0.341	0.312	0.36	0.348
	Bottom	0.352	0.359	0.34	0.299	0.363	0.343
Spring							**Average**
CB Reference	Top	0.245	0.25	0.247		0.238	0.245
	Middle	0.265	0.242	0.253	0.284	0.285	0.2658
	Bottom	0.258	0.254	0.25	0.28	0.297	0.2678
Station 1	Top	0.26	0.252	0.258	0.256	---	0.2565
	Middle	0.259	0.253	0.25	0.268	0.262	0.2584
	Bottom	0.263	0.256	0.251	0.302	0.269	0.2682
Station 2	Top	0.262	0.251	0.258	0.27	0.255	0.2592
	Middle	0.265	0.256	0.241	0.271	0.272	0.261
	Bottom	0.253	0.254	0.242	0.311	0.295	0.271
Station 3	Top	0.265	0.248	0.231	0.262	0.26	0.2532
	Middle	0.259	0.253	0.235	0.314	0.25	0.2622
	Bottom	0.253	0.257	0.241	0.326	0.286	0.2726
Station 4	Top	0.267	0.265	0.245	0.289	0.226	0.2584
	Middle	0.263	0.264	0.249	0.256	0.267	0.2598
	Bottom	0.268	0.257	0.251	0.311	0.283	0.274
Summer							**Average**
CB Reference	Top	0.145	0.218	0.299	0.367	0.34	0.2738
	Middle	0.223	---	0.33	0.435	0.359	0.33675
	Bottom	0.14	---		0.404	0.36	0.301333
Station 1	Top	0.234	0.223	0.258	0.362	0.332	0.2818
	Middle	0.111	0.238	0.296	0.399	0.364	0.2816
	Bottom	0.185	0.231	0.252	0.458	0.405	0.3062
Station 2	Top	0.227	0.242	0.28	0.372	0.33	0.2902
	Middle	0.0468	0.23	0.306	0.413	0.412	0.28156
	Bottom	0.234	0.213	0.259	0.425	0.412	0.3086
Station 3	Top	0.232	0.241	0.288	0.314	0.339	0.2828
	Middle	0.166	0.255	0.32	0.403	0.385	0.3058
	Bottom	0.159	0.227	0.253	0.48	0.398	0.3034
Station 4	Top	0.098	0.202	0.272	0.436	0.343	0.2702
	Middle	0.235	0.266	0.328	0.428	0.355	0.3224
	Bottom	0.179	0.254	0.244	0.415	0.371	0.2926

Appendix C6, continued

Nitrate Nitrogen mg/L – Clover							
BC Approved WQG = 3.7 mg/L (average over 5 samples)							
Autumn							**Average**
CB Reference	Top	0.339	0.314	0.339	0.359	0.373	0.3448
	Middle	0.403	0.404	0.408	0.309	0.395	0.3838
	Bottom	0.423	0.421	0.418	0.322	0.406	0.398
Station 1	Top	0.342	0.341	0.348	0.371	0.383	0.357
	Middle	---	0.354	0.366	0.388	0.391	0.37475
	Bottom	0.358	0.332	0.374	0.392	0.391	0.3694
Station 2	Top	0.344	0.348	0.363	0.375	0.385	0.363
	Middle	0.357	0.351	0.385	0.384	0.387	0.3728
	Bottom	0.355	0.346	0.388	0.384	0.393	0.3732
Station 3	Top	0.342	0.333	0.37	0.368	0.378	0.3582
	Middle	0.367	0.352	0.389	0.373	0.385	0.3732
	Bottom	0.369	0.342	0.385	0.302	0.395	0.3586
Station 4	Top	0.336	0.344	0.362	0.389	0.372	0.3606
	Middle	0.363	0.356	0.381	0.334	0.398	0.3664
	Bottom	0.373	0.345	0.385	---	0.394	0.37425

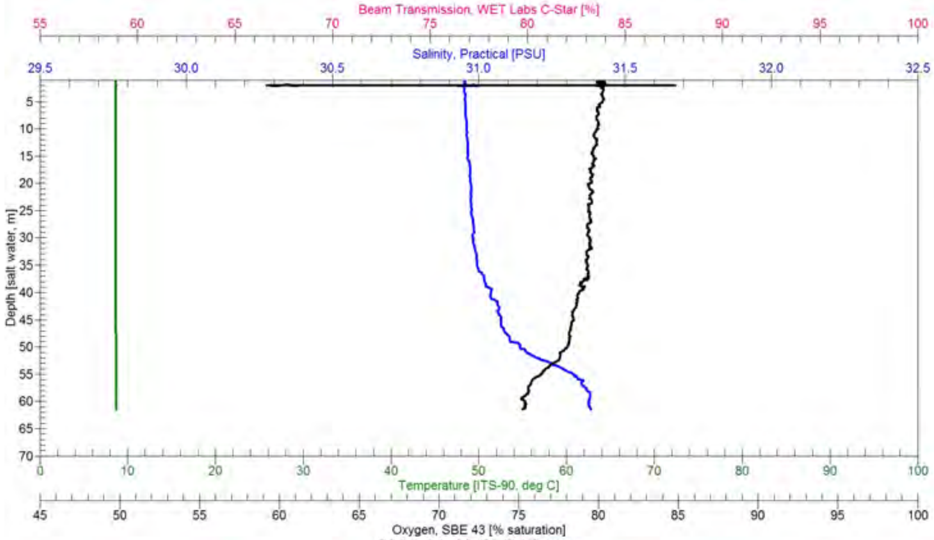
Notes: Shaded cells indicate exceedance to BC WQG. --- not sampled due to weather issues

Appendix C7 CTD Plots

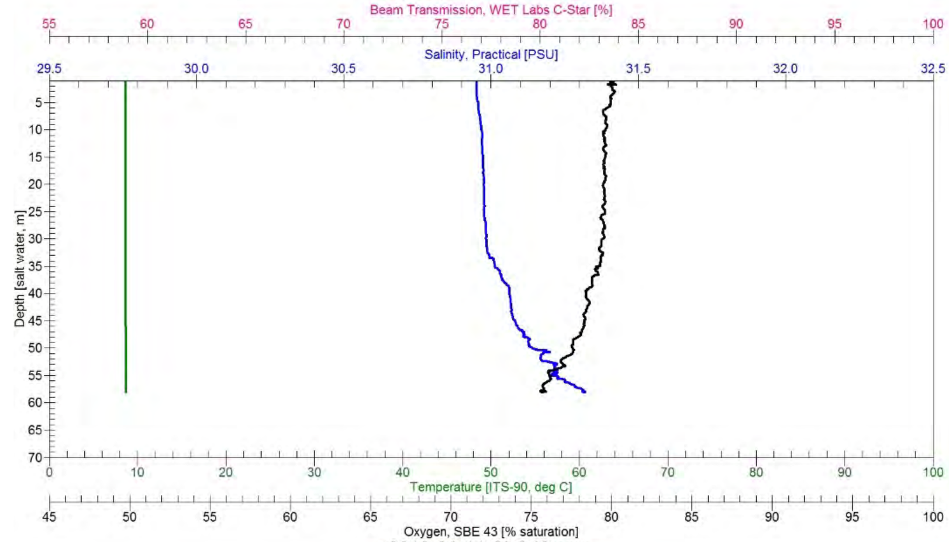


Appendix C7, continued

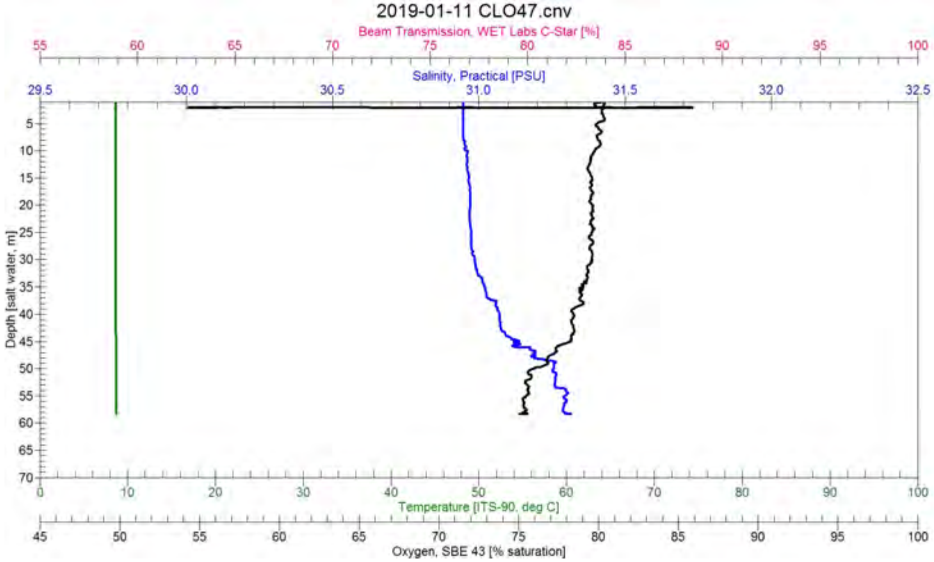
2019-01-11 CLO46.cnv



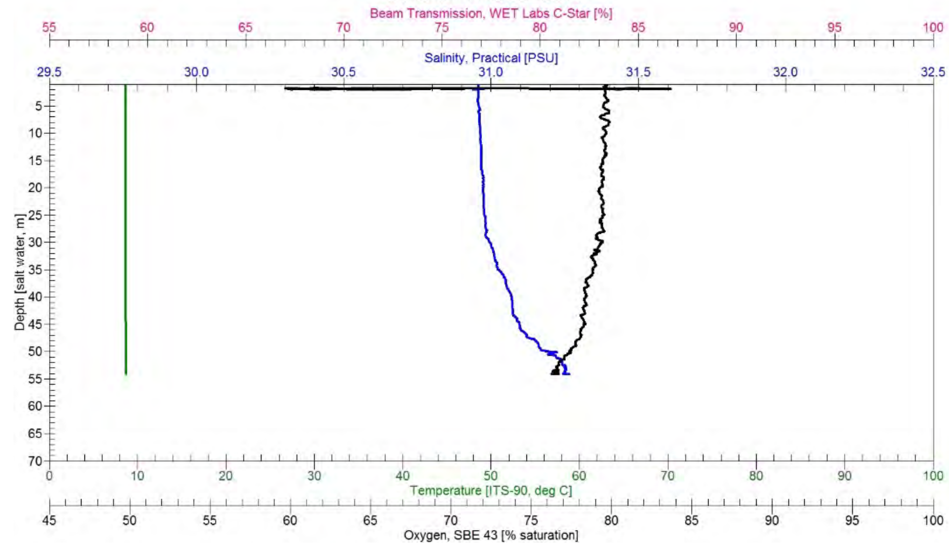
2019-01-11 CLO48.cnv



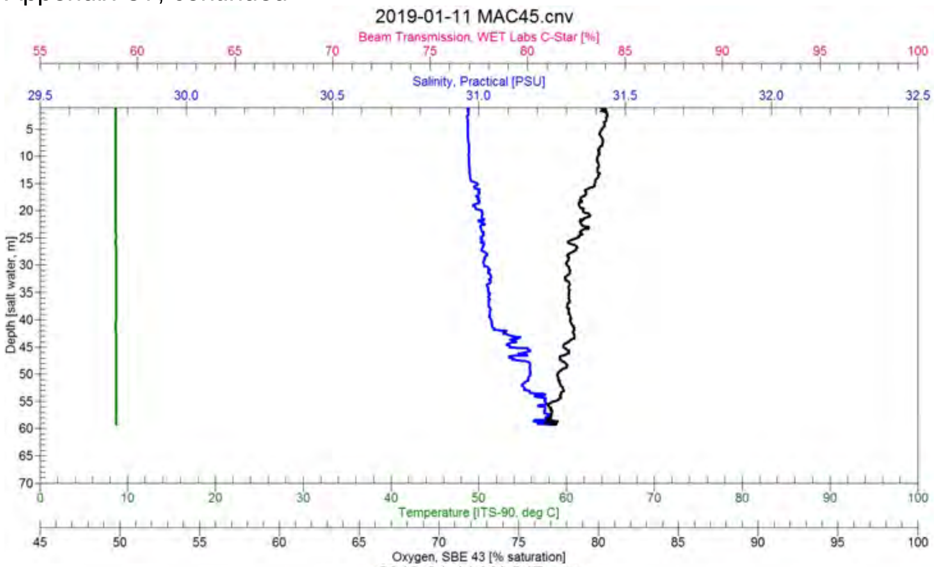
2019-01-11 CLO47.cnv

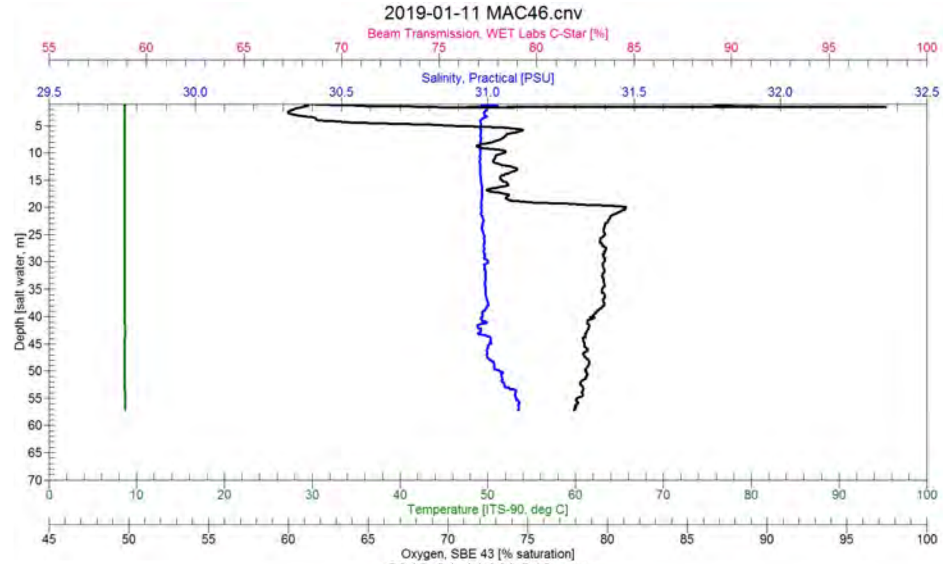


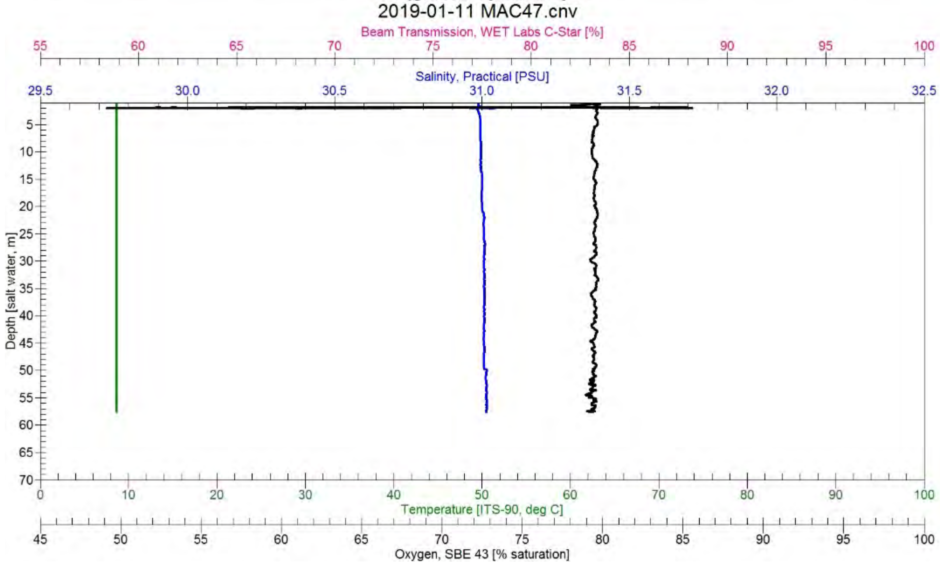
2019-01-11 CLO49.cnv

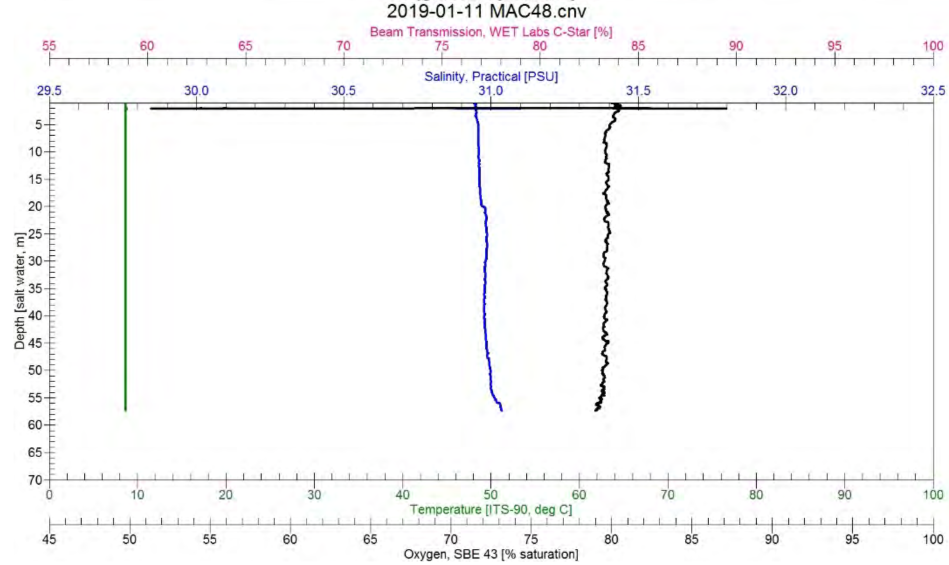


Appendix C7, continued

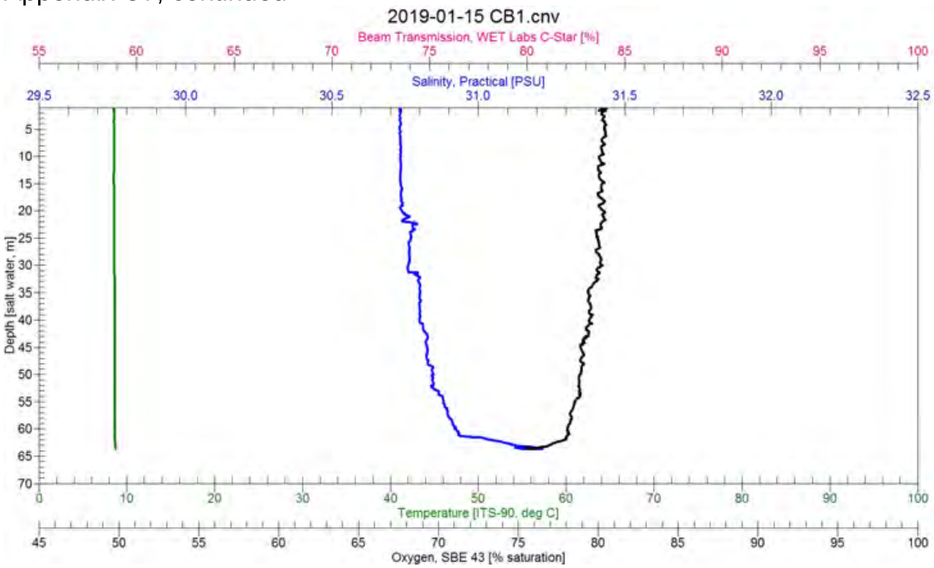




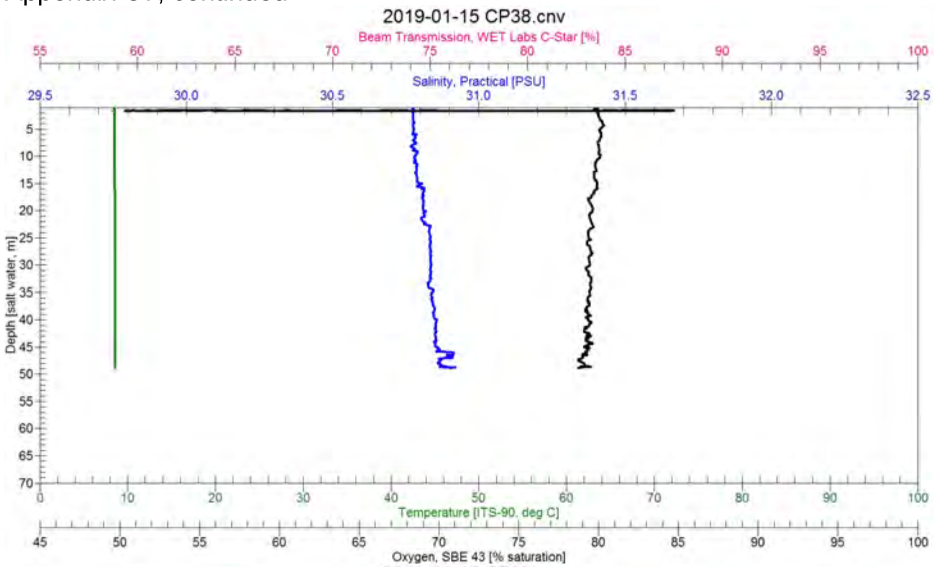


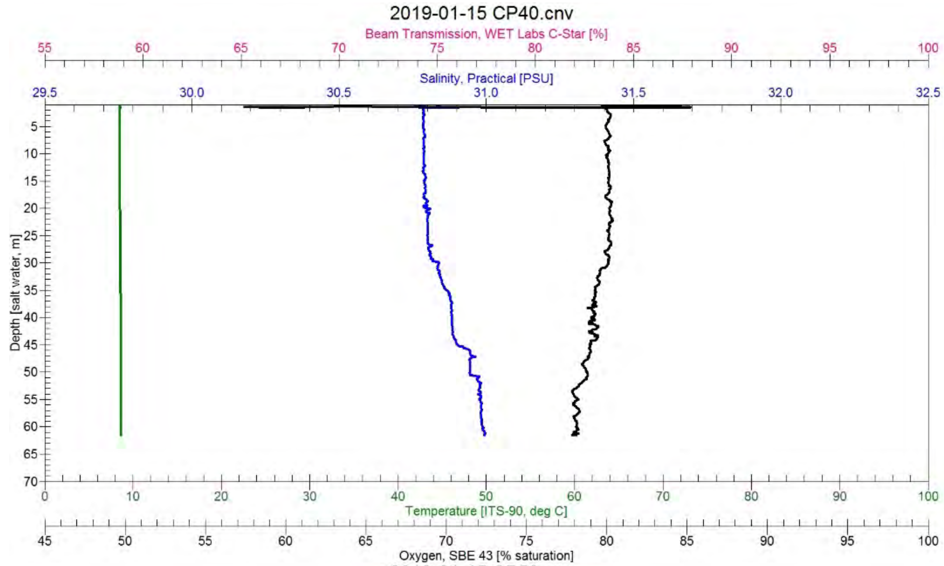


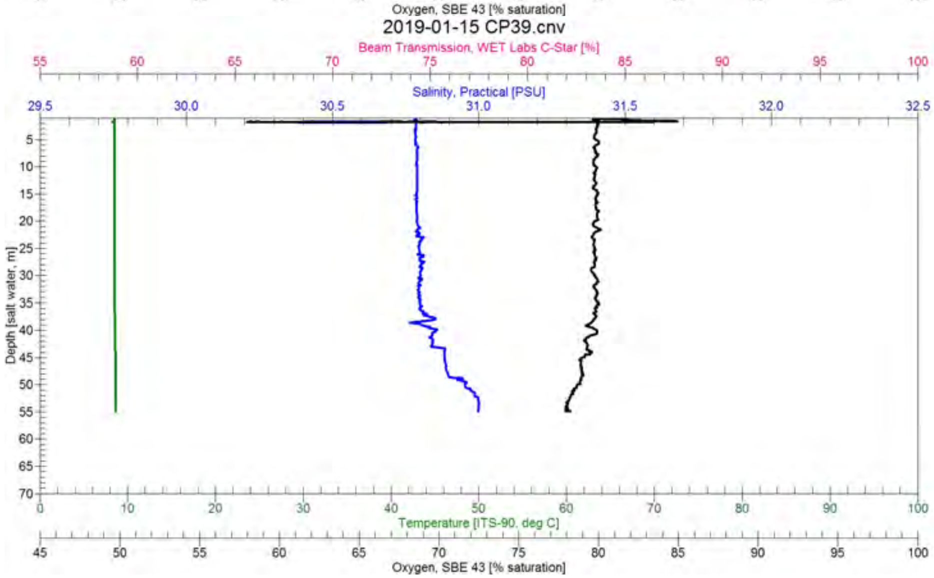
Appendix C7, continued

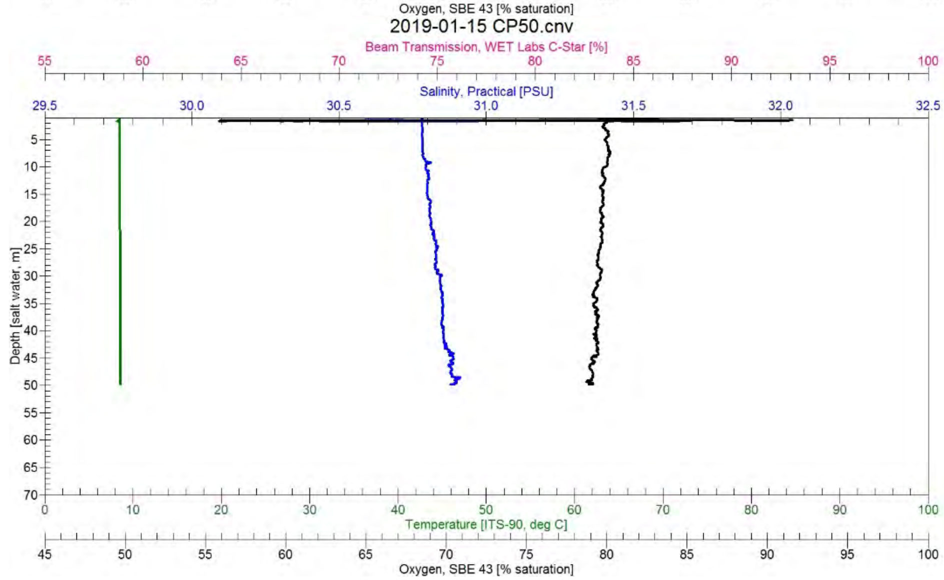


Appendix C7, continued

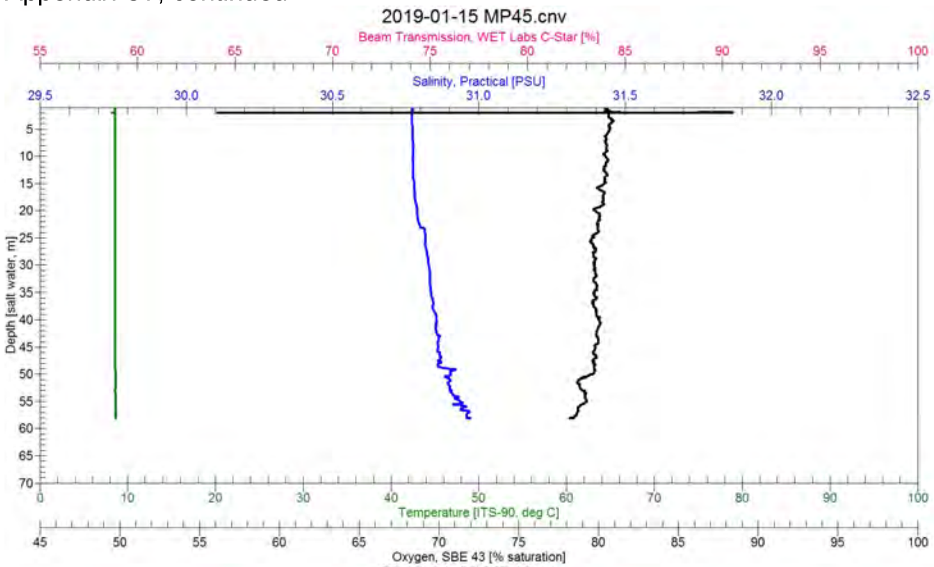


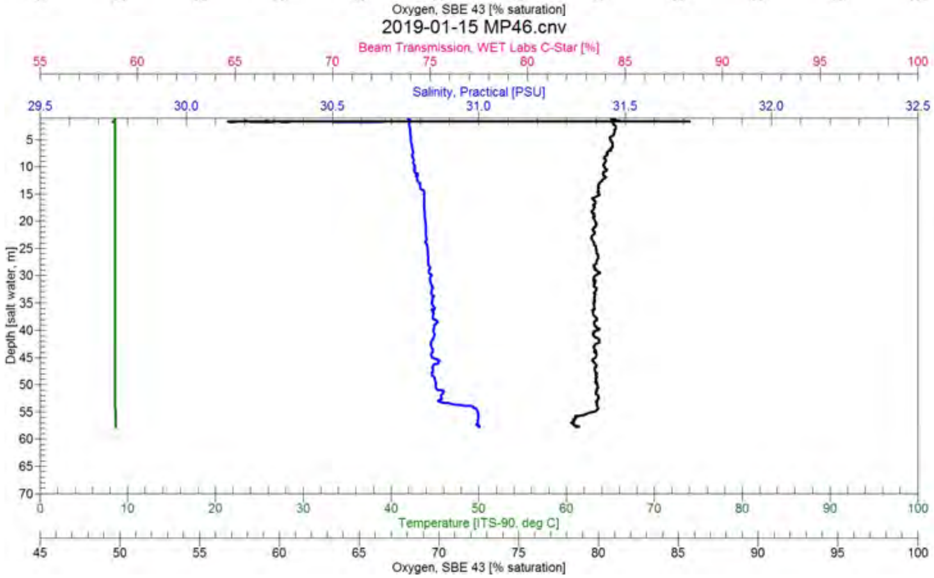


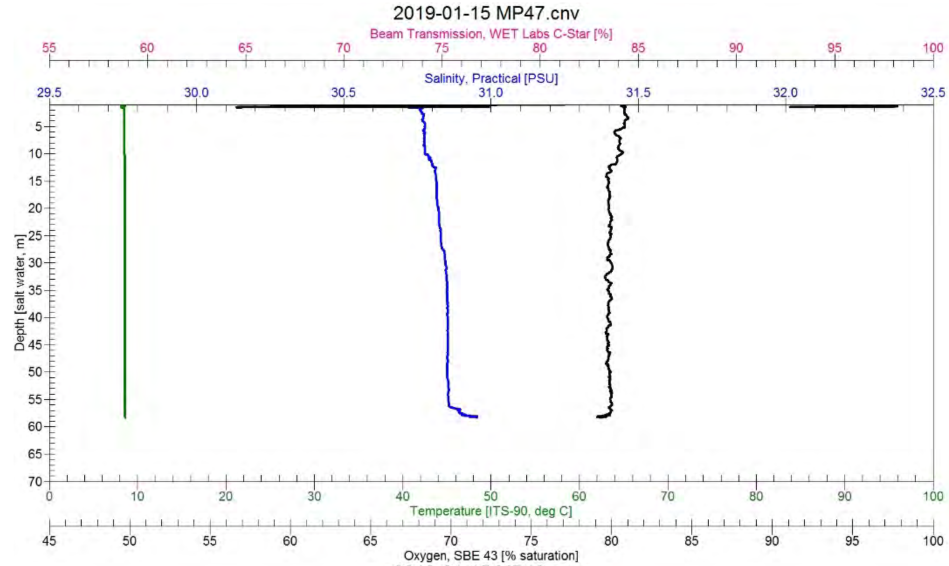


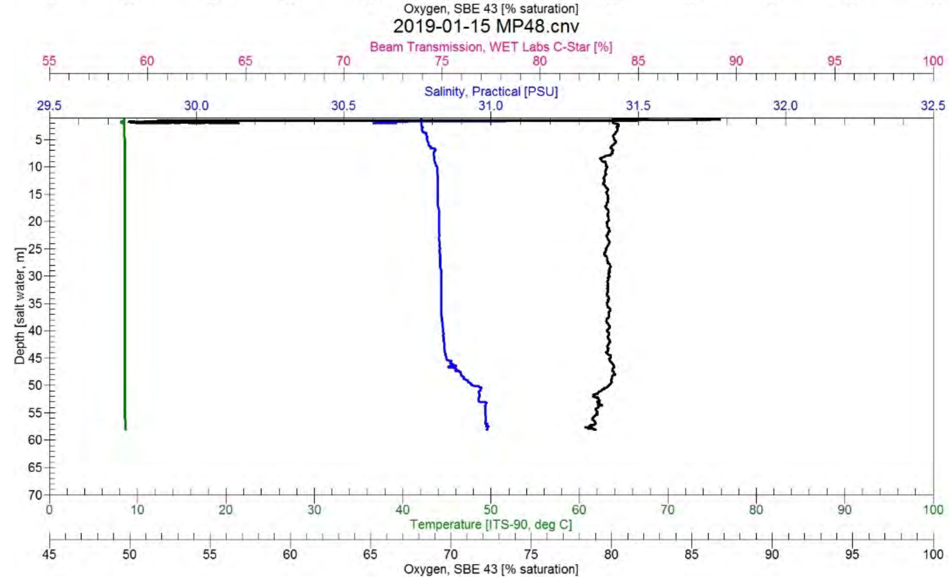


Appendix C7, continued

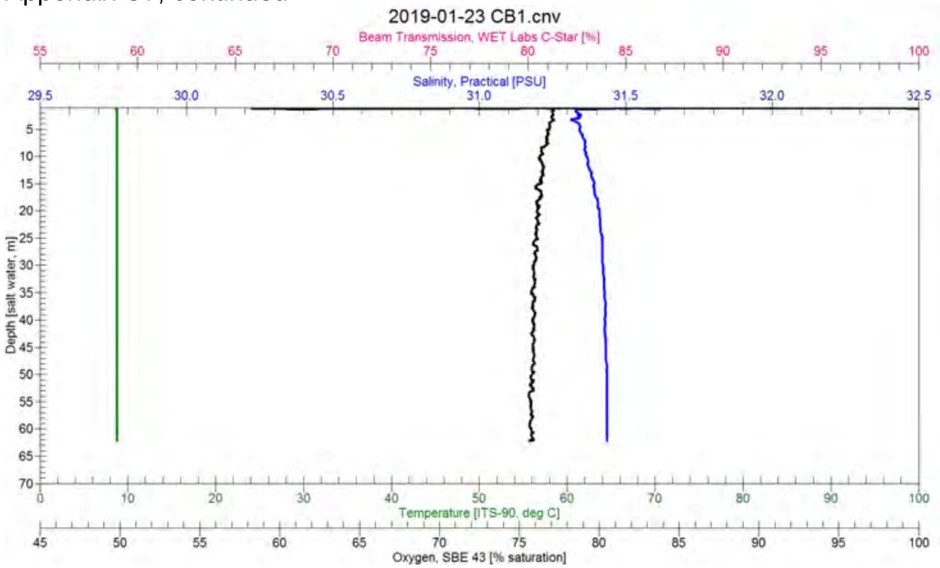




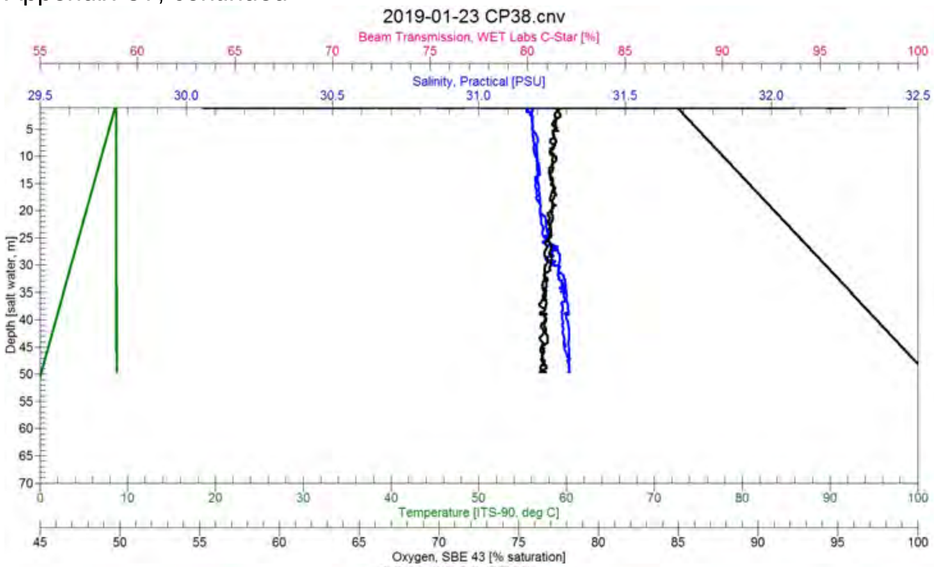


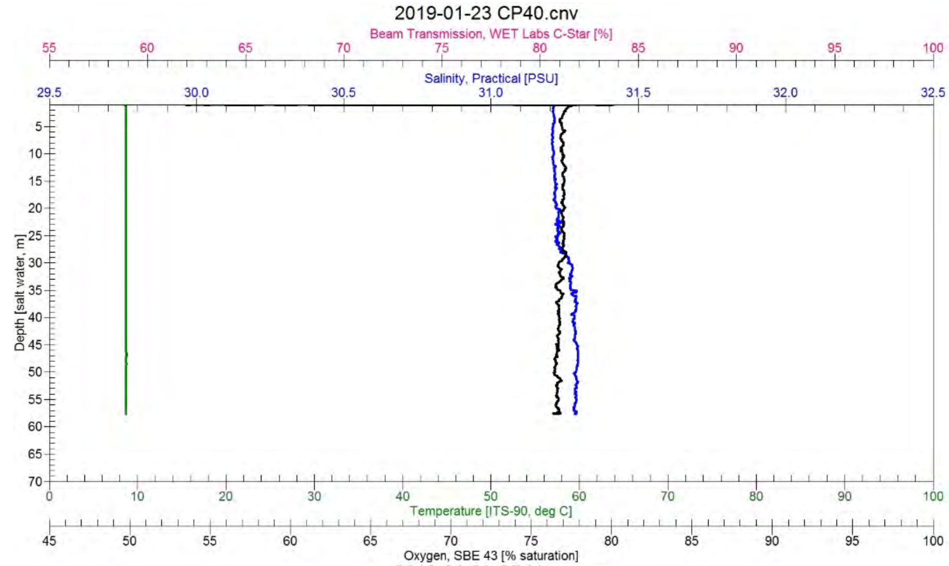


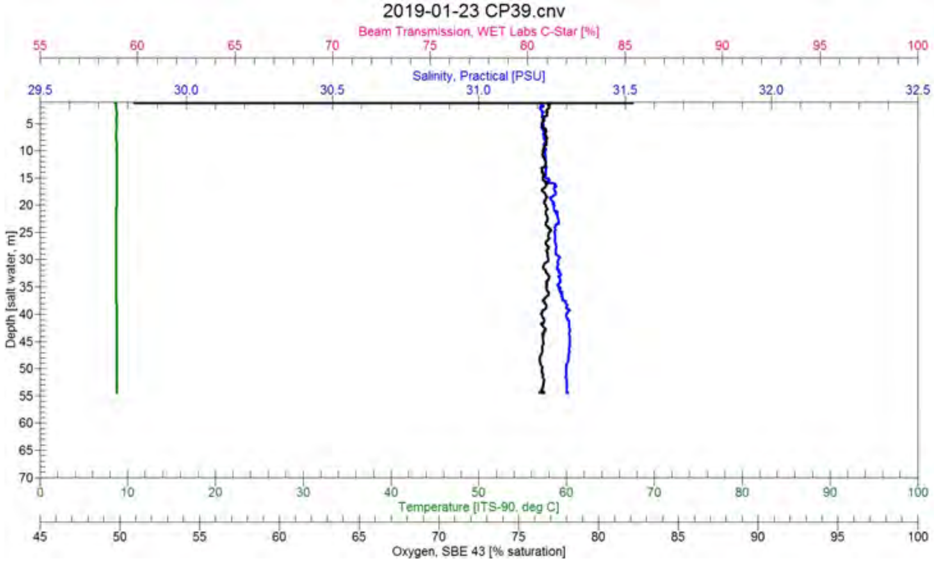
Appendix C7, continued

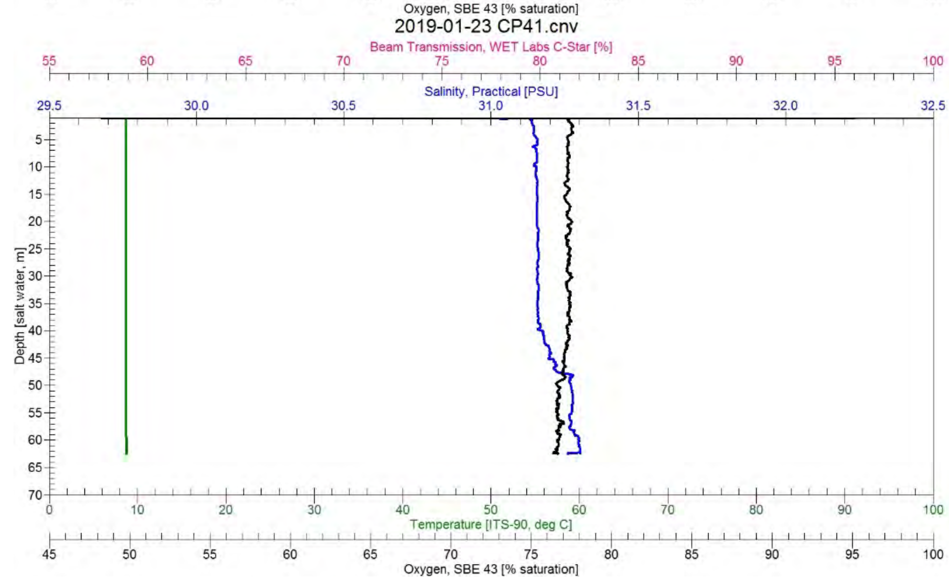


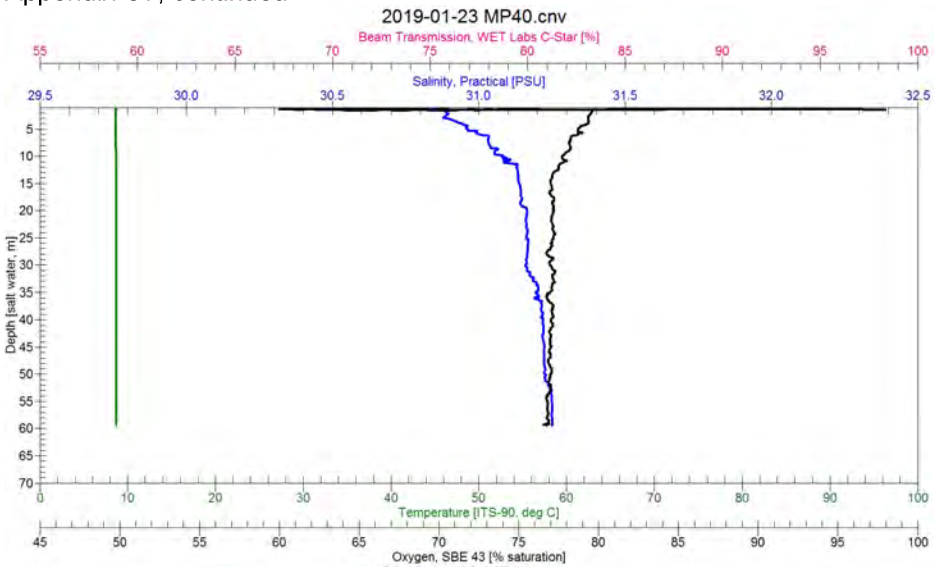
Appendix C7, continued

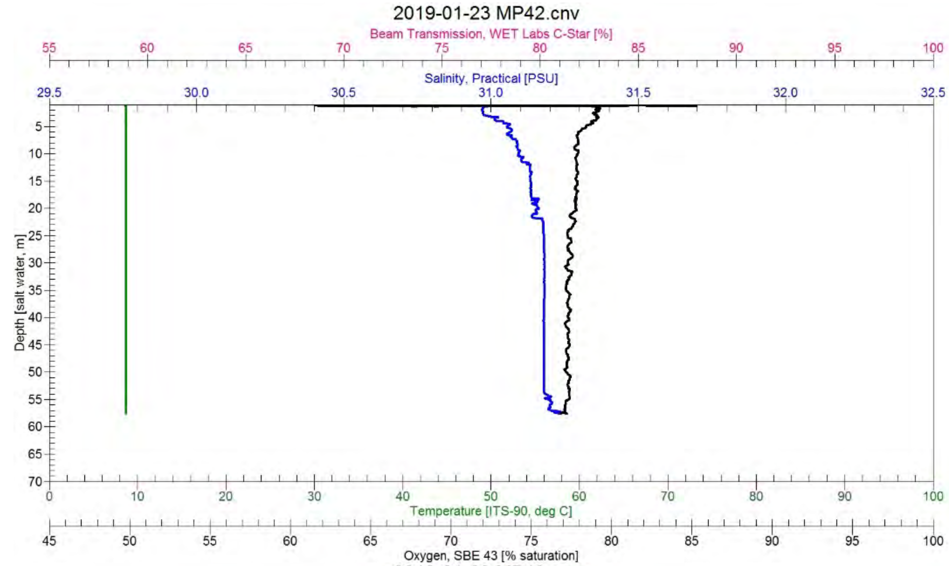


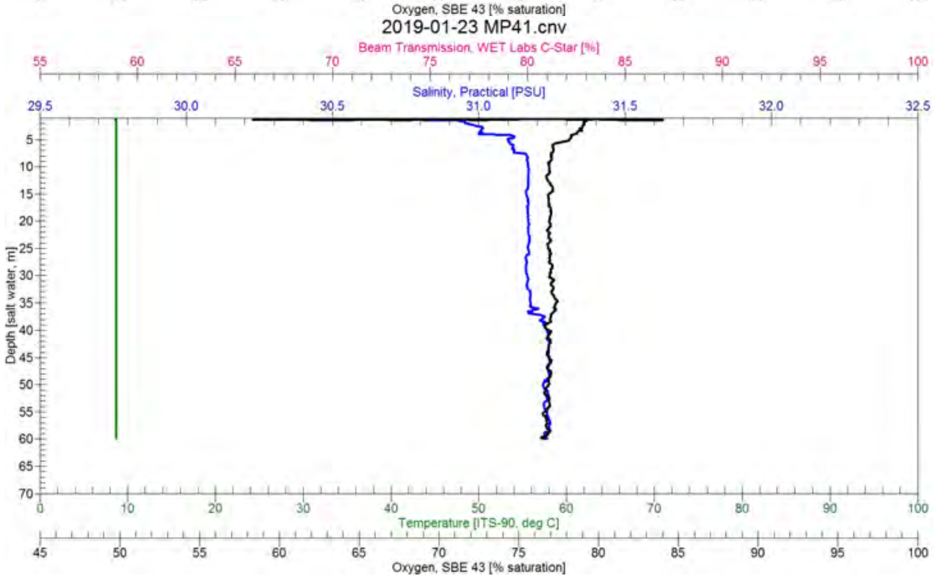


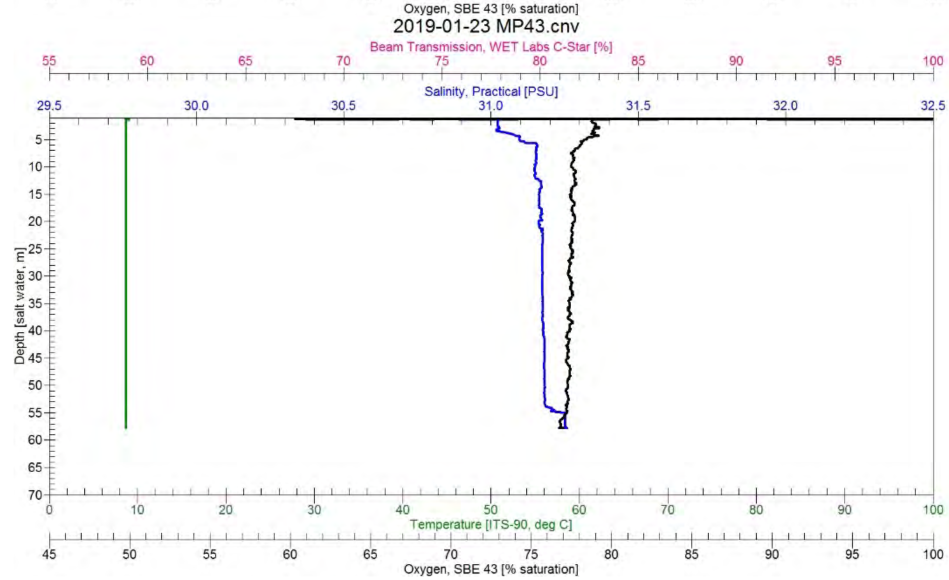




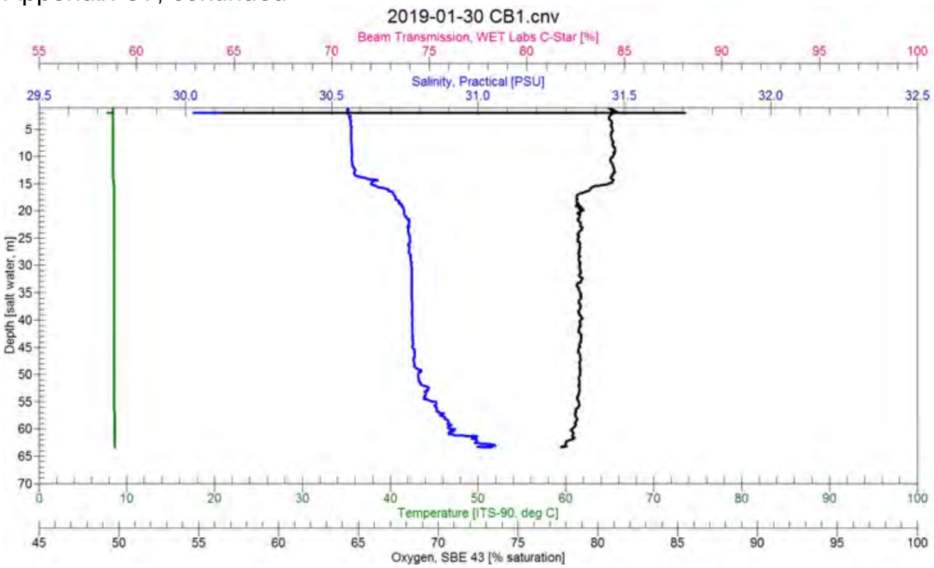

2019-01-23 MP40.cnv
Beam Transmission, WET Labs C-Star [%]
55 60 65 70 75 80 85 90 95 100
Salinity, Practical [PSU]
29.5 30.0 30.5 31.0 31.5 32.0 32.5
Depth [salt water, m]
5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 10 20 30 40 50 60 70 80 90 100
Temperature [ITS-90, deg C]
45 50 55 60 65 70 75 80 85 90 95 100
Oxygen, SBE 43 [% saturation]


2019-01-23 MP42.cnv
Beam Transmission, WET Labs C-Star [%]
55 60 65 70 75 80 85 90 95 100
Salinity, Practical [PSU]
29.5 30.0 30.5 31.0 31.5 32.0 32.5
Depth [salt water, m]
5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 10 20 30 40 50 60 70 80 90 100
Temperature [ITS-90, deg C]
45 50 55 60 65 70 75 80 85 90 95 100
Oxygen, SBE 43 [% saturation]


2019-01-23 MP41.cnv
Beam Transmission, WET Labs C-Star [%]
55 60 65 70 75 80 85 90 95 100
Salinity, Practical [PSU]
29.5 30.0 30.5 31.0 31.5 32.0 32.5
Depth [salt water, m]
5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 10 20 30 40 50 60 70 80 90 100
Temperature [ITS-90, deg C]
45 50 55 60 65 70 75 80 85 90 95 100
Oxygen, SBE 43 [% saturation]

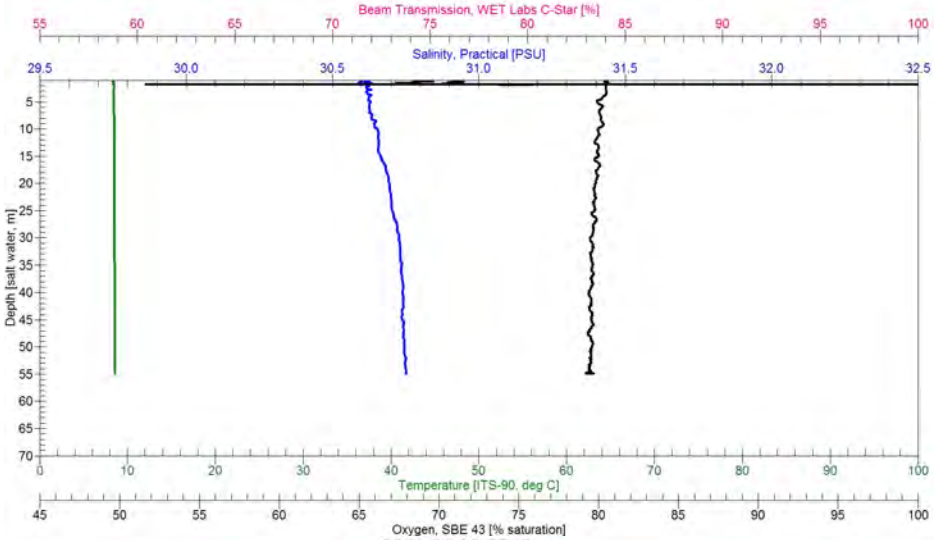

2019-01-23 MP43.cnv
Beam Transmission, WET Labs C-Star [%]
55 60 65 70 75 80 85 90 95 100
Salinity, Practical [PSU]
29.5 30.0 30.5 31.0 31.5 32.0 32.5
Depth [salt water, m]
5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 10 20 30 40 50 60 70 80 90 100
Temperature [ITS-90, deg C]
45 50 55 60 65 70 75 80 85 90 95 100
Oxygen, SBE 43 [% saturation]

Appendix C7, continued

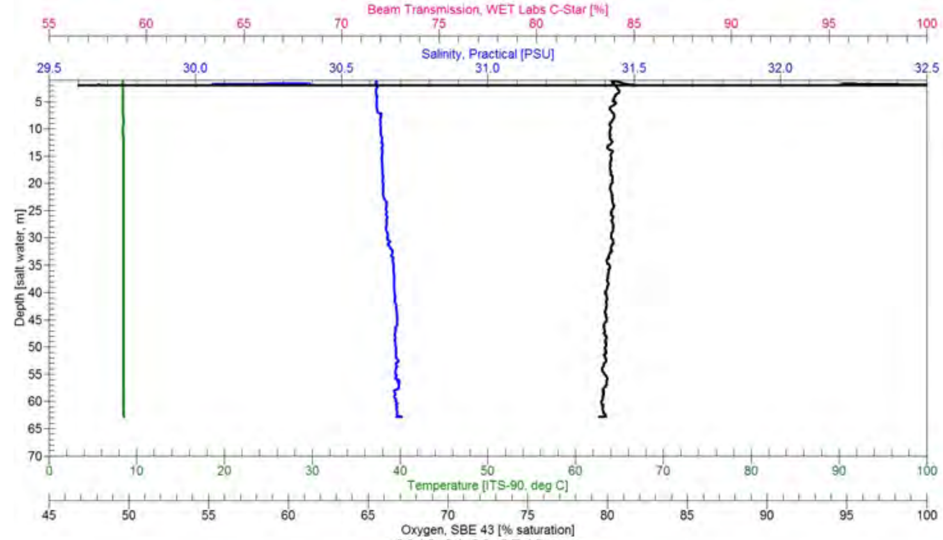


Appendix C7, continued

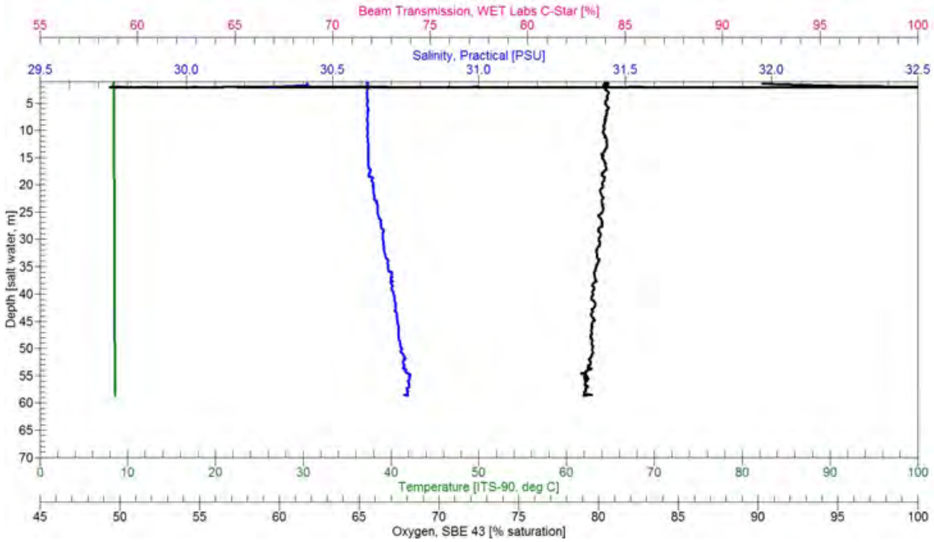
2019-01-30 CP39.cnv



2019-01-30 CP41.cnv



2019-01-30 CP40.cnv



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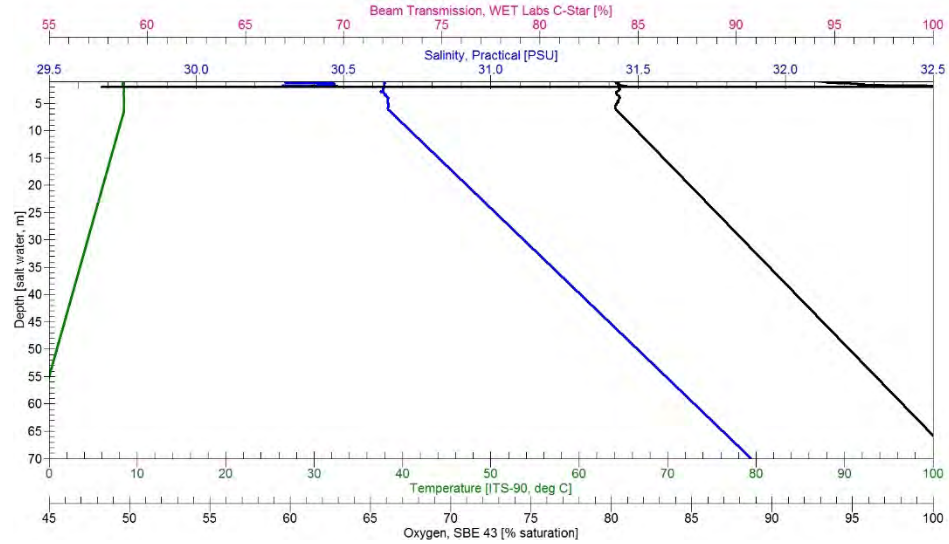

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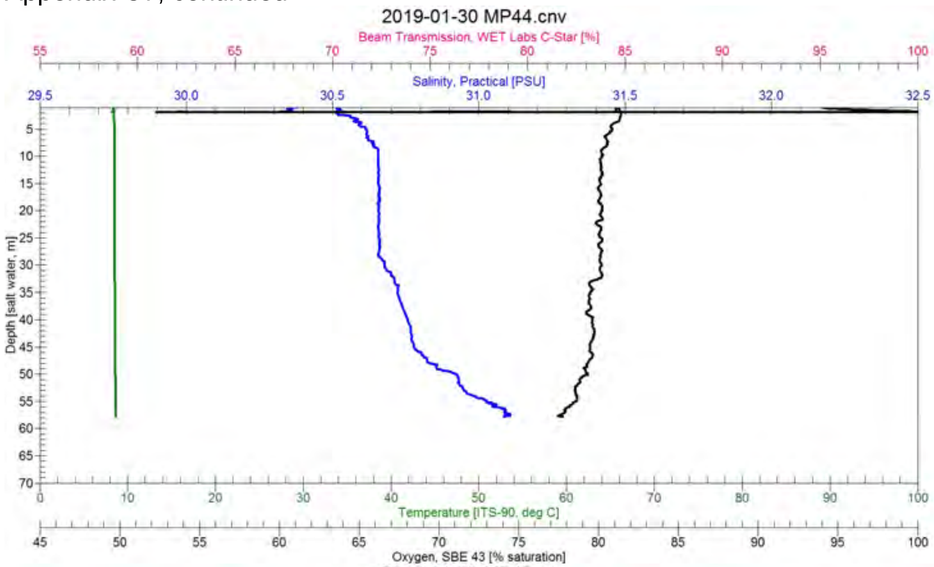
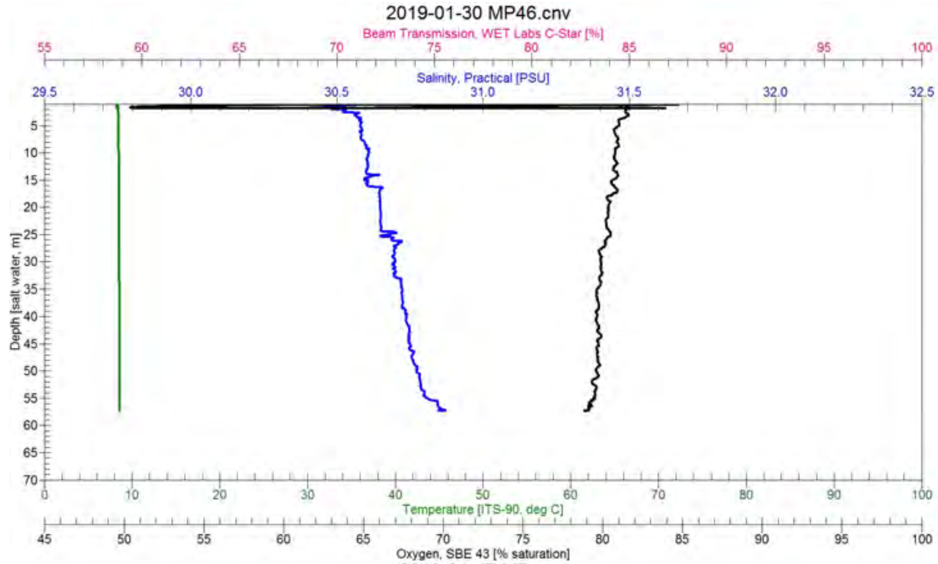
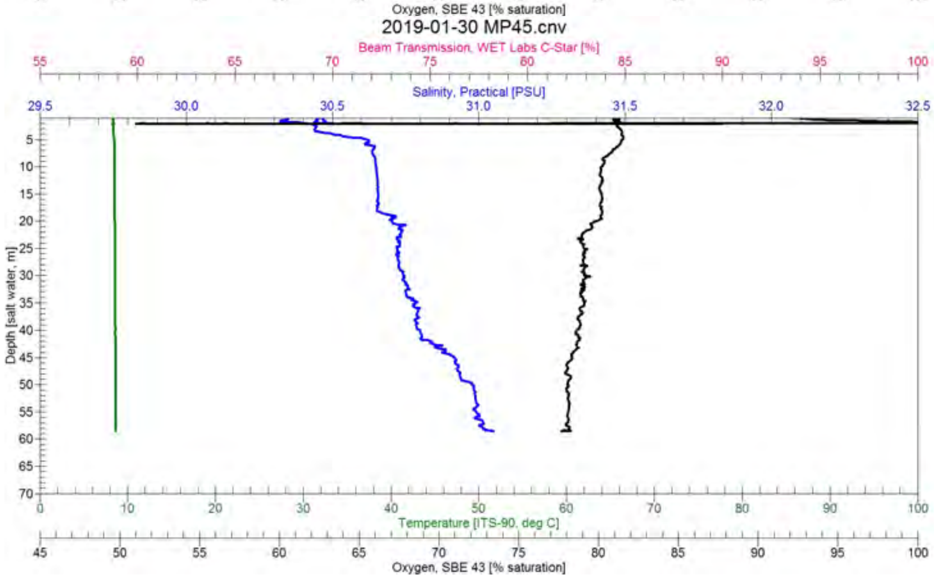
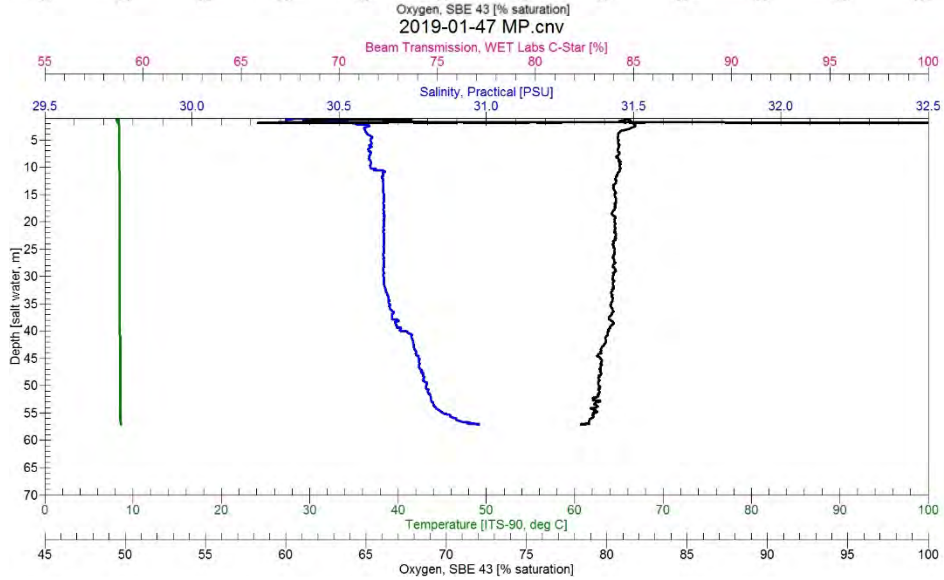
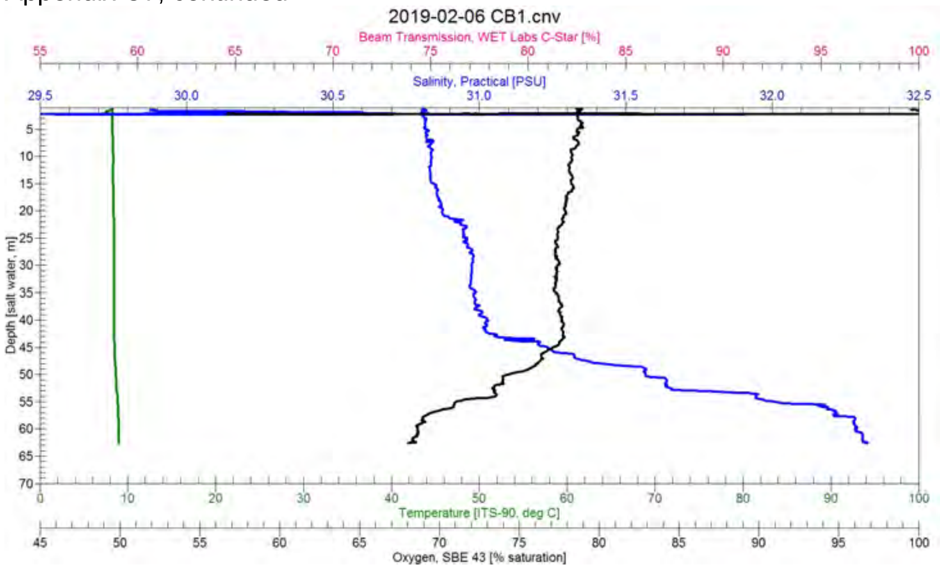




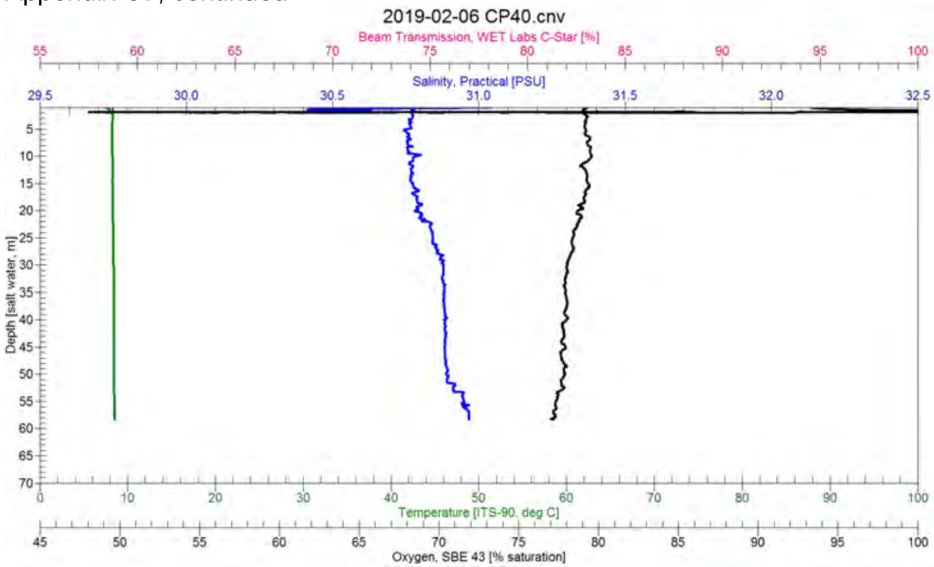


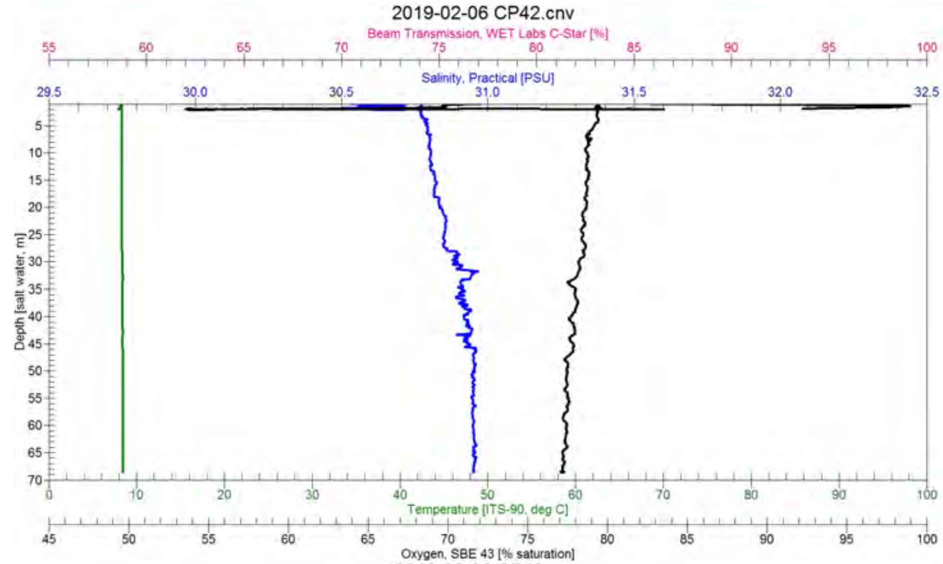


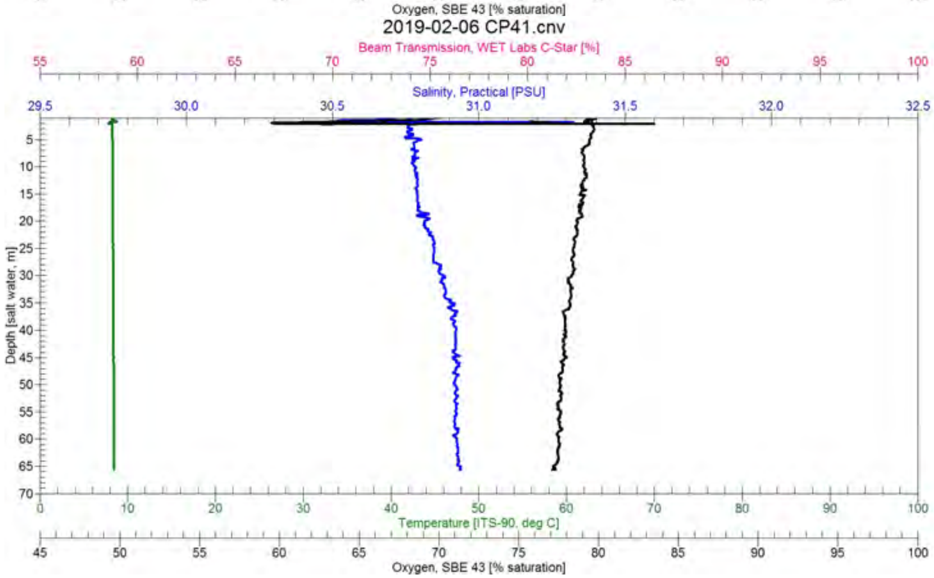
Appendix C7, continued

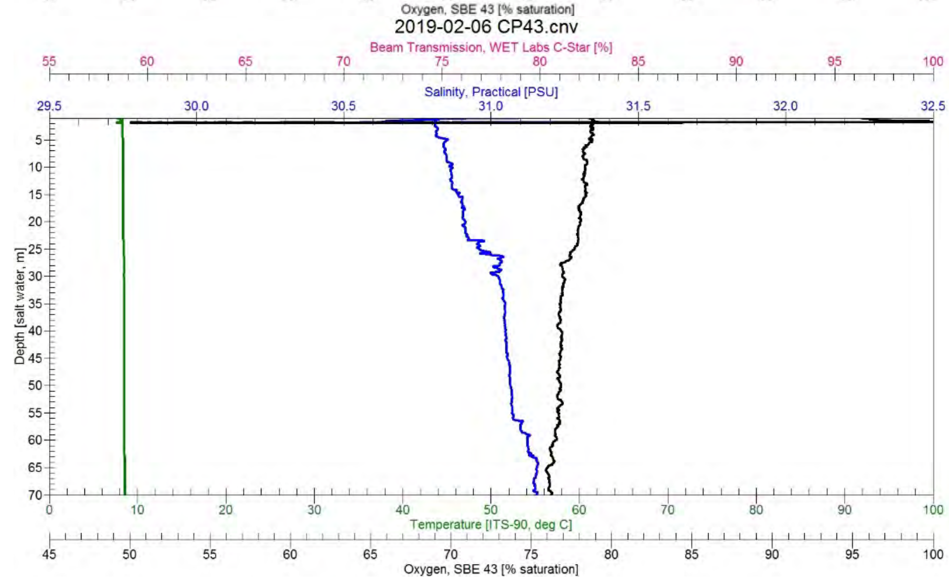


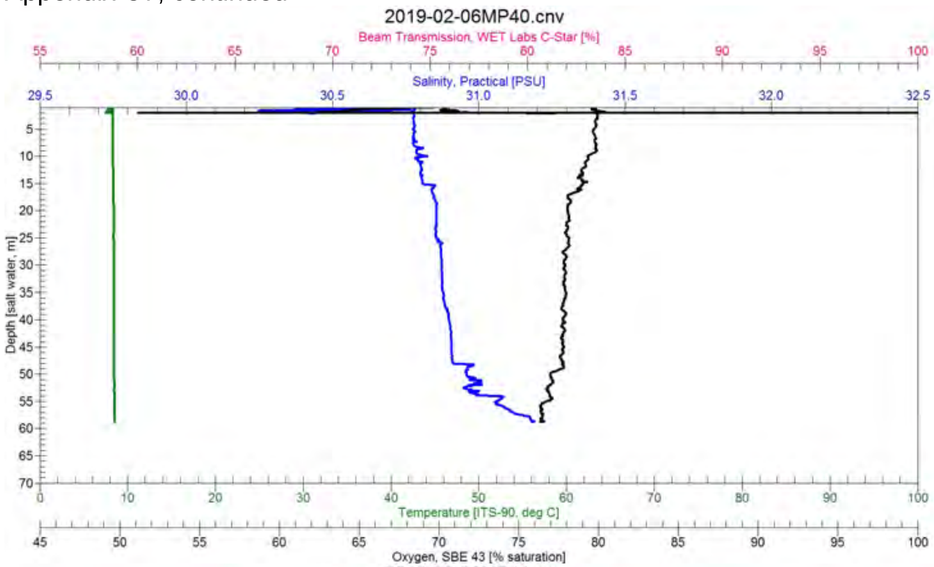
Appendix C7, continued

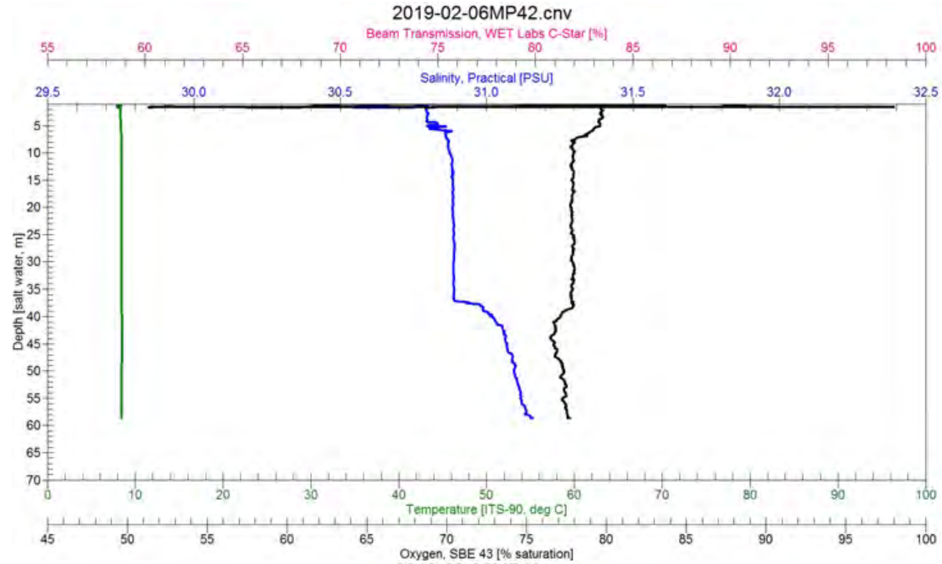


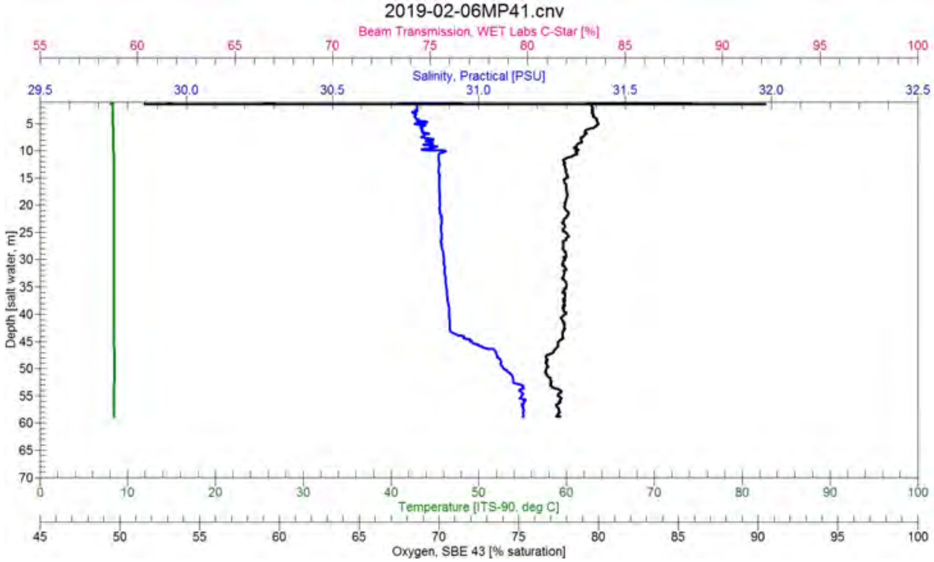


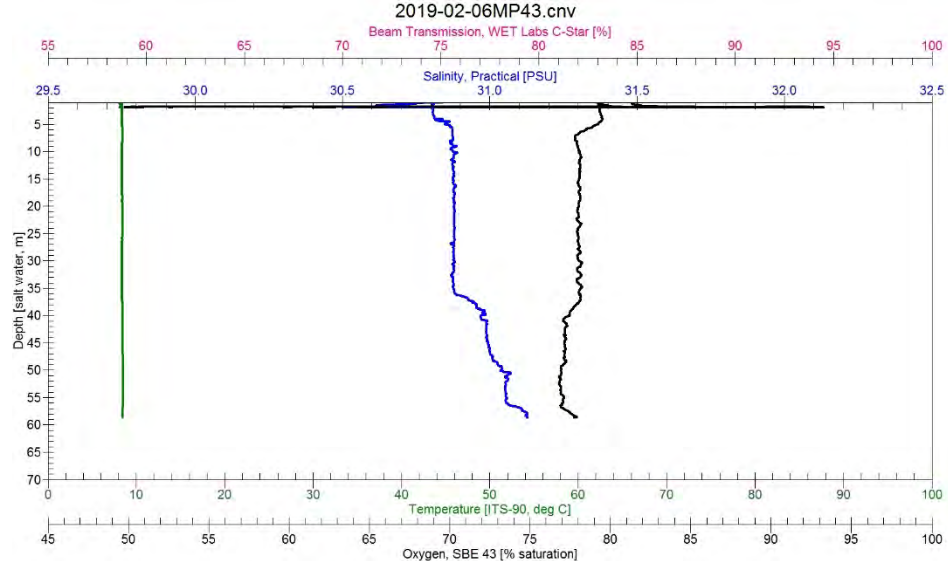




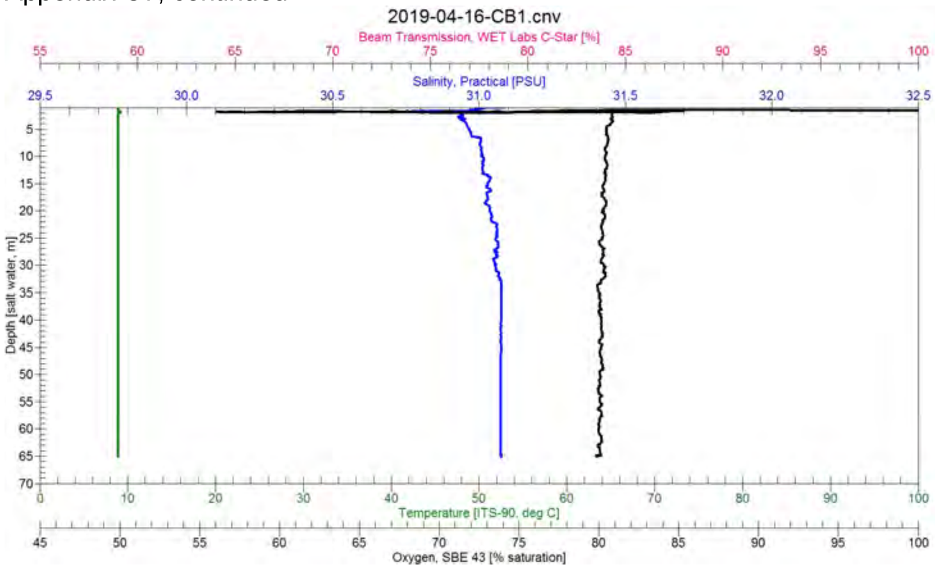

2019-02-06MP40.cnv
Beam Transmission, WET Labs C-Star [%]
55 60 65 70 75 80 85 90 95 100
Salinity, Practical [PSU]
29.5 30.0 30.5 31.0 31.5 32.0 32.5
Depth [salt water, m]
5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 10 20 30 40 50 60 70 80 90 100
Temperature [ITS-90, deg C]
45 50 55 60 65 70 75 80 85 90 95 100
Oxygen, SBE 43 [% saturation]


2019-02-06MP42.cnv
Beam Transmission, WET Labs C-Star [%]
55 60 65 70 75 80 85 90 95 100
Salinity, Practical [PSU]
29.5 30.0 30.5 31.0 31.5 32.0 32.5
Depth [salt water, m]
5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 10 20 30 40 50 60 70 80 90 100
Temperature [ITS-90, deg C]
45 50 55 60 65 70 75 80 85 90 95 100
Oxygen, SBE 43 [% saturation]

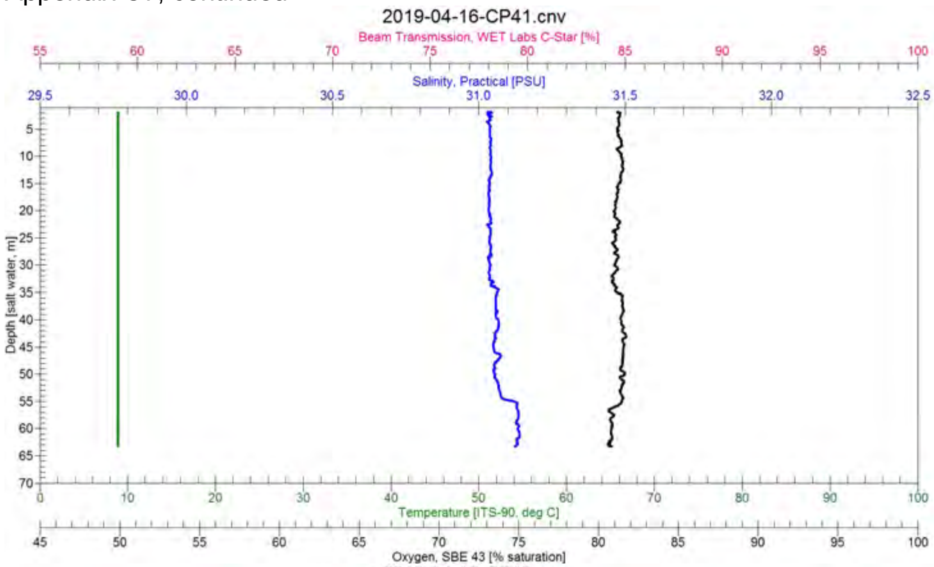

2019-02-06MP41.cnv
Beam Transmission, WET Labs C-Star [%]
55 60 65 70 75 80 85 90 95 100
Salinity, Practical [PSU]
29.5 30.0 30.5 31.0 31.5 32.0 32.5
Depth [salt water, m]
5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 10 20 30 40 50 60 70 80 90 100
Temperature [ITS-90, deg C]
45 50 55 60 65 70 75 80 85 90 95 100
Oxygen, SBE 43 [% saturation]

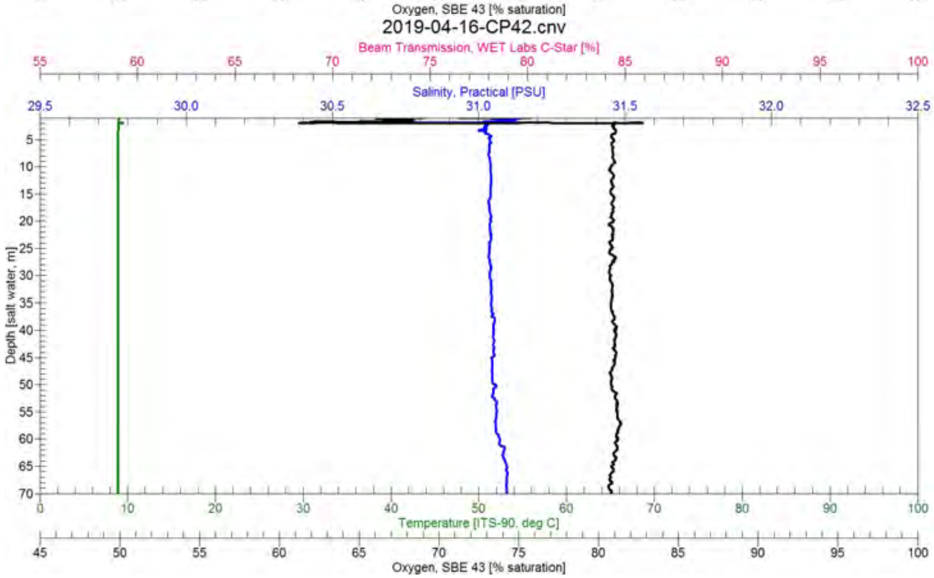

2019-02-06MP43.cnv
Beam Transmission, WET Labs C-Star [%]
55 60 65 70 75 80 85 90 95 100
Salinity, Practical [PSU]
29.5 30.0 30.5 31.0 31.5 32.0 32.5
Depth [salt water, m]
5 10 15 20 25 30 35 40 45 50 55 60 65 70
0 10 20 30 40 50 60 70 80 90 100
Temperature [ITS-90, deg C]
45 50 55 60 65 70 75 80 85 90 95 100
Oxygen, SBE 43 [% saturation]

Appendix C7, continued

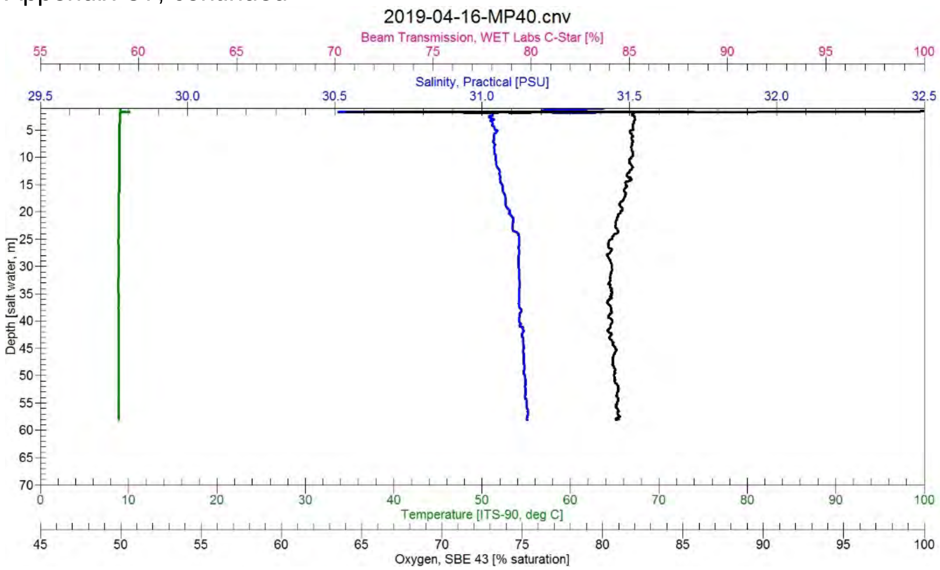


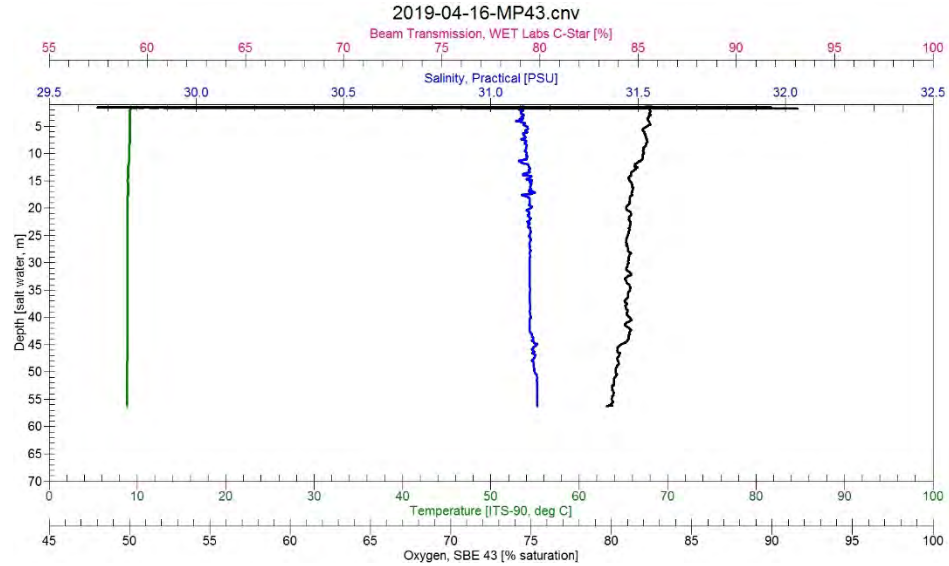
Appendix C7, continued

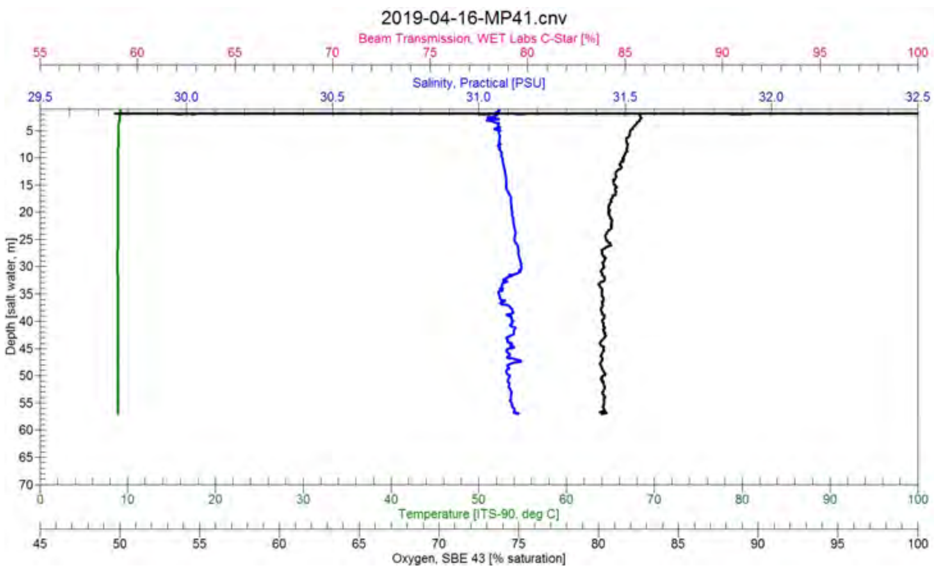




Appendix C7, continued







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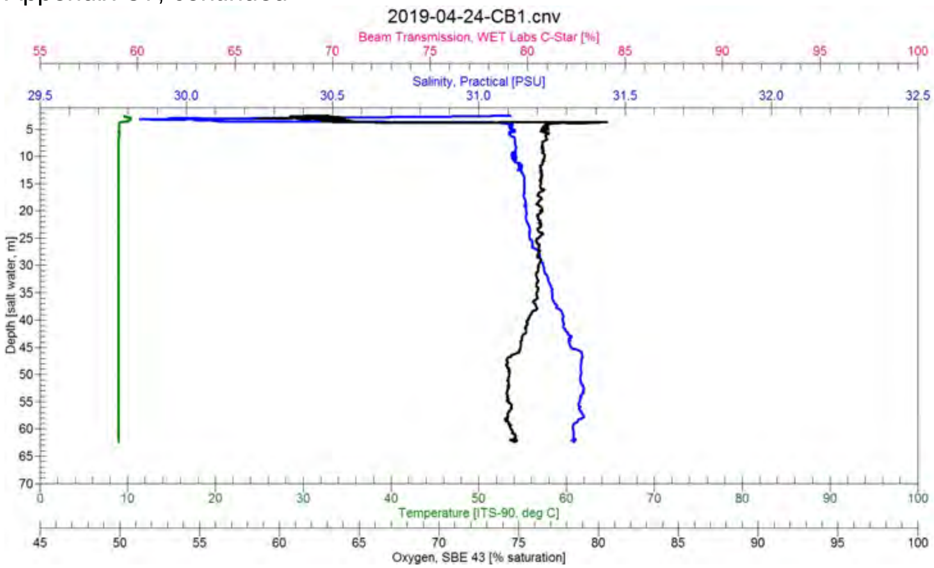
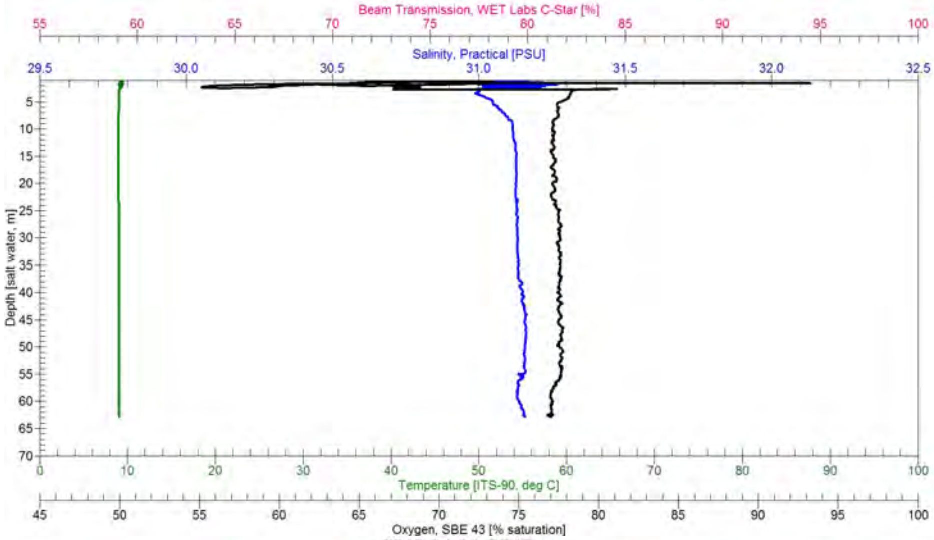
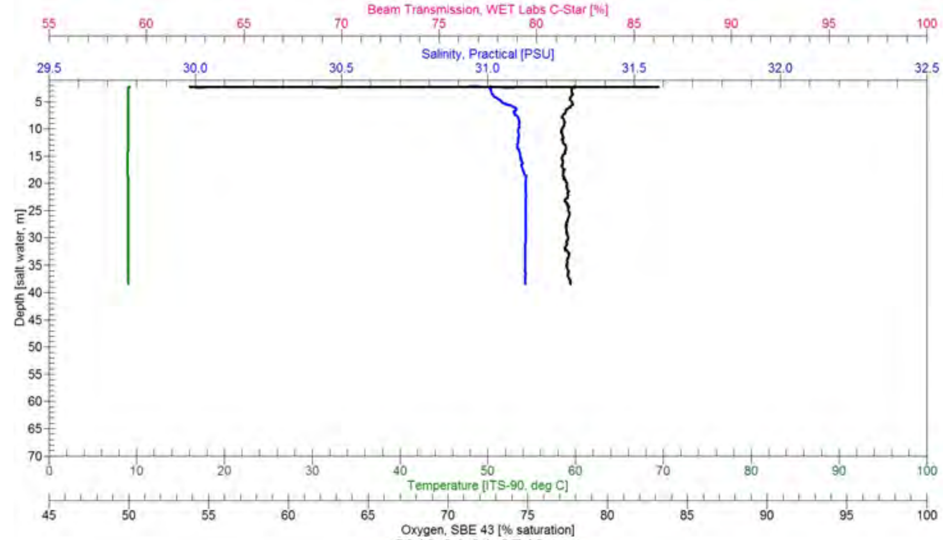


Appendix C7, continued

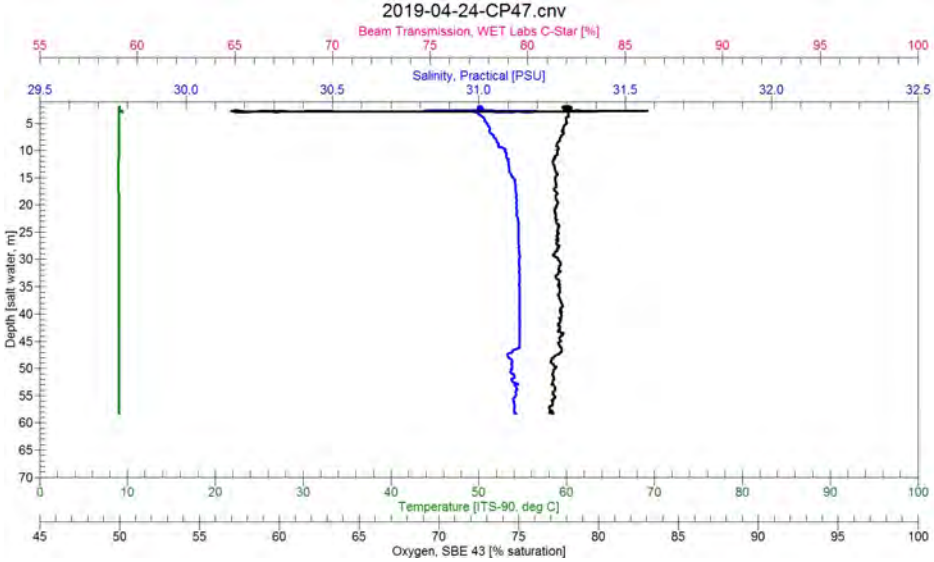
2019-04-24-CP46.cnv



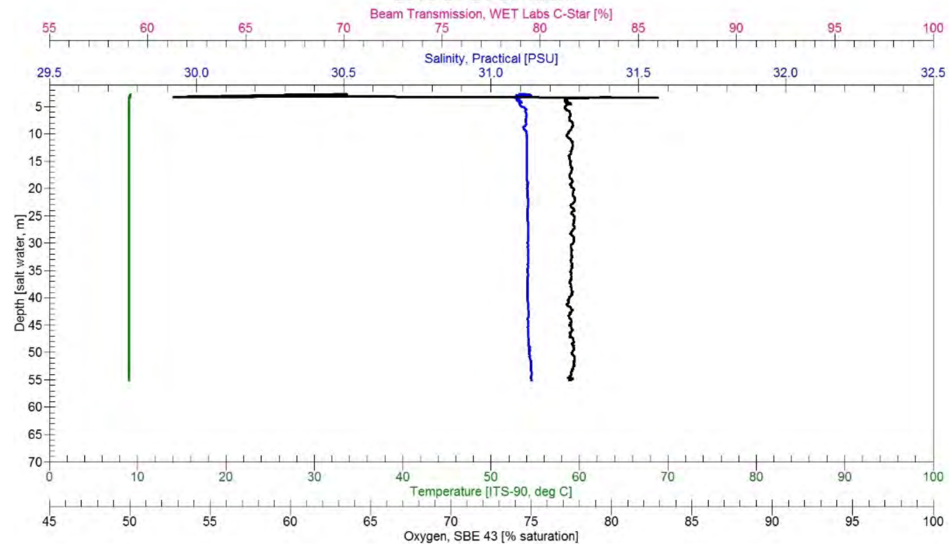
2019-04-24-CP48.cnv



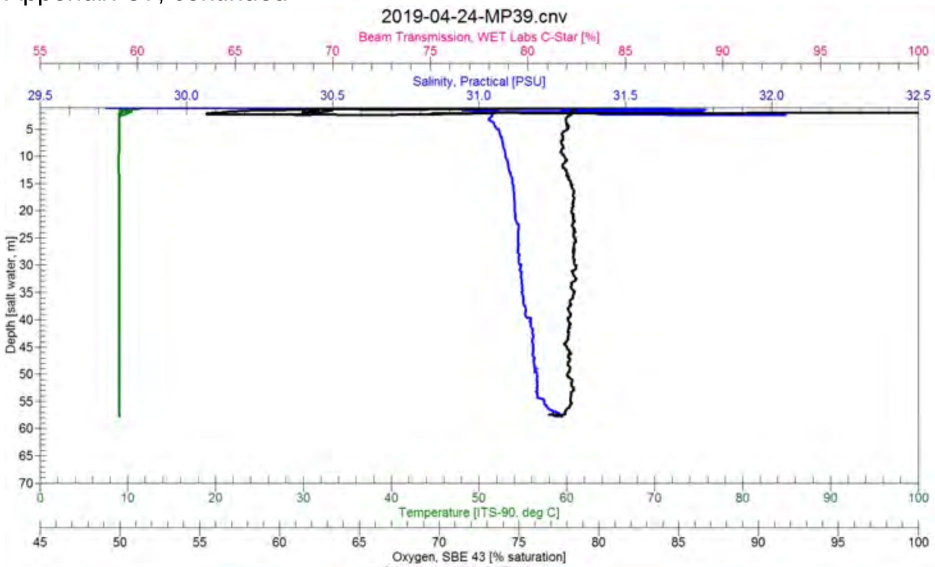
2019-04-24-CP47.cnv

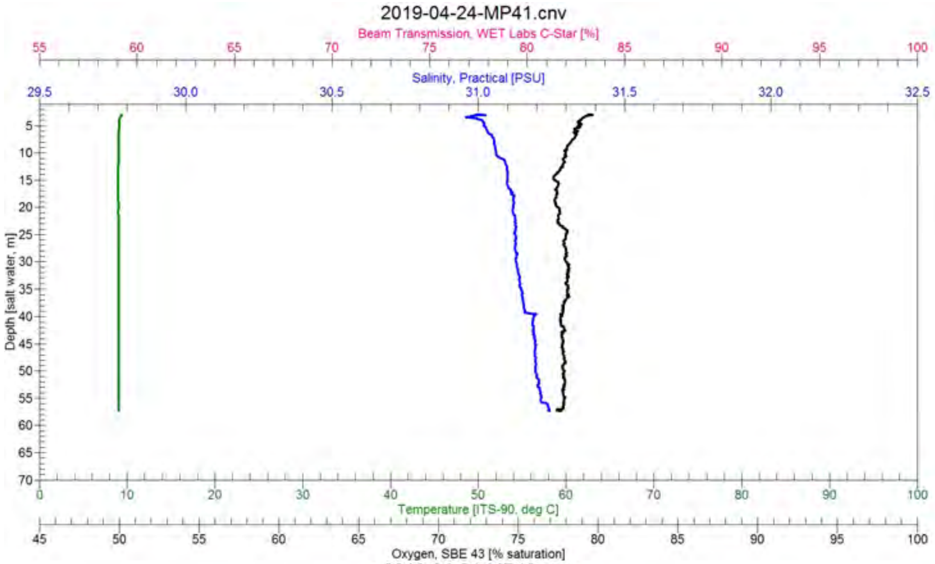


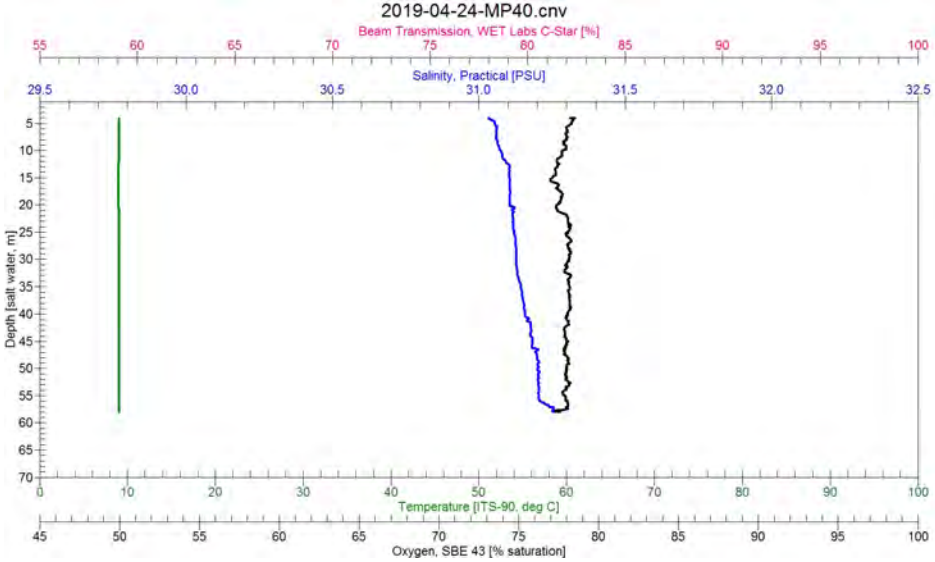
2019-04-24-CP49.cnv

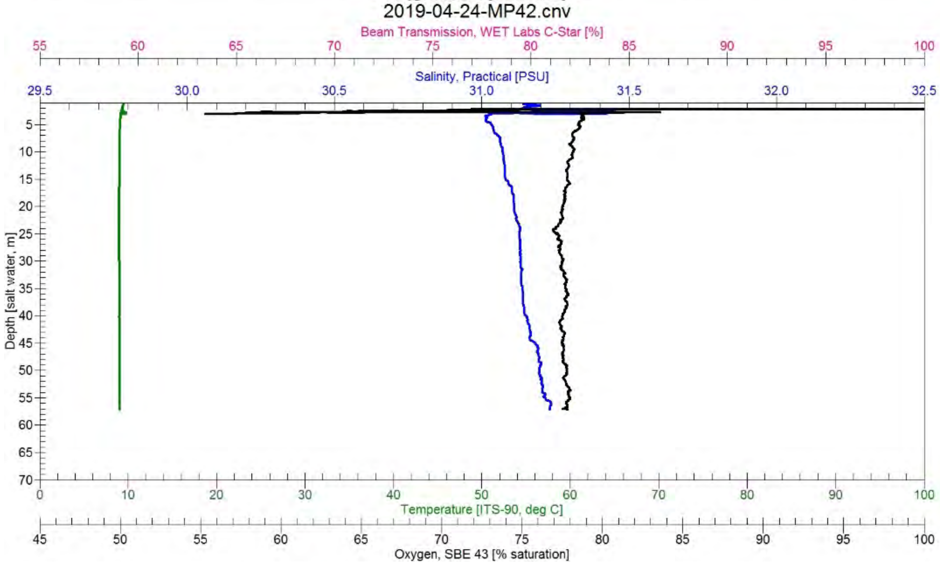


Appendix C7, continued









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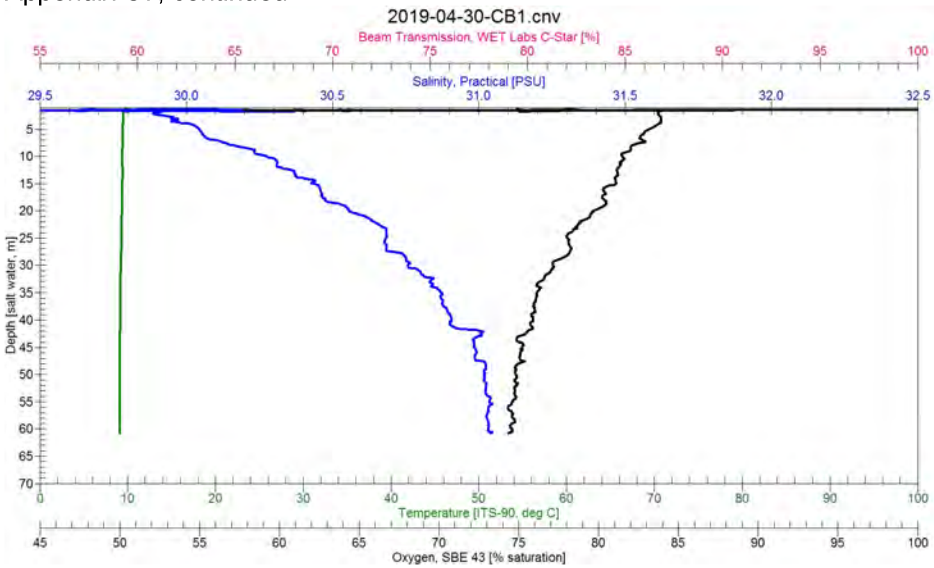
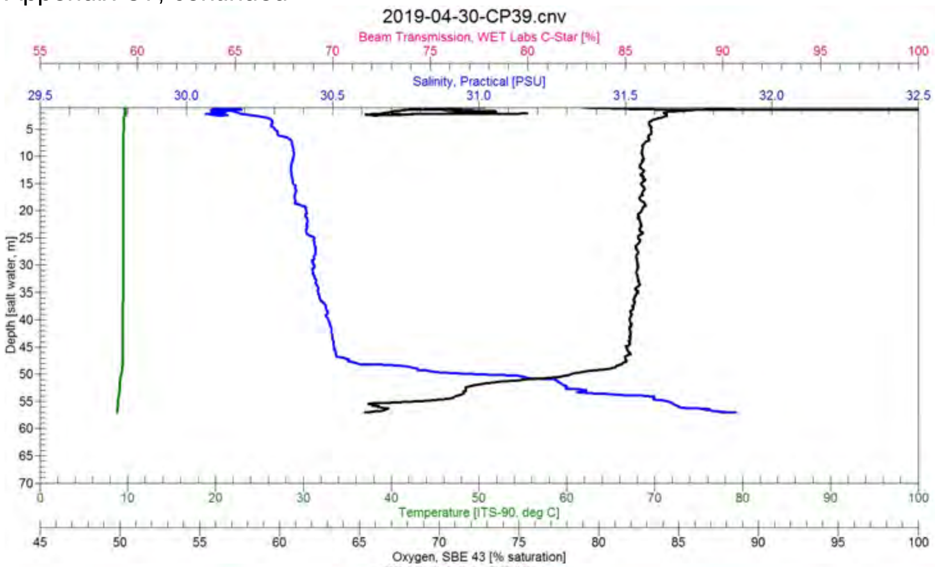
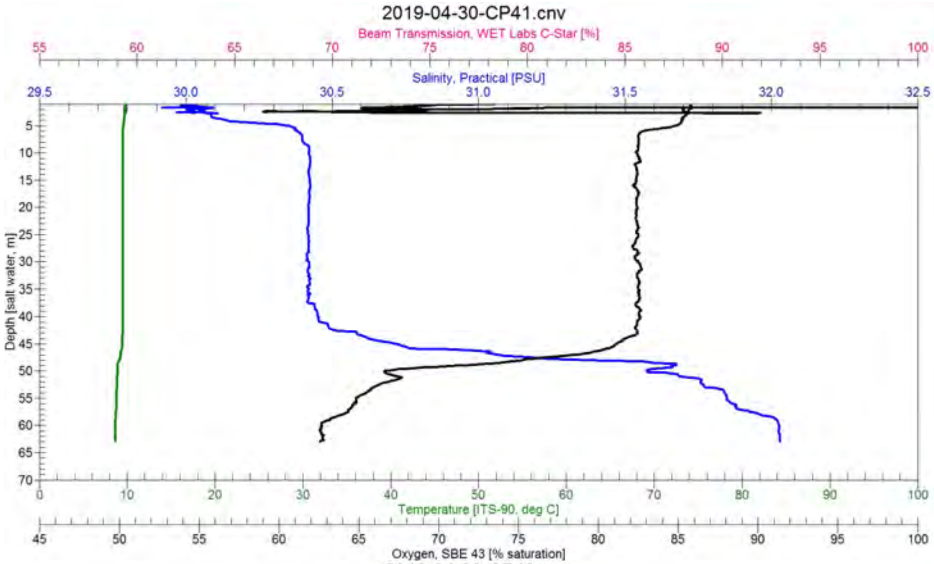
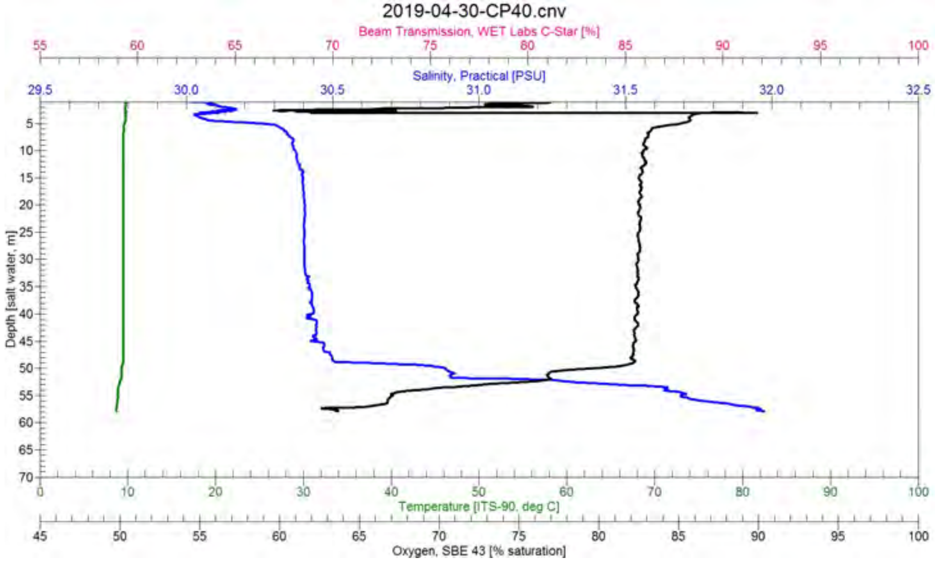
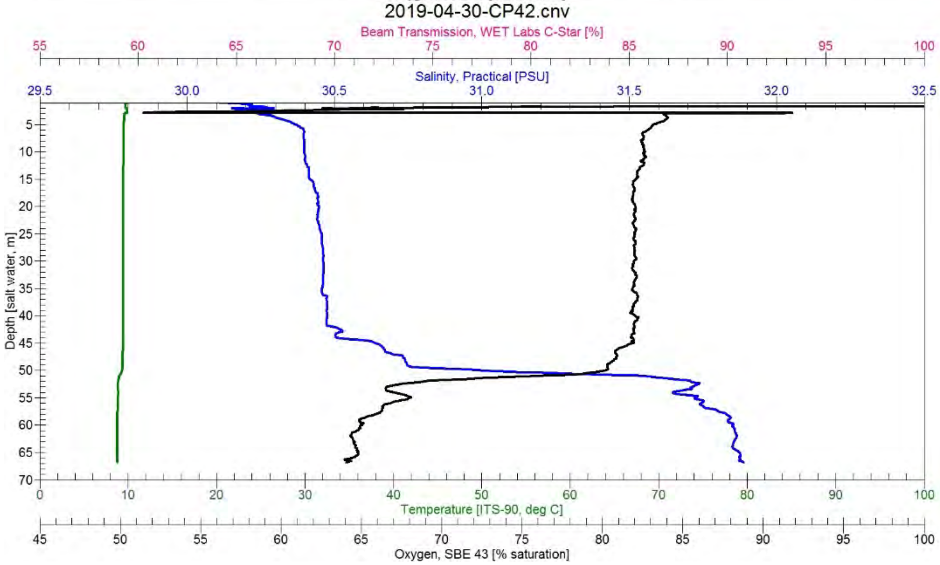


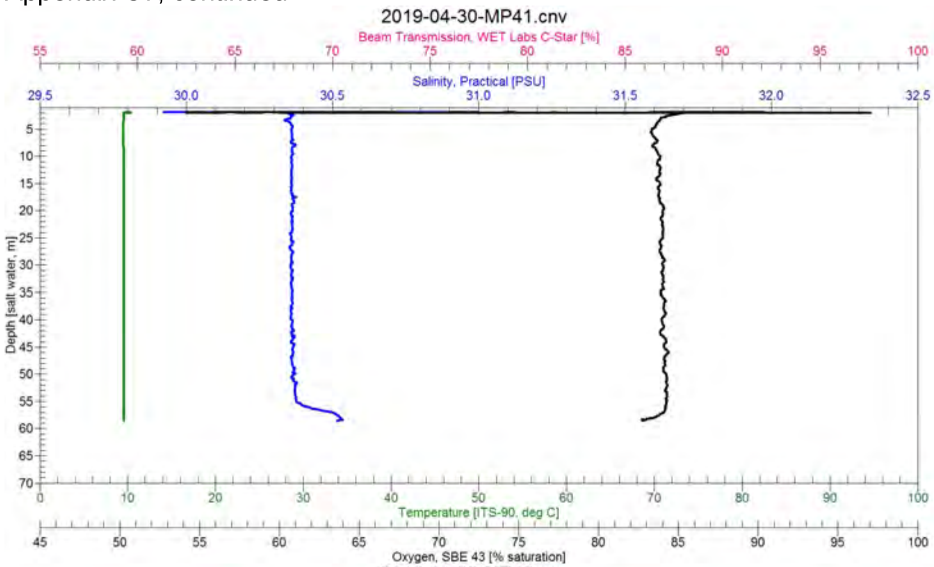

2019-04-30-CP39.cnv
Beam Transmission, WET Labs C-Star [%]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]

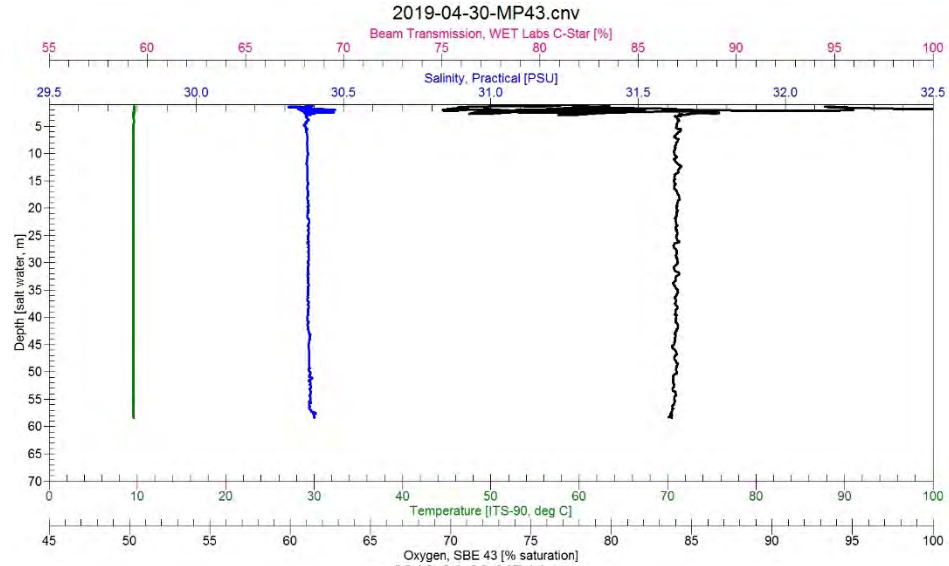

2019-04-30-CP41.cnv
Beam Transmission, WET Labs C-Star [%]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]

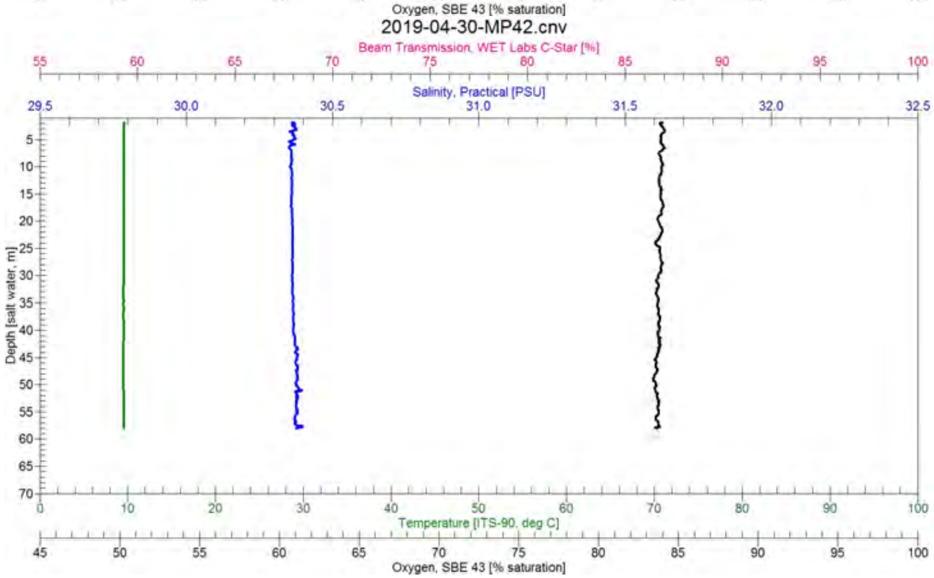

2019-04-30-CP40.cnv
Beam Transmission, WET Labs C-Star [%]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]

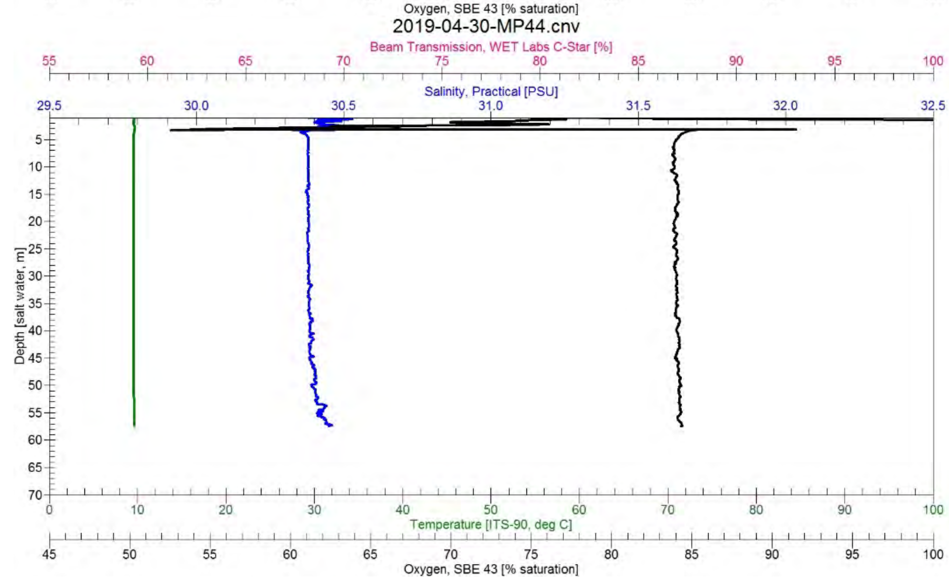

2019-04-30-CP42.cnv
Beam Transmission, WET Labs C-Star [%]
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]

Appendix C7, continued

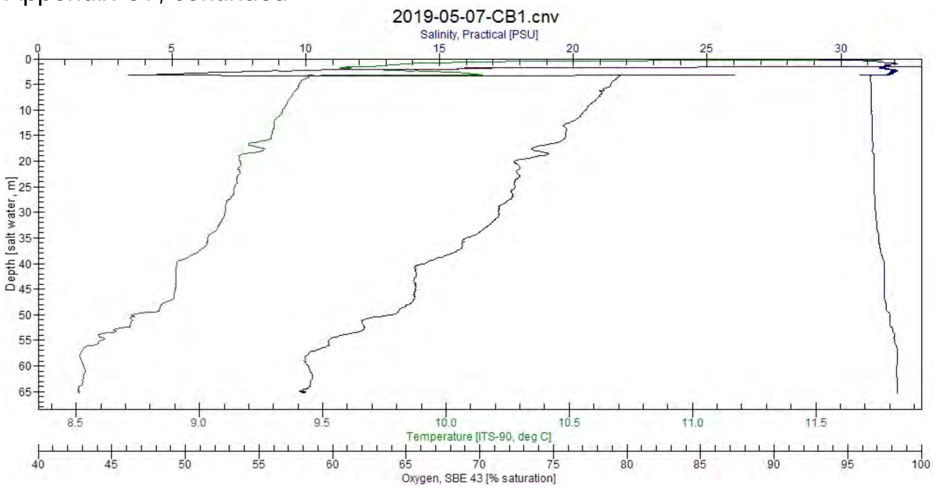




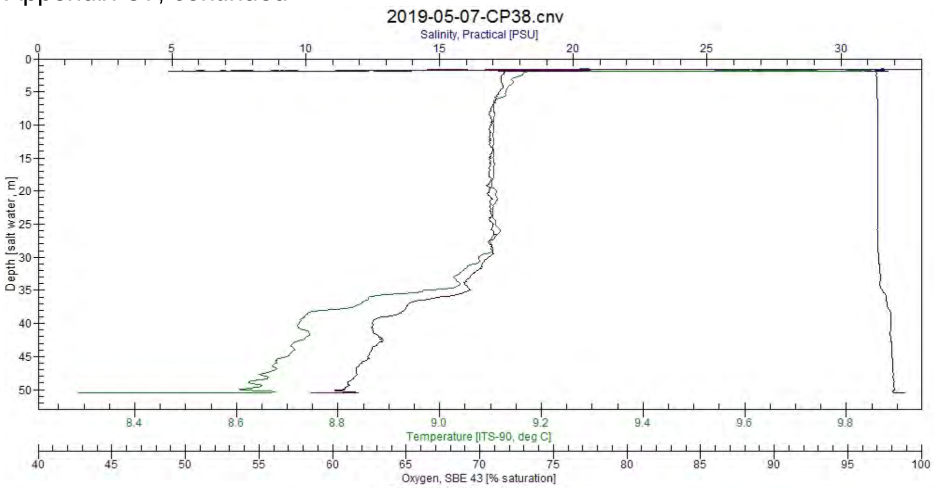


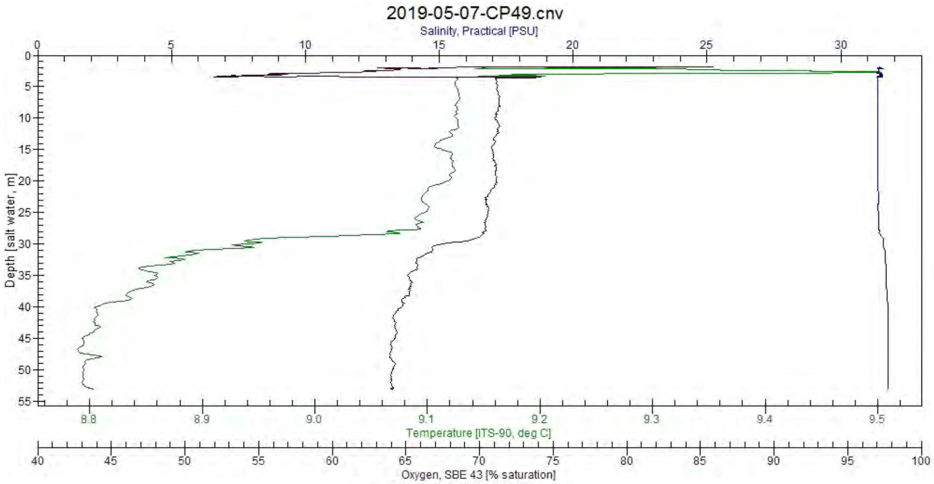


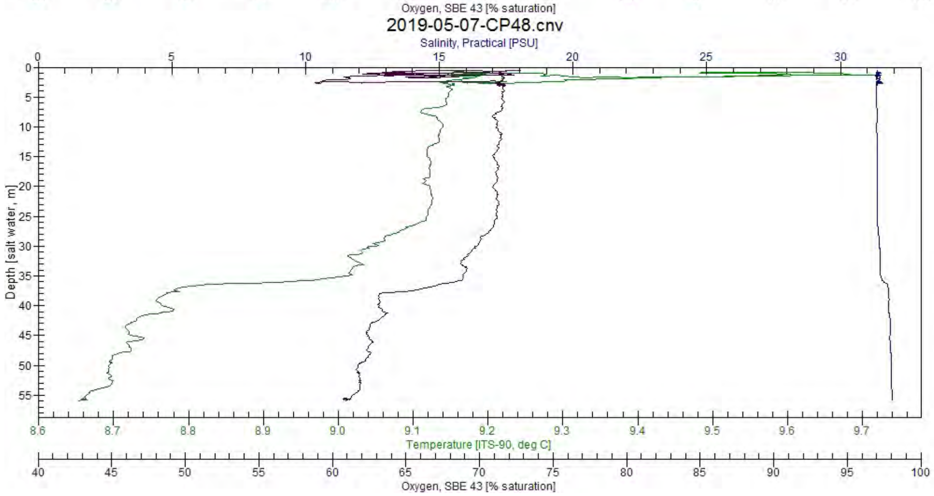
Appendix C7, continued

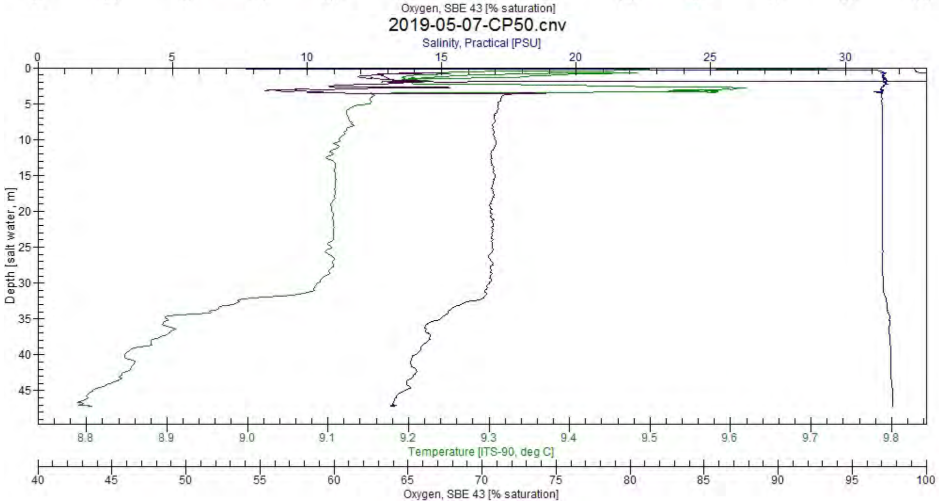


Appendix C7, continued

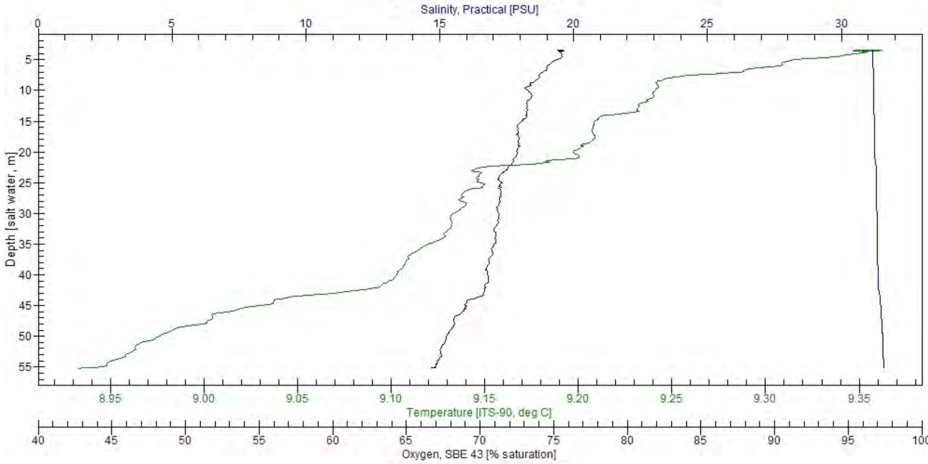




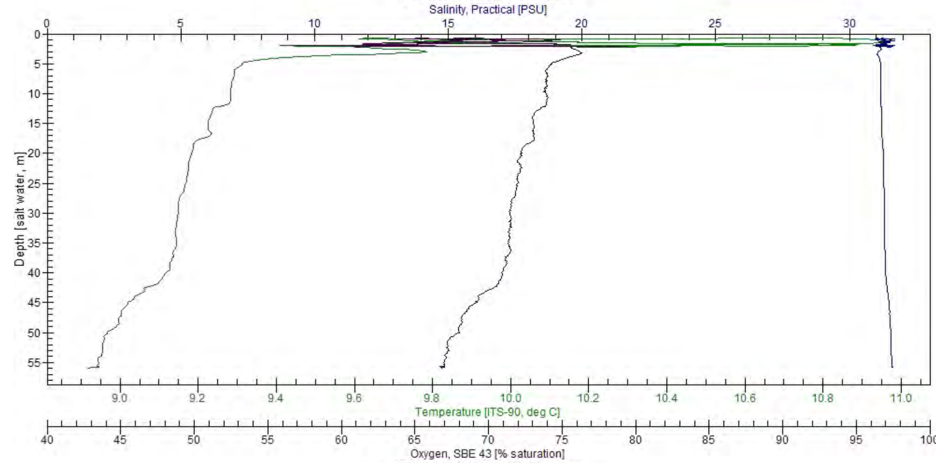




2019-05-07-MP45.cnv



2019-05-07-MP47.cnv



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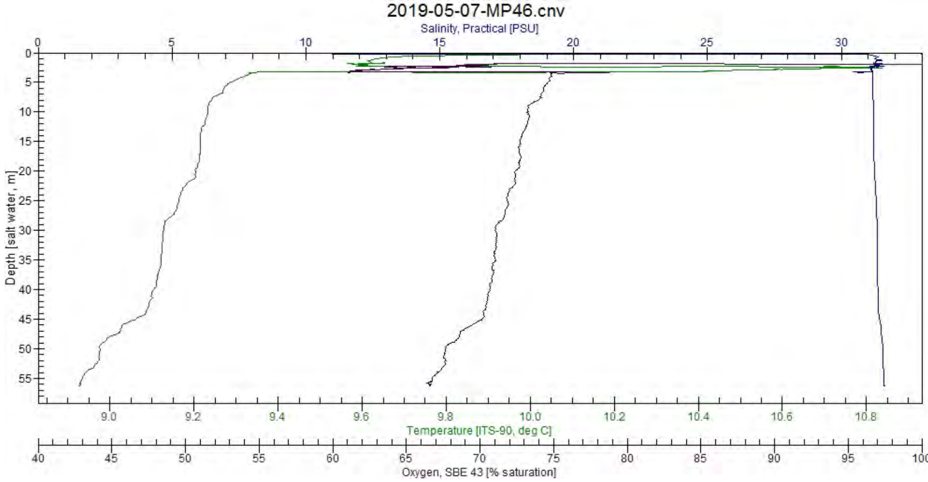

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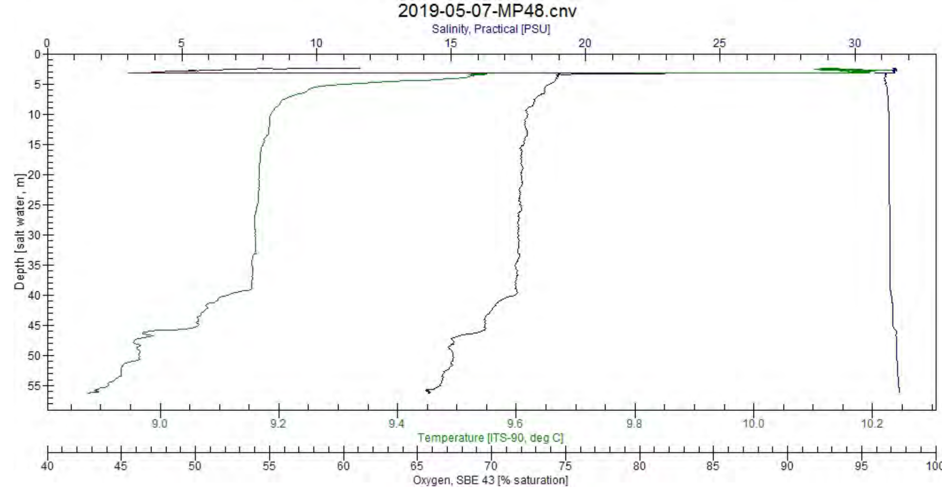

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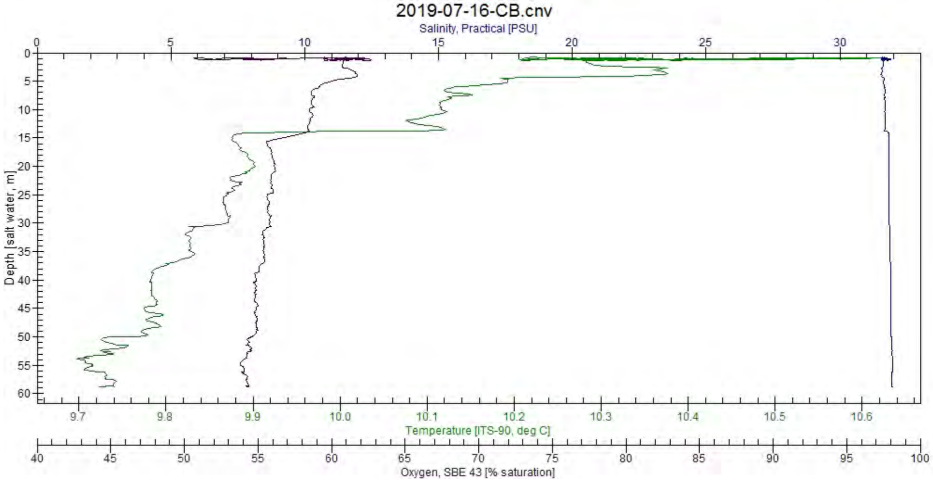

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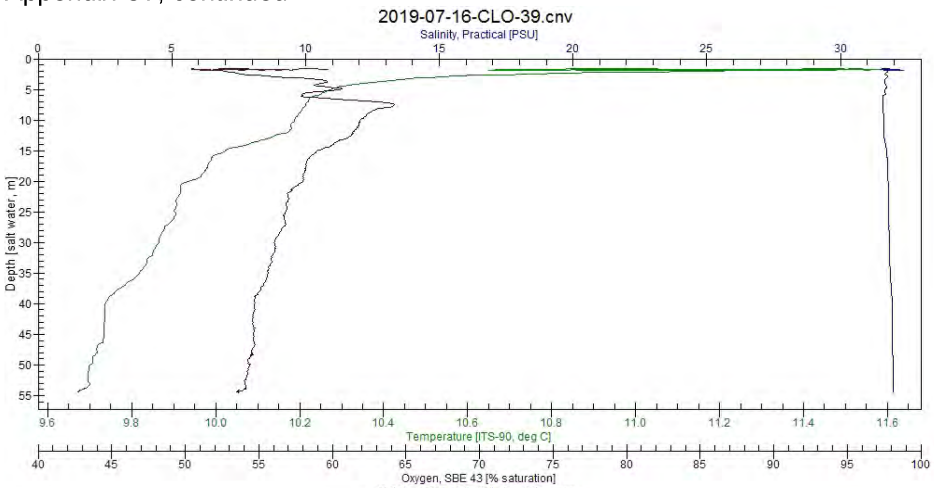

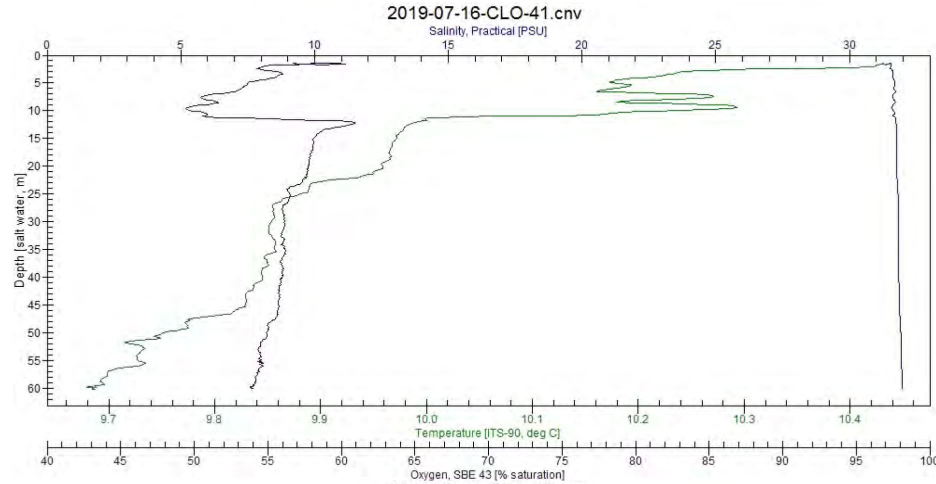

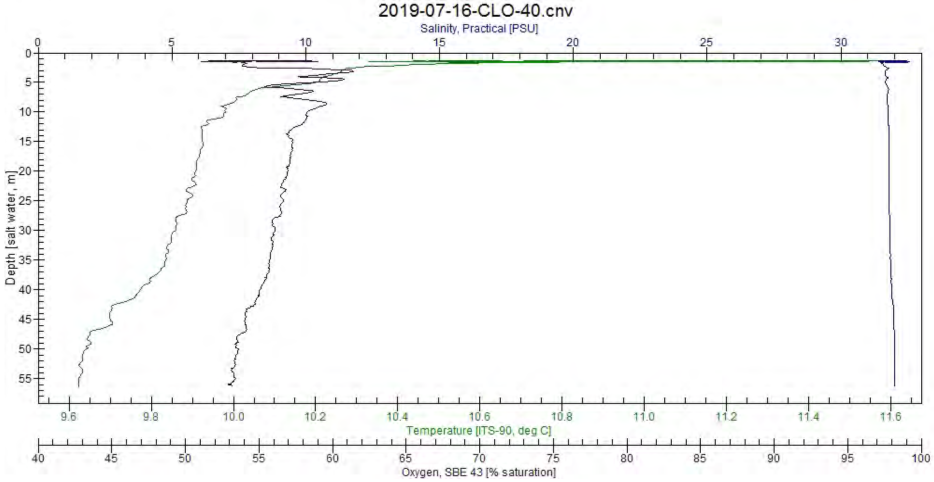

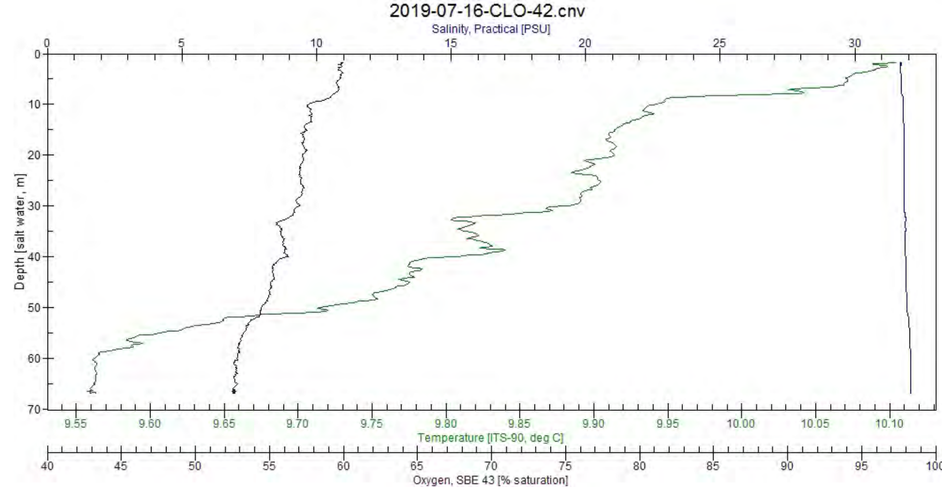

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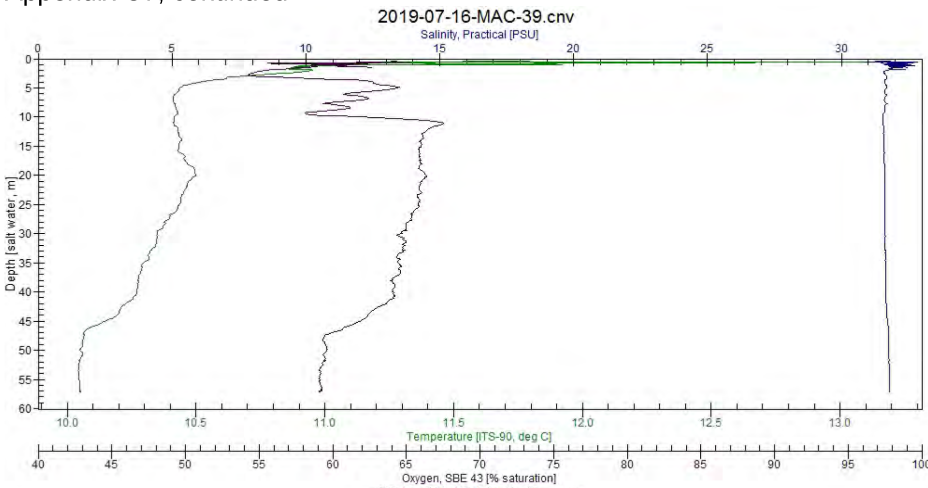

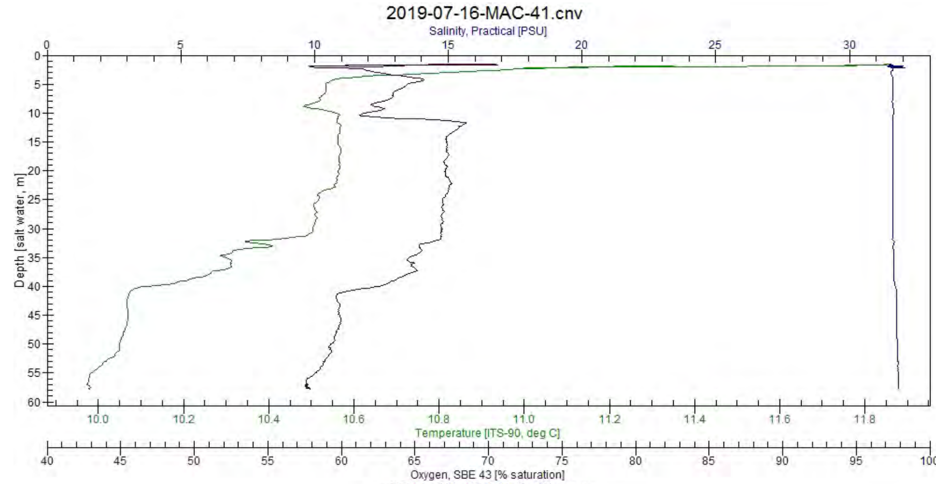

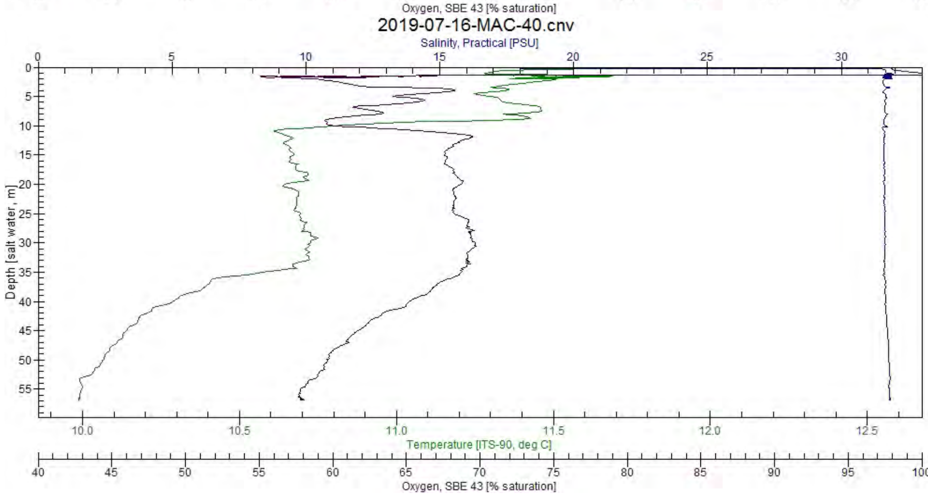

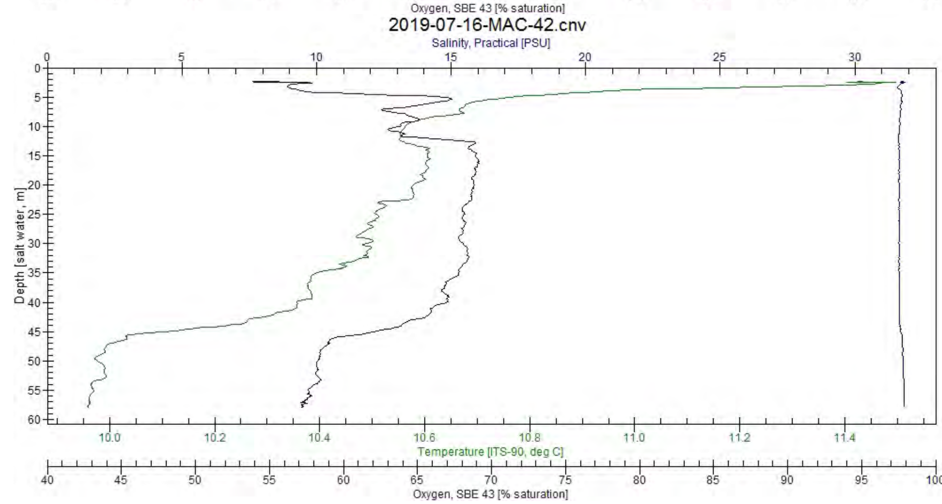

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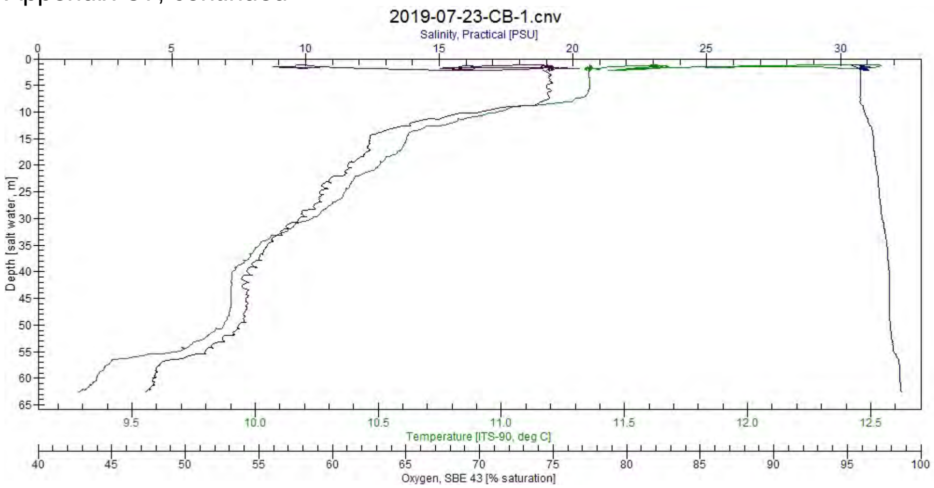

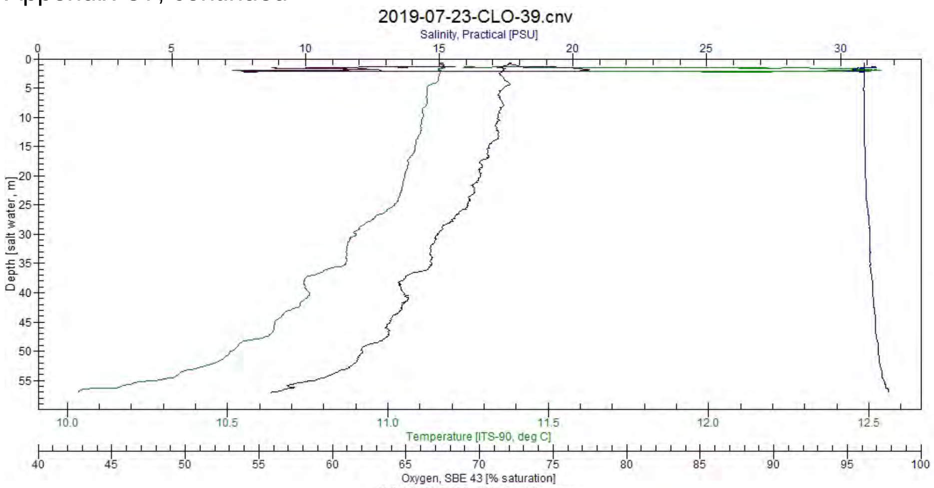
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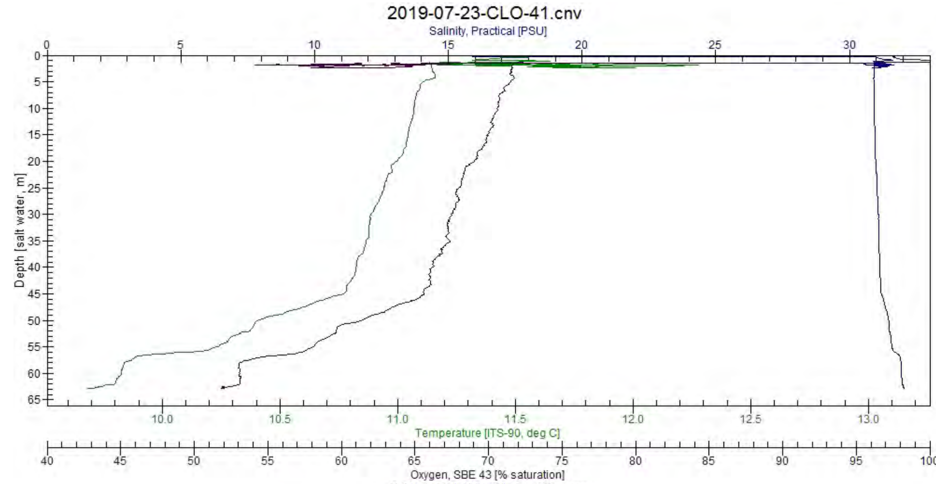
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]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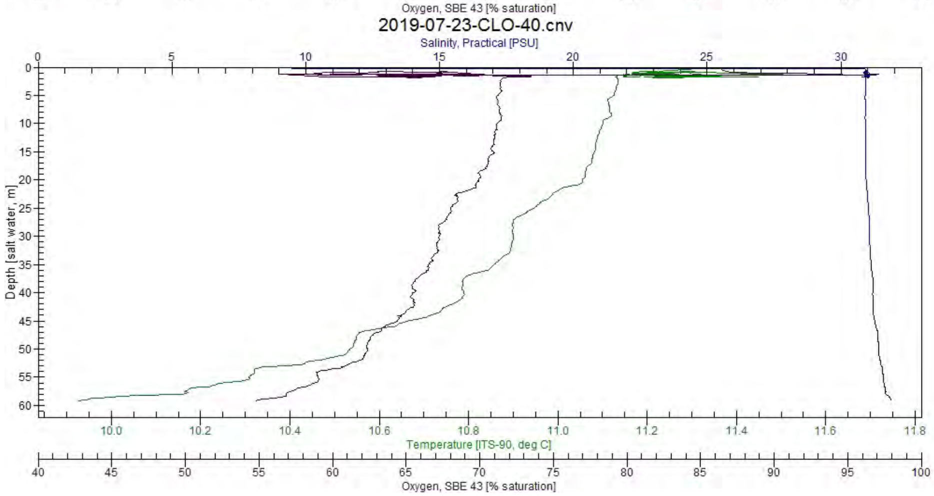
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]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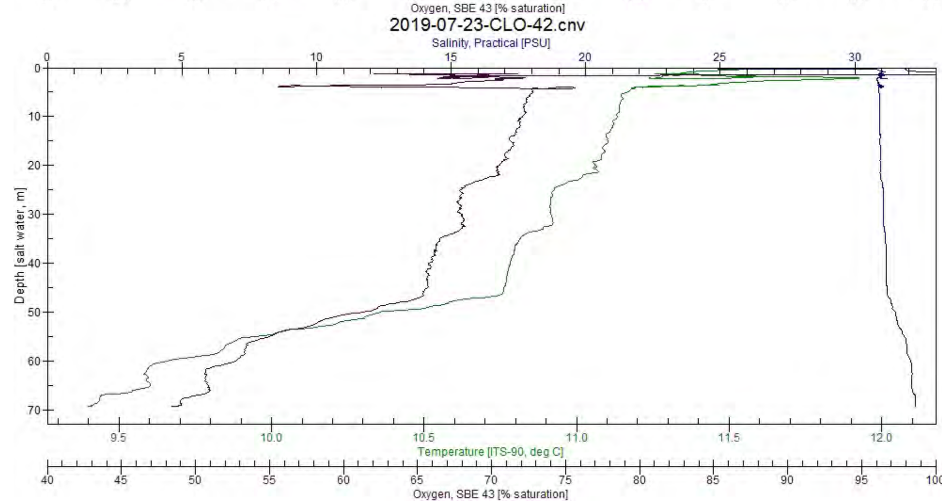
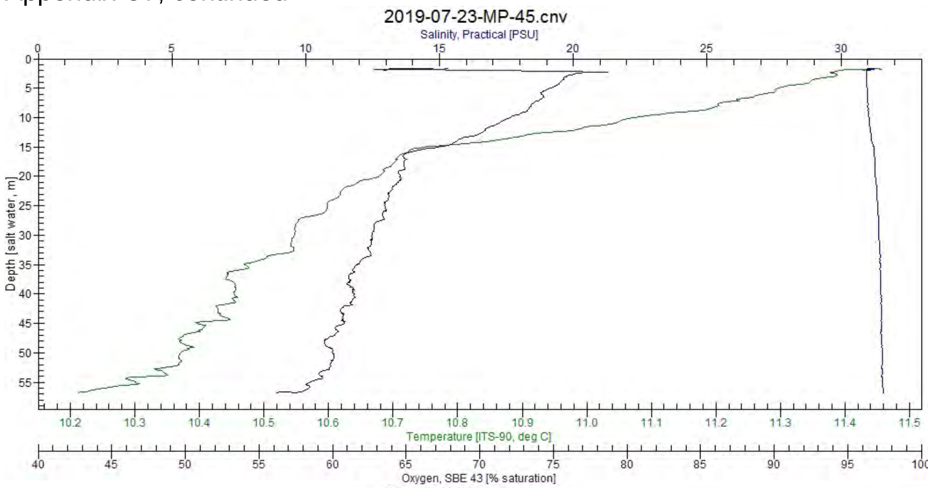
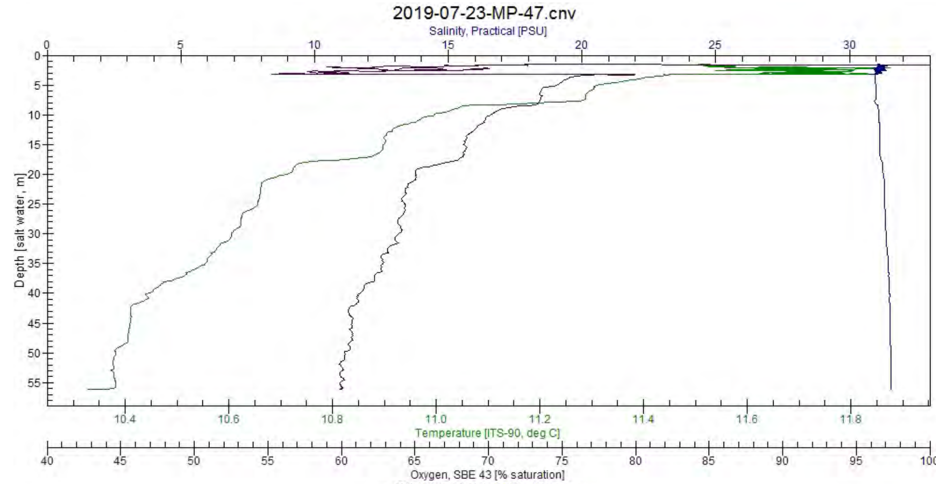
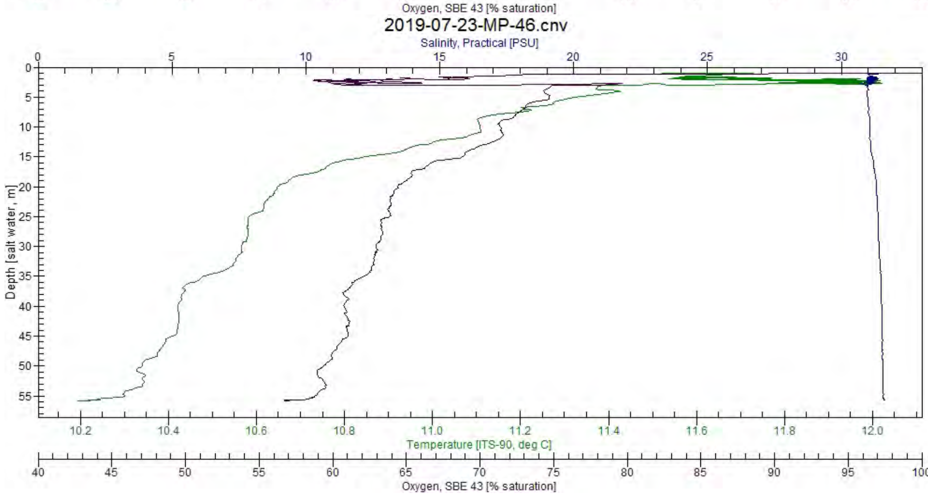
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]

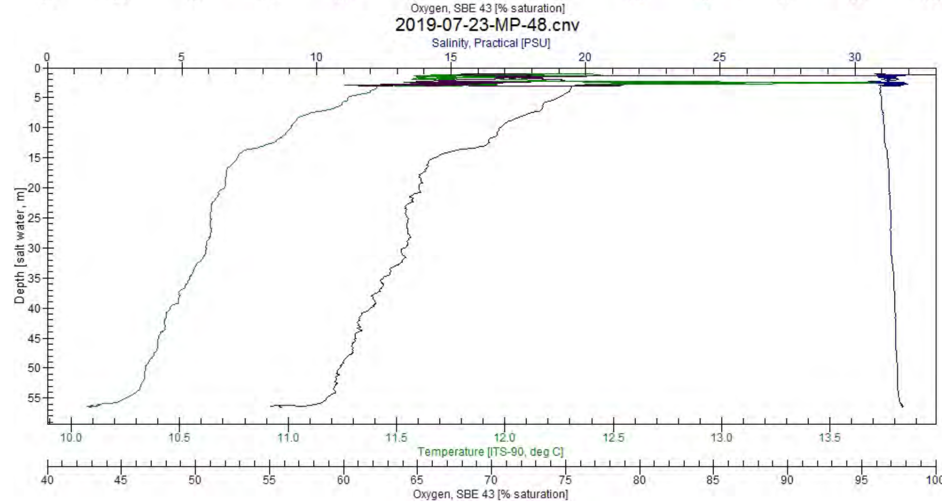

2019-07-23-CLO-42.cnv
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]

Appendix C7, continued









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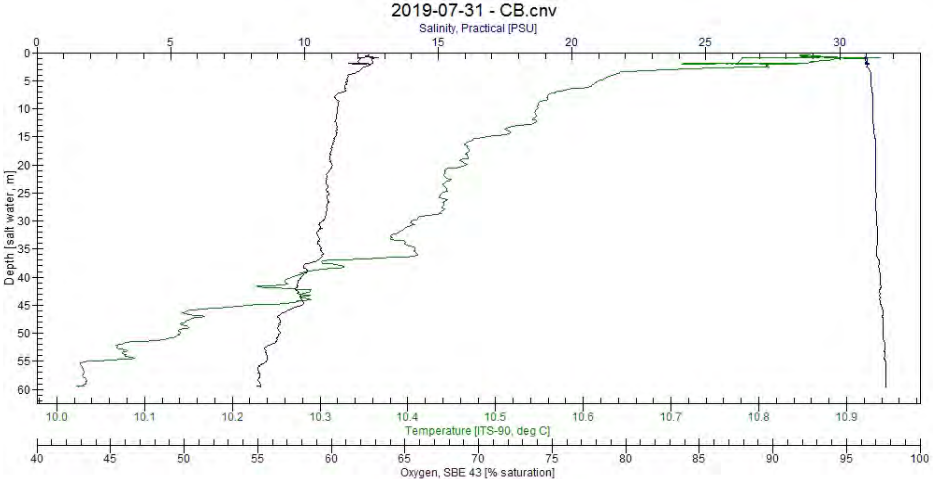

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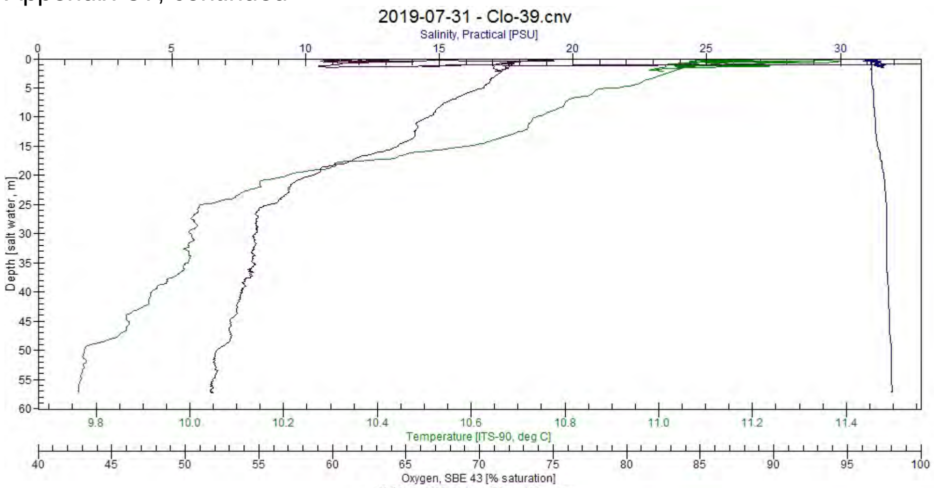

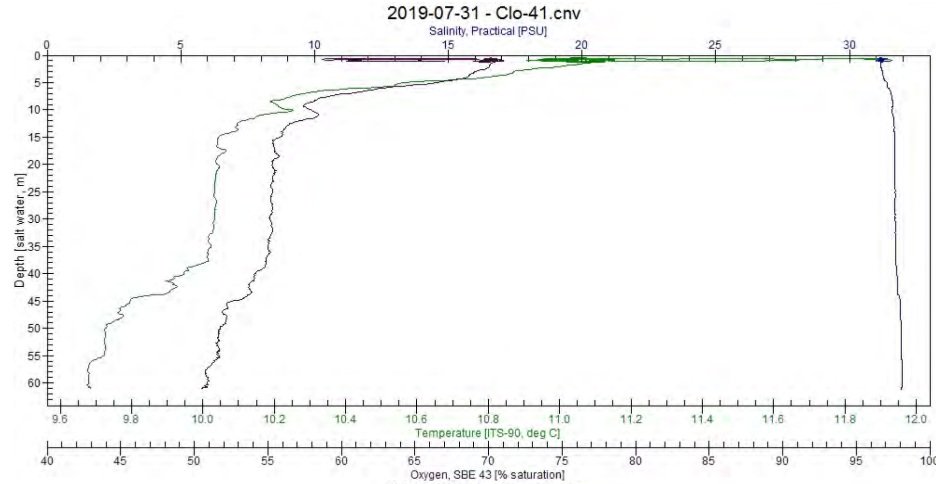

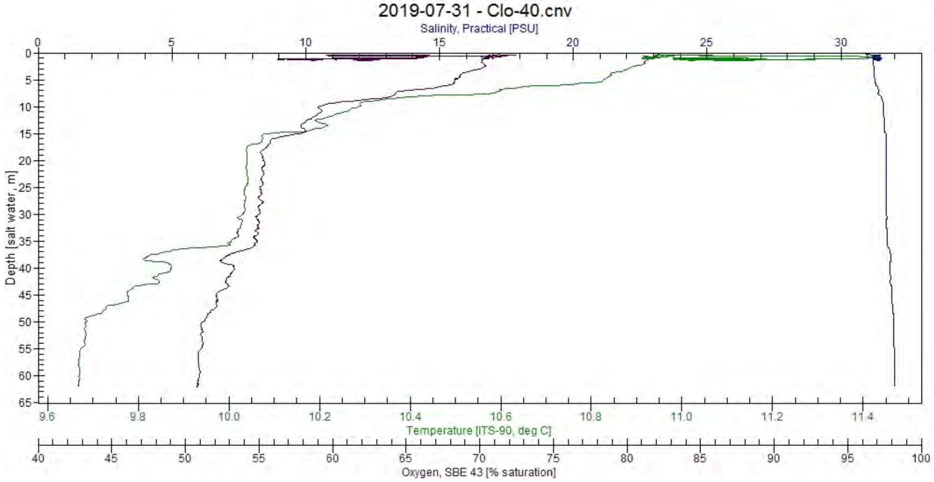

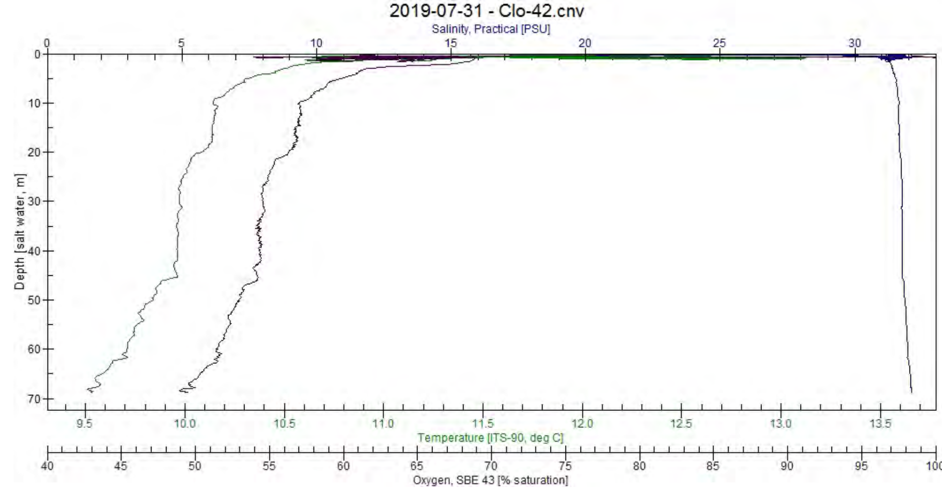

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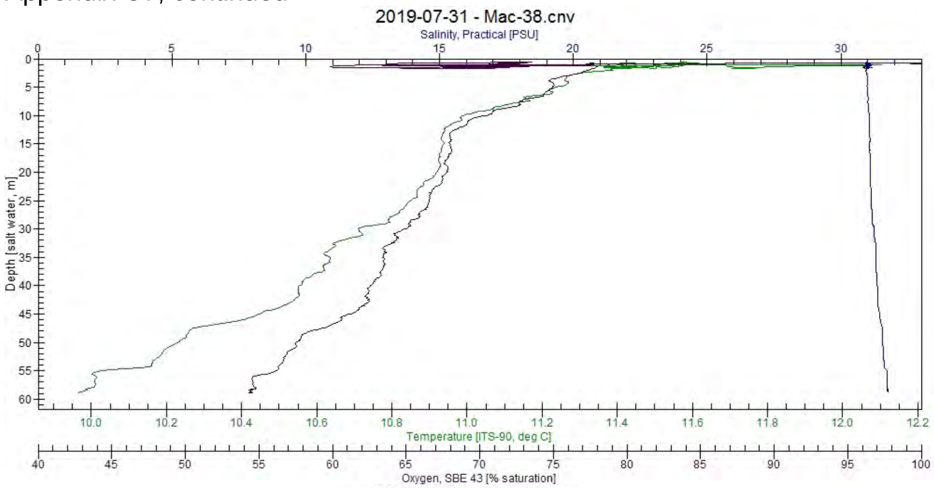

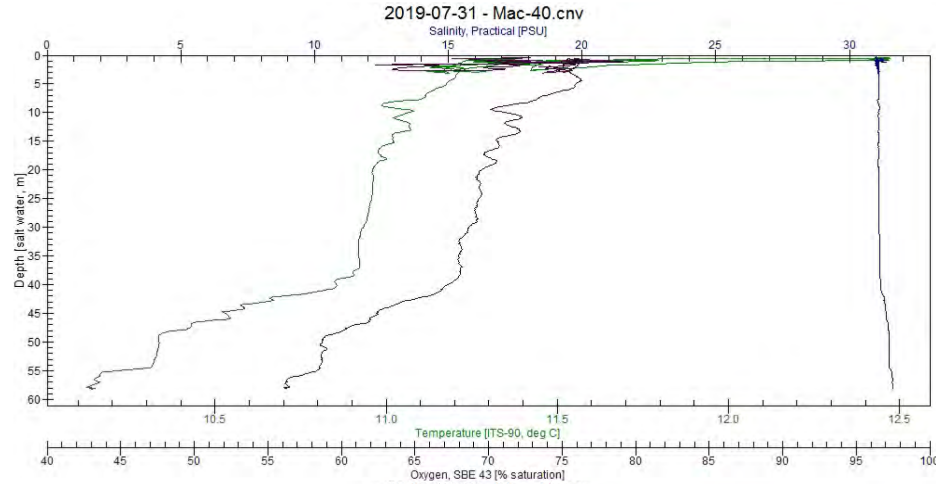

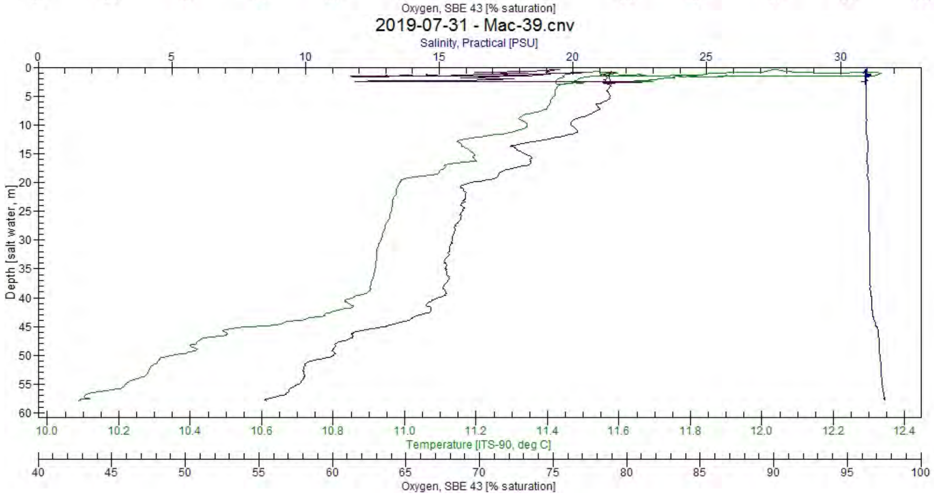

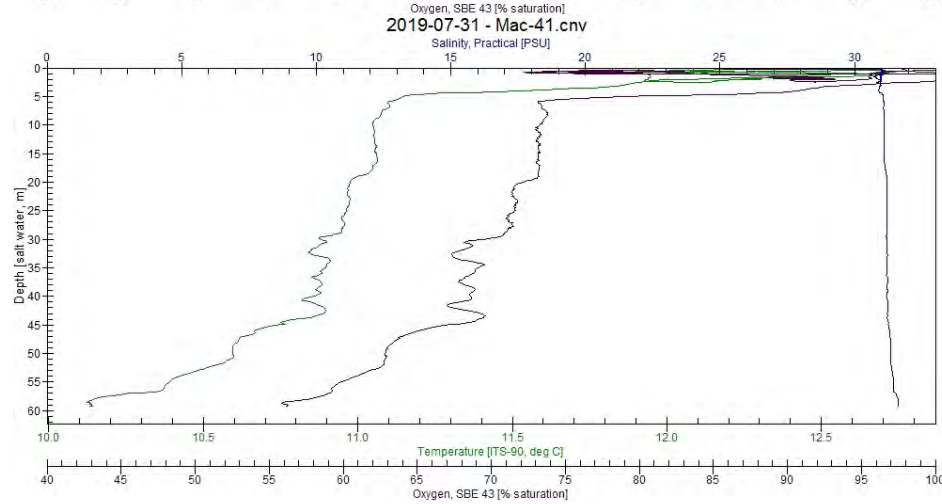

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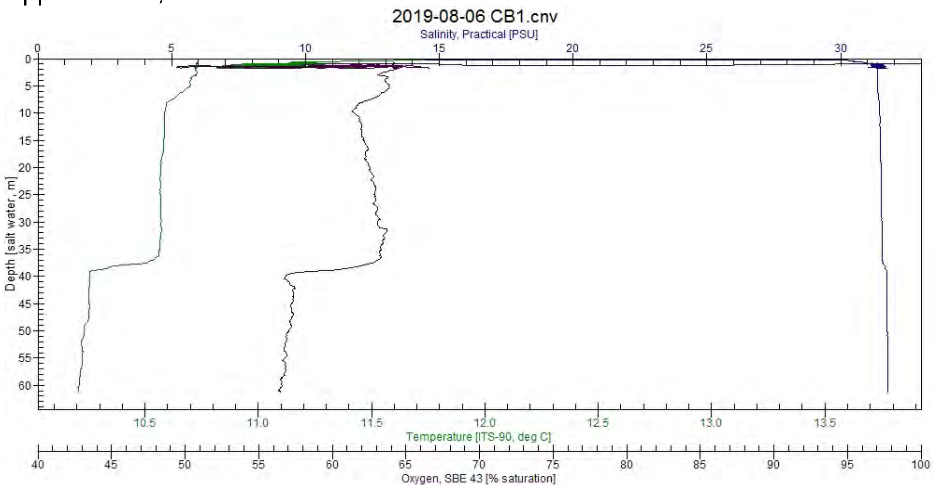

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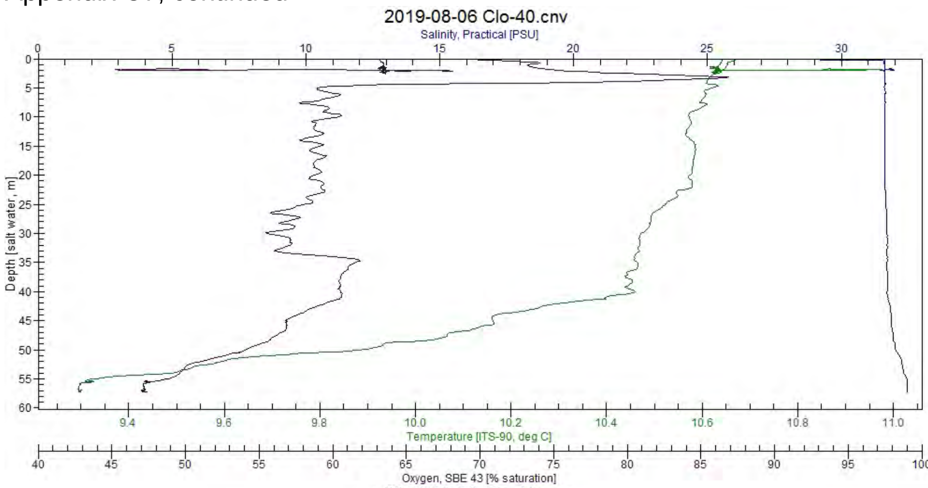
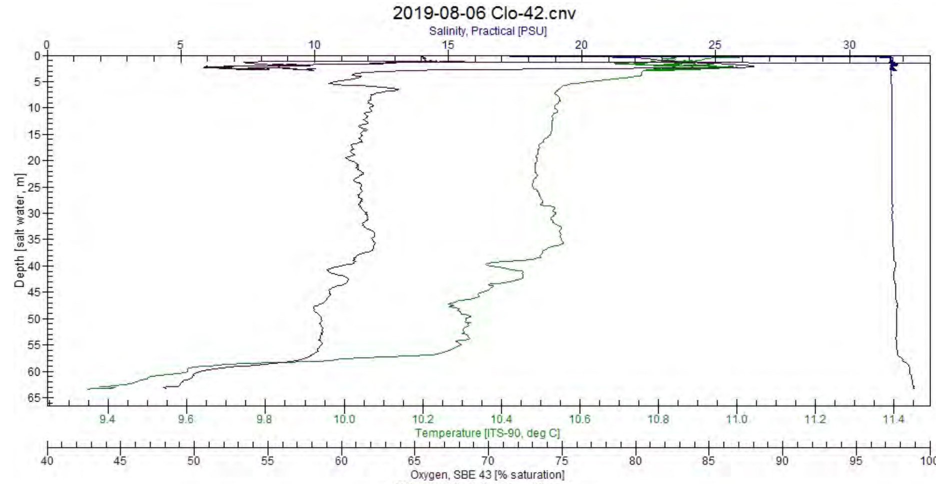
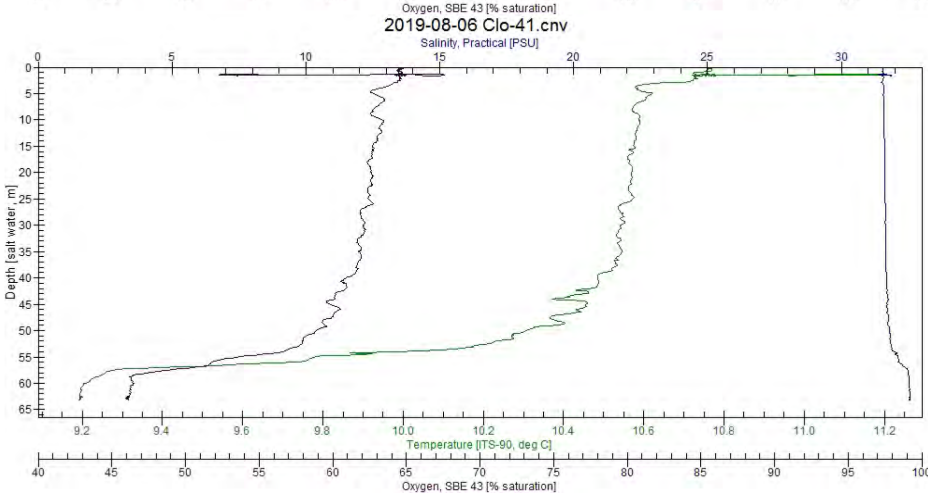
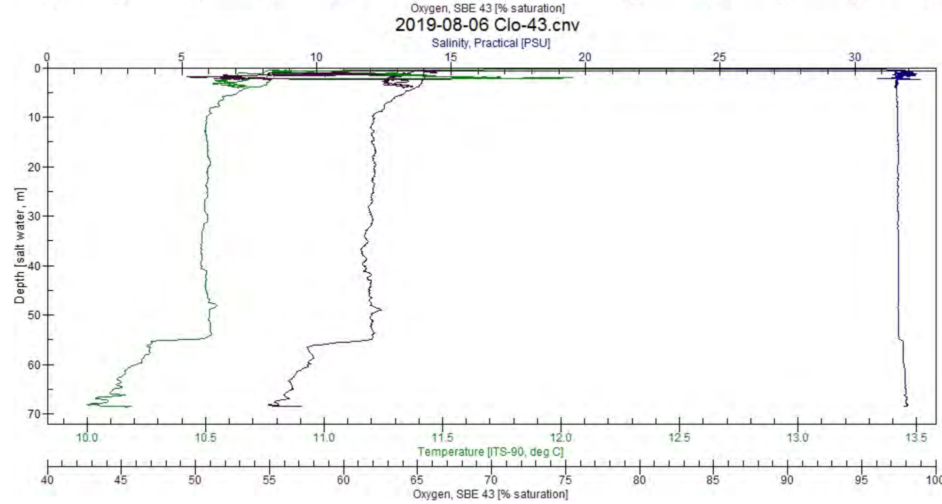


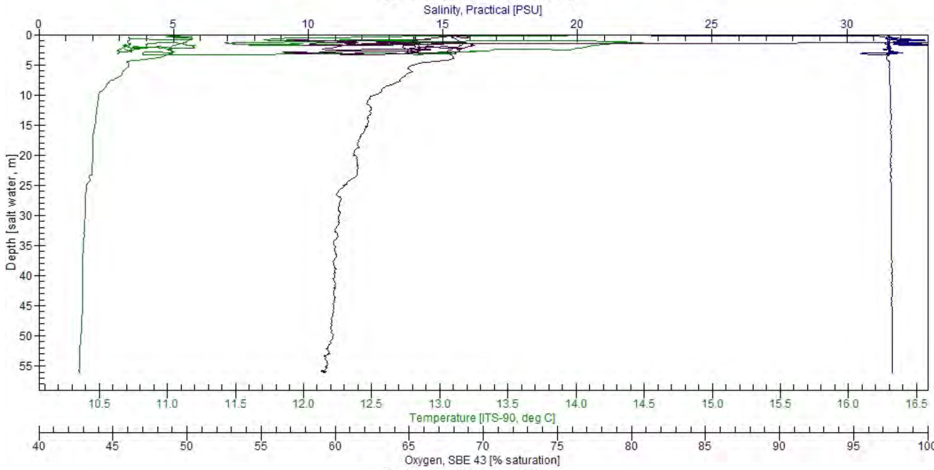






Appendix C7, continued

2019-08-06 Mac-38.cnv



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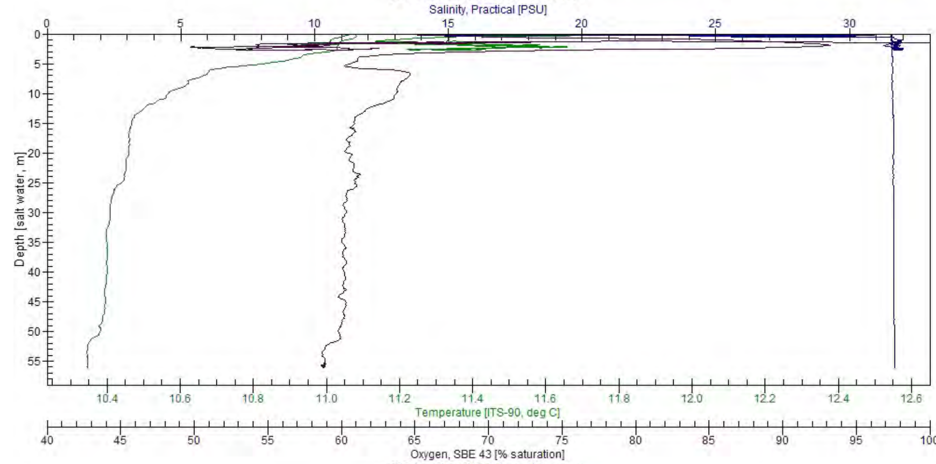

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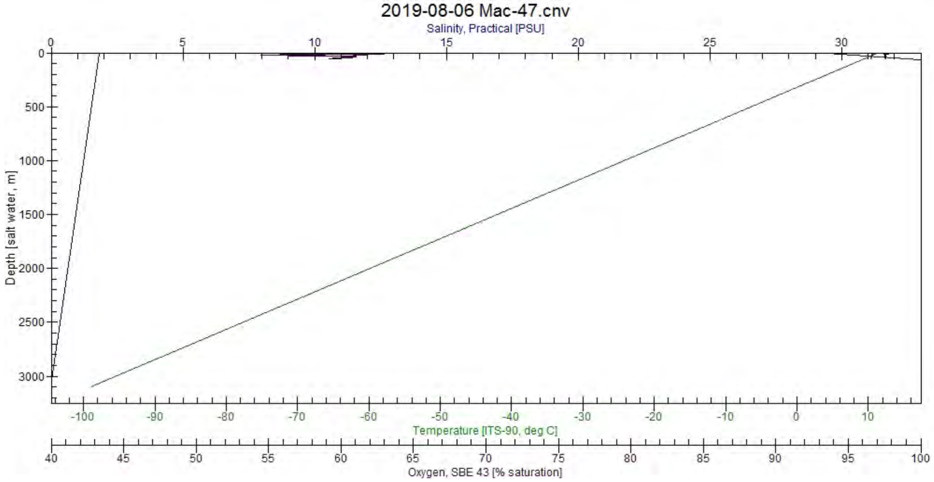

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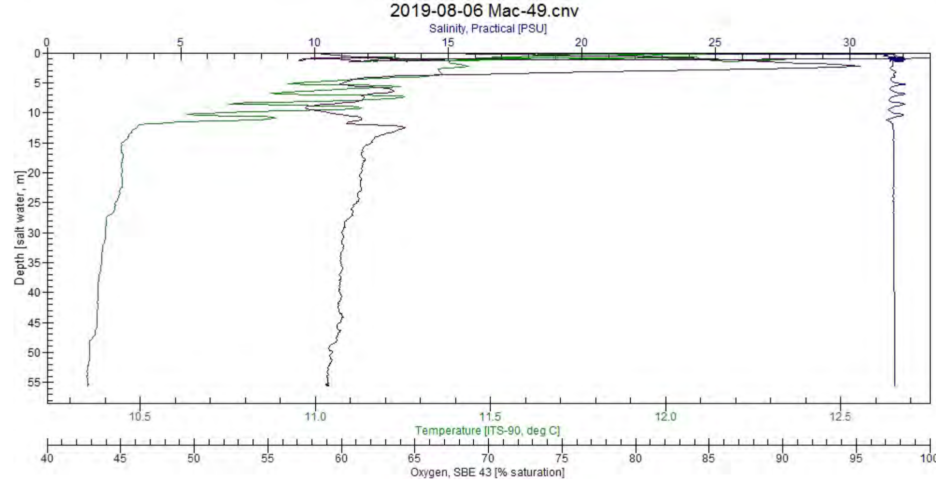

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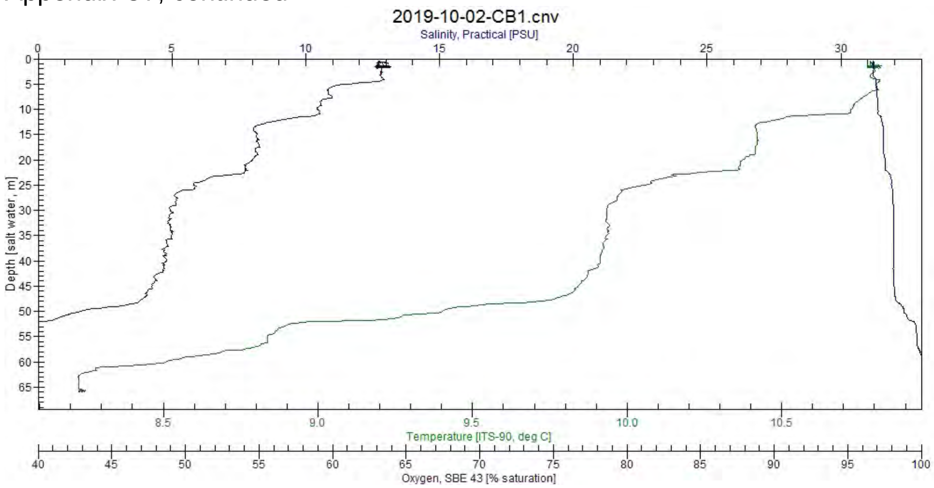

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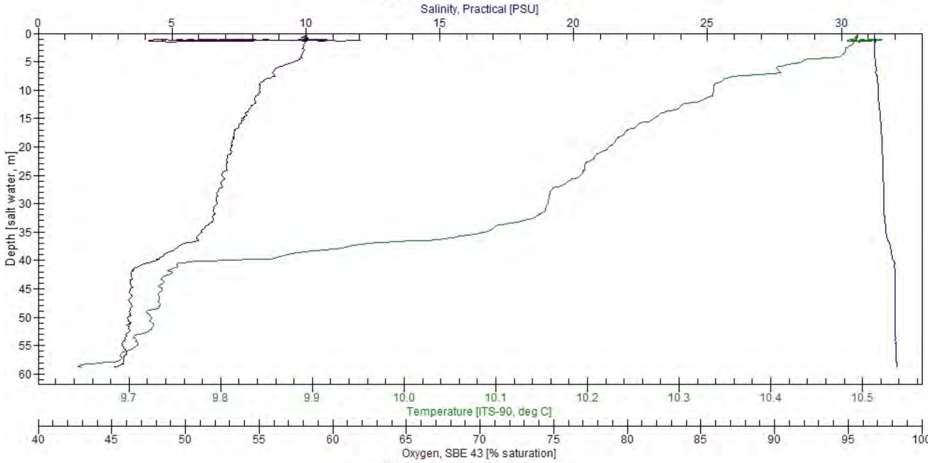
2019-10-02-CLO47.cnv



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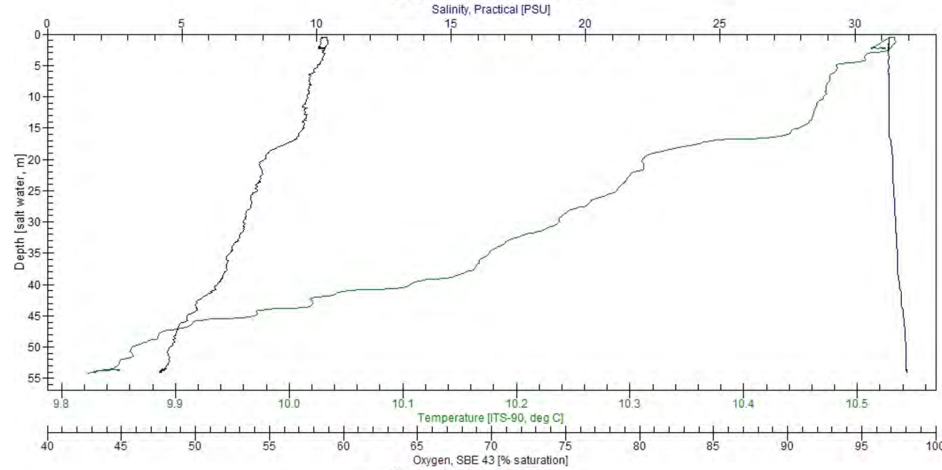

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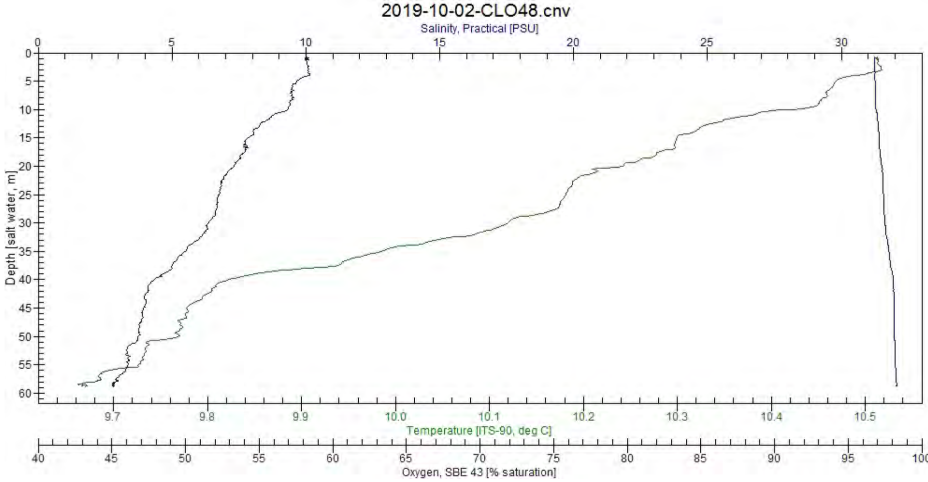
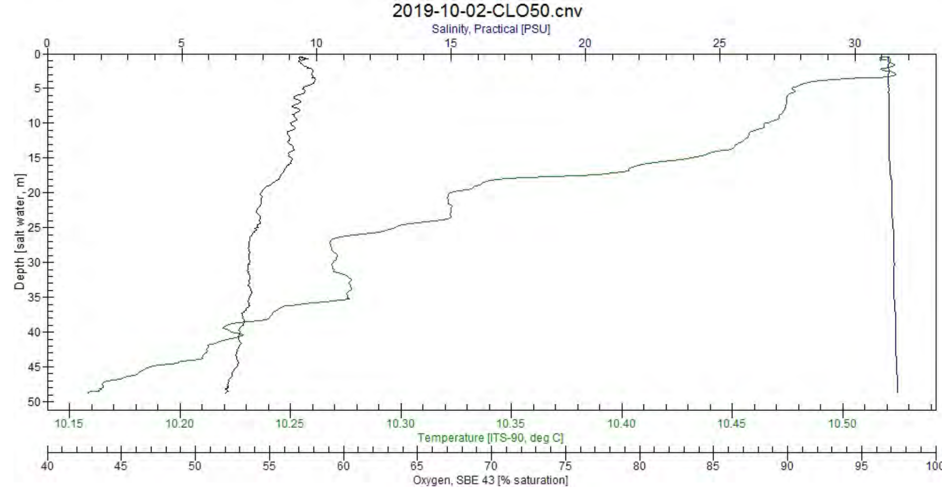


2019-10-02-CLO50.cnv



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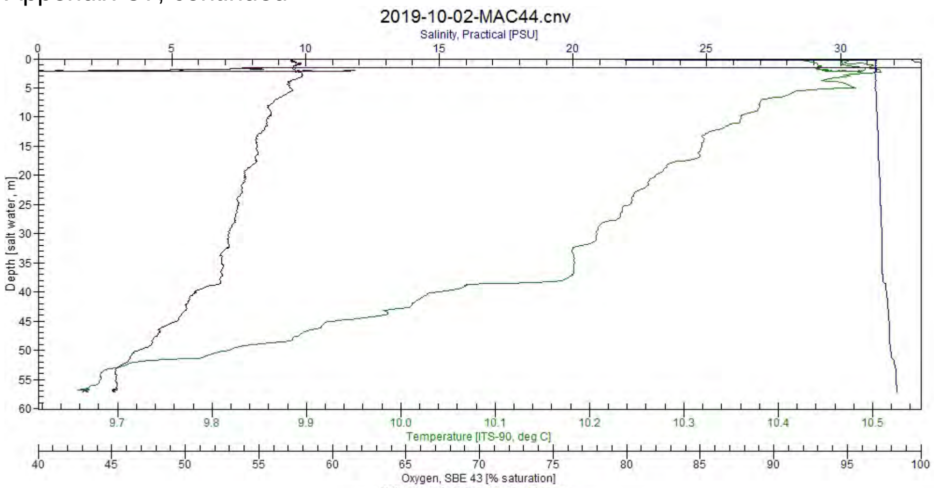

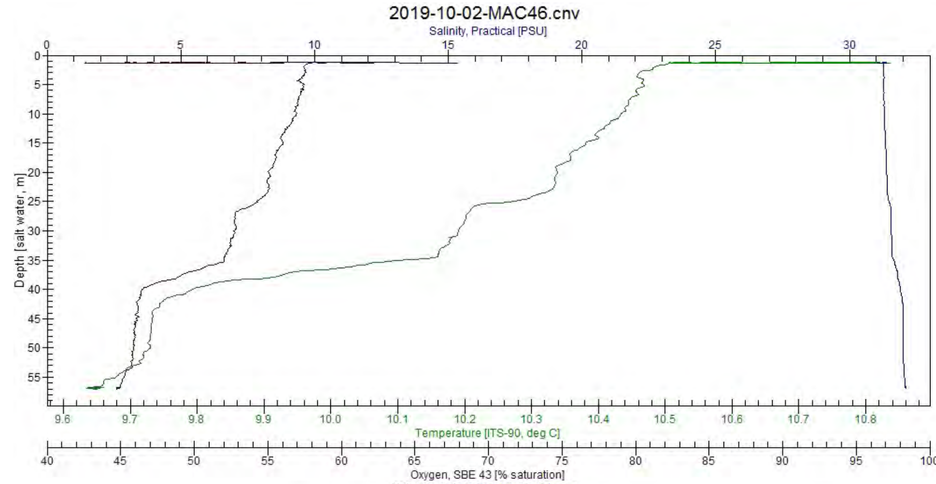

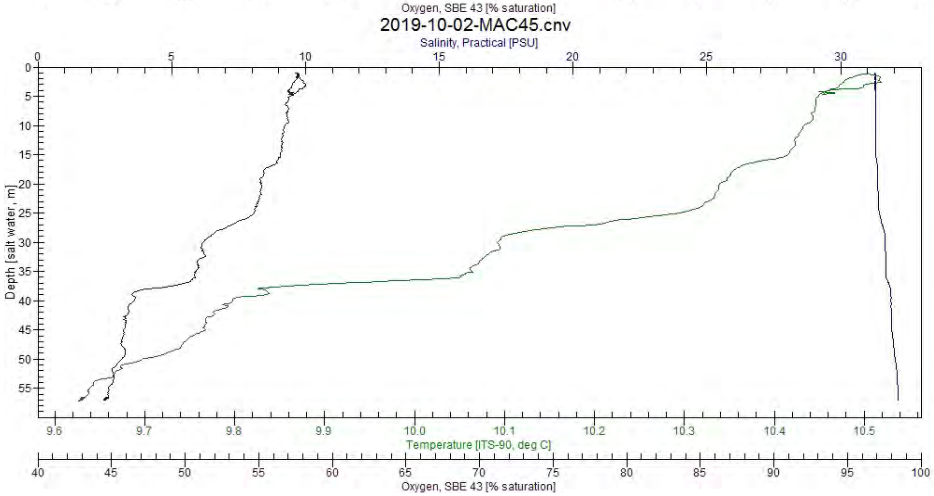

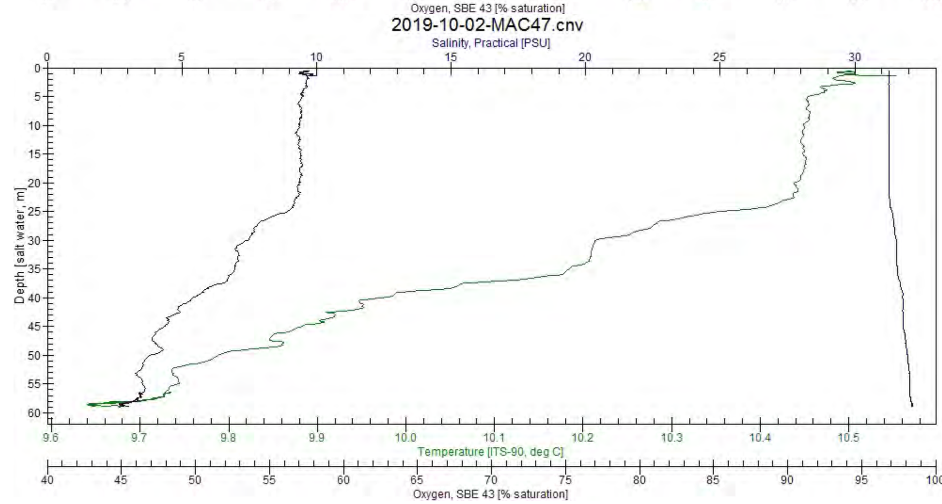

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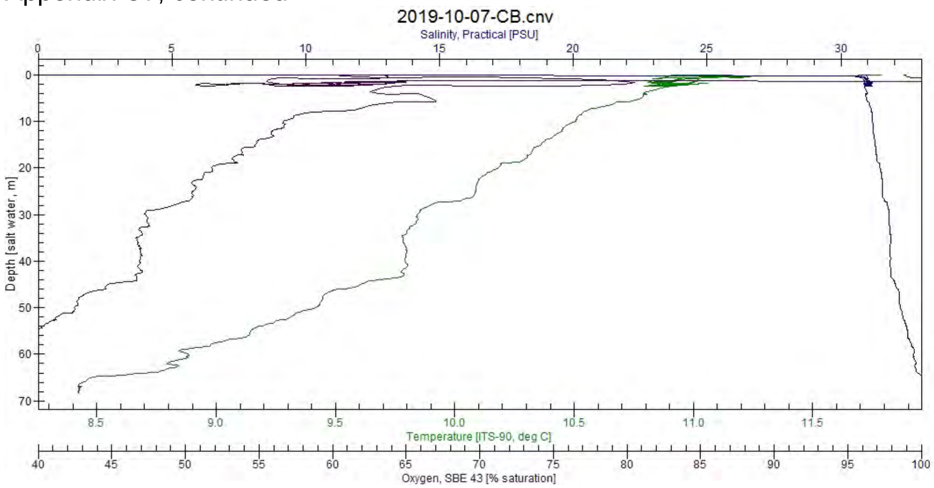

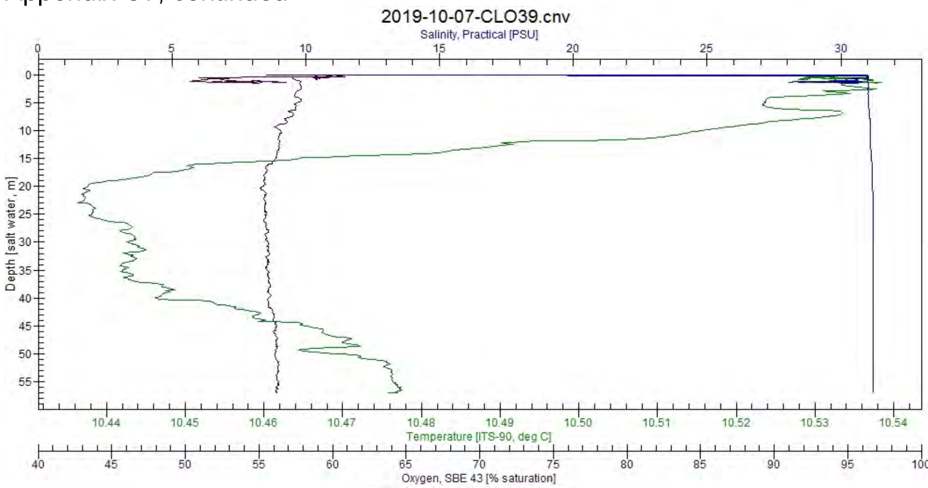
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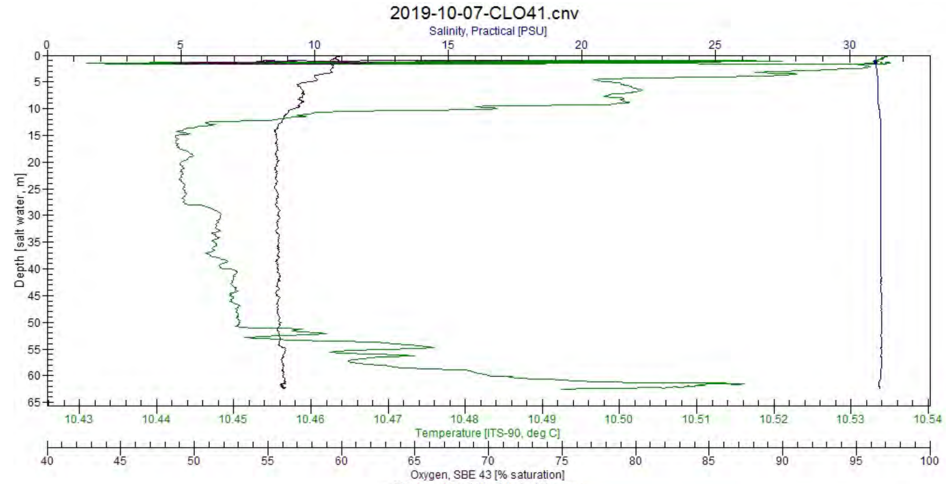
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]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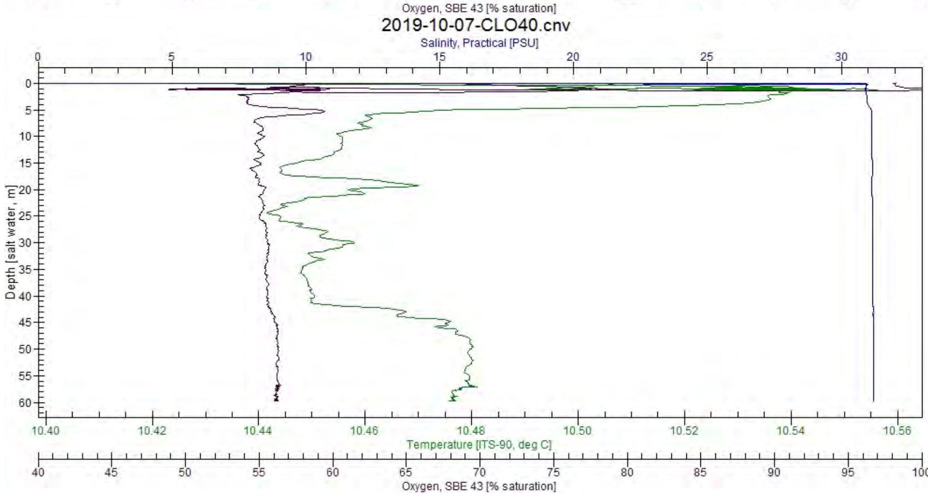
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]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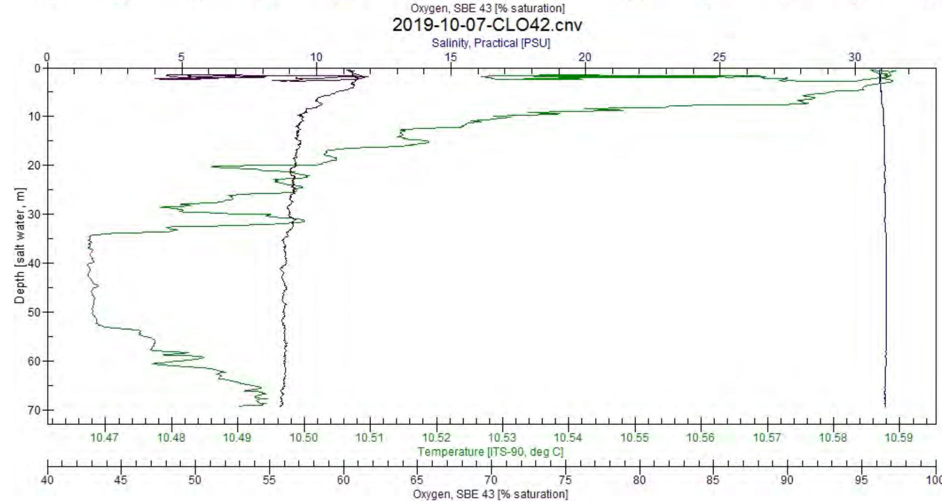
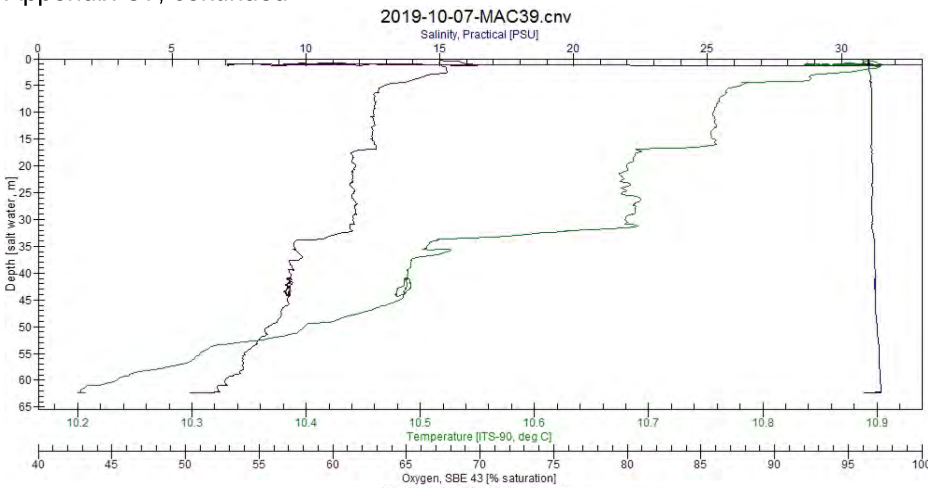
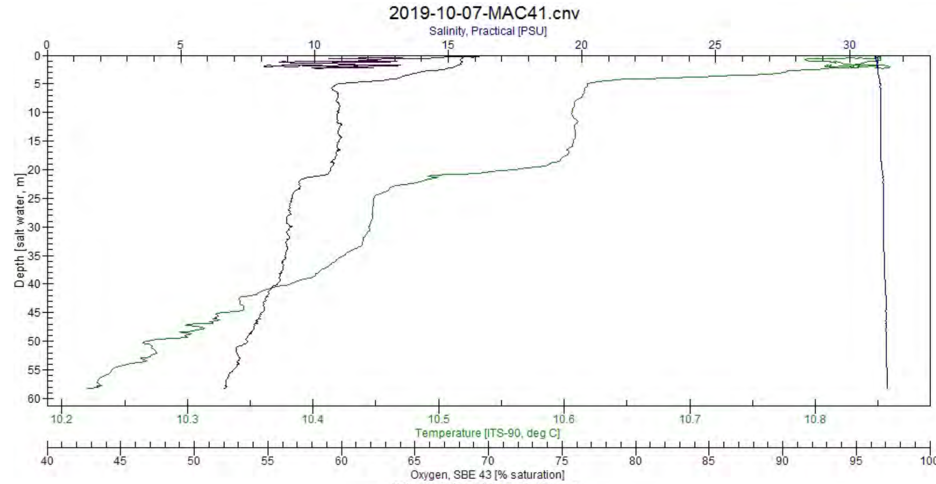
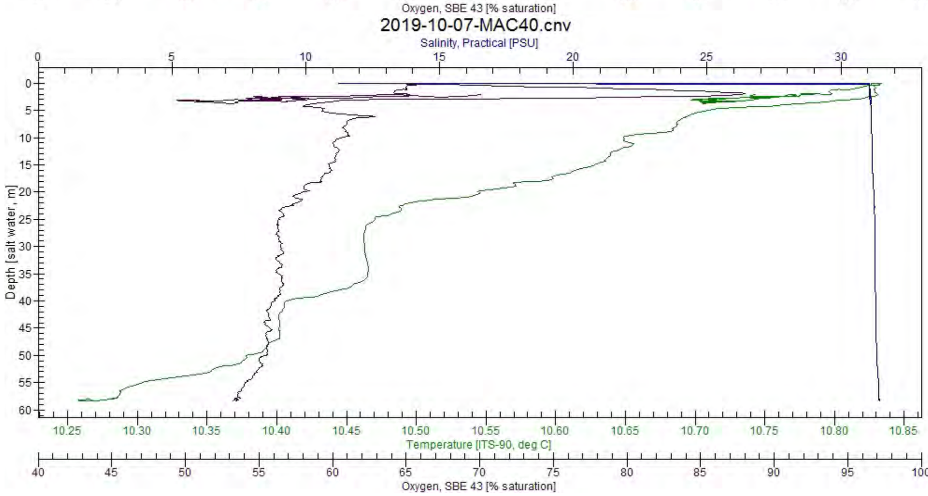
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]

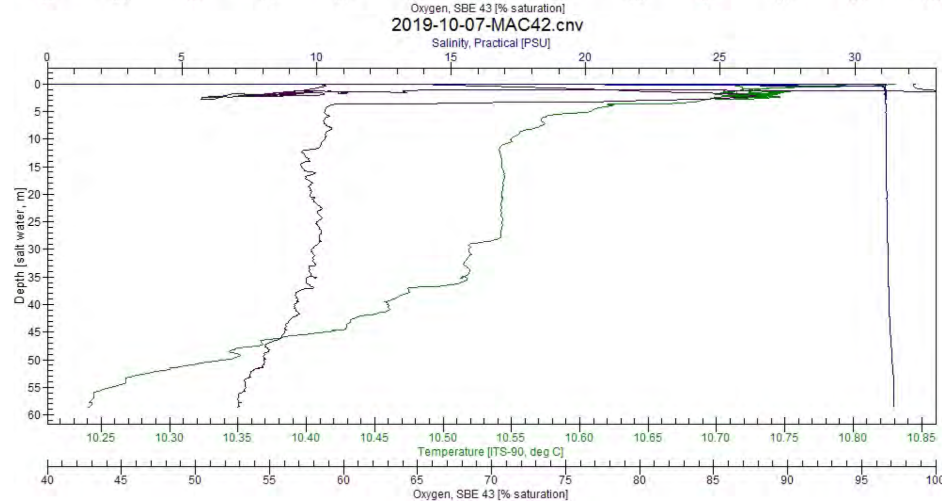

2019-10-07-CLO42.cnv
Salinity, Practical [PSU]
Depth [salt water, m]
Temperature [ITS-90, deg C]
Oxygen, SBE 43 [% saturation]

Appendix C7, continued









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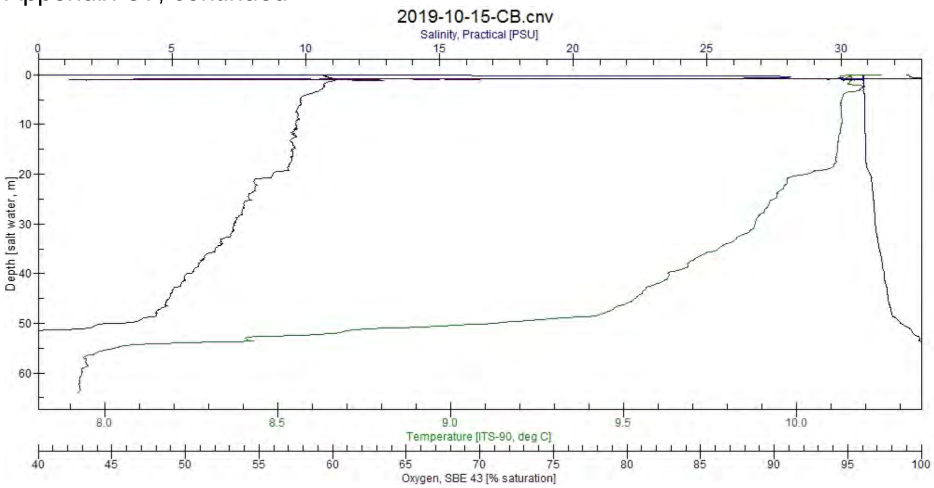

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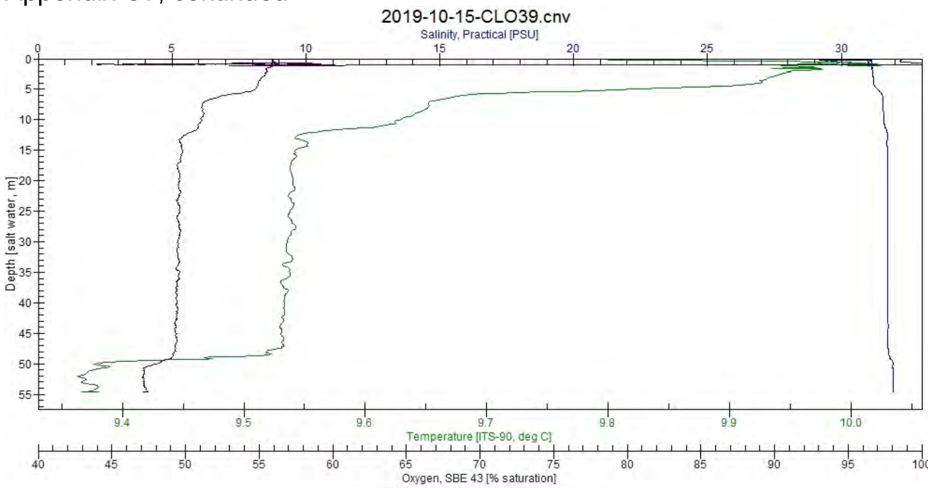

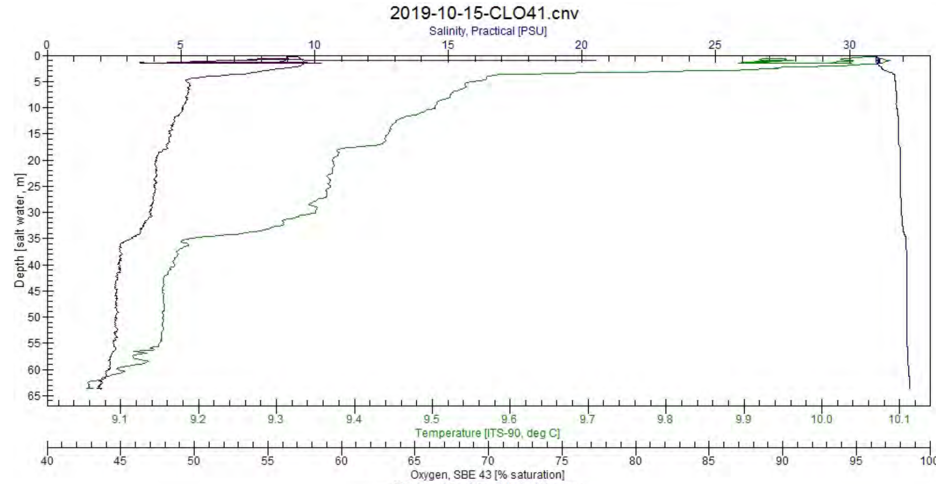

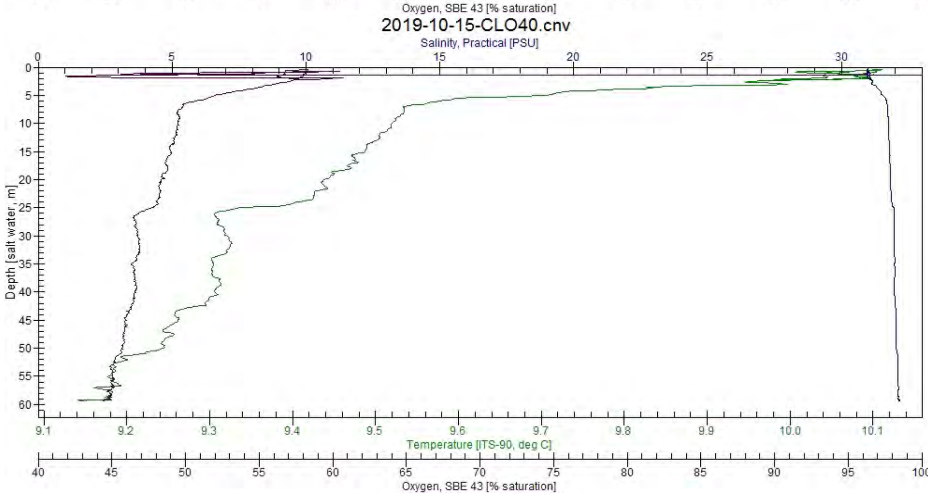

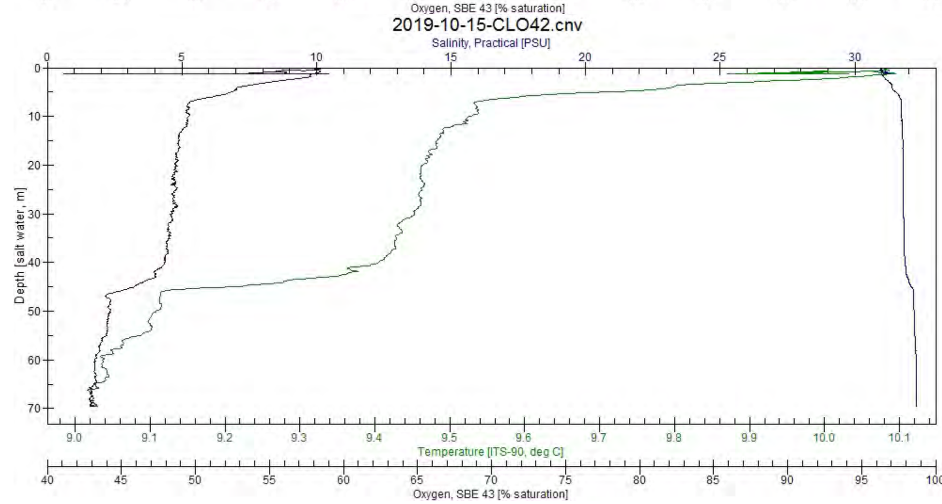

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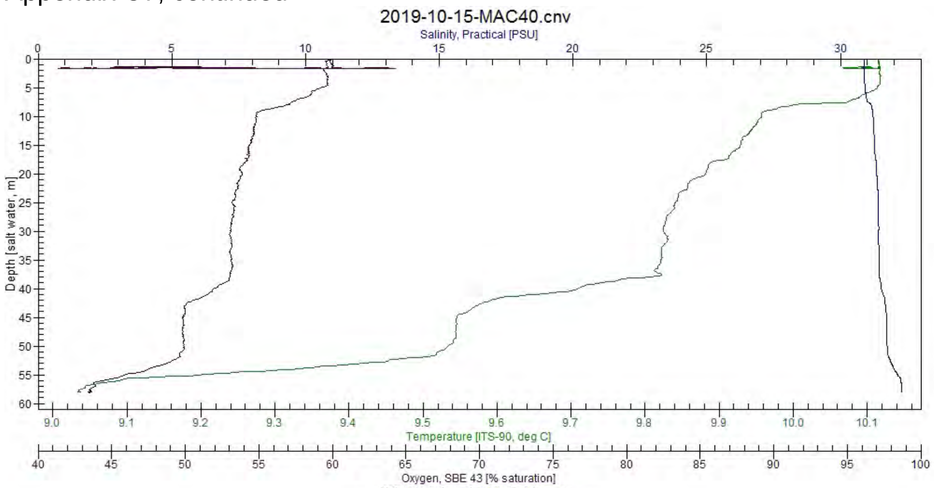

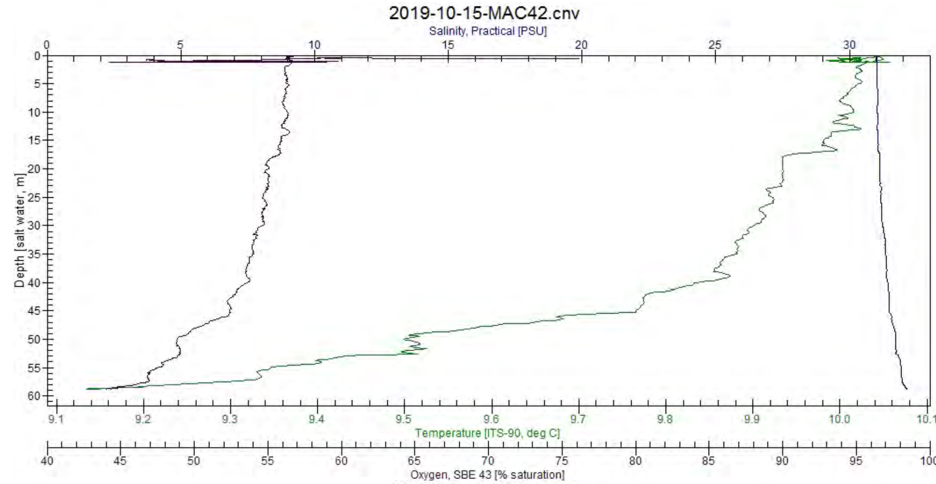

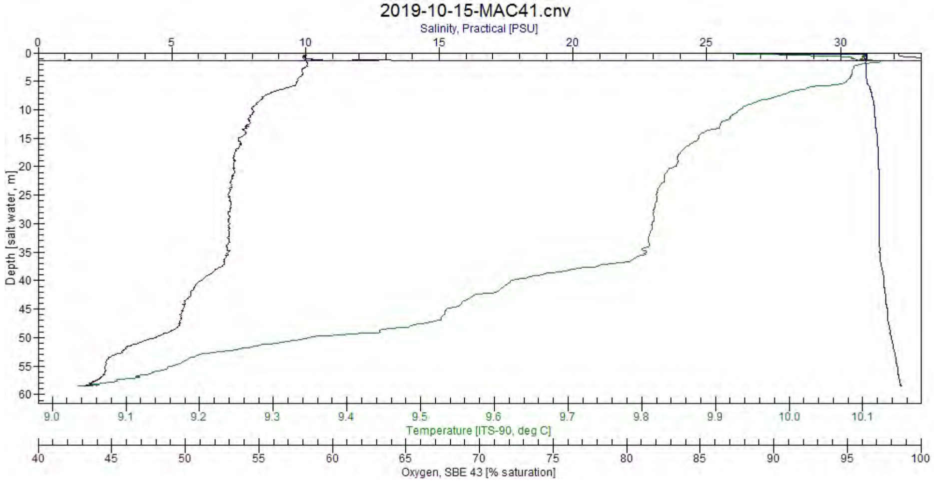

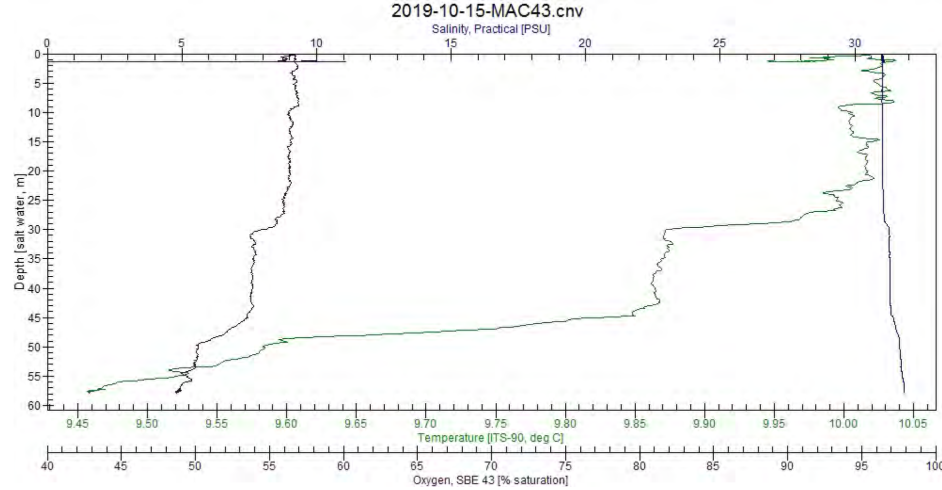

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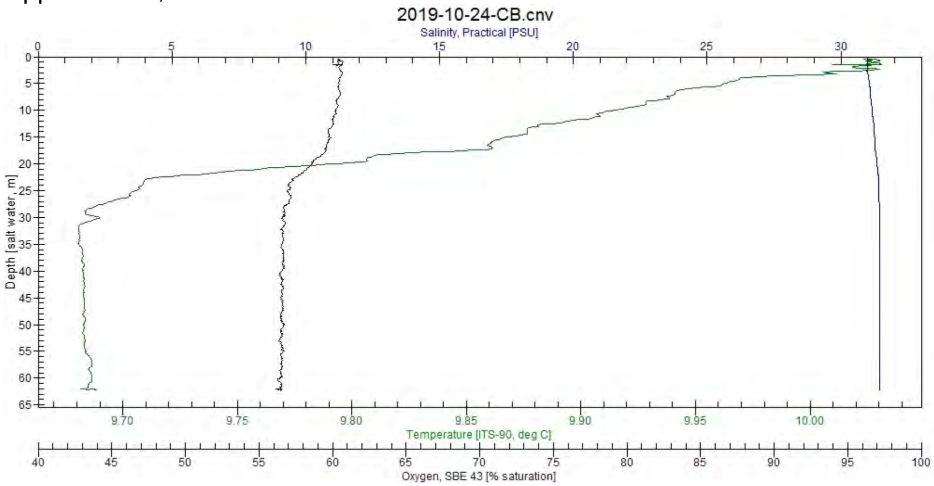

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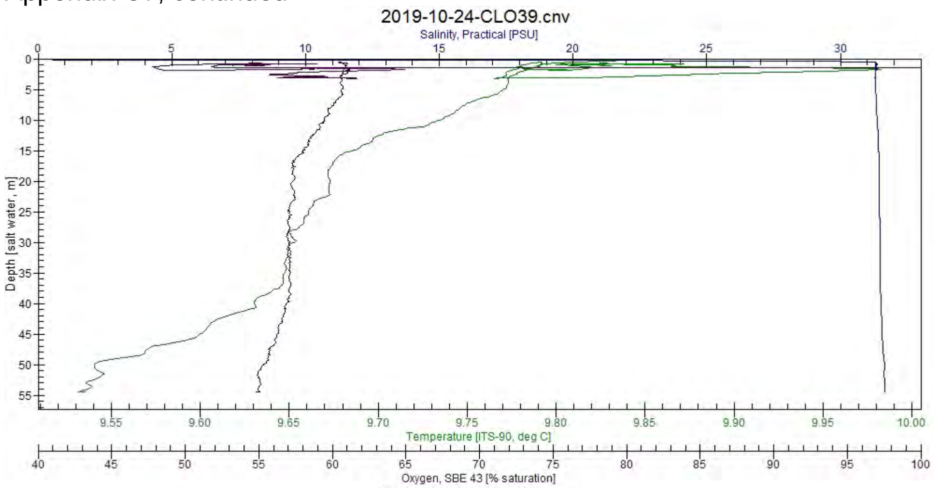

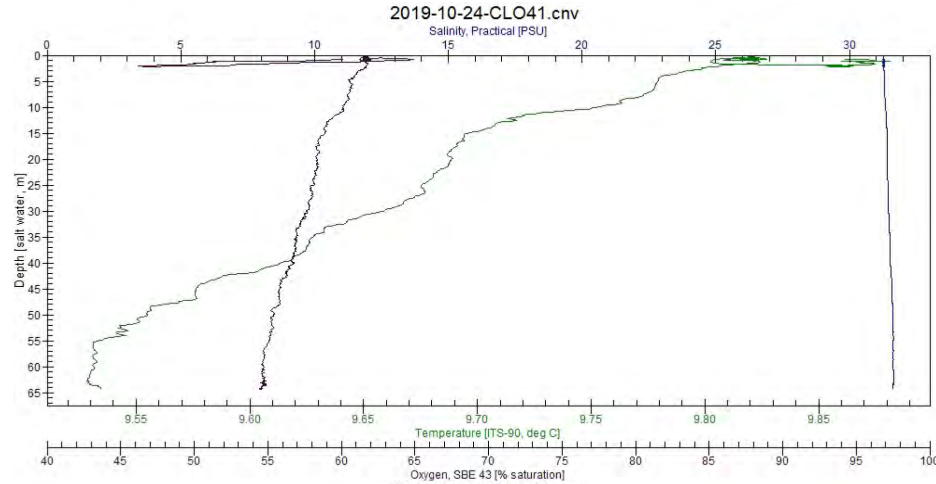

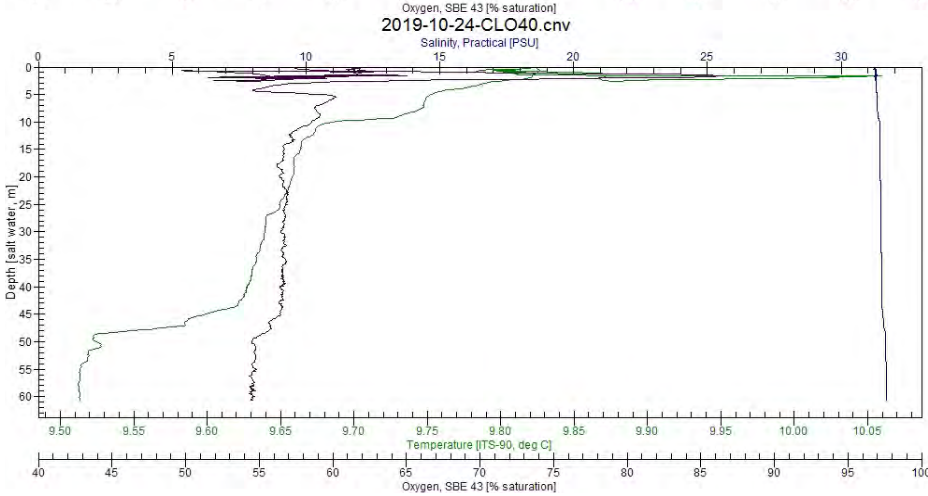

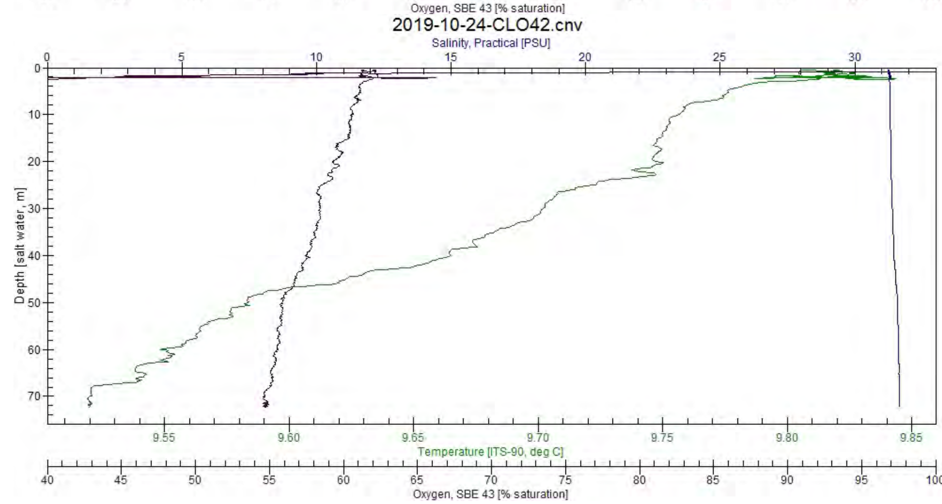

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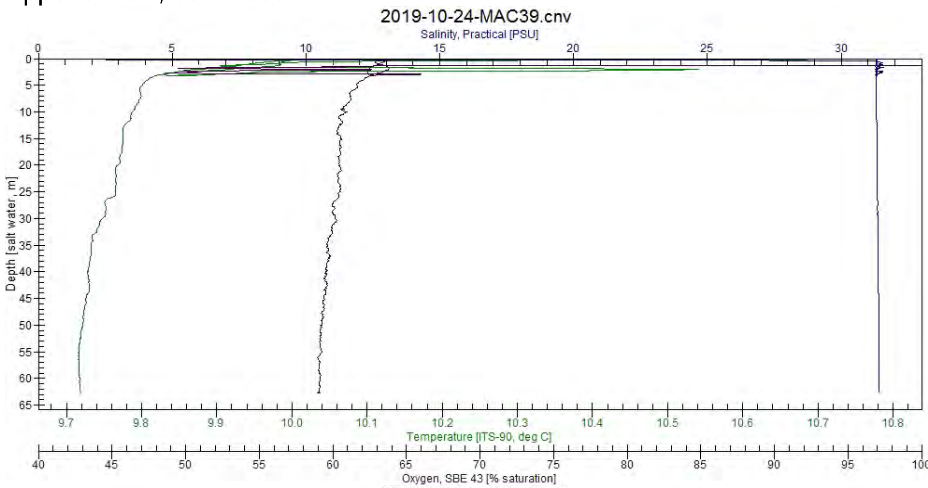

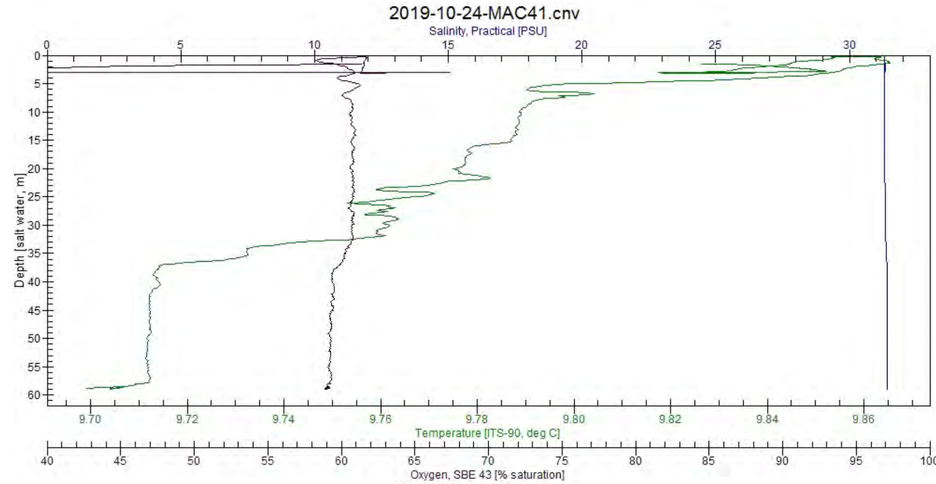

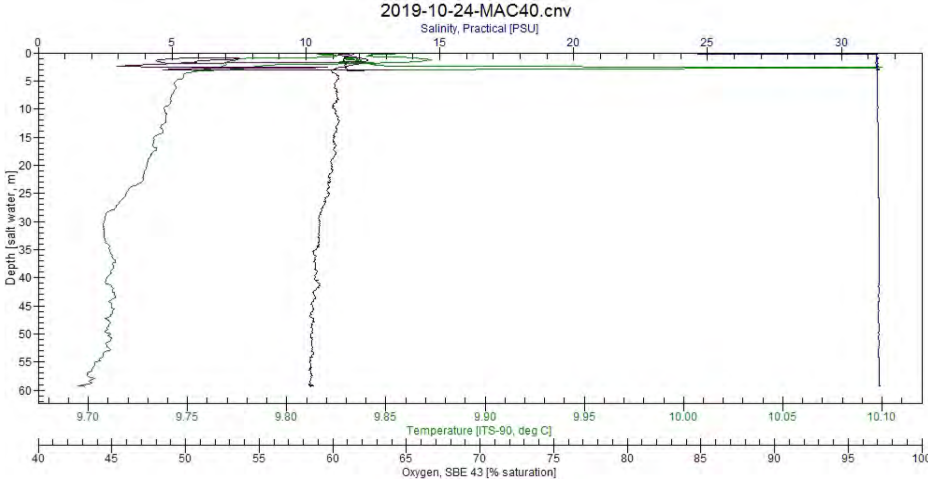

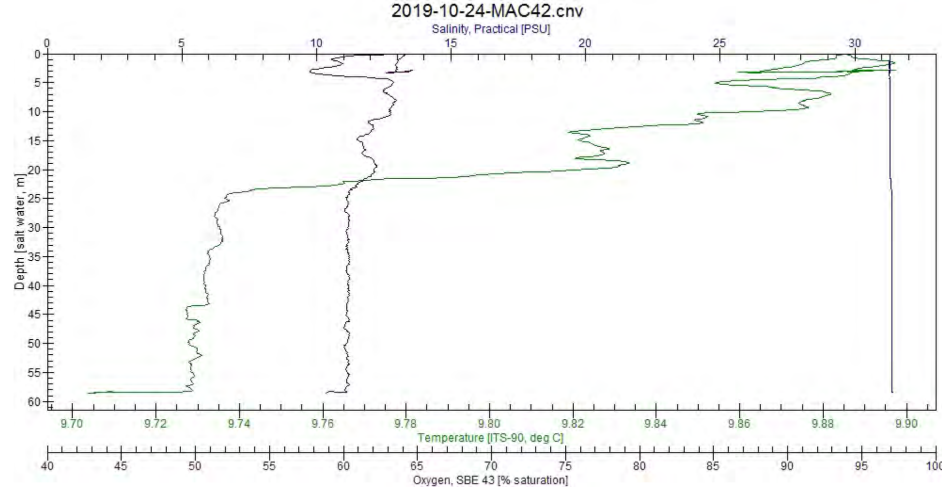

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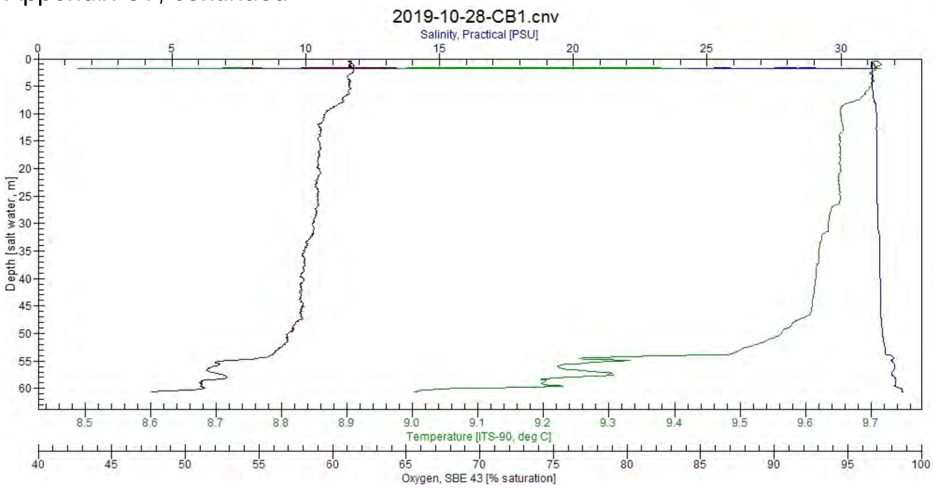

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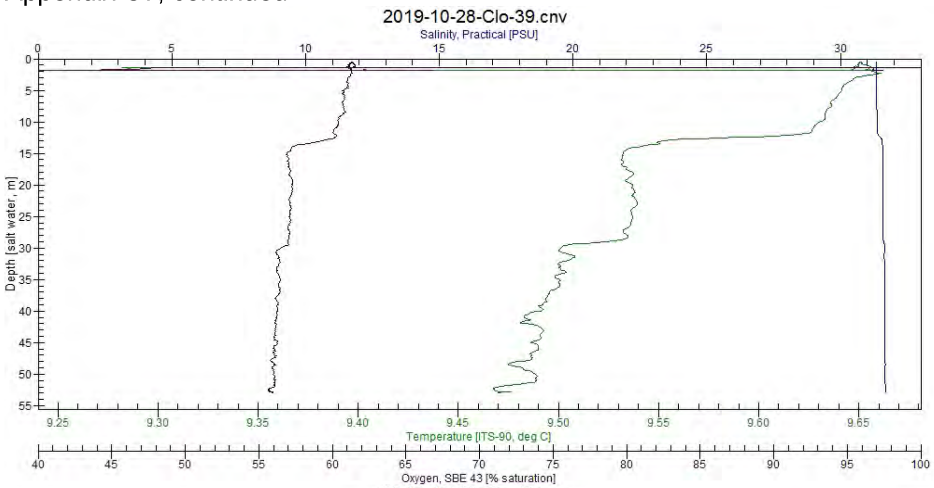

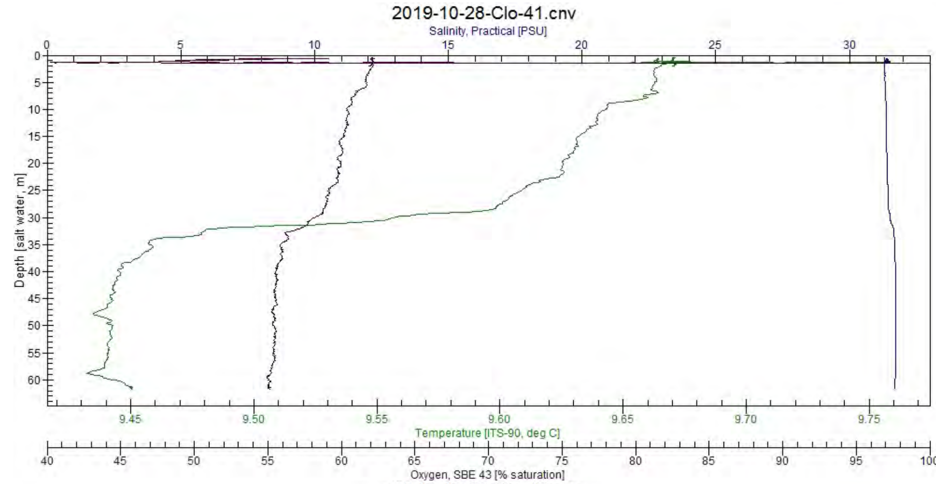

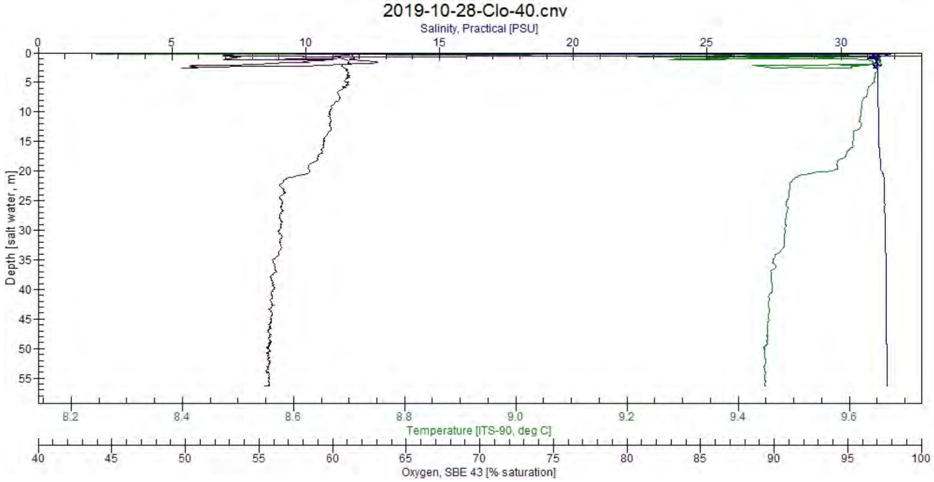

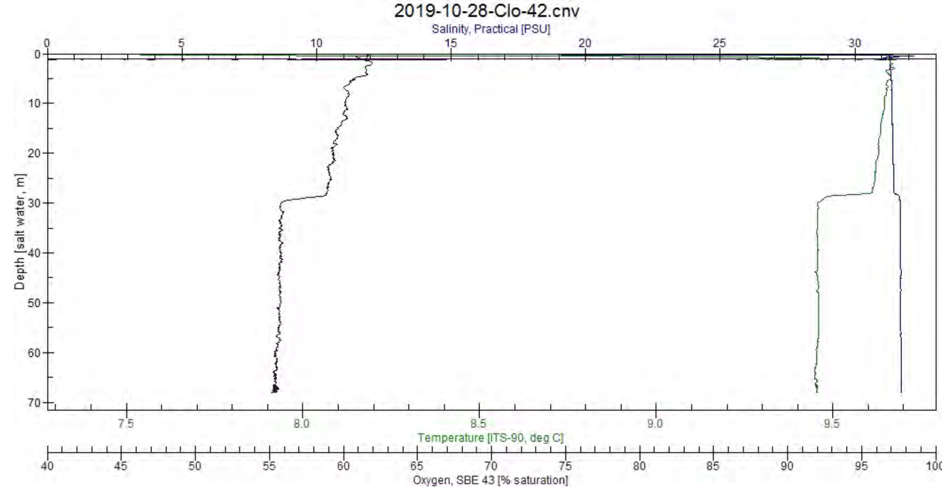

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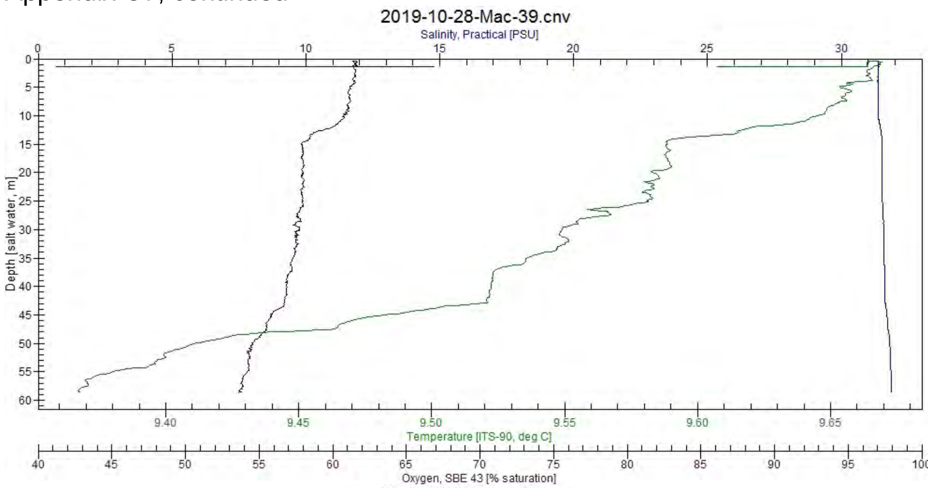

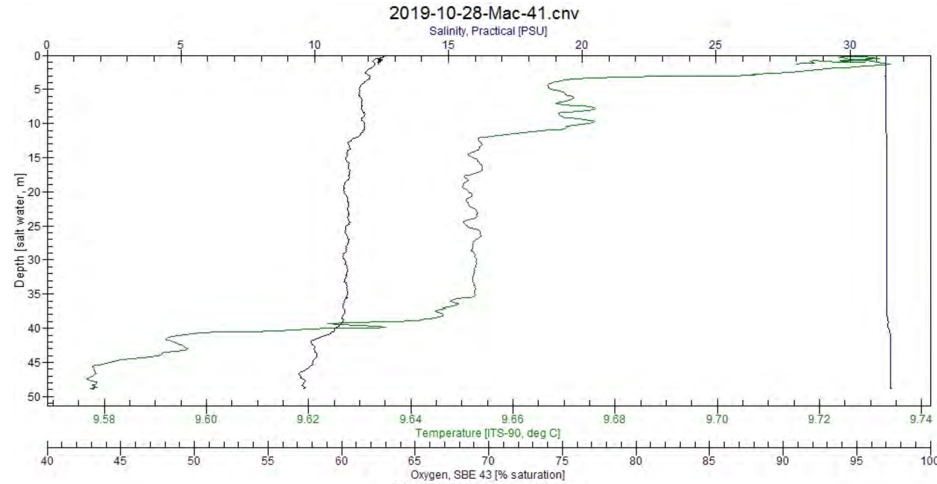

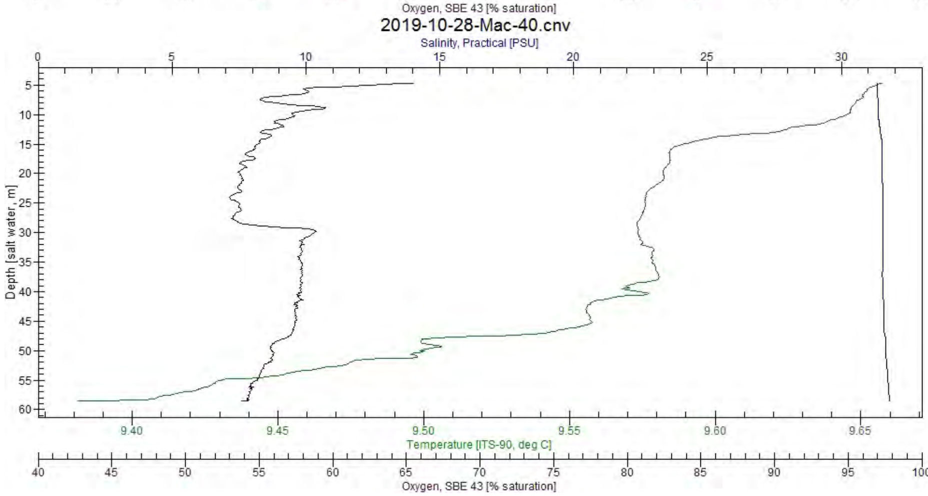

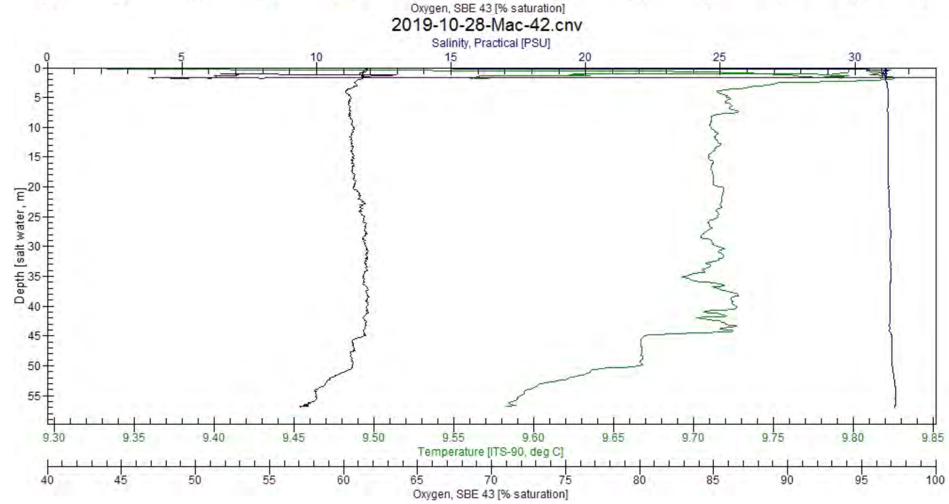

APPENDIX D
2019 SEAFLOOR MONITORING

Appendix D1 Sediment Chemistry and Bioaccumulation and Substance List

Parameter	Bioaccumulation Chemistry	Sediment Chemistry
CONVENTIONAL PARAMETERS		
Moisture		√
Carbon		√
Carbon Nitrogen Ratio		√
Lipids	√	
Moisture (low - res.)	√	√
Total Nitrogen		√
Inorganic Nitrogen		√
Organic Carbon (C)		√
Particle Size		√
pH		√
Sulphide		√
Sulphur		√
Total Cyanide		√
METALS TOTAL		
Aluminum (Al)	√	√
Antimony (Sb)	√	√
Arsenic (As)	√	√
Barium (Ba)	√	√
Beryllium (Be)	√	√
Bismuth (Bi)	√	√
Cadmium (Cd)	√	√
Calcium (Ca)	√	√
Chromium (Cr)	√	√
Cobalt (Co)	√	√
Copper (Cu)	√	√
Iron (Fe)	√	√
Lead (Pb)	√	√
Lithium (Li)	√	√
Magnesium (Mg)	√	√
Manganese (Mn)	√	√
Mercury (Hg)	√	√
Mercury (Hg)	√	√
Molybdenum (Mo)	√	√
Nickel (Ni)	√	√
Phosphorus (P)	√	√
Potassium (K)	√	√
Selenium (Se)	√	√
Silver (Ag)	√	√
Sodium (Na)	√	√
Strontium (Sr)	√	√
Thallium (Tl)	√	√
Tin (Sn)	√	√
Titanium (Ti)	√	√
Vanadium (V)	√	√
Zinc (Zn)	√	√

Appendix D1, Sediment Chemistry and Bioaccumulation and Substance List, cont'd

Parameter	Bioaccumulation Chemistry	Sediment Chemistry
METALS EXTRACTABLE		√
Cadmium (Cd)		√
Copper (Cu)		√
Lead (Pb)		√
Mercury (Hg)		√
Nickel (Ni)		√
Sulphide		√
Zinc (Zn)		√
PHENOLIC COMPOUNDS		
Total Phenols		√
CHLORINATED PHENOLICS		
2,4 + 2,5-Dichlorophenol	√	√
2,4,6-trichlorophenol	√	√
2-chlorophenol	√	√
4-chloro-3-methylphenol	√	√
Pentachlorophenol	√	√
NON CHLORINATED PHENOLICS		
2,4-dimethylphenol		√
2,4-dinitrophenol		√
2-nitrophenol		√
4,6-dinitro-2-methylphenol		√
4-nitrophenol		√
Phenol		√
SEMIVOLATILE ORGANICS		
Bis(2-ethylhexyl)phthalate	√	√
Butyl benzyl 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	√	√

Appendix D1, Sediment Chemistry and Bioaccumulation and Substance List, cont'd

Parameter	Bioaccumulation Chemistry	Sediment Chemistry
N-nitroso-di-n-propylamine	√	√
N-nitrosodiphenylamine	√	√
VOLATILE ORGANICS		
Monocyclic Aromatic Hydrocarbons		
1,2-dichlorobenzene	√	√
1,3-dichlorobenzene	√	√
1,4-dichlorobenzene	√	√
Benzene	√	√
Chlorobenzene	√	√
Ethylbenzene	√	√
m & p-Xylene	√	√
o-Xylene	√	√
Styrene	√	√
Toluene	√	√
Xylenes (Total)	√	√
Aliphatic		
Acrylonitrile	√	√
Methyl-tert-buty lether (MTBE)	√	√
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-dibromoethane	√	√
1,2-dichloroethane	√	√
1,2-dichloropropane	√	√
2-Chloroethylvinyl ether	√	√
Bromomethane	√	√
Carbon tetrachloride	√	√
Chloroethane	√	√
Chloroform	√	√
Chloromethane	√	√
cis-1,2-dichloroethene	√	√
cis-1,3-dichloropropene	√	√
Dibromomethane	√	√
Dichloromethane	√	√
Tetrabromomethane	√	√
Tetrachloroethene	√	√
trans-1,2-dichloroethene	√	√
trans-1,3-dichloropropene	√	√
Trichloroethene	√	√
Trichlorofluoromethane	√	√
Vinyl chloride	√	√
Trihalomethanes		√
Bromodichloromethane	√	√
Bromoform	√	√
Chlorodibromomethane	√	√

Appendix D1, Sediment Chemistry and Bioaccumulation and Substance List, cont'd

Parameter	Bioaccumulation Chemistry	Sediment Chemistry
Tribromomethane	√	√
trichlorofluoromethane	√	√
Ketones		
4-Methyl-2-pentanone (MIBK)	√	√
Dimethyl ketone	√	√
Endrin ketone	√	√
Methyl ethyl ketone	√	√
TERPENES		
alpha-Terpineol	√	√
HIGH RESOLUTION ANALYSES		
NP	√*	√*
PAH	√*	√*
PBDE	√*	√*
PCB	√*	√*
PCDD	√*	√*
OC Pesticides	√*	√*
PFAS	√*	√*
PPCP	√*	√*

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

Appendix D2 2019 Seafloor Stations Locations and Sampling Plan

Station	Latitude 48º	Longitude -123º	Sediment			
			Chemistry	Toxicity	Bioaccumulation	Benthic Taxonomy
Albert Head 10	22.617	28.196	√	√		√
Albert Head 5	22.668	28.196	√	√		√
FC4000ENE	29.154	14.836	√			√
M0	24.157	24.626	√	√	√	√
M1E	24.157	24.626	√	√	√	√
M1N	24.292	24.591	√	√		√
M1NW	24.252	24.701	√	√	√	√
M1S	24.079	24.64	√	√		√
M1SE	24.112	24.536	√	√	√	√
M1SW	24.116	24.718	√	√		√
M1W	24.162	24.729	√	√		√
M2E	24.157	24.435	√	√	√	√
M2NE	24.21	24.451	√	√		√
M2SE	24.096	24.493	√	√		√
M4E	24.159	24.307	√	√		√
M4SE	24.039	24.357	√	√		√
M8E	24.159	23.988	√	√		√
MC0	24.295	24.414	√	√	√	√
MC1NW	24.333	24.471	√	√		√
MC2E	24.296	24.251	√	√		√
MC4E	24.296	24.090	√	√		√
MC8SE	23.991	23.953	√	√		√
Parry Bay 1	21.257	30.646	√	√	√	√
Parry Bay 2	21.069	30.867	√	√		√

Nautilus Environmental

Marine Sediment Toxicity Testing Program, 2014

Draft Report

Report date:
February 27, 2015

Submitted to:

Capital Regional District
Victoria, BC

8664 Commerce Court
Burnaby, BC
V5A 4N7

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James Elphick, R.P.Bio.

Project Manager

1.0 INTRODUCTION

Nautilus Environmental conducted marine sediment toxicity tests for Capital Regional District (CRD) on 15 samples that were collected between September 3 and 23, 2014. The samples were received in batches at the Nautilus Environmental laboratory, Burnaby, BC, on September 10, 18 and 24, 2014. The samples were collected in 4-L and/or 12-L HDPE plastic containers.

Toxicity tests were conducted on all 15 samples using the 20-d juvenile polychaete (*Neanthes arenaceodentata*), 10-d mysid shrimp (*Mysidopsis bahia*), and 48-h bivalve (*Mytilus galloprovincialis*) larval development tests. In addition, 10-d amphipod (*Eohaustorius estuarius*) and 48-d clam (*Macoma nasuta*) bioaccumulation tests were conducted on a subset of samples.

This report describes the methods and results of these toxicity tests. Copies of raw laboratory data sheets and statistical analyses for each test are provided in Appendices A through E. Descriptions of the bulk sediment samples are provided in Appendix F and the chain-of-custody forms are provided in Appendix G.

2.0 METHODS

Sediment samples were homogenized thoroughly prior to testing using a stainless steel spoon and were not sieved. Methods for the toxicity tests are summarized in Tables 1 through 5 and are briefly described in Sections 2.1 to 2.5. Statistical analyses for the tests were performed using CETIS version 1.8.7 (Tidepool Scientific Software, 2013). Ammonia and sulphide concentrations were measured by ALS Environmental.

2.1 20-day *Neanthes arenaceodentata* survival and growth test

The 20-day survival and growth test was conducted using the marine polychaete, *N. arenaceodentata* and was initiated on October 17, 2014. Test procedures followed specifications of PSEP (1995), which are summarized in Table 1. Tests organisms were obtained from Aquatic Toxicology Support (Bremerton, WA) and received on October 16, 2014.

Seawater was obtained from the Vancouver Aquarium, Vancouver, BC. The control sediment used in the test was sand collected from the site that the *E. estuarius* were collected from. The tests were conducted in 1-L glass jars with 175 mL of sediment and approximately 775 mL of seawater and used five replicates, each containing five test organisms. The sediment and seawater were allowed to equilibrate overnight prior to introduction of the test organisms. A representative subset of organisms from the culture was dried at 60°C overnight and weighed to determine the initial weight of the test organisms.

The overlying water was aerated gently (approximately 100 bubbles per minute) throughout the exposure period. The test organisms were fed with Tetramin every second day (40 mg of Tetramin in each test container) and one-third of the overlying water was replaced with fresh seawater at three-day intervals.

Temperature was measured daily throughout the test. Dissolved oxygen, pH and salinity were measured prior to performing water changes every third day. Tests were conducted at 20 ± 1°C under continuous illumination. Ammonia and sulfides were measured in porewater collected from the sediment by centrifugation at test initiation and termination. Ammonia was also measured in the overlying water at test initiation and termination.

After the 20-day exposure period, the contents of the test containers were sieved and the live organisms were enumerated, rinsed, dried in a 60°C oven overnight, and weighed. Survival, total weight, individual worm weight and growth rate were compared statistically to the control sediment and to the reference sediments to determine significant ($p<0.05$) adverse effects. The criteria for acceptable control performance were ≥90% survival and growth rate of ≥0.38 mg/worm/day.

A 96-h reference toxicant test was conducted using *N. arenaceodentata* and cadmium as the toxicant. Test organisms were exposed to a range of cadmium concentrations for 96 h. The results of this test were compared with historical data for this species to determine whether the sensitivity of the test organisms was within the acceptable historical range.

2.2 10-d *Mysidopsis bahia* survival and growth test

A 10-day survival and growth tests was conducted using the mysid, *M. bahia,* and was initiated on October 17, 2014. Standardized test procedures have not been established for this test species and, consequently, methods used were adapted from US EPA (1991 and 2002) and are summarized in Table 2. Tests organisms were obtained from Aquatic BioSystems (Fort Collins, CO) and received October 15, 2014.

Seawater was obtained from the Vancouver Aquarium and the control sediment used in the test was clean sand collected from the *E. estuarius* collection site. The tests were conducted in 1-L glass jars with 175 mL of sediment and approximately 775 mL of seawater and used five replicates, each containing ten test organisms. Following addition of seawater, the samples were allowed to equilibrate overnight prior to introduction of the test organisms.

The overlying water was aerated gently (approximately 100 bubbles per minute) throughout the exposure period. The test organisms were fed with newly hatched brine shrimp (*Artemia* nauplii) daily (approximately 100 nauplii per mysid).

Temperature, dissolved oxygen, pH and salinity were measured daily throughout the test. Tests were conducted at 20 ± 1°C under 16:8 light:dark photoperiod. Ammonia and sulfides were measured in porewater collected from the sediment samples by centrifugation at test initiation and termination. Ammonia was also measured in the overlying water at test initiation and termination.

After the 10-day exposure period, the sediment in each of the test containers was sieved and the live organisms were enumerated, rinsed, dried in a 60°C oven overnight, and weighed. Survival and growth rate were compared statistically to the control and to the reference sediments to determine if there were any significant adverse effects ($p<0.05$). The criterion for acceptable control performance was ≥90% survival.

A 96-hr reference toxicant test was conducted using *M. bahia* and copper as the toxicant. Test organisms were exposed to a range of copper concentrations for 96-hr. The results of this test were compared with data from previous tests conducted in the laboratory to determine whether the sensitivity of the test organisms was within the acceptable range.

2.3 10-day *Eohaustorius estuarius* survival test

The 10-day survival test with *E. estuarius* was conducted according to procedures described by Environment Canada (1998) and initiated on September 26, 2014. Test organisms were obtained from Northwestern Aquatic Sciences (Newport, OR) and received on September 23, 2014.

Test conditions are summarized in Table 3. Seawater used in the test was collected from the Vancouver Aquarium. Control sediment was provided by the test organism supplier and was collected from the same site as the amphipods.

Five replicates each containing 20 organisms were used for evaluation of the samples and the control. Tests were conducted in 1-L glass jars using 175 mL of sediment and approximately 775 mL of seawater. Sediment and seawater were added to the test containers and allowed to equilibrate for 24 hours prior to addition of the test organisms. Tests were conducted at 15 ± 1°C under continuous light. The overlying water was not changed and the amphipods were not fed during the exposure period. Gentle aeration was provided throughout (approximately 100 bubbles per minute) the test period, and water quality parameters (dissolved oxygen, pH, salinity and temperature) were measured daily. Avoidance (i.e., the number of organisms emerged from the sediment), was also assessed and recorded daily. Ammonia and sulfides were measured in porewater collected from the sediment samples by centrifugation at test initiation and termination. Ammonia was also measured in the overlying water at test initiation and termination.

After 10 days of exposure, the contents of each replicate were gently sieved and the number of live and dead organisms were enumerated and recorded. The ability of surviving amphipods to rebury was measured by placing the amphipods that were recovered from the test containers in clean sediment for one hour. Survival of amphipods was evaluated statistically to determine whether the samples exhibited a significant ($p<0.05$) decrease in survival relative to the control and the reference sediment. Mean avoidance and reburial were summarized but not evaluated statistically. The criterion for acceptable test performance was ≥90% survival of control organisms.

A 96-hr reference toxicant test was also conducted using cadmium as the toxicant. Test organisms were exposed to a range of cadmium concentrations for 96-h and the results of this reference toxicant test were compared with historical data for this species to determine whether the organisms used in the toxicity tests were of acceptable quality.

2.4 48-hour *Mytilus galloprovincialis* larval development test

A bivalve larval development test was conducted using the mussel *M. galloprovincialis*, obtained from M-REP (Carlsbad, CA) and received on October 7, 2014. Tests were performed on the day or organism receipt according to procedures described in PSEP (1995), which are summarized in Table 4.

Water used for spawning the test organisms and for the test was seawater collected from the Vancouver Aquarium. Five replicates, each containing 18 g of sediment and 900 mL seawater, were prepared and gently stirred. The sediment was allowed to settle for 24 hr prior to addition of larvae. This reflects a planned deviation from the test protocol, which indicates that a four-hour settling period should be used; however, historical experience has indicated that extending the settling period to 24 hr reduces the impact of physical effect associated with settling particles on the larvae. The laboratory control consisted of clean seawater. The test was conducted at 16 ± 1°C under a 14:10 hr light:dark photoperiod throughout the 48-hr exposure period. No aeration was provided in the test containers.

Bivalve gametes were obtained by thermal stimulation of gravid adult mussels. The quality of gametes was evaluated under a microscope and high quality eggs were pooled and fertilized with actively swimming sperm. Fertilized eggs were added to the test containers to achieve a density of 20 – 40 larvae per mL and subsamples were collected from sacrificial replicates to determine the initial density of larvae in the test containers. Dissolved oxygen, pH and temperature were measured at 0, 24 and 48 hr of exposure. Salinity was measured at 0 and 48 hr. In addition, subsamples of the overlying water were collected at test initiation and termination and evaluated for concentrations of ammonia and sulphide.

At test termination, the overlying water was gently decanted from the test container, subsampled and preserved with buffered formalin for microscopic evaluation of survival and development of the larvae. The endpoint indicating normal larval development was formation of a straight-hinged D-shaped larva.

The test endpoints were determined as follows: survival was calculated as the percentage of larvae recovered at the end of the test relative to the initial density, regardless of whether they had developed normally or not; normal development was calculated as the percentage of surviving (i.e., recovered) larvae that developed normally; and normal survival endpoint was calculated as the percentage of larvae added at test initiation that survived and developed normally. The data were evaluated statistically to determine whether significant ($p<0.05$) adverse effects were present compared to the control seawater and the reference sediments. The test acceptance criterion was ≥70% normal surviving larvae in the control seawater.

A reference toxicant test was conducted in conjunction with the bivalve test using copper. Test organisms were exposed to a range of copper concentrations for 48-hr and the results of this test were compared with historical data to determine whether the organisms were of acceptable quality and sensitivity.

2.5 48-d *Macoma nasuta* Bioaccumulation Test

A bioaccumulation test was conducted using the clam *Macoma nasuta*, obtained from Brezina and Associates (Dillon Beach, CA) and received on September 10, 2014. Tests were performed according to procedures described in USEPA (1993), which are summarized in Table 5.

The clams were allowed to depurate for 24 hours in control (clean) seawater prior to exposure and a subsample of clams was frozen at test initiation to provide initial data. Five replicates each containing 25 organisms were used for evaluation of the samples and the control sediment. Tests were conducted in 20-L glass aquaria using 4 L of sediment and approximately 13 L of seawater. Sediment and seawater were added to the test containers and allowed to equilibrate for 24 hr prior to addition of the test organisms. The tests were conducted at 15 ± 2°C under a 16:8 hr light:dark photoperiod. The overlying water was renewed three times each week and the clams were not fed during the exposure period. The sediments were renewed completely at Day 28. Gentle aeration was provided throughout (approximately 100 bubbles per minute) the test period. Temperature was measured daily throughout the test and dissolved oxygen, pH and salinity were measured prior to performing water changes. Ammonia and sulphide was measured in the interstitial water at test initiation, on Day 28 and at test termination.

The initial plan had been to conduct a 56-day exposure; however, high concentrations of interstitial ammonia were observed in some of the samples on day 28, when the sediment was replaced. Consequently, a decision was made in discussion with the CRD Project Manager to terminate the exposure after 48-days, since previous results had indicated that steady state should have been reached. The clams were allowed to depurate for 24 hr in clean seawater and then were frozen and sent to AXYS Analytical Services (Sidney, BC) for analysis.

The survival data from the exposure were evaluated statistically to determine whether significant ($p<0.05$) adverse effects were present compared to the control. The test acceptance criterion was ≥90% survival in the control.

A 96-hr reference toxicant test was conducted using *Macoma nasuta* and cadmium as the toxicant. Test organisms were exposed to a range of cadmium concentrations for 96-hr. The results of this test were compared with data available for this species from previous tests in the laboratory and from the literature to determine whether the sensitivity of the test organisms was within the acceptable range.

2.6 Quality Assurance/Quality Control (QA/QC)

Nautilus follows a comprehensive QA/QC program to ensure that the data generated are of high quality and scientifically defensible. To meet these objectives, quality control procedures include the following:

- Negative controls to ensure that appropriate testing performance criteria are met;
- Positive controls to assess the health and sensitivity of the test organisms;
- Use of appropriate species and life stages to meet the study objectives;
- Use of appropriate test methodology and protocols;
- Appropriate number of replicates to allow proper statistical analyses;
- Calibration and proper maintenance of instruments to ensure accurate measurements;
- Proper documentation and record keeping to allow traceability of performance;
- Adequate supervision and training of staff to ensure that methods are followed;
- Proper handling and storage of samples to ensure their integrity;
- Procedures that are in place to address issues that may arise during testing and ensure the implementation of appropriate corrective actions; and
- Rigorous review of the data and report by a Registered Professional Biologist to ensure they are of acceptable quality and are scientifically defensible prior to finalizing the report.

Table 1. Summary of test conditions: 20-d *Neanthes arenaceodentata* sediment toxicity test.

Test organism	*Neanthes arenaceodentata*
Test organism source	Aquatic Toxicology Support, Bremerton, WA
Test organism age	Juvenile; 0.392 mg
Test type	Static-renewal
Test duration	20 days
Test vessel	1-L glass jars; 175 mL sediment; 775 mL overlying water
Test replicates	5 test replicates per treatment
No. of organisms	5 per replicate
Control water	Seawater collected from the Vancouver Aquarium
Test solution renewal	Every 3 days, replaced one-third overlying water
Test temperature	20 ± 1°C
Feeding	40 mg Tetramin per replicate every 2 days
Light intensity	100 to 500 lux at water surface
Photoperiod	24 hours light/0 hours dark
Aeration	Gentle aeration throughout test
Test protocol	PSEP (1995)
Test endpoint	Survival, individual dry weight, individual growth rate and total dry weight
Test acceptability criteria for controls	Mean control survival ≥90%; ≥0.38 mg/worm/day mean control growth rate
Reference toxicant	Cadmium

Table 2. Summary of test conditions: 10-d *Mysidopsis bahia* sediment toxicity test.

Test organism	*Mysidopsis bahia*
Test organism source	Aquatic BioSystems, Fort Collins, CO
Test organism age	5-d old
Test type	Static
Test duration	10 days
Test vessel	1-L glass jars; 175 mL sediment; 775 mL overlying water
Test replicates	5 test replicates per treatment
No. of organisms	10 per replicate
Control water	Seawater from the Vancouver Aquarium
Test solution renewal	None
Test temperature	20 ± 1°C
Feeding	100 *Artemia* nauplii per mysid daily
Light intensity	500 to 1000 lux at water surface
Photoperiod	16 hours light/8 hours dark
Aeration	Gentle aeration throughout test
Test protocol	Adapted from US EPA (1991 and 2002)
Test endpoint	Survival and individual dry weight
Test acceptability criterion	Mean control survival ≥90%
Reference toxicant	Copper

Table 3. Summary of test conditions: 10-d *Eohaustorius estuarius* sediment toxicity test.

Test organism	*Eohaustorius estuarius*
Test organism source	Northwestern Aquatic Sciences, Newport, OR
Test organism age	Immature; 3 – 5 mm size
Test type	Static
Test duration	10 days
Test vessel	1-L glass jars; 175 mL sediment; 775 mL overlying water
Test replicates	5 test replicates per treatment
No. of organisms	20 per replicate
Control water	Seawater from the Vancouver Aquarium
Test temperature	15 ± 1°C
Feeding	None
Light intensity	500 to 1000 lux at water surface
Photoperiod	24 hours light/0 hours dark
Aeration	Gentle aeration throughout test
Test protocol	Environment Canada (1998), EPS 1/RM/35
Test endpoints	Survival, avoidance and reburial
Test acceptability criterion	≥90% mean control survival
Reference Toxicant	Cadmium

Table 4. Summary of test conditions: 48-h *Mytilus galloprovincialis* larval development test.

Test organism	*Mytilus galloprovincialis*
Test organism source	M-REP, Carlsbad, CA
Test type	Static
Test duration	48 hours
Test chamber	1-L glass jars
Test volume	18 g of sediment with 900 mL seawater
Number of replicates	5
Control water	Seawater from Vancouver Aquarium
Test temperature	16 ± 1ºC
Number of organisms/replicate	20 – 40 per mL
Light intensity	100 to 500 lux
Photoperiod	14:10 hr light:dark photoperiod
Aeration	None
Test protocol	PSEP (1995)
Test endpoints	Larvae survival, normal development, normal survival
Test acceptability criterion	≥70% normal survival in control seawater
Reference toxicant	Copper

Table 5. Summary of test conditions for the bioaccumulation test.

Test organism	*Macoma nasuta*
Test organism source	Brezina and Associates, Dillon Beach, CA
Test type	Static renewal: water renewed three times per week and sediment replaced on Day 28
Test duration	48 days
Test chamber	20-L glass aquaria
Test volume	5 L of sediment and ~13 L of seawater
Number of replicates	5
Dilution/dilution water	Natural seawater from Vancouver Aquarium, Vancouver, BC
Test temperature	15 ± 2ºC
Number of organisms/replicate	5
Light intensity	500 to 1000 lux
Photoperiod	16:8 hr light:dark photoperiod
Aeration	Gentle aeration throughout test
Test protocol	USEPA (1993)
Test endpoints	Survival
Test acceptability criterion	Mean control survival ≥90%
Reference toxicant	Cadmium

3.0 RESULTS AND DISCUSSION

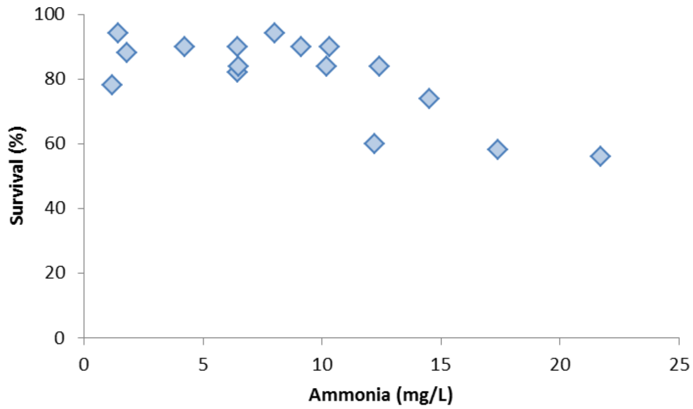
Results of bioassays using *N. arenaceodentata*, *M. bahia, E. estuarius, M. galloprovincialis* and *M. nasuta* are provided in Tables 6 through 10. Ammonia and sulphides measured during the tests are summarized in Tables 11 through 15.

None of the samples exhibited statistically significant adverse effects on survival of *N. arenaceodentata* relative to the control or the reference sediments (PB1 and PB2). However, significant reductions in individual dry weight and growth rate were observed in all samples tested relative to the control, with the exception of samples M1SE and M2SE. Total dry weight was significantly reduced relative to the control in all samples tested, with the exception of samples M1E, M1SE, AH5, M2E and M2SE. However, there were no statistically significant differences in growth metrics relative to either of the reference stations (PB1 and PB2).

In the mysid tests, samples M1NW, M2NE, PB1 and AH5 exhibited survival that was statistically significantly lower than the control. In addition, sample M2SE produced a relatively low average rate of survival (60%), but this was not statistically significant as a result of high variability between replicates. In fact, one of the replicates in this sample produced no surviving mysids; if this replicate is excluded, the mean survival for the remaining replicates was 75%. None of the samples produced survival that was significantly reduced relative to reference sample PB1, and only two stations (MWNW and AH5) exhibited survival that was significantly reduced relative to reference sample PB2.

Survival of mysids is shown in Figure 1 on the basis of the concentration of ammonia measured in the overlying water in the test containers at test termination. Samples producing the lowest rates of survival generally contained the highest ammonia concentrations. Results from sediment tests conducted in 2012 suggested that the EC50 for ammonia for this test species was approximately 20 mg/L, and this appears to be consistent with the effects observed here. Thus, ammonia may have been responsible for the adverse effects observed on mysid survival. In terms of growth, only one sample (M0) exhibited a statistically significant effect relative to the control. None of the samples exhibited significant differences in growth relative to station PB1; however, six stations (M0, M1E, M1SE, AH5, M2E and M4E) exhibited significant differences in growth relative to reference sample PB2.

Figure 1. Survival of mysids as a function of ammonia measured in the overlying water in the test containers at test termination.



In the *E. estuarius* tests, no adverse effects on survival were observed in either of the samples relative to the control, and survival was not significantly different between the sample M0 and the reference station PB1. Emergence of the amphipods during the test exposure was low, suggesting that the amphipods were not avoiding the sediment. The surviving amphipods exhibited a high rate of reburial, indicating that they could successfully bury themselves and were not moribund.

For bivalve larval development, effects on survival were observed in all samples tested relative to the control; however, this test often produces reduced survival as a result of physical effects of settling sediment particulate. When compared to reference station PB1, only two stations (M0 and M1SE) exhibited significantly lower survival, whereas relative to reference station PB2, ten samples had survival that was significantly reduced (M0, M1E, M1S, M1SE, M1W, M2E, M2NE, M2SE, M4E and M4SE).

Statistically significant effects were observed on normal development of bivalves in samples M0, M1E and M1S relative to the control. Eight samples exhibited significantly reduced normality relative to reference station PB1 (M0, M1E, M1S, M1SE, AH5, M1W, M2E and M2NE), and seven of those same eight samples were also significantly reduced relative to PB2 (of those eight, M1SE was not statistically different from PB2). Sample M0 produced the lowest rate of normal development (60.6%, compared with 88.6% in the control).

For the combined normal surviving endpoint for bivalve development, all samples were significantly reduced relative to the control. However, compared with reference station PB1, only six of the stations were significantly impacted (M0, M1E, M1S, M1SE, M2E and M2SE). Ten stations, including all six that were different from PB1, were also statistically affected relative to PB2 (M0, M1E, M1S, M1SE, M1W, M2E M2NE, M2SE, M4E and M4SE).

No statistically significant adverse effects on survival were observed in the bioaccumulation exposure in any of samples tested.

Table 6. Toxicity test results for the 20-d *Neanthes arenaceodentata* sediment toxicity test.

Sample ID	Survival (%) (Mean ± SD)	Total Dry Weight (mg) (Mean ± SD)	Mean Dry Weight (mg/worm) (Mean ± SD)	Individual Growth Rate (mg/worm/day) (Mean ± SD)
Sediment Control	92.0 ± 11.0	52.6 ± 11.0	11.5 ± 2.1	0.55 ± 0.10
M0	76.0 ± 16.7	29.4 ± 7.6 *	7.8 ± 1.2 *	0.37 ± 0.06 *
M1E	92.0 ± 17.9	40.4 ± 12.1	8.7 ± 1.6 *	0.42 ± 0.08 *
M1NW	92.0 ± 11.0	37.8 ± 9.6 *	8.2 ± 2.1 *	0.39 ± 0.11 *
M1S	100.0 ± 0.0	29.7 ± 4.4 *	5.9 ± 0.9 *	0.28 ± 0.04 *
M1SE	92.0 ± 11.0	46.1 ± 15.8	10.1 ± 3.7	0.48 ± 0.19
AH5	92.0 ± 11.0	41.3 ± 8.2	8.9 ± 1.1 *	0.43 ± 0.06 *
M1W	80.0 ± 20.0	31.9 ± 11.5 *	8.0 ± 2.2 *	0.38 ± 0.11 *
M2E	92.0 ± 11.0	39.0 ± 14.9	8.3 ± 2.6 *	0.40 ± 0.13 *
M2NE	96.0 ± 8.9	37.3 ± 5.6 *	7.8 ± 1.3 *	0.37 ± 0.06 *
M2SE	100.0 ± 0.0	50.4 ± 5.9	10.1 ± 1.2	0.48 ± 0.06
M4E	88.0 ± 26.8	30.1 ± 13.0 *	6.5 ± 1.6 *	0.31 ± 0.08 *
M4SE	84.0 ± 16.7	35.4 ± 10.0 *	8.4 ± 1.3 *	0.40 ± 0.06 *
PB1	80.0 ± 14.1	30.3 ± 13.0 *	7.4 ± 2.0 *	0.35 ± 0.10 *
PB2	96.0 ± 8.9	28.2 ± 5.2 *	5.9 ± 1.0 *	0.28 ± 0.05 *
AH10	92.0 ± 11.0	37.4 ± 6.2 *	8.2 ± 1.2 *	0.39 ± 0.06 *

* indicates samples that are significantly different from the control sediment.

\# indicates samples that are significantly different from the reference sediment, PB1

@ indicates samples that are significantly different from the reference sediment, PB2

SD = Standard Deviation.

Table 7. Toxicity test results for the 10-d *Mysidopsis bahia* sediment toxicity test.

Sample ID	Survival (%) (Mean ± SD)	Average Dry Weight (mg) (Mean ± SD)
Sediment Control	94.0 ± 5.5	0.23 ± 0.02
M0	84.0 ± 20.7	0.19 ± 0.01 * @
M1E	90.0 ± 7.1	0.21 ± 0.05 @
M1NW	56.0 ± 32.9 * @	0.23 ± 0.05
M1S	90.0 ± 10.0	0.24 ± 0.04
M1SE	74.0 ± 24.1	0.21 ± 0.03 @
AH5	58.0 ± 19.2 * @	0.21 ± 0.04 @
M1W	82.0 ± 17.9	0.33 ± 0.08
M2E	84.0 ± 15.2	0.20 ± 0.04 @
M2NE	84.0 ± 8.9 *	0.29 ± 0.04
M2SE	60.0 ± 43.0	0.24 ± 0.11
M4E	94.0 ± 5.5	0.21 ± 0.02 @
M4SE	90.0 ± 10.0	0.27 ± 0.05
PB1	78.0 ± 17.9 *	0.23 ± 0.01
PB2	88.0 ± 8.4	0.25 ± 0.03
AH10	90.0 ± 12.2	0.39 ± 0.09

* indicates samples that are significantly different from the control sediment.

\# indicates samples that are significantly different from the reference sediment, PB1

@ indicates samples that are significantly different from the reference sediment, PB2

SD = Standard Deviation

Table 8. Toxicity test results for the 10-d *E. estuarius* sediment toxicity test.

Sample ID	Survival (%) (Mean ± SD)	Avoidance (amphipods/jar/day) (Mean ± SD)	Reburial (%)
Control Sediment	93.0 ± 2.7	0.00 ± 0.00	99
M0	93.0 ± 4.5	0.04 ± 0.05	97
PB1	96.0 ± 5.5	0.00 ± 0.00	96

* indicates samples that are significantly different from the control sediment.

\# indicates samples that are significantly different from the reference sediment, PB1

SD = Standard Deviation

Table 9. Toxicity test results for the 48-h *M. galloprovincialis* sediment toxicity test.

Sample ID	Survival (%) (Mean ± SD)	Normal Larvae (%) (Mean ± SD)	Normal Surviving Larvae(%) (Mean ± SD)
Seawater Control	96.3 ± 5.3	88.6 ± 2.8	85.8 ± 5.4
M0	21.0 ± 7.2 * # @	60.6 ± 23.0 * # @	13.6 ± 9.1 * # @
M1E	54.0 ± 10.4 * @	81.3 ± 5.7 * # @	43.9 ± 9.0 * # @
M1NW	71.3 ± 10.7 *	87.0 ± 5.9	61.9 ± 9.2 *
M1S	62.1 ± 4.2 * @	80.6 ± 3.0 * # @	50.0 ± 3.8 * # @
M1SE	46.4 ± 9.0 * # @	88.8 ± 4.6 #	41.2 ± 7.8 * # @
AH5	76.5 ± 5.5 *	85.2 ± 6.0 # @	65.3 ± 7.9 *
M1W	61.9 ± 10.3 * @	88.8 ± 2.7 # @	54.9 ± 8.4 * @
M2E	56.7 ± 4.1 * @	88.6 ± 1.5 # @	50.3 ± 4.4 * # @
M2NE	59.1 ± 13.6 * @	86.9 ± 10.1 # @	51.6 ± 14.9 * @
M2SE	52.1 ± 13.6 * @	92.4 ± 1.6	48.0± 12.2 * # @
M4E	52.1 ± 13.5 * @	94.8 ± 1.7	49.5 ± 13.4 * @
M4SE	58.5 ± 8.6 * @	94.4 ± 1.9	55.1 ± 7.1 * @
PB1	64.9 ± 9.6 *	93.7 ± 1.5	60.8 ± 8.7 *
PB2	72.6 ± 4.2 *	92.5 ± 2.0	67.2 ± 5.1 *
AH10	70.9 ± 9.2 *	93.2 ± 2.4	65.9 ± 7.1 *

* indicates samples that are significantly different from the control sediment.

# indicates samples that are significantly different from the reference sediment, PB1

@ indicates samples that are significantly different from the reference sediment, PB2

SD = Standard Deviation

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Table 10. Survival results for the 48-d *Macoma nasuta* bioaccumulation test.

Sample ID	Survival (%) (Mean ± SD)
Control Sediment	90.2 ± 6.4
M0	91.2± 6.6
M1E	95.2 ± 4.8
M1NW	98.0 ± 4.0
M1SE	92.2 ± 5.4
M2E	95.1 ± 4.8
PB1	96.8 ± 5.2

SD = Standard Deviation.

Table 11. Summary of ammonia and sulphide concentrations for the 20-d *N. arenaceodentata* sediment toxicity test.

Sample ID	Overlying Water Ammonia (mg/L N)		Interstitial Water Ammonia (mg/L N)		Interstitial Water Sulphide (mg/L S)	
	Day 0	Day 20	Day 0	Day 20	Day 0	Day 20
Sediment Control	0.063	3.96	0.24	4.87	<0.020	<0.020
M0	4.11	3.24	16.0	5.68	0.039	<0.020
M1E	3.73	2.62	12.9	7.56	0.390	0.028
M1NW	3.81	6.27	7.50	9.56	<0.020	<0.020
M1S	1.83	2.67	5.99	4.43	0.054	<0.020
M1SE	4.09	5.05	12.9	7.64	0.425	0.74
AH5	4.32	5.02	16.8	5.73	<0.020	<0.020
M1W	2.34	3.11	7.66	6.55	0.650	0.052
M2E	2.84	3.59	12.7	6.32	0.045	<0.020
M2NE	2.46	3.62	7.51	4.30	0.037	<0.020
M2SE	3.05	2.93	10.4	9.83	10.1	3.62
M4E	2.58	4.91	9.15	7.30	0.031	0.025
M4SE	2.94	3.32	9.45	4.72	0.032	<0.020
PB1	0.63	3.26	3.43	4.64	<0.020	<0.020
PB2	0.76	3.38	3.22	4.26	<0.020	0.020
AH10	1.10	3.40	3.72	4.56	<0.020	<0.020

Table 12. Summary of ammonia and sulphide concentrations for the 10-d *Mysidopsis bahia* sediment toxicity test.

Sample ID	Overlying Water Ammonia (mg/L N)		Interstitial Water Ammonia (mg/L N)		Interstitial Water Sulphide (mg/L S)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Sediment Control	0.063	1.45	0.24	1.04	<0.020	<0.020
M0	4.11	12.4	16.0	16.0	0.039	8.3
M1E	3.73	10.3	12.9	17.1	0.390	1.54
M1NW	3.81	21.7	7.50	30.4	<0.020	0.126
M1S	1.83	6.43	5.99	8.64	0.054	0.029
M1SE	4.09	14.5	12.9	25.2	0.425	11.9
AH5	4.32	17.4	16.8	21.5	<0.020	0.032
M1W	2.34	6.43	7.66	12.5	0.650	0.126
M2E	2.84	10.2	12.7	17.4	0.045	0.058
M2NE	2.46	6.49	7.51	9.86	0.037	0.091
M2SE	3.05	12.2	10.4	12.7	10.1	2.02
M4E	2.58	8.03	9.15	10.9	0.031	0.025
M4SE	2.94	9.13	9.45	11.3	0.032	<0.020
PB1	0.63	1.20	3.43	4.86	<0.020	<0.020
PB2	0.76	1.78	3.22	2.02	<0.020	<0.020
AH10	1.10	4.21	3.72	6.06	<0.020	<0.020

Table 13. Summary of ammonia and sulphide concentrations for the 10-d *E. estuarius* sediment toxicity test.

Sample ID	Overlying Water Ammonia (mg/L N)		Interstitial Water Ammonia (mg/L N)		Interstitial Water Sulphide (mg/L S)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control Sediment	0.273	0.024	0.939	0.311	<0.020	<0.020
M0	2.21	11.0	5.66	11.3	<0.020	0.022
PB1	0.575	0.232	1.50	0.145	<0.020	<0.020

Table 14. Summary of total ammonia and sulphide concentrations for the 48-h *M. galloprovincialis* larval development sediment toxicity test.

Sample ID	Overlying Water Ammonia (mg/L N)		Overlying Water Sulphide (mg/L S)	
	0 h	48 h	0 h	48 h
Seawater Control	0.012	<0.005	<0.020	<0.020
M0	1.24	0.889	<0.020	0.028
M1E	0.663	0.397	<0.020	<0.020
M1NW	0.425	0.195	<0.020	<0.020
M1S	0.258	0.043	<0.020	<0.020
M1SE	0.775	0.502	<0.020	<0.020
AH5	0.838	1.26	<0.020	<0.020
M1W	0.290	0.078	<0.020	<0.020
M2E	0.749	0.421	<0.020	<0.020
M2NE	0.303	0.012	<0.020	<0.020
M2SE	0.369	0.090	<0.020	<0.020
M4E	0.340	0.033	<0.020	<0.020
M4SE	0.346	0.065	<0.020	<0.020
PB1	0.127	<0.005	<0.020	<0.020
PB2	0.114	<0.005	<0.020	<0.020
AH10	0.234	0.007	<0.020	<0.020

Table 15. Summary of total ammonia and sulphide concentrations for the 48-d *Macoma nasuta* sediment bioaccumulation test.

Sample ID	Interstitial Water Ammonia (mg/L N)			Interstitial Water Sulphide (mg/L S)		
	Day 0	Day 28	Day 48	Day 0	Day 28	Day 48
Control	7.11	35.4	1.50	0.352	52.0	<0.020
M0	7.56	24.8	2.85	0.520	18.4	0.046
M1E	3.95	24.5	1.71	0.065	9.10	0.033
M1NW	3.09	13.5	3.48	0.033	<0.020	<0.020
M1SE	5.51	17.0	2.77	0.054	6.30	0.108
M2E	4.94	15.2	1.87	0.044	0.76	0.044
PB1	2.58	3.68	0.586	<0.020	<0.020	<0.020

4.0 Quality Assurance/Quality Control

The test results reported for the 20-d *N. arenaceodentata*, 10-d *M. bahia*, 10-d *E. estuarius*, 48-h *M. galloprovincialis* and 48-d *Macoma nasuta* met the acceptability criteria for test validity specified in the protocols. Water quality parameters measured during all the toxicity tests were within acceptable ranges.

The reference toxicant test results for each test are summarized in Table 16. Results of the reference toxicant tests conducted during the testing program were within the acceptable in-house historical range (mean ± 2SD).

Table 16. Reference toxicant test results.

Test Species	Endpoint	Acceptable Range	CV(%)	Test Date
N. arenaceodentata	LC50 = 10.0 mg/L Cd	5.1 – 13.7 mg/L Cd	28	Oct 17, 2014
M. bahia	LC50 = 174.8 µg/L Cu	165.6 – 378.5 µg/L Cu	23	Oct 17, 2014
E. estuarius	LC50 = 6.7 mg/L Cd	4.8– 10.2 mg/L Cd	21	Sep 26, 2014
M. galloprovincialis	LC50 = 8.9 µg/L Cu	8.9 – 17.4 µg/L Cu	18	Oct 7, 2014
M. nasuta	LC50 = 4.7 mg/L Cd	3.1 – 5.6 mg/L Cd	16	Sept 12, 2014

5.0 REFERENCES

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Marine Sediment Toxicity Testing

Samples collected between September 5 to 29, 2017, and January 10 to January 15, 2018

Final Report

November 27, 2018

Submitted to: **Capital Regional District**
Victoria, B.C.

8664 Commerce Court, Burnaby, BC V5A 4N7

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NAUTILUS ENVIRONMENTAL

SIGNATURE PAGE

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Environmental Chemist

This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

NAUTILUS ENVIRONMENTAL

SUMMARY

Sample Information and Test Type

Sample ID	M0, M1E, M1NW, M1S, M1SE, M1SW, M1W, M2E, M2NE, M2SE, M4E, M4SE, PB1, PB2, C0, C1E, C1NW, C1S, C1SE, C1SW, C1W, C2E, C1NE, C2S, CB1, CB2, CB3, M1E-FR1, M1E-FR2, M1E-FR3
Sample collection date	September 5 to 29, 2017; January 10 to January 15, 2018
Sample receipt date	October 12, 2017; January 31, 2018
Sample receipt temperature	8.0°C and 2.8°C
Test types	10-d mysid shrimp (*Americamysis bahia*) survival
	20-d marine polychaete (*Neanthes arenaceodentata*) survival and growth
	48-h bivalve (*Mytilus galloprovincialis*) larval survival and development
	10-d marine amphipod (*Eohaustorius estuarius*) survival
	56-d bivalve (*Macoma nasuta*) bioaccumulation

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted marine sediment toxicity tests for Capital Regional District (CRD) on samples collected between September 5 to 29, 2017, and January 10 to 15, 2018. The first batch of 27 samples were delivered to the Nautilus Environmental laboratory in Burnaby, BC on October 12, 2017. These samples were collected in 4-L HDPE plastic containers and received at a temperature of 8.0°C. The second batch of eight samples was delivered on January 31, 2018. These were collected in 4- and 10-L HDPE plastic containers and received at a temperature of 2.8°C.

The samples were stored in the dark at 4 ± 2°C prior to testing. The following toxicity tests were conducted on the samples:

- 10-d mysid shrimp (*Americamysis bahia*) survival and growth
- 20-d marine polychaete (*Neanthes arenaceodentata*) survival and growth
- 48-h bivalve mussel (*Mytilus galloprovincialis*) larval survival and development
- 10-d marine amphipod (*Eohaustorius estuarius*) survival
- 56-d bivalve clam (*Macoma nasuta*) bioaccumulation

Toxicity tests were conducted on the first batch of 27 samples using *A. bahia*, *N. arenaceodentata* and *M. galloprovincialis*. Testing with *A. bahia* and *N. arenaceodentata* were initiated on October 17 and 24, 2017; testing with *M. galloprovincialis* was initiated on October 25 and November 1, 2017. The second batch of samples was tested with *E estuarius* and *M. nasuta*, with both tests initiated on February 9, 2018. The *M. nasuta* test was conducted on all eight samples, while the *E estuarius* test was conducted on two of the samples only.

The sample identified as M1E was tested for *A. bahia*, *N. arenaceodentata* and *M. galloprovincialis*; in the *M. nasuta* bioaccumulation test there were three separate M1E samples tested, identified as M1E-FR1, M1E-FR2 and M1E-FR3.

This report describes the results of these toxicity tests. Copies of raw laboratory data sheets and statistical analyses are provided in Appendices A through E. Descriptions of bulk sediment samples and its chemistry are provided in Appendix F, and the chain-of-custody forms are provided in Appendix G.

2.0 METHODS

Sediment samples were homogenized thoroughly using stainless steel spoons and were not sieved prior to testing. Methods for the toxicity tests are summarized in Tables 1 through 5. Testing with *A. bahia* was conducted according to procedures described by the US EPA (2002) with modifications to allow for sediment testing. Testing using *N. arenaceodentata* and *M. galloprovincialis* were conducted according to procedures described by the Puget Sound Estuary Program (PSEP, 1995). The *E. estuarius* test followed methods by Environment Canada (1998), and the *M. nasuta* bioaccumulation test followed US EPA (1993) methods.

The *M. nasuta* bioaccumulation test was initially scheduled for fall 2017; however, due to organism supplier issues the testing was delayed until February 2018 with recollected samples (The *E. estuarius* test used this round of samples as well). Initial tissue samples were taken to provide a comparison for the tissues collected at test termination. The clams were depurated in clean seawater for 24h after removal from the sediment and frozen. The *M. nasuta* tissue was analyzed by SGS AXYS (Sidney, BC) and the results sent directly to CRD. Overlying and interstitial ammonia measurements were taken weekly throughout the test. A small portion of sediment from the test vessels was removed and centrifuged to extract the interstitial samples.

Ammonia and sulphides were measured by ALS Environmental, Burnaby, BC. Statistical analyses for the tests were performed using CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: 10-d mysid shrimp (*A. bahia*) survival and growth.

Test species	*Americamysis bahia*
Organism source	Aquatic Biosystems, Fort Collins, CO
Organism age	5 days post hatch
Test type	Static
Test duration	10 days
Test vessel	1-L glass container
Test volume	175 mL sediment; 775 mL overlying water
Test replicates	5 per sample
Number of organisms	10 per replicate
Control/dilution water	Natural seawater
Test solution renewal	None
Test temperature	20 ± 1°C
Test salinity	28 ± 2 ppt
Feeding	40 mg Tetramin per replicate every 2 days
Light intensity	Ambient laboratory lighting
Photoperiod	24 hours light
Aeration	Continuous gentle aeration
Test measurements	Temperature, dissolved oxygen, pH and salinity of overlying water measured daily; total ammonia of overlying and interstitial water measured at test initiation and termination; total sulphide of interstitial water measured at test initiation and termination
Test protocol	US EPA (2002), EPA/821/R-02-014 - Modified
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival and average individual dry weight
Test acceptability criterion for controls	≥90% mean control survival
Reference toxicant	Copper (added as $CuCl_2$)

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Table 2. Summary of test conditions: 20-d marine polychaete (*N. arenaceodentata*) survival and growth.

Test species	*Neanthes arenaceodentata*
Organism source	Aquatic Toxicology Support, Bremerton, WA
Organism age	Juvenile
Test type	Static-renewal
Test duration	20 days
Test vessel	1-L glass container
Test volume	175 mL sediment; 775 mL overlying water
Test replicates	5 per sample
Number of organisms	5 per replicate
Control/dilution water	Natural seawater
Test solution renewal	3-day intervals (33% renewal)
Test temperature	20 ± 1°C
Test salinity	28 ± 2 ppt
Feeding	40 mg Tetramin per replicate every 2 days
Light intensity	Ambient laboratory lighting
Photoperiod	24 hours light
Aeration	Continuous gentle aeration
Test measurements	Temperature measured daily; dissolved oxygen, pH and salinity of overlying water measured at test initiation, every 3 days thereafter and at test termination; total ammonia of overlying and interstitial water measured at test initiation and termination; total sulphide of interstitial water measured at test initiation and termination
Test protocol	PSEP (1995)
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival, total dry weight, average individual dry weight, individual growth rate
Test acceptability criterion for controls	≥90% mean control survival, ≥0.38 mg/worm/day mean control growth rate
Reference toxicant	Cadmium (added as $CdCl_2$)

Table 3. Summary of test conditions: 48-h bivalve (*M. galloprovincialis*) larval survival and development.

Test species	*Mytilus galloprovincialis*
Organism source	Taylor Shellfish, Shelton, WA
Organism age	<2-h post-fertilization
Test type	Static
Test duration	48 hours
Test vessel	1-L glass container
Test volume	18 g sediment; 900 mL overlying water
Test replicates	5 per sample
Number of organisms	Approximately 20 – 40 embryos/mL
Control/dilution water	Natural seawater
Test solution renewal	None
Test temperature	16 ± 1°C
Test salinity	28 ± 2 ppt
Feeding	None
Light intensity	Ambient laboratory lighting
Photoperiod	14 hours light / 10 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, overlying ammonia and overlying sulphides measured at test initiation and termination
Test protocol	PSEP (1995)
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival, proportion normal, combined proportion normal
Test acceptability criteria for controls	≥70% combined proportion normal
Reference toxicant	Copper (added as $CuCl_2$)

Table 4. Summary of test conditions: 10-d marine amphipod (*E. estuarius*) survival.

Test species	*Eohaustorius estuarius*
Organism source	Northwestern Aquatic Sciences, Newport, OR
Organism age	Immature; 3-5 mm size
Test type	Static
Test duration	10 days
Test vessel	1-L glass jars
Test volume	175 mL sediment, 775 mL overlying water
Test replicates	5 per sample
Number of organisms	20 per replicate
Control/dilution water	Natural seawater
Test solution renewal	None
Test temperature	15 ± 2°C
Test salinity	28 ± 2 ppt
Feeding	None
Light intensity	500 to 1000 lux at water surface
Photoperiod	24 hours light
Aeration	Gentle aeration throughout test
Test measurements	Temperature, dissolved oxygen, pH and salinity of overlying water measured daily; total ammonia of overlying and interstitial water measured at test initiation and termination; total sulphide of interstitial water measured at test initiation and termination; avoidance checked daily
Test protocol	Environment Canada (1998), EPS 1/RM/35
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival, avoidance, reburial
Test acceptability criterion for controls	≥90% mean control survival
Reference toxicant	Cadmium (added as $CdCl_2$)

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Table 5. Summary of test conditions: 56-d bivalve (*M. nasuta*) bioaccumulation

Test species	*Macoma nasuta*
Organism source	Brezina and Associates, Dillon Beach, CA
Test type	Static-renewal
Test duration	56 days
Test vessel	24-L glass aquaria
Test volume	5 L of sediment and 18 L of seawater
Test replicates	5 per sample
Number of organisms	25 per replicate
Control/dilution water	Natural seawater
Test solution renewal	3 times/week (sediment renewal at 28 days)
Test temperature	15 ± 2°C
Test salinity	28 ± 2 ppt
Feeding	None
Light intensity	500 to 1000 lux at water surface
Photoperiod	16:8 hour light:dark photoperiod
Aeration	Gentle aeration throughout test
Test measurements	Temperature of overlying water measured daily; dissolved oxygen, pH and salinity measured 3 times/week, total ammonia of overlying and interstitial water measured weekly; total sulphide of interstitial water measured at test initiation and termination; survival checked daily
Test protocol	US EPA (1993), EPA/600/R-93/183
Statistical software	CETIS Version 1.8.7
Test endpoints	Survival
Test acceptability criterion for controls	≥90% mean control survival
Reference toxicant	Cadmium (added as $CdCl_2$)

3.0 RESULTS

Results of the toxicity tests are summarized in Tables 6 through 13. Ammonia and sulphides measured during the tests are summarized in Tables 14 through 23.

In the mysid (*A. bahia*) tests, only one sample (C0) exhibited statistically significantly lower survival than the control. In terms of growth, samples C1S, CB1, CB2, and CB3 exhibited a statistically significant effect relative to the control. Samples producing the lowest rates of survival and growth generally contained the highest ammonia concentrations. Thus, ammonia may have been responsible for the adverse effects observed in the endpoints tested.

In the marine polychaete (*N. arenaceodentata*) tests, survival for three (C0, C1S and C1NE) out of 27 samples tested were significantly lower relative to the control, while only sample C1S showed statistically significant reduction in all test endpoints.

For the bivalve (*M. galloprovincialis*) larval development tests, effects on survival were observed in 21 out of the 27 samples tested; however, only five of these samples (M0, M1E, C0, C1E and C1SE) had abnormal larvae rates which resulted in statistically significant reduction in all three test endpoints. Therefore, the reduced survival may have occurred as a result of physical effects of settling sediment particulate. Sample C1SE produced the lowest rate of normal larvae development (50.1%, compared with 82.6% in the control) and, combined with the reduced survival associated with this sample, resulted in overall percent normal surviving larvae of 14.6%.

The marine amphipod (*E. estuarius*) test resulted in samples M0 and PB1 being significantly different than the laboratory control for survival, However, both were less than 30% different, indicating a passed toxicity test per the reference method. Emergence of the amphipods during the test exposure was low, suggesting that the amphipods were not avoiding the sediment. The surviving amphipods exhibited a high rate of reburial, indicating that they could successfully bury themselves and were not moribund.

Survival results of the *M. nasuta* bioaccumulation test are provided in Table 13. Samples M1E-FR3 and M1SE were significantly different relative to the control sediment. However, there was adequate tissue remaining at test termination to fulfill mass requirements for the bioaccumulation analyses.

Table 6. Results: 10-d mysid shrimp (*A. bahia*) survival and growth test (initiated on October 17, 2017).

Sample ID	Survival (%) (Mean ± SD)	Average Dry Weight (mg) (Mean ± SD)
Control Sediment	98.0 ± 4.5	0.32 ± 0.05
M0	86.0 ± 15.2	0.27 ± 0.07
M1E	98.0 ± 4.5	0.28 ± 0.03
M1NW	92.0 ± 8.4	0.29 ± 0.02
M1S	92.0 ± 8.4	0.28 ± 0.03
M1SE	98.0 ± 4.5	0.31 ± 0.03
M1SW	94.0 ± 5.5	0.26 ± 0.04
M1W	94.0 ± 5.5	0.29 ± 0.01
M2E	98.0 ± 4.5	0.33 ± 0.04
M2NE	98.0 ± 4.5	0.32 ± 0.05
M2SE	98.0 ± 4.5	0.30 ± 0.03
M4E	90.0 ± 10.0	0.36 ± 0.03
M4SE	94.0 ± 8.9	0.27 ± 0.05

SD = Standard Deviation

Table 7. Results: 10-d mysid shrimp (*A. bahia*) survival and growth test (initiated on October 24, 2017).

Sample ID	Survival (%) (Mean ± SD)	Average Dry Weight (mg) (Mean ± SD)
Control Sediment	96.0 ± 5.5	0.29 ± 0.08
PB1	96.0 ± 5.5	0.28 ± 0.04
PB2	100.0 ± 0.0	0.32 ± 0.03
C0	64.0 ± 26.1*	0.32 ± 0.07
C1E	92.0 ± 4.5	0.28 ± 0.04
C1NW	88.0 ± 13.0	0.24 ± 0.03
C1S	84.0 ± 8.9	0.20 ± 0.02*
C1SE	96.0 ± 5.5	0.28 ± 0.05
C1SW	90.0 ± 12.2	0.25 ± 0.05
C1W	96.0 ± 5.5	0.24 ± 0.03
C2E	98.0 ± 4.5	0.29 ± 0.03
C1NE	90.0 ± 12.2	0.26 ± 0.04
C2S	94.0 ± 5.5	0.25 ± 0.04
CB1	88.0 ± 13.0	0.20 ± 0.03*
CB2	76.0 ± 15.2	0.16 ± 0.04*
CB3	90.0 ± 7.1	0.19 ± 0.02*

SD = Standard Deviation
* = Indicates a statistically significant effect relative to the Control Sediment

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Table 8. Results: 20-d marine polychaete (*N. arenaceodentata*) survival and growth test (initiated on October 17, 2017).

Sample ID	Survival (%) (Mean ± SD)	Total Dry Weight (mg) (Mean ± SD)	Average Individual Dry Weight (mg) (Mean ± SD)	Growth Rate (mg/worm/day) (Mean ± SD)
Control Sediment	100.0 ± 0.0	60.3 ± 7.2	12.1 ± 1.4	0.58 ± 0.07
M0	100.0 ± 0.0	48.3 ± 11.9	9.7 ± 2.4	0.46 ± 0.12
M1E	100.0 ± 0.0	54.9 ± 1.5	11.0 ± 0.3	0.52 ± 0.01
M1NW	96.0 ± 8.9	51.2 ± 10.6	10.7 ± 1.9	0.51 ± 0.09
M1S	96.0 ± 8.9	48.7 ± 11.8	10.1 ± 1.9	0.48 ± 0.09
M1SE	96.0 ± 8.9	51.4 ± 17.1	10.5 ± 2.9	0.50 ± 0.15
M1SW	100.0 ± 0.0	64.8 ± 8.0	13.0 ± 1.6	0.62 ± 0.08
M1W	100.0 ± 0.0	50.5 ± 13.9	10.1 ± 2.8	0.48 ± 0.14
M2E	100.0 ± 0.0	61.0 ± 5.9	12.2 ± 1.2	0.58 ± 0.06
M2NE	96.0 ± 8.9	66.1 ± 11.3	13.8 ± 2.0	0.66 ± 0.10
M2SE	96.0 ± 8.9	55.6 ± 18.7	12.4 ± 4.1	0.59 ± 0.21
M4E	100.0 ± 0.0	58.4 ± 4.0	11.7 ± 0.8	0.56 ± 0.04
M4SE	100.0 ± 0.0	65.2 ± 5.5	13.0 ± 1.1	0.62 ± 0.06

SD = Standard Deviation

Table 9. Results: 20-d marine polychaete (*N. arenaceodentata*) survival and growth test (initiated on October 24, 2017).

Sample ID	Survival (%) (Mean ± SD)	Total Dry Weight (mg) (Mean ± SD)	Average Individual Dry Weight (mg) (Mean ± SD)	Growth Rate (mg/worm/day) (Mean ± SD)
Control Sediment	100.0 ± 0.0	42.6 ± 9.0	8.5 ± 1.8	0.40 ± 0.09
PB1	56.0 ± 43.4	27.4 ± 14.9	8.4 ± 2.6	0.40 ± 0.13
PB2	100.0 ± 0.0	42.2 ± 8.0	8.1 ± 1.3	0.38 ± 0.06
C0	52.0 ± 26.8*	24.0 ± 12.6	9.5 ± 2.0	0.45 ± 0.10
C1E	100.0 ± 0.0	63.2 ± 18.8	12.6 ± 3.8	0.61 ± 0.19
C1NW	88.0 ± 11.0	29.3 ± 9.8	6.7 ± 2.4	0.31 ± 0.12
C1S	56.0 ± 16.7*	11.7 ± 3.2*	4.3 ± 1.2*	0.19 ± 0.06*
C1SE	92.0 ± 11.0	40.6 ± 13.7	8.8 ± 3.0	0.41 ± 0.15
C1SW	92.0 ± 11.0	41.5 ± 17.0	8.8 ± 2.9	0.41 ± 0.15
C1W	92.0 ± 11.0	39.1 ± 13.5	8.4 ± 2.4	0.39 ± 0.12
C2E	92.0 ± 11.0	44.9 ± 10.4	9.7 ± 1.4	0.46 ± 0.07
C1NE	64.0 ± 16.7*	23.1 ± 10.4	6.9 ± 1.9	0.32 ± 0.09
C2S	72.0 ± 30.3	27.4 ± 16.2	7.1 ± 2.3	0.33 ± 0.11
CB1	96.0 ± 8.9	31.5 ± 6.7	6.6 ± 1.4	0.30 ± 0.07
CB2	92.0 ± 11.0	33.9 ± 11.4	7.2 ± 1.9	0.33 ± 0.09
CB3	92.0 ± 17.9	40.7 ± 12.2	8.9 ± 2.1	0.42 ± 0.11

SD = Standard Deviation
* = Indicates a statistically significant effect relative to Control Sediment

Table 10. Results: 48-h bivalve (*M. galloprovincialis*) larval survival and development test (initiated on October 25, 2017).

Concentration (% v/v)	Survival (%) (Mean ± SD)	Proportion Normal (%) (Mean ± SD)	Combined Proportion Normal (%) (Mean ± SD)
Control Seawater	88.4 ± 4.1	82.6 ± 1.2	73.0 ± 3.1
M0	43.6 ± 13.4*	56.9 ± 8.6*	25.0 ± 8.7*
M1E	54.5 ± 17.1*	68.6 ± 3.6*	37.6 ± 13.0*
M1NW	86.9 ± 5.3	81.9 ± 3.0	71.2 ± 4.5
M1S	64.2 ± 3.2*	79.7 ± 4.9	51.2 ± 5.4*
M1SE	64.0 ± 11.6*	83.1 ± 2.4	53.3 ± 10.6*
M1SW	62.7 ± 9.6*	79.6 ± 2.1	50.0 ± 8.3*
M1W	66.8 ± 7.9*	82.6 ± 4.1	55.2 ± 7.8*
M2E	79.5 ± 2.6	85.7 ± 3.4	68.1 ± 3.0
M2NE	77.2 ± 2.5	87.7 ± 1.8	67.8 ± 3.4
M2SE	73.6 ± 4.4*	85.4 ± 1.9	62.9 ± 5.2
M4E	80.5 ± 4.6	90.4 ± 1.4	72.8 ± 4.7
M4SE	63.0 ± 6.2*	83.9 ± 3.8	52.8 ± 5.3*
PB1	90.2 ± 5.3	79.1 ± 0.5*	71.4 ± 4.1
PB2	91.4 ± 4.3	79.3 ± 0.8*	72.5 ± 3.8
CB1	72.0 ± 6.3*	76.0 ± 6.5	54.9 ± 8.5*
CB2	63.8 ± 10.7*	74.0 ± 4.8	47.5 ± 10.4*
CB3	72.0 ± 7.1*	76.9 ± 3.8	55.5 ± 7.5*

SD = Standard Deviation
* = Indicates a statistically significant effect relative to Control Seawater

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Table 11. Results: 48-h bivalve (*M. galloprovincialis*) larval survival and development test (initiated on November 1, 2017).

Concentration (% v/v)	Survival (%) (Mean ± SD)	Proportion Normal (%) (Mean ± SD)	Combined Proportion Normal (%) (Mean ± SD)
Control Seawater	90.2 ± 2.0	79.0 ± 4.0	71.2 ± 4.0
C0	40.7 ± 2.8*	56.9 ± 11.8*	23.0 ± 4.4*
C1E	42.0 ± 10.7*	65.9 ± 5.8*	28.1 ± 9.9*
C1NW	76.2 ± 3.5*	83.0 ± 3.3	63.3 ± 4.3
C1S	52.3 ± 14.1*	72.0 ± 15.0	38.9 ± 16.7*
C1SE	29.9 ± 6.4*	50.1 ± 10.3*	14.6 ± 2.3*
C1SW	49.4 ± 12.1*	69.2 ± 6.0	34.1 ± 7.9*
C1W	50.7 ± 13.8*	71.8 ± 4.4	36.6 ± 10.7*
C2E	46.0 ± 5.0*	69.3 ± 10.5	31.8 ± 5.3*
C1NE	74.1 ± 4.6*	78.8 ± 3.1	58.4 ± 4.6*
C2S	80.4 ± 3.7*	86.8 ± 2.6	69.8 ± 2.9

SD = Standard Deviation
* = Indicates a statistically significant effect relative to Control Seawater

Table 12. Results: 10-d marine amphipod (*E. estuarius*) survival test (initiated on February 9, 2018).

Sample ID	Survival (%) (Mean ± SD)	Emergence (amphipods/jar/day) (Mean ± SD)	Reburial (%)
Control Sediment	100.0 ± 0.0	0.00 ± 0.00	98
M0	91.0 ± 10.8*	0.08 ± 0.08	96
PB1	93.0 ± 4.5*	0.00 ± 0.00	93

SD = Standard Deviation
* = Indicates a statistically significant effect relative to Control Sediment

Table 13. Results: 56-d bivalve (*M. nasuta*) bioaccumulation test (initiated on February 9, 2018).

Sample ID	Survival (%) (Mean ± SD)
Control Sediment	93.6 ± 3.6
M0	91.2 ± 3.3
M1E-FR1	88.8 ± 4.4
M1E-FR2	86.4 ± 10.0
M1E-FR3	78.4 ± 6.7 *
M1NW	91.2 ± 5.2
M1SE	79.2 ± 8.7 *
M2E	95.2 ± 1.8
PB1	94.4 ± 4.6

SD = Standard Deviation
* = Indicates a statistically significant effect relative to Control Sediment

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Table 14. Ammonia and sulphide: 10-d mysid shrimp (*A. bahia*) survival and growth test (initiated on October 17, 2017).

Sample ID	Overlying Water Total Ammonia (mg/L N)		Interstitial Water Total Ammonia (mg/L N)		Interstitial Water Total Sulphide (mg/L S)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control Sediment	0.211	0.365	0.451	0.398	<0.018	<0.018
M0	0.847	6.19	15.6	12.2	22.6	0.066
M1E	0.523	3.98	10.1	7.03	<0.018	0.018
M1NW	0.352	5.42	4.05	7.41	<0.018	<0.018
M1S	0.874	5.95	8.99	7.33	<0.018	0.110
M1SE	0.979	5.92	11.7	11.1	0.068	0.057
M1SW	0.977	4.53	12.7	9.04	0.018	0.018
M1W	0.584	1.61	12.5	9.49	0.050	0.033
M2E	0.362	1.80	7.92	3.98	<0.018	<0.018
M2NE	0.799	3.26	6.66	8.36	<0.018	0.020
M2SE	0.724	4.13	14.7	7.38	1.51	<0.018
M4E	0.580	0.599	9.43	12.1	<0.018	0.019
M4SE	0.829	2.31	13.1	7.00	<0.018	<0.018

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Table 15. Ammonia and sulphide: 10-d mysid shrimp (*A. bahia*) survival and growth test (initiated on October 24, 2017).

Sample ID	Overlying Water Total Ammonia (mg/L N)		Interstitial Water Total Ammonia (mg/L N)		Interstitial Water Total Sulphide (mg/L S)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control Sediment	0.403	1.18	0.625	0.626	<0.018	<0.018
PB1	0.490	0.997	4.70	1.89	<0.018	<0.018
PB2	0.574	1.30	5.28	8.00	<0.018	9.4
C0	2.80	13.2	23.8	11.6	43.8	21.9
C1E	2.24	8.15	18.6	12.2	28.2	5.40
C1NW	5.24	17.6	34.6	21.9	0.034	0.025
C1S	4.12	15.1	32.1	24.9	0.112	0.081
C1SE	2.43	9.90	19.8	17.9	0.169	0.019
C1SW	3.04	13.1	21.0	17.1	0.147	0.043
C1W	3.60	18.1	23.6	18.3	1.03	0.587
C2E	2.30	10.5	22.1	19.6	42.2	19.4
C1NE	3.30	19.3	22.1	20.3	<0.018	<0.018
C2S	3.83	15.3	18.8	23.1	0.036	0.020
CB1	5.96	18.3	34.3	28.8	0.027	0.027
CB2	5.53	20.3	33.1	25.2	0.052	0.019
CB3	4.95	16.4	29.5	22.0	0.039	<0.018

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Table 16. Ammonia and sulphide: 20-d marine polychaete (*N. arenaceodentata*) survival and growth test (initiated on October 17, 2017).

Sample ID	Overlying Water		Interstitial Water			
	Total Ammonia (mg/L N)		Total Ammonia (mg/L N)		Total Sulphide (mg/L S)	
	Day 0	Day 20	Day 0	Day 20	Day 0	Day 20
Control Sediment	0.211	2.36	0.451	2.30	<0.018	<0.018
M0	0.847	8.76	15.6	12.5	22.6	2.62
M1E	0.523	5.82	10.1	7.70	<0.018	<0.018
M1NW	0.352	5.57	4.05	8.44	<0.018	<0.018
M1S	0.874	4.76	8.99	5.14	<0.018	<0.018
M1SE	0.979	6.30	11.7	11.4	0.068	0.202
M1SW	0.977	4.66	12.7	6.21	0.018	<0.018
M1W	0.584	6.39	12.5	9.17	0.050	0.025
M2E	0.362	6.18	7.92	13.7	<0.018	0.787
M2NE	0.799	5.13	6.66	6.90	<0.018	<0.018
M2SE	0.724	6.19	14.7	10.9	1.51	0.073
M4E	0.580	4.67	9.43	7.75	<0.018	<0.018
M4SE	0.829	5.76	13.1	8.31	<0.018	0.020

Table 17. Ammonia and sulphide: 20-d marine polychaete (*N. arenaceodentata*) survival and growth test (initiated on October 24, 2017).

Sample ID	Overlying Water Total Ammonia (mg/L N)		Interstitial Water Total Ammonia (mg/L N)		Interstitial Water Total Sulphide (mg/L S)	
	Day 0	Day 20	Day 0	Day 20	Day 0	Day 20
Control Sediment	0.403	3.05	0.625	5.70	<0.018	0.038
PB1	0.490	6.38	4.70	7.25	<0.018	<0.018
PB2	0.574	5.15	5.28	6.43	<0.018	<0.018
C0	2.80	11.3	23.8	16.1	43.8	14.5
C1E	2.24	7.08	18.6	10.0	28.2	7.9
C1NW	5.24	10.3	34.6	18.5	0.034	0.025
C1S	4.12	8.16	32.1	15.3	0.112	0.019
C1SE	2.43	7.24	19.8	8.91	0.169	0.020
C1SW	3.04	7.62	21.0	13.4	0.147	1.42
C1W	3.60	11.2	23.6	15.1	1.03	4.94
C2E	2.30	9.02	22.1	13.2	42.2	13.0
C1NE	3.30	8.01	22.1	15.2	<0.018	0.029
C2S	3.83	7.71	18.8	12.5	0.036	<0.018
CB1	5.96	10.5	34.3	18.4	0.027	0.039
CB2	5.53	9.26	33.1	16.1	0.052	0.021
CB3	4.95	9.01	29.5	13.0	0.039	<0.018

Table 18. Ammonia and sulphide: 48-h bivalve (*M. galloprovincialis*) larval survival and development test (initiated on October 25, 2017).

Sample ID	Overlying Water			
	Total Ammonia (mg/L N)		Total Sulphide (mg/L S)	
	0 hr	48 hr	0 hr	48 hr
Control Seawater	<0.0050	<0.0050	<0.018	<0.018
M0	0.335	0.327	<0.018	<0.018
M1E	0.348	0.320	<0.018	<0.018
M1NW	0.188	0.177	<0.018	<0.018
M1S	0.368	0.323	<0.018	<0.018
M1SE	0.323	0.336	<0.018	<0.018
M1SW	0.334	0.311	<0.018	<0.018
M1W	0.282	0.265	<0.018	<0.018
M2E	0.338	0.285	<0.018	<0.018
M2NE	0.248	0.233	<0.018	<0.018
M2SE	0.399	0.360	<0.018	<0.018
M4E	0.248	0.215	<0.018	<0.018
M4SE	0.430	0.408	<0.018	<0.018
PB1	0.0897	0.0498	<0.018	<0.018
PB2	0.121	0.0713	<0.018	<0.018
CB1	1.15	1.09	<0.018	<0.018
CB2	1.42	1.45	<0.018	<0.018
CB3	1.15	1.08	<0.018	<0.018

Table 19. Ammonia and sulphide: 48-h bivalve (*M. galloprovincialis*) larval survival and development test (initiated on November 1, 2017).

Sample ID	Overlying Water			
	Total Ammonia (mg/L N)		Total Sulphide (mg/L S)	
	0 hr	48 hr	0 hr	48 hr
Control Seawater	0.0564	0.0137	<0.018	<0.018
C0	0.580	0.750	<0.036	0.032
C1E	0.638	0.983	<0.036	<0.018
C1NW	1.23	1.60	<0.036	<0.090
C1S	1.14	1.92	<0.036	<0.090
C1SE	1.41	1.74	<0.036	0.210
C1SW	1.38	1.38	<0.036	<0.090
C1W	1.20	1.25	<0.036	0.036
C2E	0.616	0.874	<0.036	0.019
C1NE	0.835	1.16	<0.036	<0.18
C2S	0.707	0.926	<0.036	<0.036

Table 20. Ammonia and sulphide: 10-d marine amphipod (*E. estuarius*) survival test (initiated on February 9, 2018).

Sample ID	Overlying Water		Interstitial Water			
	Total Ammonia (mg/L N)		Total Ammonia (mg/L N)		Total Sulphide (mg/L S)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control Sediment	0.151	0.0092	0.186	0.0215	<0.018	<0.018
M0	4.78	6.35	9.87	9.01	0.285	0.032
PB1	0.832	0.22	1.29	1.16	<0.018	<0.018

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Table 21. Sulphide: 56-d bivalve (*M. nasuta*) bioaccumulation test (initiated on February 9, 2018).

Sample ID	Interstitial Water Total Sulphide (mg/L S)	
	Day 0	Day 56
Control Sediment	<0.018	<0.036
M0	0.018	<0.036
M1E-FR1	0.034	<0.036
M1E-FR2	0.020	<0.036
M1E-FR3	0.027	<0.036
M1NW	<0.018	<0.036
M1SE	9.63	<0.036
M2E	<0.018	<0.036
PB1	<0.018	<0.036

Table 22. **Ammonia (Overlying): 56-d bivalve (*M.nasuta*) bioaccumulation test (initiated on February 9, 2018).**

Sample ID	Overlying Water Total Ammonia (mg/L N)								
	Day 0	Day 7	Day 14	Day 21	Day 28	Day 35	Day 42	Day 49	Day 56
Control Sediment	0.249	2.80	1.31	1.89	1.48	2.76	1.64	1.68	1.58
M0	2.29	6.14	2.65	3.11	2.41	4.02	2.37	3.52	2.47
M1E-FR1	23.3	5.07	1.51	2.01	1.46	3.90	2.47	2.09	1.41
M1E-FR2	2.29	4.80	1.43	1.89	1.09	4.68	2.47	1.88	1.30
M1E-FR3	2.01	5.72	1.57	1.89	1.11	2.24	0.969	0.499	0.0740
M1NW	1.19	4.96	2.07	3.00	1.82	6.01	4.95	5.66	4.00
M1SE	2.74	5.70	2.42	5.04	2.94	6.19	4.14	3.74	2.31
M2E	1.88	4.46	2.34	2.04	1.00	3.18	1.59	1.42	0.886
PB1	0.417	2.25	1.03	1.27	0.710	1.77	1.00	0.882	0.566

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Table 23. **Ammonia (Interstitial): 56-d bivalve (*M.nasuta*) bioaccumulation test (initiated on February 9, 2018).**

Sample ID	Interstitial Water – Total Ammonia (mg/L N)								
	Day 0	Day 7	Day 14	Day 21	Day 28	Day 35	Day 42	Day 49	Day 56
Control Sediment	1.63	3.11	1.87	1.92	1.98	2.74	1.58	1.78	2.37
M0	6.04	5.15	3.66	3.25	2.88	5.37	2.54	3.62	2.82
M1E-FR1	4.70	4.48	2.68	2.00	1.96	4.07	2.25	2.18	1.85
M1E-FR2	7.46	4.46	2.19	1.80	1.67	5.14	2.54	2.01	1.70
M1E-FR3	8.75	4.13	2.73	2.10	1.55	4.17	1.32	0.507	2.04
M1NW	2.51	4.36	3.00	2.71	2.29	7.45	4.94	5.52	4.96
M1SE	7.97	6.03	4.24	4.64	3.82	8.13	4.29	4.39	2.64
M2E	5.42	4.53	3.38	2.11	1.50	3.37	1.71	1.56	1.07
PB1	1.29	2.04	1.56	1.26	0.714	1.77	1.04	0.788	0.520

4.0 QA/QC

The health history of the test organisms used in the exposure was acceptable and met the requirements of the PSEP, US EPA and Environment Canada protocols. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocol throughout the test. Uncertainty associated with this test is best described by the standard deviation around the mean and/or the confidence intervals around the point estimates.

For the marine polychaete test which was initiated on October 24, 2017, porewater at the end of the test were collected one day after test termination due to equipment malfunction. The samples were placed at 4 ± 2°C overnight and were centrifuged the following day.

The result of the reference toxicant test conducted during the testing program is summarized in Table 24. Results for this test fell within the range for organism performance of the mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in these tests was appropriate.

Table 24. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
A. bahia	Survival (LC50): 244.3 mg/L Cd	235.8 (147.1 – 378) mg/L Cd	27	October 17, 2017
	Survival (LC50): 282.8 mg/L Cd	237.0 (153.9 – 364.9) mg/L Cd	24	October 24, 2017
N. arenaceodentata	Survival (LC50): 9.9 mg/L Cd	8.8 (5.6 – 13.9) mg/L Cd	26	October 17, 2017
	Survival (LC50): 9.9 mg/L Cd	8.7 (5.6 – 13.7) mg/L Cd	25	October 24, 2017
M. galloprovincialis	Normal development (EC50): 9.3 µg/L Cu	12.4 (8.7 – 17.7) µg/L Cu	20	October 25, 2017
	Normal development (EC50): 9.3 µg/L Cu	12.2 (8.4 – 17.7) µg/L Cu	20	November 1, 2017
E. estuarius	Survival (LC50): 5.8 mg/L Cd	7.7 (4.7 – 12.4) mg/L Cd	27	February 9, 2018
M. nasuta	Survival (LC50): 3.1 mg/L Cd	4.0 (2.7 – 5.9) mg/L Cd	21	February 9, 2018

SD = Standard Deviation, CV = Coefficient of Variation, IC = Inhibition Concentration, LC = Lethal Concentration

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5.0 REFERENCES

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Marine Sediment Toxicity Testing

Samples collected between August 28 and September 10, 2019

Final Report

February 25, 2020

Submitted to: **Capital Regional District**
Victoria, B.C.

8664 Commerce Court, Burnaby, BC V5A 4N7

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SIGNATURE PAGE

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Jeslin Wijaya, B.Sc.	Armando Tang, R.P.Bio
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This report has been prepared by Nautilus Environmental Company Inc. based on data and/or samples provided by our client and the results of this study are for their sole benefit. Any reliance on the data by a third party is at the sole and exclusive risk of that party. The results presented here relate only to the samples tested.

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SUMMARY

Sample Information and Test Type

Sample ID	M0	M4E
	M1E-FR1, M1E-FR2, M1E-FR3	M4SE
	M1N	M8E
	M1NW	MC0
	M1S	MC1NW
	M1SE	MC2E
	M1SW	MC4E
	M1W	MC8SE
	M2E	PB1
	M2NE	PB2
	M2SE	
Sample collection date	August 28 to September 10, 2019	
Sample receipt date	September 11 to 25, 2019	
Sample receipt temperature	6.6 – 15.9°C	
Test types	10-d mysid shrimp (*Americamysis bahia*) survival	
	20-d marine polychaete (*Neanthes arenaceodentata*) survival and growth	
	48-h bivalve (*Mytilus galloprovincialis*) larval survival and development	
	10-d marine amphipod (*Eohaustorius estuarius*) survival	
	56-d bivalve (*Macoma nasuta*) bioaccumulation	

1.0 INTRODUCTION

Nautilus Environmental Company Inc. conducted marine sediment toxicity tests for Capital Regional District (CRD) on samples collected between August 28 and September 10, 2019 and were delivered to the Nautilus Environmental laboratory in Burnaby, BC between September 11 and 25, 2019. These samples were collected in 4-L and 10-L HDPE plastic containers and received at a temperature range of 6.6° to 15.9° C. The samples were stored in the dark at 4 ± 2°C prior to testing. The following toxicity tests were conducted on the samples:

- 10-d mysid shrimp (*Americamysis bahia*) survival and growth
- 20-d marine polychaete (*Neanthes arenaceodentata*) survival and growth
- 48-h bivalve mussel (*Mytilus galloprovincialis*) larval survival and development
- 10-d marine amphipod (*Eohaustorius estuarius*) survival
- 56-d bivalve clam (*Macoma nasuta*) bioaccumulation

Testing with *A. bahia*, *N. arenaceodentata* were conducted on all samples and were initiated on October 1, 2019. Testing with *M. galloprovincialis* was also conducted on all samples and was initiated on October 16, 2019. Testing with *M. nasuta* and *E. estuarius* were initiated on September 13 and October 1, 2019, respectively. The *M. nasuta* test was conducted on nine of the samples, while the *E estuarius* test was conducted on three of the samples.

The sample identified as M1E-FR1 was tested with *A. bahia*, *N. arenaceodentata* and *M. galloprovincialis*; in the *M. nasuta* bioaccumulation test there were three separate M1E samples tested, identified as M1E-FR1, M1E-FR2 and M1E-FR3.

This report describes the results of these toxicity tests. Copies of raw laboratory data sheets and statistical analyses are provided in Appendices A through E. Descriptions of bulk sediment samples and chemistry are provided in Appendix F, and the chain-of-custody forms are provided in Appendix G.

2.0 METHODS

Sediment samples were homogenized thoroughly using stainless steel spoons and were not sieved prior to testing. Methods for the toxicity tests are summarized in Tables 1 through 5. Testing with *A. bahia* was conducted according to procedures described by the US EPA (2002) with modifications to allow for testing with sediment. Testing using *N. arenaceodentata* and *M. galloprovincialis* were conducted according to procedures described by the Puget Sound Estuary Program (PSEP, 1995). The *E. estuarius* test followed methods by Environment Canada (1998), and the *M. nasuta* bioaccumulation test followed US EPA (1993) methods.

For the *M. nasuta* bioaccumulation test, initial tissue samples were collected to provide a comparison for the tissues collected at test termination. The clams were depurated in clean seawater for 24h after removal from the sediment and frozen. The *M. nasuta* tissue was analyzed by SGS AXYS (Sidney, BC) and the results sent directly to CRD. Overlying and interstitial ammonia measurements were taken weekly throughout the test. A small portion of sediment from the test vessels was removed and centrifuged to extract the interstitial ammonia samples.

Ammonia and sulphides were measured by ALS Environmental, Burnaby, BC. Statistical analyses for the tests were performed using CETIS (Tidepool Scientific Software, 2013).

Table 1. Summary of test conditions: 10-d mysid shrimp (*A. bahia*) survival and growth.

Test species	*Americamysis bahia*
Organism source	Aquatic Biosystems, Fort Collins, CO
Organism age	4 days post hatch
Test type	Static
Test duration	10 days
Test vessel	1-L glass container
Test volume	175 mL sediment; 775 mL overlying water
Test replicates	5 per sample
Number of organisms	10 per replicate
Control/dilution water	Natural seawater
Test solution renewal	None
Test temperature	20 ± 1°C
Test salinity	28 ± 2 ppt
Feeding	100 *Artemia* nauplii per mysid daily
Light intensity	Ambient laboratory lighting
Photoperiod	24 hours light
Aeration	Continuous gentle aeration
Test measurements	Temperature, dissolved oxygen, pH and salinity of overlying water measured daily; total ammonia of overlying and interstitial water measured at test initiation and termination; total sulphide of interstitial water measured at test initiation and termination
Test protocol	US EPA (2002), EPA/821/R-02-014 - Modified
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival and average individual dry weight
Test acceptability criterion for controls	**≥90% mean control survival**
Reference toxicant	Copper (added as $CuCl_2$)

Table 2. Summary of test conditions: 20-d marine polychaete (*N. arenaceodentata*) survival and growth.

Test species	*Neanthes arenaceodentata*
Organism source	Aquatic Toxicology Support, Bremerton, WA
Organism age	Juvenile
Test type	Static-renewal
Test duration	20 days
Test vessel	1-L glass container
Test volume	175 mL sediment; 775 mL overlying water
Test replicates	5 per sample
Number of organisms	5 per replicate
Control/dilution water	Natural seawater
Test solution renewal	3-day intervals (33% renewal)
Test temperature	20 ± 1°C
Test salinity	28 ± 2 ppt
Feeding	40 mg Tetramin per replicate every 2 days
Light intensity	Ambient laboratory lighting
Photoperiod	24 hours light
Aeration	Continuous gentle aeration
Test measurements	Temperature measured daily; dissolved oxygen, pH and salinity of overlying water measured at test initiation, every 3 days thereafter and at test termination; total ammonia of overlying and interstitial water measured at test initiation and termination; total sulphide of interstitial water measured at test initiation and termination
Test protocol	PSEP (1995)
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival, total dry weight, average individual dry weight, individual growth rate
Test acceptability criterion for controls	**≥90% mean control survival, ≥0.38 mg/worm/day mean** control growth rate
Reference toxicant	Cadmium (added as $CdCl_2$)

Table 3. Summary of test conditions: 48-h bivalve (*M. galloprovincialis*) larval survival and development.

Test species	*Mytilus galloprovincialis*
Organism source	Taylor Shellfish, Shelton, WA
Organism age	<2-h post-fertilization
Test type	Static
Test duration	48 hours
Test vessel	1-L glass container
Test volume	18 g sediment; 900 mL overlying water
Test replicates	5 per sample
Number of organisms	Approximately 20 – 40 embryos/mL
Control/dilution water	Natural seawater
Test solution renewal	None
Test temperature	16 ± 1°C
Test salinity	28 ± 2 ppt
Feeding	None
Light intensity	Ambient laboratory lighting
Photoperiod	14 hours light / 10 hours dark
Aeration	None
Test measurements	Temperature, dissolved oxygen and pH measured daily; salinity, overlying ammonia and overlying sulphides measured at test initiation and termination
Test protocol	PSEP (1995)
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival, proportion normal, combined proportion normal
Test acceptability criteria for controls	≥70% combined proportion normal
Reference toxicant	Copper (added as $CuCl_2$)

Table 4. Summary of test conditions: 10-d marine amphipod (*E. estuarius*) survival.

Test species	*Eohaustorius estuarius*
Organism source	Northwestern Aquatic Sciences, Newport, OR
Organism age	Immature; 3-5 mm size
Test type	Static
Test duration	10 days
Test vessel	1-L glass jars
Test volume	175 mL sediment, 775 mL overlying water
Test replicates	5 per sample
Number of organisms	20 per replicate
Control/dilution water	Natural seawater
Test solution renewal	None
Test temperature	15 ± 2°C
Test salinity	28 ± 2 ppt
Feeding	None
Light intensity	500 to 1000 lux at water surface
Photoperiod	24 hours light
Aeration	Gentle aeration throughout test
Test measurements	Temperature, dissolved oxygen, pH and salinity of overlying water measured daily; total ammonia of overlying and interstitial water measured at test initiation and termination; total sulphide of interstitial water measured at test initiation and termination; avoidance checked daily
Test protocol	Environment Canada (1998), EPS 1/RM/35
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival, avoidance, reburial
Test acceptability criterion for controls	**≥90% mean control survival**
Reference toxicant	Cadmium (added as $CdCl_2$)

Table 5. Summary of test conditions: 56-d bivalve (*M. nasuta*) bioaccumulation.

Test species	*Macoma nasuta*
Organism source	Brezina and Associates, Dillon Beach, CA
Test type	Static-renewal
Test duration	56 days
Test vessel	24-L glass aquaria
Test volume	5 L of sediment and 18 L of seawater
Test replicates	5 per sample
Number of organisms	25 per replicate
Control/dilution water	Natural seawater
Test solution renewal	3 times/week (sediment renewal at 28 days)
Test temperature	15 ± 2°C
Test salinity	28 ± 2 ppt
Feeding	None
Light intensity	500 to 1000 lux at water surface
Photoperiod	16:8 hour light:dark photoperiod
Aeration	Gentle aeration throughout test
Test measurements	Temperature of overlying water measured daily; dissolved oxygen, pH and salinity measured 3 times/week, total ammonia of overlying and interstitial water measured weekly; total sulphide of interstitial water measured at test initiation and termination; survival checked daily
Test protocol	US EPA (1993), EPA/600/R-93/183
Statistical software	CETIS Version 1.9.4
Test endpoints	Survival
Test acceptability criterion for controls	**≥90% mean control survival**
Reference toxicant	Cadmium (added as $CdCl_2$)

3.0 RESULTS

Results of the toxicity tests are summarized in Tables 6 through 10. Ammonia and sulphides measured during the tests are summarized in Tables 11 through 17.

Results for the mysid shrimp (*A. bahia*) test are provided in Table 6. None of the samples tested exhibited a statistically significant difference in survival compared to the control sediment. Similarly, none of the samples tested with *M. nasuta* (Table 10) exhibited a statistically significant difference in survival compared to the control sediment.

In the marine polychaete (*N. arenaceodentata*) test (Table 7), none of the samples exhibited a significant reduction in survival compared to the control sediment. Eight out of the 21 samples tested exhibited statistically significant reduction in all growth endpoints relative to the control sediment. An additional four samples were statistically significant in total dry weight endpoint.

For the bivalve (*M. galloprovincialis*) larval development test (Table 8), effects on survival were observed in all samples tested; however, only one of these samples (M1SE) had abnormal larvae rates which resulted in statistically significant reduction in all three test endpoints. Therefore, the reduced survival may have occurred as a result of physical effects of settling sediment particulate. Sample M1SE produced the lowest rate of normal larvae development (63.3%, compared with 77.5% in the control) and, combined with the reduced survival associated with this sample, resulted in overall percent normal surviving larvae of 21.6%.

The marine amphipod (*E. estuarius*) test resulted in samples M0 and MC0 being significantly different than the laboratory control for survival (Table 9); however, the survival of MC0 was high at 90%. Emergence of the amphipods during the test exposure was low in samples PB1 and MCO (0 and 0.32 amphipods/jar/day, respectively), suggesting that the amphipods were not avoiding the sediment. Emergence in sample M0 was higher (1.38 amphipods/jar/day) and may be a result of higher a sulphide concentration (24.7 mg/L S) at the beginning of the test compared to the other two samples (<0.018 mg/L S). The higher sulphide concentration in M0 may have also contributed to the lower survival (63%) in the sample. The surviving amphipods exhibited a high rate of reburial, indicating that they could successfully bury themselves and were not moribund.

Table 6. Results: 10-d mysid shrimp (*A. bahia*) survival and growth test.

Sample ID	Survival (%) (Mean ± SD)
Control Sediment	96.0 ± 5.5
PB1	92.0 ± 8.4
PB2	98.0 ± 4.5
M0	82.0 ± 11.0
M1E-FR1	94.0 ± 8.9
M1N	86.0 ± 11.4
M1NW	92.0 ± 8.4
M1S	92.0 ± 4.5
M1SE	80.0 ± 24.5
M1SW	98.0 ± 4.5
M1W	100.0 ± 0.0
M2E	100.0 ± 0.0
M2NE	98.0 ± 4.5
M2SE	98.0 ± 4.5
M4E	96.0 ± 5.5
M4SE	96.0 ± 8.9
M8E	96.0 ± 5.5
MC0	86.0 ± 5.5
MC1NW	100.0 ± 0.0
MC2E	90.0 ± 10.0
MC4E	90.0 ± 7.1
MC8SE	94.0 ± 8.9

SD = Standard Deviation

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Table 7. Results: 20-d marine polychaete (*N. arenaceodentata*) survival and growth test.

Sample ID	Survival (%) (Mean ± SD)	Total Dry Weight (mg) (Mean ± SD)	Average Individual Dry Weight (mg) (Mean ± SD)	Growth Rate (mg/worm/day) (Mean ± SD)
Control Sediment	100.0 ± 0.0	85.2 ± 5.9	17.0 ± 1.2	0.82 ± 0.06
PB1	100.0 ± 0.0	64.7 ± 10.6 *	13.0 ± 2.1 *	0.62 ± 0.11 *
PB2	100.0 ± 0.0	76.0 ± 9.1	15.2 ± 1.8	0.73 ± 0.09
M0	100.0 ± 0.0	54.4 ± 7.4 *	10.9 ± 1.5 *	0.51 ± 0.07 *
M1E-FR1	96.0 ± 8.9	68.0 ± 8.1 *	14.2 ± 1.3	0.68 ± 0.07
M1N	84.0 ± 16.7	45.1 ± 8.8 *	11.1 ± 3.0 *	0.53 ± 0.15 *
M1NW	100.0 ± 0.0	77.1 ± 4.6	15.4 ± 0.9	0.74 ± 0.05
M1S	100.0 ± 0.0	65.1 ± 5.4 *	13.0 ± 1.1 *	0.62 ± 0.05 *
M1SE	100.0 ± 0.0	65.1 ± 14.5 *	13.0 ± 2.9 *	0.62 ± 0.15 *
M1SW	100.0 ± 0.0	73.3 ± 15.8	14.6 ± 3.2	0.70 ± 0.16
M1W	100.0 ± 0.0	76.1 ± 13.3	15.2 ± 2.7	0.73 ± 0.13
M2E	96.0 ± 8.9	68.0 ± 9.8 *	14.2 ± 2.0	0.68 ± 0.10
M2NE	100.0 ± 0.0	69.7 ± 11.7	13.9 ± 2.3	0.67 ± 0.12
M2SE	96.0 ± 8.9	53.8 ± 7.8 *	11.2 ± 0.9 *	0.53 ± 0.04 *
M4E	100.0 ± 0.0	64.1 ± 6.9 *	12.8 ± 1.4 *	0.61 ± 0.07 *
M4SE	100.0 ± 0.0	52.8 ± 6.5 *	10.6 ± 1.3 *	0.50 ± 0.07 *
M8E	100.0 ± 0.0	70.7 ± 10.0	14.1 ± 2.0	0.68 ± 0.10
MC0	100.0 ± 0.0	71.6 ± 7.1	14.3 ± 1.4	0.69 ± 0.07
MC1NW	100.0 ± 0.0	76.0 ± 4.5	15.2 ± 0.9	0.73 ± 0.05
MC2E	100.0 ± 0.0	73.4 ± 7.9	14.7 ± 1.6	0.70 ± 0.08
MC4E	92.0 ± 11.0	64.2 ± 13.2 *	14.0 ± 2.3	0.67 ± 0.11
MC8SE	100.0 ± 0.0	69.1 ± 2.4 *	13.8 ± 0.5	0.66 ± 0.02

SD = Standard Deviation
* = Indicates a statistically significant effect relative to Control Sediment

Table 8. Results: 48-h bivalve (*M. galloprovincialis*) larval survival and development test.

Concentration (% v/v)	Survival (%) (Mean ± SD)	Proportion Normal (%) (Mean ± SD)	Combined Proportion Normal (%) (Mean ± SD)
Control Seawater	95.1 ± 3.4	77.5 ± 2.2	74.1 ± 5.0
PB1	74.4 ± 5.1 *	92.3 ± 1.8	68.7 ± 4.7 *
PB2	80.6 ± 6.3 *	89.5 ± 1.3	72.2 ± 6.2
M0	48.6 ± 9.7 *	79.5 ± 4.1	38.7 ± 8.1 *
M1E-FR1	51.7 ± 7.0 *	85.3 ± 1.8	44.2 ± 6.2 *
M1N	65.7 ± 12.7 *	82.3 ± 4.0	54.1 ± 10.6 *
M1NW	69.6 ± 4.9 *	86.1 ± 4.7	60.0 ± 6.4 *
M1S	62.3 ± 4.8 *	83.6 ± 5.1	52.0 ± 4.2 *
M1SE	33.3 ± 8.7 *	63.3 ± 9.7 *	21.6 ± 9.0 *
M1SW	59.7 ± 12.4 *	83.7 ± 4.6	49.9 ± 10.2 *
M1W	53.1 ± 10.4 *	82.6 ± 5.7	43.6 ± 7.6 *
M2E	50.9 ± 6.3 *	83.7 ± 5.4	42.7 ± 6.8 *
M2NE	66.2 ± 11.4 *	83.8 ± 4.3	55.6 ± 11.0 *
M2SE	57.2 ± 8.1 *	86.0 ± 2.0	49.2 ± 7.2 *
M4E	63.6 ± 7.3 *	89.9 ± 3.7	57.0 ± 4.4 *
M4SE	55.6 ± 8.2 *	84.7 ± 3.9	47.1 ± 7.7 *
M8E	71.6 ± 7.1 *	85.5 ± 4.3	61.2 ± 6.9 *
MC0	78.4 ± 7.5 *	86.4 ± 3.4	67.7 ± 6.1
MC1NW	73.8 ± 8.4 *	86.8 ± 1.3	64.0 ± 6.8 *
MC2E	80.5 ± 6.4 *	87.5 ± 5.0	70.6 ± 8.6
MC4E	67.1 ± 7.8 *	86.9 ± 2.7	58.2 ± 6.8 *
MC8SE	78.1 ± 9.4 *	86.8 ± 3.4	67.6 ± 7.4

SD = Standard Deviation
* = Indicates a statistically significant effect relative to Control Seawater

Table 9. Results: 10-d marine amphipod (*E. estuarius*) survival test.

Sample ID	Survival (%) (Mean ± SD)	Emergence (amphipods/jar/day) (Mean ± SD)	Reburial (%)
Control Sediment	100.0 ± 0.0	0.00 ± 0.00	100
PB1	98.0 ± 4.5	0.00 ± 0.00	100
M0	63.0 ± 14.8*	1.38 ± 0.47	96
MC0	90.0 ± 3.5*	0.32 ± 0.30	98

SD = Standard Deviation
* = Indicates a statistically significant effect relative to Control Sediment

Table 10. Results: 56-d bivalve (*M. nasuta*) bioaccumulation test.

Sample ID	Survival (%) (Mean ± SD)
Control Sediment	93.1 ± 7.0
PB1	97.2 ± 3.2
M0	80.6 ± 25.0
M1E-FR1	94.4 ± 7.9
M1E-FR2	93.1 ± 5.3
M1E-FR3	91.7 ± 3.2
M1NW	91.7 ± 5.6
M1SE	93.1 ± 5.3
M2E	95.8 ± 8.3
MC0	87.5 ± 2.8

SD = Standard Deviation

Table 11. Ammonia and sulphide: 10-d mysid shrimp (*A. bahia*) survival and growth test.

Sample ID	Overlying Water Total Ammonia (mg/L N)		Interstitial Water Total Ammonia (mg/L N)		Interstitial Water Total Sulphide (mg/L S)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control Sediment	1.13	0.367	1.66	0.449	<0.018	<0.018
PB1	0.647	0.452	1.99	3.37	<0.018	<0.018
PB2	2.60	6.66	9.91	8.37	<0.018	0.022
M0	5.71	11.8	11.7	17.1	25.4	8.8
M1E-FR1	2.20	6.77	8.41	11.0	<0.018	0.018
M1N	2.86	19.5	11.5	33.0	<0.018	0.021
M1NW	1.75	7.89	7.36	6.27	<0.018	<0.018
M1S	2.93	7.27	8.34	9.63	<0.018	<0.018
M1SE	2.16	7.74	11.7	12.0	84.0	0.150
M1SW	2.48	6.89	11.5	11.9	0.050	0.024
M1W	1.29	7.11	7.84	9.99	<0.018	<0.018
M2E	2.21	6.94	7.12	8.21	0.029	<0.018
M2NE	1.53	5.95	6.79	8.36	0.040	<0.018
M2SE	2.50	8.19	11.2	14.5	11.6	0.031
M4E	1.84	5.60	8.01	8.56	<0.018	0.019
M4SE	2.40	8.18	10.0	8.00	0.027	<0.018
M8E	1.59	4.73	10.5	12.2	0.021	0.054
MC0	2.09	7.66	6.78	4.11	<0.018	0.020
MC1NW	1.20	3.21	4.79	15.3	<0.018	<0.018
MC2E	2.89	15.6	10.6	21.1	0.023	<0.018
MC4E	1.71	6.24	5.16	15.0	<0.018	<0.018
MC8SE	2.36	9.99	8.79	0.0055	0.026	0.019

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Table 12. Ammonia and sulphide: 20-d marine polychaete (*N. arenaceodentata*) survival and growth test.

Sample ID	Overlying Water Total Ammonia (mg/L N)		Interstitial Water Total Ammonia (mg/L N)		Interstitial Water Total Sulphide (mg/L S)	
	Day 0	Day 20	Day 0	Day 20	Day 0	Day 20
Control Sediment	1.13	1.50	1.66	1.02	<0.018	0.022
PB1	0.647	1.40	1.99	4.11	<0.018	<0.018
PB2	2.60	3.75	9.91	6.91	<0.018	<0.018
M0	5.71	8.21	11.7	13.4	25.4	8.84
M1E-FR1	2.20	5.16	8.41	8.30	<0.018	0.022
M1N	2.86	10.1	11.5	22.3	<0.018	0.029
M1NW	1.75	4.56	7.36	8.20	<0.018	0.041
M1S	2.93	3.77	8.34	4.74	<0.018	0.038
M1SE	2.16	7.41	11.7	8.95	84.0	1.38
M1SW	2.48	4.69	11.5	11.0	0.050	0.019
M1W	1.29	4.40	7.84	4.81	<0.018	0.036
M2E	2.21	4.85	7.12	7.18	0.029	0.021
M2NE	1.53	4.42	6.79	7.44	0.040	0.036
M2SE	2.50	6.73	11.2	9.43	11.6	<0.018
M4E	1.84	4.06	8.01	9.47	<0.018	0.025
M4SE	2.40	5.52	10.0	7.49	0.027	<0.018
M8E	1.59	3.35	10.5	4.40	0.021	<0.018
MC0	2.09	2.83	6.78	3.54	<0.018	<0.018
MC1NW	1.20	2.32	4.79	3.89	<0.018	0.034
MC2E	2.89	5.72	10.6	14.7	0.023	0.039
MC4E	1.71	2.77	5.16	3.05	<0.018	0.037
MC8SE	2.36	3.81	8.79	6.63	0.026	<0.018

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Table 13. Ammonia and sulphide: 48-h bivalve (*M. galloprovincialis*) larval survival and development test.

Sample ID	Overlying Water			
	Total Ammonia (mg/L N)		Total Sulphide (mg/L S)	
	0 hr	48 hr	0 hr	48 hr
Control Sediment	0.0225	0.0399	<0.018	<0.018
PB1	0.110	0.101	<0.018	<0.018
PB2	0.345	0.350	<0.018	<0.018
M0	0.789	0.798	<0.018	0.031
M1E-FR1	0.599	0.609	<0.018	<0.018
M1N	0.992	0.835	<0.018	<0.018
M1NW	0.525	0.667	<0.018	<0.018
M1S	0.546	0.613	<0.018	<0.018
M1SE	0.521	0.568	<0.018	0.032
M1SW	0.704	0.780	<0.018	0.019
M1W	0.556	0.580	<0.018	<0.018
M2E	0.564	0.586	<0.018	0.022
M2NE	0.494	0.554	<0.018	0.020
M2SE	0.664	0.691	<0.018	<0.018
M4E	0.518	0.515	<0.018	0.019
M4SE	0.740	0.757	<0.018	<0.018
M8E	0.471	0.571	<0.018	<0.018
MC0	0.636	0.642	<0.018	0.023
MC1NW	0.330	0.434	<0.018	<0.018
MC2E	0.664	0.615	<0.018	<0.018
MC4E	0.488	0.496	0.018	<0.018
MC8SE	0.404	0.435	0.024	0.024

Table 14. Ammonia and sulphide: 10-d marine amphipod (*E. estuarius*) survival test.

Sample ID	Overlying Water Total Ammonia (mg/L N)		Interstitial Water Total Ammonia (mg/L N)		Interstitial Water Total Sulphide (mg/L S)	
	Day 0	Day 10	Day 0	Day 10	Day 0	Day 10
Control Sediment	1.16	0.836	1.71	0.827	<0.018	<0.018
PB1	0.434	0.304	1.59	0.673	<0.018	0.029
M0	4.23	8.70	14.3	11.7	24.7	0.095
MC0	2.19	4.77	6.37	4.74	<0.018	<0.018

Table 15. Sulphide: 56-d bivalve (*M. nasuta*) bioaccumulation test.

Sample ID	Interstitial Water Total Sulphide (mg/L S)	
	Day 0	Day 56
Control Sediment	<0.018	<0.018
PB1	0.039	0.023
M0	0.046	0.031
M1E-FR1	0.029	<0.018
M1E-FR2	0.032	0.025
M1E-FR3	<0.018	0.021
M1NW	<0.036	<0.018
M1SE	0.028	0.019
M2E	<0.018	<0.018
MC0	<0.018	0.034

Table 16. **Ammonia (Overlying): 56-d bivalve (*M.nasuta*) bioaccumulation test.**

Sample ID	Overlying Water Total Ammonia (mg/L N)								
	Day 0	Day 7	Day 14	Day 21	Day 29	Day 35	Day 42	Day 49	Day 56
Control Sediment	6.75	1.67	1.54	1.33	6.98	1.80	1.17	0.398	0.0848
PB1	1.55	1.55	2.05	1.03	2.46	1.56	1.11	0.560	0.374
M0	2.00	4.93	5.15	4.83	9.89	5.98	4.80	2.61	0.673
M1E-FR1	4.63	4.26	4.26	2.38	7.36	4.46	3.46	0.935	0.313
M1E-FR2	4.18	3.63	3.35	1.87	8.79	4.92	3.70	0.323	0.155
M1E-FR3	1.26	4.20	3.86	1.91	7.35	5.18	4.13	0.754	0.133
M1NW	3.37	3.11	3.33	2.63	8.68	6.95	4.77	3.55	1.75
M1SE	2.17	4.20	4.18	4.80	7.25	4.74	3.84	2.90	0.129
M2E	3.17	4.18	3.70	1.87	8.81	5.05	3.77	0.128	0.617
MC0	2.97	2.76	2.96	1.40	7.50	4.42	4.54	1.56	0.216

Table 17. **Ammonia (Interstitial): 56-d bivalve (*M.nasuta*) bioaccumulation test.**

Sample ID	Interstitial Water Total Ammonia (mg/L N)								
	Day 0	Day 7	Day 14	Day 21	Day 29	Day 35	Day 42	Day 49	Day 56
Control Sediment	5.25	1.29	1.50	0.914	7.25	1.24	1.14	0.403	0.139
PB1	1.78	1.91	1.69	0.892	2.57	1.71	1.15	0.635	0.394
M0	2.97	4.07	3.84	3.90	10.6	6.97	6.04	4.02	1.55
M1E-FR1	4.10	5.35	4.98	2.48	7.95	5.11	4.04	2.10	0.957
M1E-FR2	4.48	4.78	4.14	2.63	11.2	6.24	4.26	2.02	1.11
M1E-FR3	1.46	3.25	2.77	1.91	7.80	5.81	4.34	2.18	0.521
M1NW	2.32	3.92	3.20	1.92	10.2	7.53	5.45	4.92	3.85
M1SE	2.47	3.98	2.95	2.17	8.20	5.99	4.13	2.44	8.19
M2E	3.45	3.95	3.42	2.15	10.4	5.38	3.85	2.65	0.882
MC0	3.32	3.13	3.16	2.02	9.93	5.01	5.31	1.71	1.25

4.0 QA/QC

The health history of the test organisms used in the exposure was acceptable and met the requirements of the PSEP, US EPA and Environment Canada protocols. The tests met all control acceptability criteria and water quality parameters remained within ranges specified in the protocol throughout the test. Uncertainty associated with this test is best described by the standard deviation around the mean and/or the confidence intervals around the point estimates.

The results of the reference toxicant tests conducted during the testing program are summarized in Table 18. With the exception of the *E. estuarius*, results for this test fell within the range for organism performance of the mean and two standard deviations, based on historical results obtained by the laboratory with these tests. Thus, the sensitivity of the organisms used in these tests was appropriate.

The result for the *E. estuarius* reference toxicant test fell below the historical laboratory mean and two standard deviations. A through investigation was performed and the results indicated that proper procedures were followed and no technical errors occurred during testing. Approximately 5% of the reference toxicant test results could be expected to fall outside the two standard deviation range due to organism variability. Since no other unusual circumstances were observed, the organism sensitivity was considered acceptable.

Table 18. Reference toxicant test results.

Test Species	Endpoint	Historical Mean (2 SD Range)	CV (%)	Test Date
A. bahia	Survival (LC50): 326.6 mg/L Cd	242.3 (159.4 – 368.3) mg/L Cd	21	October 1, 2019
N. arenaceodentata	Survival (LC50): 10.6 mg/L Cd	9.1 (6.2 – 13.3) mg/L Cd	19	October 1, 2019
M. galloprovincialis	Normal development (EC50): 10.4 µg/L Cu	11.9 (8.3 – 17.0) µg/L Cu	18	October 16, 2019
E. estuarius	Survival (LC50): 3.6 mg/L Cd	6.3 (4.3 – 9.3) mg/L Cd	20	October 1, 2019
M. nasuta	Survival (LC50): 2.9 mg/L Cd	3.8 (2.5 – 5.7) mg/L Cd	20	September 13, 2019

SD = Standard Deviation, CV = Coefficient of Variation, IC = Inhibition Concentration, LC = Lethal Concentration

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5.0 REFERENCES

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**Appendices for Marine Sediment Toxicity Testing Final Reports (2014, 2017 and 2019) available upon request

Appendix D4 Sediment Chemistry Results (Maxxam) - 2019

	Conventional Parameters														
Parameter	Moisture	Chromium VI	Total Cyanide	Hardness (As Caco3)	pH	Soluble (2:1) pH	Chromium lll	N - Nh3 (As N)	TOC	C:N	Carbon	Calcium	Magnesium	Sulfur	TN
Units	%	mg/kg dry	mg/kg dry	mg/L	pH	pH	mg/kg dry	mg/L	%	No Units	%	mg/L	mg/L	%	%
MDL	0.3	0.08	1	0.5	0.1	0.1	0.5	0.75	0.05		0.05	0.5	0.5	0.06	0.2
CCME PEL															
BC CSR Typical															
WSDoE 2nd Lowest AET															
Macaulay Point															
M0	39	<0.08	<0.2	5,520	6.99	18.3	39	150	1.2	5.4	4.2	331	1,140	0.29	0.8
M100E	47	<0.08	<1	5,740	7.04	22.4	35	170	2.2	4.92	3.5	347	1,180	0.42	0.7
M100N	35	<0.08	<0.2	5,160	7.11	17.1	28	185	0.44	0.594	0.37	354	1,040	0.15	0.6
M100NW	35	<0.08	<0.2	5,370	7.32	17	29	230	0.38	0.732	0.45	362	1,090	0.15	0.6
M100SE	46	<0.08	<1	5,740	7.81	21.8	34	180	0.61	2.7	1.6	404	1,150	0.23	0.6
M100S	39	<0.08	<0.2	5,470	7.55	18.5	30	63	0.44	1.11	0.65	376	1,100	0.16	0.6
M100SW	39	<0.08	<0.2	5,370	8.09	18.5	31	78	0.77	1.01	0.53	371	1,080	0.19	0.5
M100W	43	<0.08	<1	5,600	8.13	20.3	30	50	1.1	1.01	0.52	390	1,120	0.21	0.5
M200E	42	<0.08	<1	5,220	8.14	20	30	140	1.6	3.35	1.8	300	1,090	0.27	0.5
M200NE	41	<0.08	0.75	5,940	8.11	19.6	29	85	0.92	3	2.1	412	1,190	0.56	0.7
M200SE	48	<0.08	<0.2	5,200	7.41	23	34	81	1.7	3.73	3.4	330	1,060	0.69	0.9
M400E	42	<0.08	<0.2	5,760	7.4	20	31	47	0.56	1.4	1.1	392	1,160	0.54	0.8
M400SE	41	<0.08	<0.2	5,390	7.43	19.3	85	83	1.1	2.12	1.5	344	1,100	0.59	0.7
M800E	39	<0.08	<1	5,520	8.06	18.7	30	43	0.41	1.12	0.78	377	1,110	0.59	0.7
AH5	36	<0.08	<0.2	5,500	8.08	17.7	25	44	0.23	0.544	0.4	352	1,120	0.16	0.7
AH10	37	<0.08	<0.2	5,630	7.26	17.7	28	32	0.32	0.484	0.42	386	1,130	0.22	0.9
FC4000ENE4000ENE	30	<0.08	<0.2	5,070	8.12	15.8	24	50	0.13	0.905	0.63	296	1,050	0.12	0.7
PB1	39	<0.08	<0.2	5,720	7.3	18.7	30	46	0.28	---	0.48	398	1,150	0.58	<0.2
PB2	37	<0.08	<1	5,720	7.94	18	30	31	0.23	---	0.49	400	1,150	0.56	<0.2
McLoughlin Point															
MC0	38	<0.08	0.32	5,510	7.97	18.2	30	75	1.1	2.17	1.6	350	1,130	0.46	0.7
MC100NW	38	<0.08	<0.2	5,760	8.01	18.3	29	48	0.37	1.01	0.69	401	1,160	0.79	0.7
MC200E	40	<0.08	<1	5,850	8.02	18.9	29	89	0.5	1.36	0.87	408	1,170	0.7	0.6
MC400E	41	<0.08	<0.2	5,470	8.01	19.9	31	63	0.84	2.54	1.3	338	1,120	0.67	0.5
MC800SE	40	<0.08	<1	5,490	7.99	19.3	30	49	0.56	5.95	1.3	344	1,120	0.57	0.2

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Particle Size				Metals											
Parameter	Particle Size, Clay	Particle Size, gravel	Particle Size, sand	Particle Size, silt	Aluminum	Antimony	Arsenic	Barium	Beryllium	Bismuth	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper
Units	%	%	%	%	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
MDL	2	2	2	2	100	0.1	0.2	0.1	0.2	0.1	1	0.05	100	0.5	0.1	0.5
CCME PEL							41.6					4.20		160		108
BC CSR Typical							50					5		190		130
WSDoE 2nd Lowest AET							93					6.7		270		390
Macaulay Point																
M0	6.3	9.2	71	14	15,500	1.77	13	122	0.36	0.23	29.4	0.939	8,600	39.2	7.47	162
M100E	8.3	4.5	63	24	14,200	1.59	13.8	92.2	0.33	0.18	39	0.905	6,600	35.3	7.15	90.1
M100N	8.3	4.6	67	20	15,300	0.35	6.73	47.4	0.42	<0.1	26.5	0.241	6,100	28.1	7.42	16.9
M100NW	8.3	<2	70	22	15,900	0.26	6.38	36	0.43	<0.1	24.3	0.306	4,950	28.9	7.73	41.2
M100SE	8.3	<2	65	27	15,800	0.74	7.32	59	0.37	0.33	28.9	0.929	5,560	34	7	196
M100S	8.2	2	62	28	15,800	0.66	6.66	82.1	0.42	0.12	27.6	0.316	6,390	30.3	7.3	22.6
M100SW	10	2.2	65	22	16,400	0.37	6.87	66.3	0.36	0.11	26.1	0.384	5,310	31.2	7.52	38.9
M100W	10	<2	62	26	16,100	0.36	7.61	99.8	0.39	0.11	27.9	0.516	5,320	29.8	7.39	26.9
M200E	8.1	8.1	62	22	14,400	1.46	10.4	120	0.36	0.12	30.4	0.606	6,560	29.5	7.38	52.4
M200NE	6.6	5.7	64	23	15,500	0.48	7.84	66.1	0.42	0.42	36.6	0.454	5,670	28.9	7.32	24.4
M200SE	5.7	13	61	21	13,700	2.01	9.07	108	0.34	5.04	31.4	0.715	5,780	34	6.68	39.6
M400E	7.9	<2	61	30	16,500	0.74	6.7	50.1	0.4	0.17	25.9	0.253	6,430	30.8	7.44	22.8
M400SE	7.4	4.9	60	28	16,200	1.55	8.81	180	0.38	0.12	29.3	36.3	6,800	84.8	8.07	55.3
M800E	7.8	<2	64	28	16,500	0.26	5.28	53.3	0.38	<0.1	26.7	0.24	6,410	29.7	7.53	18.3
AH5	8.2	5.8	62	24	14,700	0.2	6.99	30.6	0.34	<0.1	25.2	0.162	19,000	25.3	7.92	15.2
AH10	12	<2	65	22	15,200	0.2	5.45	39.7	0.38	<0.1	23	0.127	10,400	28.4	7.54	14.8
FC4000ENE	8.3	4.5	77	10	9,960	0.2	4.56	22	0.22	<0.1	22.2	0.128	43,700	23.8	6.31	9.63
PB1	5.4	<2	72	23	15,100	0.18	6.48	36.9	0.38	<0.1	22.2	0.125	6,610	29.6	7.81	12.8
PB2	6.3	<2	72	22	14,700	0.17	6.34	32.8	0.38	<0.1	23.6	0.123	6,900	30.1	7.79	12.2
McLoughlin Point																
MC0	7.9	4.6	63	25	16,800	0.32	7.07	63.9	0.38	0.1	28.7	0.23	7,760	30.4	7.61	24.5
MC100NW	9.1	<2	65	26	16,300	0.38	5.97	41.1	0.37	<0.1	24.6	0.222	6,560	29.2	7.5	21.7
MC200E	5.4	<2	74	20	15,800	0.31	5.46	64	0.39	0.13	23.1	0.231	5,310	28.6	7.58	18.7
MC400E	5.8	<2	63	30	17,200	0.73	7.82	104	0.42	0.62	32	0.576	7,270	30.6	9.16	91.5
MC800SE	6.2	<2	67	26	16,100	0.81	8.28	114	0.42	0.14	35.4	0.29	9,950	29.6	7.94	35.5

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Metals													
Parameter	Iron	Lead	Lithium	Magnesium	Manganese	Mercury	Molybdenum	Nickel	P - Po4 - Total (As P)	Potassium	Selenium	Silver	Sodium	Strontium
Units	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
MDL	100	0.1	0.5	100	0.2	0.05	0.1	0.5	10	100	0.5	0.05	100	0.1
CCME PEL		112				0.700		42.8				1.77		
BC CSR Typical		130				0.84								
WSDoE 2nd Lowest AET		530				0.59						6.1		
Macaulay Point														
M0	28,000	70.3	19.3	7,530	234	17.7	6.48	22.9	1,440	2,070	0.53	10.9	6,270	81.8
M100E	29,100	107	19.2	7,010	192	0.132	10.6	23.2	855	2,030	0.71	0.284	8,050	86.1
M100N	27,100	13	22.9	7,750	210	0.117	1.11	20.4	679	2,450	<0.5	0.066	7,120	52.6
M100NW	27,000	15	24.2	7,970	209	0.08	1.49	20.6	617	2,470	<0.5	0.065	6,880	41.8
M100SE	25,200	15.8	23.1	7,470	199	0.069	5.46	19.9	728	2,380	<0.5	0.127	8,010	56.2
M100S	27,400	94.4	23.7	7,780	231	0.063	2.69	20.5	705	2,380	<0.5	0.07	8,430	54.4
M100SW	28,200	31.5	21.1	8,030	207	0.061	3.42	25.6	671	2,490	<0.5	0.118	9,810	59.9
M100W	27,000	24.3	23.4	7,820	217	0.065	4.31	21.2	642	2,450	<0.5	0.875	8,710	53.6
M200E	25,800	186	20.4	8,390	202	3.64	4.3	28.3	709	2,020	0.5	0.139	7,450	64.1
M200NE	25,700	28.8	22.4	7,670	207	0.108	3.48	21	715	2,340	<0.5	0.562	9,240	54.1
M200SE	23,400	157	20	7,310	188	0.08	6.07	19.8	716	1,970	0.53	0.331	7,210	50.7
M400E	28,200	20.1	22.6	7,920	222	0.057	1.52	20.7	761	2,350	<0.5	0.063	7,360	51.3
M400SE	29,900	70.1	22.1	7,750	241	0.254	3.74	66.3	758	2,320	<0.5	0.087	7,850	60.7
M800E	27,600	27.3	24.7	7,970	228	0.055	0.93	20.7	670	2,450	<0.5	0.139	8,140	54.4
AH5	25,700	6.76	19.2	7,520	229	<0.05	0.56	19.4	635	2,310	<0.5	<0.05	5,870	98.5
AH10	27,300	7.79	21.9	7,650	223	<0.05	0.48	20.5	611	2,240	<0.5	<0.05	7,330	58.3
FC4000ENE	21,200	4.38	14	6,420	201	<0.05	0.48	17.8	480	1,830	<0.5	<0.05	5,930	223
PB1	28,100	6.89	22.4	7,870	233	<0.05	0.36	21.3	680	2,130	<0.5	<0.05	5,010	42.3
PB2	27,900	6.56	21.4	7,850	230	<0.05	0.34	21.2	633	2,170	<0.05	<0.05	5,900	43.8
McLoughlin Point														
MC0	28,000	19.2	23.6	7,910	241	<0.05	1.12	21.5	757	2,490	<0.5	0.073	8,060	61.6
MC100NW	28,400	13.4	23.3	7,800	216	0.061	1.22	21.6	639	2,380	<0.5	0.065	7,540	52.7
MC200E	26,600	13.3	24.5	7,810	211	0.05	1.07	20.3	641	2,390	<0.5	0.124	6,970	46.3
MC400E	31,100	53.3	23.1	8,120	257	0.12	2.72	24.8	837	2,400	<0.5	0.107	8,270	75
MC800SE	31,200	107	22.6	7,770	235	0.087	1.4	23.4	832	2,280	<0.5	0.115	6,830	131

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Metals								Phenolic Compounds	Chlorinated Phenolics			
Parameter	Thallium	Tin	Titanium	Tungsten	Uranium	Vanadium	Zinc	Zirconium	Total Phenols	2-Chlorophenol	2,5-Dichlorophenol	4-Chloro-3-Methylphenol	Pentachlorophenol
Units	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry
MDL	0.05	0.1	1	0.5	0.05	1	1	0.5	0.02	0.4	0.4	0.4	0.8
CCME PEL							271						
BC CSR Typical							330						0.69
WSDoE 2nd Lowest AET							960						0.69
Macaulay Point													
M0	0.178	61.7	825	<0.5	2.38	52.8	244	2.81	1.5	<0.4	<0.4	<0.4	<0.8
M100E	0.19	60	813	<0.5	3.02	51.2	163	2.5	0.75	<0.4	<0.4	<0.4	<0.8
M100N	0.139	8.26	972	<0.5	1.11	51.3	60.9	7.78	1	<0.4	<0.4	<0.4	<0.8
M100NW	0.167	3.09	996	<0.5	1.32	51.6	63.6	5.24	1.7	<0.4	<0.4	<0.4	<0.8
M100SE	0.17	9.47	973	<0.5	1.9	51.7	83.9	3.23	1.9	<0.4	<0.4	<0.4	<0.8
M100S	0.144	25.3	981	<0.5	1.56	52.2	68.2	3.75	0.43	<0.4	<0.4	<0.4	<0.8
M100SW	0.149	18.5	1,010	<0.5	1.74	52.7	71.1	7.37	0.33	<0.4	<0.4	<0.4	<0.8
M100W	0.18	42.8	1,030	<0.5	1.74	53.1	101	4.81	0.36	<0.4	<0.4	<0.4	<0.8
M200E	0.171	48.2	877	<0.5	2	50.4	186	3.68	0.21	<0.4	<0.4	<0.4	<0.8
M200NE	0.169	11.6	1,020	<0.5	1.73	53.1	97.4	4.83	0.36	<0.4	<0.4	<0.4	<0.8
M200SE	0.176	39.2	806	0.58	1.99	48.6	131	2.14	0.66	<0.4	<0.4	<0.4	<0.8
M400E	0.146	6.5	992	<0.5	1.3	53.7	80.6	5.75	0.59	<0.4	<0.4	<0.4	<0.8
M400SE	0.163	71.6	1,070	<0.5	1.87	55.5	154	3.34	0.31	<0.4	<0.4	<0.4	<0.8
M800E	0.114	11.9	1,030	<0.5	1.02	52.7	65.2	7.93	0.043	<0.4	<0.4	<0.4	<0.8
AH5	0.178	0.51	956	<0.5	0.906	52.2	51.2	6.04	1.0	<0.2	<0.2	<0.2	<0.4
AH10	0.112	0.64	925	<0.5	0.787	54.2	55.9	7.76	0.27	<0.4	<0.4	<0.4	<0.8
FC4000ENE4000ENE	0.125	0.31	651	<0.5	0.753	42.3	38.7	2.48	0.31	<0.2	<0.2	<0.2	<0.4
PB1	0.127	0.53	951	<0.5	0.606	53.6	55	7.62	0.8	<0.4	<0.4	<0.4	<0.8
PB2	0.131	0.5	982	<0.5	0.585	52.7	53.7	6.84	0.18	<0.2	<0.2	<0.2	<0.4
McLoughlin Point													
MC0	0.123	28.9	1,060	<0.5	1.07	55.2	72.2	4.94	0.51	<0.4	<0.4	<0.4	<0.8
MC100NW	0.133	15.1	989	<0.5	1.15	51.8	61.1	5.71	0.21	<0.2	<0.2	<0.2	<0.4
MC200E	0.132	4.98	948	<0.5	1.08	51.1	75.8	8.43	0.44	<0.4	<0.4	<0.4	<0.8
MC400E	0.151	35.4	1,000	<0.5	1.47	55.6	227	6.45	0.38	<0.4	<0.4	<0.4	<0.8
MC800SE	0.129	45.7	918	<0.5	1.7	53.1	91.7	5.42	0.1	<0.4	<0.4	<0.4	<0.8

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Non-Chlorinated Phenolics						Semi-Volatile Organics					
Parameter	2,4-dimethylphenol	2,4-dinitrophenol	2-Nitrophenol	2-Methyl-4,6-Dinitrophenol	4-Nitrophenol	Phenol	Bis(2-Ethylhexyl) Phthalate	Butylbenzyl Phthalate	Diethyl Phthalate	Dimethyl Phthalate	Di-N-Butyl Phthalate	Di-N-Octyl Phthalate
Units	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry
MDL	0.4	4	2	2	2	0.8	2	0.8	0.8	0.8	0.8	2
CCME PEL												
BC CSR Typical												
WSDoE 2nd Lowest AET	0.029					1.2						
Macaulay Point												
M0	<0.4	<4	<2	<2	<2	<0.8	7.8	<0.8	<0.8	<0.8	<0.8	<2
M100E	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M100N	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M100NW	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M100SE	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M100S	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M100SW	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M100W	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M200E	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M200NE	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M200SE	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M400E	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M400SE	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
M800E	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
AH5	<0.2	<2	<1	<1	<1	<0.4	<1	<0.4	<0.4	<0.4	<0.4	<1
AH10	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
FC4000ENE	<0.2	<2	<1	<1	<1	<0.4	<1	<0.4	<0.4	<0.4	<0.4	<1
PB1	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
PB2	<0.2	<2	<1	<1	<1	<0.4	<1	<0.4	<0.4	<0.4	<0.4	<1
McLoughlin Point												
MC0	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
MC100NW	<0.2	<2	<1	<1	<1	<0.4	<1	<0.4	<0.4	<0.4	<0.4	<1
MC200E	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
MC400E	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2
MC800SE	<0.4	<4	<2	<2	<2	<0.8	<2	<0.8	<0.8	<0.8	<0.8	<2

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Miscellaneous Semi-Volatile Organics									
Parameter	1,2,4-trichlorobenzene	1,3,5-trimethylbenzene	2,4-dinitrotoluene	2,6-dinitrotoluene	3,3-dichlorobenzidine	4-Bromophenyl Phenyl Ether	4-Chlorophenyl Phenyl Ether	Bis(2-Chloroethoxy)Methane	Bis(2-Chloroethyl)Ether	Bis(2-Chloroisopropyl)Ether
Units	µg/g dry	mg/kg dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry
MDL	0.8	0.2	0.4	0.4	2	0.4	0.4	0.4	0.8	0.4
CCME PEL										
BC CSR Typical										
WSDoE 2nd Lowest AET	0.051									
Macaulay Point										
M0	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M100E	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M100N	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M100NW	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M100SE	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M100S	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M100SW	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M100W	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M200E	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M200NE	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M200SE	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M400E	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M400SE	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
M800E	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
AH5	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.4	<0.2
AH10	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
FC4000ENE4000ENE	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.4	<0.2
PB1	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
PB2	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.4	<0.2
McLoughlin Point										
MC0	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
MC100NW	<0.4	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.4	<0.2
MC200E	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
MC400E	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4
MC800SE	<0.8	<0.2	<0.4	<0.4	<2	<0.4	<0.4	<0.4	<0.8	<0.4

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Miscellaneous Semi-Volatile Organics									
Parameter	Hexachlorobenzene	Hexachlorobutadiene	Hexachlorobutadiene	Hexachlorocyclopentadiene	Hexachloroethane	Isophorone	Isopropylbenzene	Nitrobenzene	Nitrosodiphenylamine/ Diphenylamine	N-Nitrosodi-N-Propylamine
Units	µg/g dry	µg/g dry	mg/kg dry	µg/g dry	µg/g dry	µg/g dry	mg/kg dry	µg/g dry	µg/g dry	µg/g dry
MDL	0.8	0.4	0.2	2	0.4	0.4	0.2	0.4	0.8	0.4
CCME PEL										
BC CSR Typical										
WSDoE 2nd Lowest AET	0.07									
Macaulay Point										
M0	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M100E	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M100N	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M100NW	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M100SE	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M100S	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M100SW	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M100W	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M200E	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M200NE	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M200SE	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M400E	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M400SE	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
M800E	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
AH5	<0.4	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2
AH10	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
FC4000ENE	<0.4	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2
PB1	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
PB2	<0.4	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2
McLoughlin Point										
MC0	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
MC100NW	<0.4	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.4	<0.2
MC200E	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
MC400E	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4
MC800SE	<0.8	<0.4	<0.2	<2	<0.4	<0.4	<0.2	<0.4	<0.8	<0.4

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Monocyclic Aromatic Hydrocarbons											
Parameter	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene	Benzene	Bromobenzene	Chlorobenzene	Ethylbenzene	M & P Xylenes	O-Xylene	Styrene	Toluene	Xylenes
Units	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
MDL	0.02	0.02	0.02	0.005	0.2	0.02	0.01	0.04	0.04	0.03	0.05	0.04
CCME PEL												
BC CSR Typical												
WSDoE 2nd Lowest AET												
Macaulay Point												
M0	<0.02	<0.02	0.46	0.012	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	0.077	<0.04
M100E	<0.02	<0.02	0.028	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	0.14	<0.04
M100N	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
M100NW	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
M100SE	<0.02	<0.02	<0.02	0.0073	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
M100S	<0.02	<0.02	<0.02	0.0069	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
M100SW	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
M100W	<0.02	<0.02	0.036	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
M200E	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	0.085	<0.04
M200NE	<0.02	<0.02	0.028	0.01	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	0.068	<0.04
M200SE	<0.02	<0.02	0.045	0.012	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	0.062	<0.04
M400E	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
M400SE	<0.02	<0.02	0.055	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
M800E	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	0.012	<0.04	<0.04	<0.03	<0.05	<0.04
AH5	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	0.08	<0.04
AH10	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
FC4000ENE4000ENE	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
PB1	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
PB2	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
McLoughlin Point												
MC0	<0.02	<0.02	0.02	0.0085	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	0.064	<0.04
MC100NW	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
MC200E	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
MC400E	<0.02	<0.02	<0.02	0.0054	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04
MC800SE	<0.02	<0.02	<0.02	<0.005	<0.2	<0.02	<0.01	<0.04	<0.04	<0.03	<0.05	<0.04

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Polycyclic Aromatic Hydrocarbons (PAH)											
Parameter	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(A) Anthracene	Benzo(A) Pyrene	Benzo(B) Fluoranthene	Benzo(B) Fluoranthene + Benzo(J) Fluoranthene	Benzo(G,H,I) Perylene	Benzo(K) Fluoranthene	Chrysene	Dibenzo(A,H) Anthracene
Units	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
MDL	0.001	0.0005	0.0005	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.0005
CCME PEL	0.201	0.0889	0.128	0.245	0.693	0.763					0.846	0.135
BC CSR Typical	0.240	0.110	0.150	0.290	0.830	0.920					1.00	0.160
WSDoE 2nd Lowest AET		1.30	0.960	0.500	1.60	1.60			0.720		2.80	0.230
Macaulay Point												
M0	0.0075	0.01	0.0046	0.031	0.096	0.078	0.068	0.1	0.037	0.037	0.082	0.011
M100E	0.022	0.012	0.006	0.031	0.061	0.04	0.058	0.09	0.025	0.027	0.063	0.0066
M100N	0.012	0.0029	0.0078	0.011	0.095	0.11	0.086	0.13	0.059	0.051	0.088	0.018
M100NW	0.008	0.019	0.0043	0.048	0.11	0.11	0.084	0.13	0.052	0.049	0.1	0.018
M100SE	0.017	0.051	0.0035	0.16	0.42	0.36	0.28	0.43	0.15	0.16	0.38	0.062
M100S	0.014	0.0026	0.0067	0.013	0.13	0.16	0.16	0.27	0.074	0.082	0.14	0.019
M100SW	0.0096	0.0021	0.012	0.028	0.099	0.084	0.085	0.14	0.047	0.042	0.11	0.0083
M100W	0.013	0.0023	0.003	0.0091	0.061	0.059	0.049	0.075	0.032	0.029	0.061	0.0091
M200E	0.12	0.26	0.012	0.42	0.51	0.47	0.3	0.49	0.19	0.19	0.51	0.068
M200NE	0.012	0.0031	0.0051	0.012	0.059	0.061	0.051	0.079	0.034	0.028	0.06	0.0097
M200SE	0.024	0.067	0.019	0.21	0.64	0.62	0.5	0.77	0.24	0.3	0.62	0.098
M400E	0.45	0.47	0.026	0.89	0.88	0.7	0.38	0.65	0.21	0.27	0.85	0.085
M400SE	0.13	0.17	0.011	0.28	0.29	0.25	0.16	0.25	0.091	0.1	0.32	0.038
M800E	0.012	0.002	0.0056	0.01	0.052	0.066	0.053	0.08	0.038	0.028	0.054	0.01
AH5	0.0065	0.00093	0.00062	0.0014	0.0031	0.0036	0.0047	0.0062	0.0039	0.0016	0.0053	0.00062
AH10	0.0097	0.0016	0.00063	0.0043	0.029	0.031	0.025	0.037	0.018	0.013	0.03	0.0046
FC4000ENE	0.0029	<0.0005	<0.0005	<0.001	0.0014	0.0019	0.0024	0.0024	0.0021	0.001	0.0027	<0.0005
PB1	0.0082	0.00098	0.00098	0.002	0.0048	0.0046	0.0056	0.0077	0.0038	0.0021	0.0072	0.00082
PB2	0.008	0.0008	0.00064	0.0014	0.003	0.0033	0.0048	0.0064	0.0033	0.0014	0.0057	0.00064
McLoughlin Point												
MC0	0.015	0.014	0.019	0.076	0.22	0.2	0.12	0.2	0.083	0.079	0.21	0.029
MC100NW	0.0094	0.0016	0.0019	0.0044	0.0065	0.0076	0.0092	0.013	0.0081	0.0037	0.0097	0.0013
MC200E	0.013	0.013	0.0037	0.03	0.041	0.038	0.03	0.047	0.019	0.017	0.043	0.0063
MC400E	0.011	0.065	0.0019	0.12	0.25	0.25	0.19	0.29	0.1	0.11	0.24	0.035
MC800SE	0.14	0.26	0.085	0.52	0.56	0.49	0.34	0.53	0.2	0.21	0.51	0.076

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Polycyclic Aromatic Hydrocarbons (PAH)								
Parameter	Fluoranthene	Fluorene	Indeno(1,2,3-C,D)Pyrene	Naphthalene	Phenanthrene	Pyrene	Total Hmw-PAHs	Total Lmw-PAHs	Total PAHs
Units	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
MDL	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.001	0.001
CCME PEL	1.494	0.144		0.391	0.544	1.398			
BC CSR Typical	1.80	0.170		0.470	0.650	1.70			20
WSDoE 2nd Lowest AET	2.50	0.540	0.690	2.10	1.50	3.30			
Macaulay Point									
M0	0.27	0.013	0.04	0.0097	0.11	0.21	0.74	0.18	0.93
M100E	0.16	0.016	0.023	0.041	0.069	0.15	0.47	0.2	0.67
M100N	0.1	0.0066	0.064	0.011	0.028	0.1	0.52	0.08	0.6
M100NW	0.26	0.014	0.059	0.0051	0.14	0.2	0.8	0.24	1
M100SE	0.87	0.052	0.19	0.02	0.41	0.69	2.8	0.71	3.5
M100S	0.23	0.0081	0.088	0.0091	0.039	0.48	1.2	0.093	1.3
M100SW	0.21	0.0075	0.052	0.005	0.031	0.55	1.1	0.095	1.2
M100W	0.14	0.0063	0.034	0.0065	0.027	0.13	0.46	0.067	0.53
M200E	1.2	0.28	0.21	0.15	1.5	1.2	4	2.7	6.7
M200NE	0.11	0.0075	0.035	0.012	0.03	0.1	0.4	0.082	0.48
M200SE	1.4	0.059	0.32	0.027	0.65	1.1	4.5	1.1	5.6
M400E	2.2	0.69	0.25	0.52	3.4	2.3	7	6.5	13
M400SE	0.55	0.25	0.1	0.19	0.91	0.58	2	1.9	4
M800E	0.11	0.0074	0.041	0.0062	0.038	0.11	0.4	0.082	0.48
AH5	0.0078	0.0034	0.0028	0.0025	0.01	0.0098	0.03	0.026	0.056
AH10	0.068	0.0049	0.018	0.0036	0.023	0.061	0.22	0.048	0.27
FC4000ENE4000ENE	0.0039	0.0013	<0.002	<0.001	0.0051	0.0039	0.014	0.0093	0.023
PB1	0.011	0.0039	0.0033	0.003	0.015	0.011	0.039	0.034	0.073
PB2	0.008	0.0038	0.003	0.0029	0.012	0.0078	0.029	0.03	0.058
McLoughlin Point									
MC0	0.39	0.029	0.087	0.01	0.23	0.46	1.5	0.4	1.9
MC100NW	0.02	0.0055	0.0066	0.0065	0.018	0.022	0.066	0.048	0.11
MC200E	0.1	0.016	0.021	0.0096	0.089	0.091	0.32	0.17	0.49
MC400E	0.49	0.051	0.13	0.007	0.37	0.39	1.7	0.63	2.3
MC800SE	1.4	0.32	0.24	0.35	1.7	1.1	4.1	3.3	7.5

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Chlorinated Aliphatic										
Parameter	1,1,1,2-Tetrachloroethane	1,1,1-trichloroethane	1,1,2,2-tetrachloroethane	1,1,2-trichloroethane	1,1-dichloroethane	1,1-dichloroethene	1,2,3-Trichlorobenzene	1,2-dibromoethane	1,2-dichloroethane	1,2-dichloropropane	Bromomethane
Units	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
MDL	0.02	0.02	0.02	0.02	0.025	0.025	0.03	0.02	0.02	0.02	0.3
CCME PEL											
BC CSR Typical											
WSDoE 2nd Lowest AET											
Macaulay Point											
M0	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	0.024	<0.02	<0.3
M100E	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M100N	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M100NW	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M100SE	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M100S	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M100SW	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M100W	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M200E	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M200NE	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M200SE	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M400E	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M400SE	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
M800E	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
AH5	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
AH10	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
FC4000ENE	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
PB1	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
PB2	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
McLoughlin Point											
MC0	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
MC100NW	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
MC200E	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
MC400E	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3
MC800SE	<0.02	<0.02	<0.02	<0.02	<0.025	<0.025	<0.03	<0.02	<0.02	<0.02	<0.3

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Chlorinated Aliphatic									Trihalomethanes			
Parameter	Chloroethane	Chloroethene	Chloromethane	Cis-1,2-Dichloroethene	cis-1,3-dichloropropene	Csr Vh C6-C10 (Includes Btex)	Dibro-momethane	Tetra-chloroethene	Tetrachloro-methane	Bromodichloro-methane	Chlorodibromo-methane	Tribromo-methane	Trichloro-methane
Units	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry
MDL	0.1	0.04	0.05	0.03	0.02	10	0.08	0.01	0.02	0.05	0.05	0.05	0.02
CCME PEL													
BC CSR Typical													
WSDoE 2nd Lowest AET													
Macaulay Point													
M0	<0.1	<0.04	<0.016	<0.03	<0.02	<10	<0.08	0.044	<0.02	<0.05	<0.05	<0.05	<0.02
M100E	<0.1	<0.04	<0.19	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M100N	<0.1	<0.04	<0.11	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M100NW	<0.1	<0.04	<0.15	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M100SE	<0.1	<0.04	<0.23	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M100S	<0.1	<0.04	<0.14	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M100SW	<0.1	<0.04	<0.17	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M100W	<0.1	<0.04	<0.23	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M200E	<0.1	<0.04	<0.2	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M200NE	<0.1	<0.04	<0.14	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M200SE	<0.1	<0.04	<0.2	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M400E	<0.1	<0.04	<0.16	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
M400SE	<0.1	<0.04	<0.05	<0.03	<0.02	<10	<0.08	0.036	<0.02	<0.05	<0.05	<0.05	<0.02
M800E	<0.1	<0.04	<0.05	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
AH5	<0.1	<0.04	<0.089	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
AH10	<0.1	<0.04	<0.062	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
FC4000ENE4000ENE	<0.1	<0.04	<0.087	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
PB1	<0.1	<0.04	<0.05	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
PB2	<0.1	<0.04	<0.05	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
McLoughlin Point													
MC0	<0.1	<0.04	<0.05	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
MC100NW	<0.1	<0.04	<0.05	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
MC200E	<0.1	<0.04	<0.05	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
MC400E	<0.1	<0.04	<0.05	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02
MC800SE	<0.1	<0.04	<0.05	<0.03	<0.02	<10	<0.08	<0.01	<0.02	<0.05	<0.05	<0.05	<0.02

Appendix D4 Sediment Chemistry Results (Maxxam), cont'd

	Aliphatic					Ketones	Pesticides								
Parameter	Methyl Tertiary Butyl Ether	Trans-1,2-Dichloroethene	trans-1,3-dichloropropene	Trichloroethene	Trichloro-fluoromethane	Endrin Ketone	ALDR+ DELDR	Chlordane	DDT + Metabolites	Endosulfan, Total	Heptachlor + Heptachlor epoxide	OPDDD& PPDDD	OPDDE& PPDDE	OPDDT& PPDDT	VPH
Units	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	mg/kg dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	µg/g dry	mg/kg dry
MDL	0.1	0.03	0.02	0.009	0.2	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	10
CCME PEL								0.0048			0.0027				
BC CSR Typical						0.075		0.0057	0.0057		0.0033				
WSDoE 2nd Lowest AET															
Macaulay Point															
M0	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
M100E	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
M100N	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<10
M100NW	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
M100SE	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
M100S	<0.1	<0.03	<0.02	<0.009	<0.2	<0.003	---	---	---	---	---	---	---	---	<10
M100SW	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
M100W	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
M200E	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<10
M200NE	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
M200SE	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
M400E	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
M400SE	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<10
M800E	<0.1	<0.03	<0.02	<0.009	<0.2	<0.003	---	---	---	---	---	---	---	---	<10
AH5	<0.1	<0.03	<0.02	<0.009	<0.2	<0.003	---	---	---	---	---	---	---	---	<10
AH10	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
FC4000ENE	<0.1	<0.03	<0.02	<0.009	<0.2	<0.003	---	---	---	---	---	---	---	---	<10
PB1	<0.1	<0.03	<0.02	<0.009	<0.2	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<10
PB2	<0.1	<0.03	<0.02	<0.009	<0.2	<0.003	---	---	---	---	---	---	---	---	<10
McLoughlin Point															
MC0	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
MC100NW	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<10
MC200E	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
MC400E	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10
MC800SE	<0.1	<0.03	<0.02	<0.009	<0.2	<0.004	---	---	---	---	---	---	---	---	<10

***Note:**
Method detection limits (MDL) are not given for high-resolution data as they are result specific rather than sample specific
NDR: data not quantifiable

Appendix D4 Sediment Chemistry Results (AXYS)

	Nonylphenols				Polycyclic Aromatic Hydrocarbons								
Parameter	4-Nonylphenol Diethoxylates	4-Nonylphenol Monoethoxylates	4-Nonylphenols	Octylphenol	1-Methylphen-anthrene	2,3,5-trimethyl-naphthalene	2,6-dimethy-lnaphthalene	2-Methyl-naphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(A) Anthracene	Benzo(A) Pyrene
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL									123	245	89	693	763
BC CSR Typical								240	110	150	290	830	920
WSDoE 2nd Lowest AET									1,300	960	500	1,600	1,600
Macaulay Point													
M0	43.6	43.4	161	0.186	790	216	98.2	97.1	1,790	11.8	3,670	6,760	6,280
M100E	<2.96	18.6	228	<0.337	359	140	96.5	157	394	9.7	970	4,010	3,410
M100N	<1.43	6.85	23.2	<0.0625	27.9	32.5	37.1	46.5	5.2	2.73	11.4	132	129
M100NW	10.2	5.24	26.5	<0.102	23.3	35.6	37.8	52	3.24	2.83	8.23	21.4	19.2
M100SE	8.35	25.5	59.9	<0.0896	71.3	82.1	77.5	140	15.9	14.8	87.5	276	252
M100S	<1.22	8.19	29.9	<0.0985	52.7	50.1	52.5	67.4	11.7	12.4	30.9	61.2	97.9
M100SW	10.7	20.2	45.6	<0.0965	31.7	38.9	45.7	62.1	12.6	3.36	24.4	71.4	69
M100W	9.89	20.1	42.3	<0.0929	121	191	67.6	73.8	59.2	5.93	131	368	331
M200E	24.5	26	119	<0.122	216	154	81.4	78.6	241	7.89	573	2,230	2,180
M200NE	15.2	8.53	95.3	<0.114	44.9	67.2	53.9	67	26.5	17.1	62	133	165
M200SE	33.5	47.7	104	0.193	218	133	89.4	120	164	96	488	1,380	1,590
M400E	2.97	13.1	18.5	0.083	55.3	69.4	61.1	90	20.8	15.2	69.1	160	169
M400SE	6.4	15.9	48.3	<0.0488	92.7	133	86.3	80.3	23.9	10.2	56.6	118	117
M800E	<0.345	2.53	9.27	<0.118	55.5	93.6	93.1	200	5.01	3.97	15.1	28.3	26.6
AH5	<0.526	<0.557	1.48	<0.0568	16.9	19.1	28.1	37.6	1.3	1.56	2.07	7.04	6.72
AH10	<0.729	1.07	3.41	<0.0808	14.7	25.7	35	43.1	1.44	0.353	1.6	4.39	4.3
FC4000ENE4000ENE	<0.531	0.727	1	<0.22	5.94	10.7	12.5	14.2	0.587	0.172	0.904	2.03	1.64
PB1	<0.422	1.22	2.78	<0.0682	14.6	24.5	27.7	28.6	1.27	0.406	1.35	3.19	2.58
PB2	<0.133	0.602	1.22	<0.0604	13	22.3	25.6	29.3	1.2	0.463	1.32	3.21	2.84
McLoughlin Point													
MC0	2.09	<0.883	16.2	0.3	50.1	98.5	55.1	77.6	13.5	32.3	50.8	166	183
MC100NW	1.26	5.11	14.7	<0.0781	20.9	33.1	35.9	40.9	4.28	4.71	12.6	34.5	31.8
MC200E	1.98	1.98	11.9	<0.0584	23.7	50.7	49.7	68.7	5.38	8.1	8.5	8.69	8.56
MC400E	3.97	14.8	28.3	0.091	37.4	143	74.7	112	3.65	4.79	9.73	26.2	31.5
MC800SE	2.91	8.4	16.3	0.266	41.3	93.1	54.8	60.4	7.88	47.7	24.8	150	124

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polycyclic Aromatic Hydrocarbons													
Parameter	Benzo(B) Fluoranthene	Benzo(E) Pyrene	Benzo(G,H,I) Perylene	Benzo[J,K] Fluoranthenes	Chrysene	Dibenzo(A,H) Anthracene	Dibenzothiophene	Fluoranthene	Fluorene	Indeno (1,2,3-C,D) Pyrene	Naphthalene	Perylene	Phenanthrene	Pyrene
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL					846	135		1,494	144		391		544	1,398
BC CSR Typical					1,000	160		1,800	170		470		650	1,700
WSDoE 2nd Lowest AET			720		2,800	230		2,500	540	690	2,100		1,500	3,300
Macaulay Point														
M0	3,550	3,500	3,550	4,040	7,080	631	829	13,600	908	3,820	78.3	1,550	11,000	10,100
M100E	2,680	2,080	2,090	2,790	4,020	408	190	5,760	229	2,160	200	826	3,200	4,710
M100N	110	90.8	73.2	119	131	22.5	5.28	192	9.43	81.9	43.3	51.6	63.1	180
M100NW	18	16.4	13.6	18.6	27.2	4.13	4.31	38.3	8.56	14.4	44.1	18.7	57.5	39.5
M100SE	203	186	143	234	290	48.9	16.6	476	21.8	159	106	78.4	272	394
M100S	113	98.4	77.8	123	155	17.3	17.7	327	13.7	81.5	44.4	32.4	385	263
M100SW	68	62.2	48.6	70.4	79.4	15.4	7.81	137	9.61	49.9	39.4	39.3	125	122
M100W	258		189	283	419	53.6	40	710	67.9	199	54.8	104	618	724
M200E	1,760	1,490	1,750	1,580	2,220	268	151	4,310	149	1,740	89.8	585	2,130	3,740
M200NE	141	116	110	133	149	25.5	24.1	294	25	102	72.6	66.2	280	295
M200SE	1,470	1,150	1,180	1,530	2,140	215	150	3,580	170	1,150	167	344	2,550	3,230
M400E	130	107	107	137	165	24.6	18.8	372	22.1	106	89.6	60.6	277	356
M400SE	88	74.7	90.4	99.6	131	21.4	25.4	227	24.3	81.7	60	42	252	216
M800E	22.7	18.2	16.2	22.9	34.7	4.36	12.5	54.1	11.5	15.9	135	25.6	107	56.3
AH5	6.94	5.91	5.45	5.74	11.3	1.35	3.21	9.7	5.51	4.72	23.4	20.5	37.4	13.6
AH10	5.98	4.99	4.34	3.18	8.97	0.944	3.41	9.27	7.47	3.42	19.3	18.6	41.7	9.83
FC4000ENE	2.72	2.36	2.19	1.47	4.09	0.432	1.15	4.51	2.33	1.51	6.81	10.8	14.1	4.4
PB1	3.65	3.03	3.03	2.06	7.13	0.645	2.72	7.42	5.78	2.04	11.7	16.5	34.5	8.02
PB2	3.76	3.03	3.14	2.2	6.97	0.635	2.55	7.6	5.07	2.29	12.3	16.6	31.8	8.17
McLoughlin Point														
MC0	121	106	101	140	175	28.3	14.3	276	21.3	101	60.3	59.3	200	349
MC100NW	34.8	30.4	29.1	32.3	42	5.6	5.45	80.6	10.7	26	30.1	27.3	77.7	90.7
MC200E	9.22	8.67	9.52	7.24	14.4	1.84	6.11	24.1	13.9	6.95	81.8	21.1	65.7	27.6
MC400E	32.1	26.4	24.6	29.9	37	6.61	5.34	42.6	10.6	22.1	83.9	20.3	67.9	48.4
MC800SE	86.3	72.3	59.3	117	165	18	7.1	152	13.7	63.5	44.4	45.2	91.8	200

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polybrominated Diphenyl Ethers												
Parameter	Pbde 7	Pbde 8/11	Pbde 10	Pbde 12/13	Pbde 15	Pbde 17/25	Pbde 28/33	Pbde 30	Pbde 32	Pbde 35	Pbde 37	Pbde 47	Pbde 49
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL													
BC CSR Typical													
WSDoE 2nd Lowest AET													
Macaulay Point													
M0	42	24.6	<0.17	2.69	10.1	125	25.8	<0.289	0.646	<0.193	0.622	670	127
M100E	61.3	34.5	<0.528	2.27	8.67	159	31.5	4.02	1.2	<0.926	<0.876	891	175
M100N	11.6	12.6	<0.201	1.04	4.34	25.8	11.4	<0.142	0.546	0.197	0.391	122	21.2
M100NW	9.82	11.2	<0.0983	0.751	4.43	25.5	15.5	<0.127	0.388	0.121	0.665	487	30.1
M100SE	28.2	18.4	<0.102	1.82	8.71	83.6	22.9	<0.17	0.613	0.321	0.676	432	86
M100S	21.5	12.1	<0.153	0.886	3.91	38.7	13.1	<0.111	0.461	0.122	0.555	188	34
M100SW	24.6	20.2	<0.127	1.71	7.22	49.1	28.9	<0.206	0.496	0.26	0.918	1340	67.7
M100W	20.7	13.4	<0.975	1.25	5.12	42.1	11.2	<1.1	<0.868	0.805	<0.7	201	40.9
M200E	31	21.8	<0.107	1.54	5.99	76.7	23.2	<0.154	0.516	0.533	0.731	365	71.9
M200NE	29.4	18.2	<0.19	1.21	5.92	71	19.4	<0.336	0.584	<0.251	0.826	415	71.9
M200SE	57.7	28.7	<0.142	1.69	7.62	122	23.2	<0.355	0.635	0.334	0.798	487	117
M400E	21.1	14.9	<0.049	1.07	3.83	33.2	13.3	<0.133	0.373	<0.0994	0.567	159	29.7
M400SE	27.3	17	<0.0493	1	5.72	58.4	17.1	<0.122	0.438	0.167	0.626	291	48.3
M800E	10.5	9.79	<0.0464	0.723	3.67	19.8	10.7	<0.117	0.356	0.357	0.757	127	18.3
AH5	1.15	1.57	<0.141	1.8	1.01	5.5	2.8	<0.126	<0.126	<0.126	0.845	28.3	4.53
AH10	1.74	2.04	<0.118	0.824	1.2	7.3	3.19	<0.118	<0.118	<0.118	0.808	32.9	6.26
FC4000ENE4000ENE	0.775	0.929	<0.13	0.194	0.488	2.88	1.8	<0.116	<0.116	<0.116	0.327	20.3	2.67
PB1	1.56	1.58	<0.0477	0.508	0.943	5.86	3.24	<0.0608	0.076	<0.0477	0.409	31.7	5.31
PB2	1.08	1.21	<0.049	0.576	0.696	4.17	2.22	<0.049	0.071	<0.049	0.444	25.5	4.05
McLoughlin Point													
MC0	18.1	11.6	<0.0458	0.839	3.82	39.1	13.3	<0.119	0.55	<0.0891	0.593	137	29.4
MC100NW	8.36	8.99	<0.0499	0.749	3.73	23.9	10.8	<0.0499	0.443	0.082	0.578	109	22.1
MC200E	11.2	10	<0.142	0.819	3.63	19.8	10	<0.0754	0.786	0.112	0.699	118	20.9
MC400E	1.96	25.4	<0.17	1.4	4.17	32.3	11.4	<0.068	0.62	0.048	0.552	149	26.6
MC800SE	14.9	11	<0.158	0.863	4.51	25.5	10.6	<0.133	0.665	<0.0833	0.644	136	22.4

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polybrominated Diphenyl Ethers												
Parameter	Pbde 51	Pbde 66	Pbde 71	Pbde 75	Pbde 77	Pbde 79	Pbde 85	Pbde 99	Pbde 100	Pbde 105	Pbde 116	Pbde 119/120	Pbde 126
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL													
BC CSR Typical													
WSDoE 2nd Lowest AET													
Macaulay Point													
M0	12.5	13.6	10.9	1.05	<0.102	0.836	15.8	459	100	<5.91	<7.73	<5.04	<3.19
M100E	17.5	21.1	12.2	1.86	<0.0956	0.488	26.5	603	145	<4.41	<5.77	<3.76	<2.04
M100N	3.23	4.25	1.65	0.396	<0.125	0.396	2.52	66.1	18.5	<0.686	<0.898	<0.586	<0.344
M100NW	2.82	6.45	2.54	0.558	<0.0983	2.68	9.47	357	93	<1.2	<1.54	1.63	<0.604
M100SE	7.8	6.8	8.58	0.733	<0.102	2.26	8.7	261	62.5	<0.51	<0.653	1.71	0.593
M100S	4.06	4.02	2.64	0.361	<0.111	1.89	3.75	117	30	<0.426	<0.607	1.01	0.27
M100SW	7.49	24.5	5.37	1.88	0.258	3.5	14.2	583	148	<1.07	<1.19	3.17	<0.648
M100W	4.63	5.42	3.03	0.404	<0.11	0.352	4.87	122	31.6	<0.641	<0.84	0.764	<0.3
M200E	6.88	7.69	5.27	0.634	0.191	2.62	7.64	211	51.3	<1.31	<1.67	4.7	<0.722
M200NE	6.43	9.13	6.5	0.517	<0.123	3.1	15.2	392	80	<3.82	<4.87	<3.12	<2.15
M200SE	10.1	9.25	7.37	0.673	<0.105	3.3	11.4	298	72.8	<1.75	<2.23	1.44	<0.944
M400E	3.25	3.58	2.16	0.325	<0.0474	2.14	2.69	98.8	26.6	<0.893	<1.14	0.749	<0.56
M400SE	4.66	5.6	3.29	0.456	<0.0493	1.87	9.74	258	58.6	<3	<3.82	<2.44	<1.66
M800E	2.12	3.81	1.61	0.347	<0.0464	1.91	2.15	73.7	20.5	<0.195	<0.255	0.674	0.283
AH5	0.827	1.21	0.442	<0.126	<0.126	2.9	0.529	15.7	5.42	<0.182	<0.216	0.192	0.171
AH10	0.81	1.19	0.346	<0.118	<0.118	2.05	0.517	17.4	6.17	<0.143	0.174	0.161	<0.118
FC4000ENE	0.5	0.834	0.391	<0.116	<0.116	3.07	0.245	8.42	3.1	<0.138	0.366	<0.128	<0.116
PB1	0.671	0.932	0.477	0.083	<0.0477	1.66	0.453	16.6	5.5	<0.117	<0.147	0.166	0.09
PB2	0.457	0.922	0.289	0.053	<0.049	1.81	0.392	14.4	4.59	<0.101	<0.128	0.175	0.063
McLoughlin Point													
MC0	3.52	3.42	3.11	0.35	<0.0458	1.6	1.99	92.2	25.6	<0.918	<1.17	0.78	<0.584
MC100NW	2.42	2.74	1.66	0.236	<0.0499	1.78	1.74	61.9	18.1	<0.434	<0.553	0.713	0.366
MC200E	2.18	4.14	1.71	0.248	<0.0493	2.5	1.85	70.7	19.4	<0.528	<0.693	0.553	<0.31
MC400E	3.2	3.88	2.02	0.326	<0.0401	1.75	1.96	76.4	22.5	<0.464	<0.608	0.749	<0.289
MC800SE	3.1	3.97	1.98	0.369	<0.0486	2.5	2.02	70.4	21.1	<1.02	<1.34	<0.827	<0.598

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polybrominated Diphenyl Ethers													
Parameter	Pbde 128	Pbde 138/166	Pbde 140	Pbde 153	Pbde 154	Pbde 155	Pbde 181	Pbde 183	Pbde 190	Pbde 203	Pbde 206	Pbde 207	Pbde 208	Pbde 209
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	<3.2	<1.36	2.05	54.7	38.6	4.22	<3.28	41.8	<5.67	26.9	58.6	88.5	68.6	3,010
M100E	<4.95	4.98	4	69.4	62.9	4.63	4.27	25.7	<6.39	41.3	270	365	298	12,000
M100N	<6.23	<1.97	<1.42	7.84	8.14	2.22	<3.42	4.79	<5.91	6.06	38.8	34.9	36.8	657
M100NW	<1.39	1.51	0.742	18.7	23.6	3.37	0.359	3.65	0.624	4.89	23.9	40	28	957
M100SE	13.9	0.68	1.52	30.6	24.6	3.47	2.16	29.5	5.23	77.5	286	509	317	4,100
M100S	3.24	1.3	0.593	14.3	12.2	2.89	<0.909	8.05	<1.56	27.1	67	93.3	81.1	4,480
M100SW	<4.39	3.78	0.978	42.7	31.4	5.29	<1.05	37.4	4.16	32.8	79.4	126	66.1	2,470
M100W	<2.93	1.11	0.709	13	12.9	1.63	<1.51	4.28	<2.61	<5.58	58.6	46.5	38.9	1,260
M200E	<3	2	1.29	27.7	19.9	3.05	<0.469	24.1	1.49	17.1	66.3	111	69.4	4,410
M200NE	<8.33	4.62	2.09	45.3	40.2	6.23	0.393	14.3	1.98	7.93	33.2	77.7	37.6	1,360
M200SE	<9.61	3.64	1.65	31.7	27.1	4.62	0.586	11	0.557	9.73	43	104	54.4	1,490
M400E	<1.64	0.792	0.552	11.2	10.4	3.01	0.17	5.22	1.02	3	21.7	26.2	11.2	571
M400SE	<1.98	1.14	1.44	30	24.1	4.6	<0.798	5.59	<1.34	23.1	314	500	270	11,700
M800E	<0.881	0.784	0.297	7.63	6.99	2.18	0.216	2.72	<0.153	1.44	18.4	11.7	10.3	635
AH5	<0.707	0.6	<0.189	2.21	2.49	0.808	0.205	0.804	0.275	1.07	9.28	5.41	5.87	236
AH10	0.85	0.429	<0.137	2.37	2.7	0.855	<0.118	12.8	0.494	5.12	6.17	4.22	5.13	159
FC4000ENE	0.182	<0.116	<0.116	1.58	1.67	0.562	<0.116	2.58	<0.116	0.651	<0.294	7.05	6.51	<114
PB1	<0.296	0.21	0.133	2.33	2.82	0.799	0.061	0.862	0.092	0.484	7.68	11	7.85	127
PB2	<0.403	0.2	0.109	1.95	2.18	0.627	0.067	0.504	<0.049	0.816	4.58	9.54	7.9	103
McLoughlin Point														
MC0	<3.26	0.858	0.528	8.04	7.45	2.13	0.062	2.3	0.269	2.01	15.8	15.7	14.8	660
MC100NW	<2.09	0.644	0.335	8.2	7.58	2.31	<0.0715	4.7	0.29	2.35	16.8	15.6	10.6	468
MC200E	<2.82	1.83	<0.59	7.78	7.45	1.95	<0.263	2.75	0.612	1.98	27.2	22	11.7	544
MC400E	<3.61	<1.23	<0.774	8.45	7.22	3.19	<0.362	3.19	<0.629	2.58	21.1	14.9	10	558
MC800SE	<5.55	2.14	<1.26	10.1	8.8	2.91	<0.619	2.67	<1.08	2.41	41.9	30.4	19.4	1,220

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls												
Parameter	Pcb 1	Pcb 2	Pcb 3	Pcb 4	Pcb 5	Pcb 6	Pcb 7	Pcb 8	Pcb 9	Pcb 10	Pcb 11	Pcb 12/13	Pcb 14
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL													
BC CSR Typical													
WSDoE 2nd Lowest AET													
Macaulay Point													
M0	36.2	41.4	31.4	29.7	2.8	13.5	3.48	69.5	3.66	0.932	57.4	13.3	0.926
M100E	159	134	215	273	5.71	53.3	14.2	226	13.2	4.93	84.2	50.6	1.44
M100N	16.9	28.6	15.8	24.4	1	9.24	2.49	56.7	2.07	0.781	41.6	7.11	0.582
M100NW	13.5	19.5	9.94	11.6	0.42	4.88	1.26	28.7	1.39	0.405	35	5.27	0.653
M100SE	25.6	56	28.6	23.3	1.66	10.6	2.82	60	2.38	0.612	82.9	13.9	1.18
M100S	71.9	142	103	26.9	1.62	8.92	2.83	53	3.18	0.691	51	10.1	1.3
M100SW	28.5	38.1	18.3	24.7	1.52	8.43	2.3	51.8	2.29	0.538	46.2	8.97	0.574
M100W	24.1	39.5	16.5	19.2	0.584	6.53	1.76	40.4	1.92	0.44	51.2	7.86	0.598
M200E	59.5	42.3	38.4	73.9	3.85	24.4	6.67	148	6.75	1.92	62.8	23.1	1.07
M200NE	26	43.4	25.8	25.5	1.24	9.03	3.13	58.3	2.87	0.742	38.6	10.5	0.772
M200SE	68.4	55.9	50.8	48.2	4.28	20.1	6.88	103	7.72	1.45	67.8	25.2	2.09
M400E	15.1	28.5	13.2	13.8	0.875	6.49	1.86	34.3	1.47	0.351	43	9.14	0.747
M400SE	58.7	49.2	31.5	29.2	4.87	14.6	4.13	83.5	4.1	0.941	46.7	15.3	1.99
M800E	9.91	26.9	21.2	23.3	<10.8	10.6	<10.2	78.8	<9.57	<9.42	44.8	<11.1	<10.3
AH5	4.51	18.1	2.39	5.53	<0.143	2.25	0.528	13.9	0.445	0.144	35.1	2.8	0.303
AH10	8.02	22.8	8.94	7.83	<0.412	2.88	0.684	18.1	0.645	<0.365	38.3	3.88	0.397
FC4000ENE	2.54	12.5	4.01	2.28	<0.237	1.16	0.366	6.76	0.344	<0.21	16.6	1.51	0.265
PB1	6.41	19	3.19	6.14	0.166	2.13	0.417	14.2	0.422	0.12	32	2.95	0.218
PB2	6.1	17.4	4.03	4.77	<0.111	1.64	0.391	11.1	0.385	<0.0976	28.4	2.59	0.16
McLoughlin Point													
MC0	12.8	24.8	10.5	9.63	0.365	3.74	1.06	24.2	0.933	0.225	32	4.38	0.454
MC100NW	8.58	17	6.61	8.14	0.245	3.75	1.03	26.3	0.714	0.174	32.3	4.32	0.291
MC200E	12.2	22.1	9.23	12.1	0.489	5.45	1.31	31.4	1.14	0.327	39.5	5.81	0.526
MC400E	15	38.9	22.6	17.3	1.19	7.5	1.61	33.7	1.38	0.374	41.4	19.2	1.2
MC800SE	29.1	37.7	18.3	22.3	1.47	10.7	2.87	64.3	3.58	0.565	43.7	11.5	0.897

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls												
Parameter	Pcb 15	Pcb 16	Pcb 17	Pcb 18/30	Pcb 19	Pcb 20/28	Pcb 21/33	Pcb 22	Pcb 23	Pcb 24	Pcb 25	Pcb 26/29	Pcb 27
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL													
BC CSR Typical													
WSDoE 2nd Lowest AET													
Macaulay Point													
M0	49.6	33.1	34	69.8	14.3	159	67.3	57.5	0.24	1.06	9.59	20	6.4
M100E	106	151	174	846	1000	488	221	120	0.35	6.48	73.4	68.1	341
M100N	33.2	19.2	23.6	50	10.4	140	56.6	41.3	<0.288	0.42	8.27	18.5	4.18
M100NW	20.2	10.1	11.6	25.6	4.54	59.2	27	18.2	0.128	0.391	4.14	7.81	2.99
M100SE	33.8	17.2	23.4	50.2	26.9	140	52.1	42.1	<0.144	0.575	9.77	19	10.1
M100S	35.7	17.2	22.5	42.7	11.5	110	44.1	34.1	<0.117	0.508	7.04	13.4	3.89
M100SW	37.6	18.3	19.5	39.5	9.67	98.2	37.8	31.7	0.135	0.503	5.9	11.9	3.39
M100W	27.4	14	15.4	35.3	11.6	73.8	29.5	25.2	<0.189	0.299	27.9	9.06	3.75
M200E	70.9	51.3	61.2	137	42.8	280	109	87.7	<0.287	1.49	14.3	26.5	13.6
M200NE	36.4	36.2	29	51.2	12.4	202	63.7	69	0.141	0.5	10.5	22.3	6.5
M200SE	54.1	39	45.8	88.1	23.5	173	83.6	55	0.405	0.979	12	22.6	9.99
M400E	25.7	12.5	15.4	28.7	14.9	74	27.7	20.2	0.106	0.401	6.47	12.5	12.3
M400SE	44.7	32.6	45	79.8	21.3	190	72	56.8	0.503	0.815	11.6	24.6	8.68
M800E	39.8	37.5	47.5	109	13.4	227	110	64.2	<1.14	0.465	26.3	18.8	7.33
AH5	12.7	3.55	4.84	9.61	1.27	28.3	11.6	8.92	<0.0691	0.13	1.91	3.75	0.855
AH10	17.3	5.39	6.31	12.5	1.35	43.6	16.6	13.2	<0.202	0.183	3.04	5.95	1.16
FC4000ENE	7.95	1.88	2.32	4.36	0.73	17.3	6.68	4.95	<0.0634	0.066	1.13	2.21	0.41
PB1	13.8	3.41	3.79	7.95	1.19	33.3	12.7	9.65	<0.0596	0.069	2.05	3.97	0.652
PB2	11.3	2.95	3.25	7.32	1.05	28.6	12	8.33	<0.0792	0.063	1.72	3.44	0.548
McLoughlin Point													
MC0	17.4	9.38	10.6	19.1	4.55	56.6	22.8	16.1	<0.0617	0.199	3.2	6.89	2.22
MC100NW	18.9	6.92	8.84	17.1	6.59	58.3	24.5	15.4	<0.0667	0.097	3.4	6.22	3.79
MC200E	20.5	8.98	11.7	24.6	11.4	61	27.4	17.4	0.07	0.212	4.71	9.92	8.84
MC400E	28.5	11.9	18.8	32.7	7.97	79.9	27.8	23.3	0.21	0.343	13	21	3.3
MC800SE	35.7	21	27.5	64.2	21.5	126	50.7	35.3	0.158	0.64	7.86	15.9	16.8

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls												
Parameter	Pcb 31	Pcb 32	Pcb 34	Pcb 35	Pcb 36	Pcb 37	Pcb 38	Pcb 39	Pcb 40/41/71	Pcb 42	Pcb 43	Pcb 44/47/65	Pcb 45/51
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL													
BC CSR Typical													
WSDoE 2nd Lowest AET													
Macaulay Point													
M0	105	25.6	0.651	5.53	0.929	34.6	0.629	1.25	65.9	29.9	4.28	131	18.5
M100E	457	135	2.9	16.6	<0.237	126	<0.245	19.8	2,310	1,440	58.8	6,870	568
M100N	96.8	20.2	0.437	3.16	1.03	31.8	0.488	1.1	52.7	26.6	3.3	110	13.1
M100NW	41.6	7.79	0.34	2.51	0.923	14.2	0.45	0.657	25.3	11.6	1.42	46.8	5.68
M100SE	86.5	17.6	0.519	5.5	1.44	25	0.652	1.53	66.9	26.7	3.14	195	12.9
M100S	69.5	17.4	0.509	4.06	1.38	24.2	0.856	1.1	45.3	19.3	2.56	90.9	10.2
M100SW	59.2	14.3	0.37	3.93	1.09	24	0.56	0.892	42.5	17.8	2.31	85.6	8.91
M100W	53.3	10.9	0.275	3.14	<0.188	22.6	<0.195	1.13	118	2.33	5.01	473	15.9
M200E	160	44.1	1.17	11.1	1.13	50	1.82	3.03	167	67	7.33	369	33.4
M200NE	148	9.25	0.565	6.16	1.64	48.3	0.887	2.48	159	65.6	8.83	246	38.1
M200SE	126	23.5	0.909	7.43	1.67	37.7	1.81	2.87	134	55.3	5.95	382	28
M400E	47.1	10.8	0.474	4.36	1.54	20.2	0.83	1.46	53.7	22.2	1.97	112	11.1
M400SE	124	32.1	1.04	4.47	1.9	32.1	1.25	1.67	71.3	29	3.75	148	17.1
M800E	475	36.2	<1.08	2.98	<1.08	76.8	3.42	13.5	1,350	624	71.1	8,250	115
AH5	19.6	3.91	0.15	1.24	0.72	9.79	0.217	0.293	9.64	4.51	0.631	19.5	2.49
AH10	27.4	4.57	0.22	1.72	0.946	12.3	0.314	0.384	13.2	6.76	0.593	23.1	2.92
FC4000ENE	11.1	1.92	0.076	0.783	0.374	5.78	0.15	0.172	5.77	2.66	0.339	10.1	1.16
PB1	20.6	3.25	0.137	1.43	0.856	9.92	0.276	0.345	10.5	5.13	0.597	17.4	1.83
PB2	18.9	2.83	0.1	1.39	0.601	8.14	0.19	0.289	9.68	4.9	0.505	16.4	1.76
McLoughlin Point													
MC0	34.1	7.84	0.285	2.73	0.982	13.6	0.353	0.656	24.1	10.2	1.05	47.3	4.93
MC100NW	29.5	7.55	0.281	2.66	0.816	15.1	0.323	0.591	30.2	12.6	1.29	48.6	5.62
MC200E	41	9.07	0.346	3.04	1.04	15.7	0.443	0.79	36.8	14.8	1.62	93.1	6.76
MC400E	56	18	0.699	14.1	2.19	26.9	2.65	2.26	57.5	18.8	1.86	75.4	11.8
MC800SE	76.4	21.3	0.604	4.99	1.2	30.2	0.732	1.43	66	31.7	2.85	120	14.7

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls													
Parameter	Pcb 46	Pcb 48	Pcb 49/69	Pcb 50/53	Pcb 52	Pcb 54	Pcb 55	Pcb 56	Pcb 57	Pcb 58	Pcb 59/62/75	Pcb 60	Pcb 61/70/74/76	Pcb 63
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	7.66	22.9	83.5	20.6	217	1.4	1.81	58.1	<0.633	<0.641	8.72	35	260	4.53
M100E	324	507	4,260	1,240	20,700	141	19.2	1,900	5.24	15.4	296	932	27,100	166
M100N	5.16	16	80.8	14.7	157	0.751	2.28	69.3	0.611	0.554	9.17	40.8	291	4.86
M100NW	2.16	8.07	31.2	7.22	70.7	0.36	0.841	26.5	<0.318	<0.33	3.63	15.1	119	2.18
M100SE	7.14	19	116	33.8	433	5.88	2.08	70.7	0.327	0.682	6.94	38.3	444	5.44
M100S	4.62	14.5	53.9	14.4	142	1.16	1.3	45.3	0.45	0.478	5.75	25.2	222	3.59
M100SW	3.73	13.1	49.6	10.5	125	1.26	1.06	33.4	0.371	0.335	5.29	21.1	153	2.91
M100W	7.05	25.1	227	34.5	1,420	2.52	<1.59	120	<1.61	1.7	1.11	54.5	1,120	10.3
M200E	23	47.8	241	70.6	744	8.07	2.42	139	0.898	1.29	18.3	75	796	11.4
M200NE	15.1	54.8	137	31	302	1.95	<0.212	144	0.963	0.982	17.7	83.7	504	10.2
M200SE	13.9	38.4	236	48.9	867	3.96	4.44	156	<0.922	1.17	14.2	77.2	1,070	12.4
M400E	6.13	21.8	84.6	33.5	239	3.81	1.02	44.4	0.389	0.473	6.51	22	257	3.68
M400SE	9.1	24.1	90.3	29.9	277	6.34	2.24	68.1	0.669	0.697	8.56	35.9	356	5.91
M800E	57	252	4,450	378	21,100	1.6	57.8	2,210	<12.4	<12.3	81.7	962	24,300	174
AH5	0.647	3.2	13.1	2.02	24.9	<0.0658	0.318	10.7	0.137	0.118	1.66	7.79	41.5	1.04
AH10	1.03	4.13	15.9	2.31	26.2	<0.458	0.55	16.5	<0.458	<0.464	1.96	11.2	64	1.35
FC4000ENE	0.396	1.77	6.54	1.05	10.8	<0.194	0.299	7.23	<0.185	<0.187	0.855	4.41	26.5	0.674
PB1	0.782	3.06	10.8	1.52	18.7	<0.0596	0.705	18.1	0.167	0.124	1.82	11.4	57.2	1.13
PB2	0.691	2.83	9.79	1.46	17.4	0.07	0.593	15.1	0.111	0.098	1.45	9.45	48.3	1.11
McLoughlin Point														
MC0	2.38	7.23	28.9	7.2	73.7	0.674	0.596	24.7	<0.191	0.258	2.97	14.7	100	1.82
MC100NW	3.37	8.06	32.8	10.2	75.4	0.987	1.1	31.6	<0.166	<0.168	3.33	18.3	122	2.21
MC200E	3.51	10.9	63.7	17.5	202	1.44	1.21	39	<0.25	0.367	4.26	20.4	245	3.09
MC400E	6.35	9.6	59	13.2	122	0.824	2.27	43.7	0.659	0.527	4.75	22.2	157	3.37
MC800SE	9.2	20.6	102	27.8	199	1.62	2.34	67.2	0.401	0.487	10	37.6	302	4.69

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls													
Parameter	Pcb 64	Pcb 66	Pcb 67	Pcb 68	Pcb 72	Pcb 73	Pcb 77	Pcb 78	Pcb 79	Pcb 80	Pcb 81	Pcb 82	Pcb 83/99	Pcb 84
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	52.3	108	3.12	0.967	1.46	2	12.1	<0.691	3.46	<0.602	0.725	47.2	193	90.2
M100E	2,860	4,460	33.5	15.4	25.7	144	218	<2.16	390	<1.63	22.8	4,940	22,900	8,990
M100N	44.8	160	3.08	1.28	1.94	1.55	15	<0.422	4.09	<0.368	0.74	25.3	180	71.8
M100NW	19.1	55.9	1.81	0.594	0.554	0.759	5.81	<0.383	1.29	<0.316	<0.337	11.1	53.4	20.3
M100SE	66.3	142	2.96	0.973	1.5	4.12	10.4	0.28	5.1	<0.236	0.617	55.7	230	134
M100S	34.2	96	2.37	0.792	1.12	1.44	10	<0.474	3.41	<0.414	0.429	33	127	65.5
M100SW	32.2	67.3	2.32	0.763	0.984	1.04	10.2	<0.329	3.39	<0.249	0.649	21.7	113	48.6
M100W	178	245	2.64	2.67	1.55	10.4	13.3	<1.92	43.5	<1.45	<1.67	456	1,480	1,000
M200E	143	278	5.36	2.65	4.28	6.16	28.6	1.4	14.5	<0.708	2.59	192	697	311
M200NE	116	259	6.31	1.54	4.39	1.08	27.2	0.594	4.29	2.14	1.52	36.5	186	93.9
M200SE	141	327	5.53	2.29	3.52	2.47	18.7	<1.09	18.9	<0.958	1.31	166	713	436
M400E	39.1	110	3.63	1.65	2.76	1.14	12.6	0.477	4.26	0.449	1.1	33.4	214	81.1
M400SE	53.5	149	3.51	1.41	2.33	1.11	11.3	<0.256	4.58	0.644	0.795	39.9	197	101
M800E	2,950	6,260	18.7	<11.8	<11.5	50.5	68.5	<14.2	466	<12.1	23.2	5,360	22,800	10,900
AH5	7.95	24.6	0.652	0.424	0.38	0.215	4.28	<0.11	0.594	<0.103	0.125	5.47	25.4	6.68
AH10	10.2	36	0.996	0.55	0.493	0.375	5.19	<0.5	0.439	<0.436	<0.462	5.31	23.9	6.6
FC4000ENE	4.21	15.3	0.433	0.296	0.31	<0.124	2.5	<0.202	0.261	<0.176	<0.181	1.75	10.8	2.52
PB1	8.19	35.9	0.816	0.332	0.474	0.133	4.71	<0.128	0.481	<0.106	0.137	4.71	19.5	5.81
PB2	7.57	31	0.698	0.21	0.319	0.108	3.84	<0.0894	0.426	<0.074	0.112	3.32	15.2	4.45
McLoughlin Point														
MC0	18.5	49.2	1.13	0.431	0.677	0.3	6.68	<0.244	1.43	<0.202	0.237	9.92	57.9	22.8
MC100NW	21	76.1	1.31	0.605	0.73	0.4	8.23	<0.213	1.72	<0.176	0.24	20.2	84.9	36.5
MC200E	32	98.9	1.64	0.983	1.51	0.946	8.12	<0.321	3.4	<0.266	0.383	32.1	141	69.7
MC400E	28.8	81.9	2.15	1.18	1.56	0.595	22.4	3.84	6.42	1.2	3.4	28.6	85.2	56.2
MC800SE	45.9	160	3.07	1.32	2.53	0.893	15.3	0.393	4.33	0.292	0.531	32.4	160	65.5

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls													
Parameter	Pcb 85/116/117	Pcb 86/87/97/108/119/125	Pcb 88/91	Pcb 89	Pcb 90/101/113	Pcb 92	Pcb 93/95/98/100/102	Pcb 94	Pcb 96	Pcb 103	Pcb 104	Pcb 105	Pcb 106	Pcb 107/124
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	59.2	236	41.5	3.09	363	60.4	286	1.2	1.74	2.27	<0.213	142	0.905	13.7
M100E	6,010	28,000	4,180	272	43,000	4,880	35,900	105	264	141	2.38	14,100	79.8	1,330
M100N	49.3	176	36	2.96	262	45.6	187	0.88	1.1	2.52	<0.305	117	0.307	10.6
M100NW	16.6	62	10.5	0.938	89	15.1	67.1	0.376	0.44	0.718	<0.0492	49.3	<0.482	3.43
M100SE	71.7	282	52.9	3.27	438	69.8	396	1.71	1.9	3.3	<0.134	159	0.766	14
M100S	39	169	28.1	1.97	230	38.7	193	0.911	1.02	1.56	<0.14	129	0.245	9.93
M100SW	39.1	148	21.6	1.95	192	29.3	152	0.933	1.06	1.51	<0.0622	85.7	<0.654	7.16
M100W	472	2,620	354	17.4	4130	688	3520	9.42	4.12	11.7	0.128	1410	<3.86	151
M200E	222	843	139	8.86	1250	190	928	4.46	5.4	8.71	0.212	610	2.31	46.7
M200NE	71.6	220	46.3	4.96	345	<0.13	319	2	2.79	3.04	0.078	129	<0.34	12
M200SE	221	922	187	11.9	1430	242	1170	4.61	6.56	9.77	0.531	460	<2.28	47.1
M400E	57.3	206	40.8	2.33	355	51.8	266	1.12	1.36	3.6	0.143	125	<0.594	15
M400SE	53.5	221	42.8	3.18	523	75.8	431	1.88	2.92	5.02	0.133	106	<1.15	9.15
M800E	7,780	28,400	5,380	299	39,300	5,590	28,500	115	150	117	1.28	15,700	<46.9	1,530
AH5	8.26	23.7	4.17	0.402	35.7	6.67	23.8	0.123	0.216	0.419	<0.063	15.5	0.136	1.35
AH10	7.88	20.8	3.99	0.49	30	5.37	21.4	<0.346	<0.235	0.338	<0.35	19.9	<0.445	1.5
FC4000ENE	3.4	10	1.56	<0.214	13.9	2.52	9.48	<0.218	<0.102	<0.177	<0.156	9.07	<0.219	0.567
PB1	7.03	17.8	3.39	0.33	25.6	4.68	15.6	0.109	0.145	0.261	<0.0596	16.9	<0.174	1.23
PB2	4.83	13.6	2.59	0.333	19.9	3.92	11.8	<0.0851	0.073	0.26	<0.0612	13.8	<0.157	0.985
McLoughlin Point														
MC0	17.2	59.4	10.6	0.677	88.1	14.8	65.9	0.368	0.494	0.866	<0.111	41.6	<0.475	3.09
MC100NW	28	86	18	1.37	122	20.3	84.7	0.414	0.713	1.08	<0.12	58.5	<0.384	4.19
MC200E	42.2	160	30.6	1.84	238	38.7	182	0.704	0.982	1.46	<0.0781	98.3	<0.418	8.54
MC400E	41.2	134	27.4	1.86	178	29.5	133	0.905	1.19	1.35	0.084	87.8	1.09	9.11
MC800SE	47.6	157	34	2.41	252	44.2	166	1.03	1.17	2.26	<0.0955	120	<0.184	9.6

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls													
Parameter	Pcb 109	Pcb 110/115	Pcb 111	Pcb 112	Pcb 114	Pcb 118	Pcb 120	Pcb 121	Pcb 122	Pcb 123	Pcb 126	Pcb 127	Pcb 128/166	Pcb 129/138/160/163
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	22.9	398	<0.369	<0.351	5.96	344	0.673	<0.369	3.19	5.27	1.37	0.703	81.2	375
M100E	1,990	49,800	<1.09	<0.963	761	32,100	6.53	<0.917	338	536	38	65.5	9,870	31,500
M100N	21.8	313	<0.434	<0.413	4.47	284	1.2	<0.434	2.99	5.07	0.676	0.716	65.4	314
M100NW	6.74	98.3	0.103	<0.0919	2.1	111	0.489	<0.0919	1.08	1.49	0.599	<0.531	30.5	126
M100SE	24.3	503	<0.254	<0.242	6.66	390	0.504	<0.254	2.79	6.08	0.698	1.02	75	316
M100S	17.8	282	<0.24	<0.229	5.25	282	0.649	<0.24	3.34	3.69	1.02	0.468	77	324
M100SW	13.5	248	0.131	<0.0951	3.56	189	0.438	0.121	1.88	3.32	2.03	<0.743	48.6	213
M100W	206	4,700	<0.546	<0.484	69	3,700	1.09	<0.461	31.4	41.5	4.45	9.18	1540	7,750
M200E	88.1	1,500	<0.57	<0.506	27.2	1,480	2.57	<0.482	10.6	19.3	5.5	2.92	391	1,290
M200NE	21.6	388	0.269	<0.0964	7	291	1.05	0.12	4.43	6.03	2.33	<0.368	53.3	396
M200SE	72.1	1,540	0.75	<0.637	24.9	1,090	2.08	<0.657	14.8	17.1	2.69	<2.42	212	1,080
M400E	25.6	406	0.392	<0.108	6.84	381	1.8	0.163	4.02	5.71	3.08	0.703	56.7	325
M400SE	17.7	399	0.367	<0.132	5.02	264	1.39	0.293	3.54	4.92	2.07	<1.22	63.4	1,210
M800E	2,490	56,400	<3.48	<3.55	899	37,100	5.91	<3.46	481	596	47.3	86.9	10,200	39,400
AH5	3.08	39.6	<0.063	<0.063	0.796	37.7	0.223	<0.063	0.49	0.673	0.185	<0.0924	10.1	45.2
AH10	3.94	36.8	<0.252	<0.24	0.778	40.3	<0.241	<0.252	<0.47	0.743	<0.466	<0.47	8.35	43
FC4000ENE	1.82	15.1	<0.159	<0.151	0.365	18.8	<0.151	<0.159	<0.232	0.327	<0.215	<0.232	4.02	23.1
PB1	2.76	31.5	<0.0596	<0.0596	0.645	35.4	0.232	<0.0596	0.379	0.845	0.27	<0.206	8.01	43.3
PB2	2.41	23.8	<0.0683	<0.0623	0.506	28.1	0.125	<0.0636	0.335	0.604	0.218	<0.186	6.66	35.2
McLoughlin Point														
MC0	6.31	102	0.248	<0.127	1.65	90.7	0.463	<0.129	0.984	2.02	0.584	<0.561	19.8	89.9
MC100NW	8.61	167	<0.197	<0.179	2.28	138	0.435	<0.183	1.35	2.45	0.492	<0.453	32.6	141
MC200E	15.3	285	<0.158	<0.145	4.69	236	0.586	<0.148	2.62	3.45	0.593	<0.494	46.8	245
MC400E	15	252	0.351	<0.11	5.21	204	0.846	<0.112	4.94	4.25	11.3	2.01	47.6	206
MC800SE	18.6	278	<0.237	<0.216	5.51	281	0.964	<0.221	2.52	4.34	1.36	<0.217	95	439

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls													
Parameter	Pcb 130	Pcb 131	Pcb 132	Pcb 133	Pcb 134/143	Pcb 135/151/154	Pcb 136	Pcb 137	Pcb 139/140	Pcb 141	Pcb 142	Pcb 144	Pcb 145	Pcb 146
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	22.3	5.77	143	5.19	18.4	104	43.2	16.5	5.57	61.4	<1.66	16.5	<0.148	54.6
M100E	2,110	517	14,400	295	1,920	6,180	3,200	2,460	689	4,550	<11.6	1170	14.1	3,680
M100N	20.2	4.13	103	3.87	14.7	63.7	23.8	15.2	5.96	34	<0.561	9.44	<0.267	43.8
M100NW	6.47	1.09	28.9	1.69	4.3	30.4	9.71	4.63	1.6	16.2	<0.515	4.72	0.055	25.8
M100SE	18.9	4.34	130	3.47	15.7	83.2	37.4	16.2	5.29	47.4	<1.39	13.7	0.09	42.8
M100S	19.2	4.12	108	3.32	13.2	63.9	27	16.1	4.86	46.1	<1.03	9.24	0.141	41.2
M100SW	11.9	2.67	68	2.64	9.51	51.3	19.6	8.35	3.2	24.8	<0.629	7.07	0.085	29.1
M100W	403	103	2,700	68.3	375	1,480	697	301	96	1,190	<3.66	255	1.71	882
M200E	81.6	17.4	512	12.3	60.7	286	123	73.9	23	174	<3.31	46.3	0.675	181
M200NE	21.6	4.53	119	5.54	17	466	109	11.4	5.69	95.4	<2.85	38.2	0.185	59.1
M200SE	66.2	18.6	493	17	64.6	325	144	63.8	22.4	186	<2.82	49.3	0.417	177
M400E	22.5	5.67	121	4.44	16.4	77.3	29.3	20.1	7.79	46.6	<1.72	13	0.177	40
M400SE	31.6	6.49	421	10.8	42.4	505	179	14.1	5.54	288	<2.57	74	0.707	191
M800E	2,010	567	14,000	276	1,660	8,030	<0.427	2,470	769	4,680	<37.1	1170	18.8	3,070
AH5	2.36	0.311	11.7	0.599	1.44	11.1	3.47	1.57	0.631	4.84	<0.161	1.54	<0.063	6.5
AH10	2.46	<0.822	9.67	<0.777	1.45	11.5	3.29	1.08	<0.692	4.62	<0.787	1.32	<0.185	8.36
FC4000ENE	1.58	<0.214	4.35	0.294	0.806	4.95	1.28	0.829	0.379	1.96	<0.205	0.594	<0.103	4.28
PB1	2.49	0.358	10.3	0.719	1.31	8.34	2.38	1.42	0.499	4.08	<0.153	0.914	<0.0596	7.52
PB2	1.87	0.213	7.73	0.569	1.04	7.22	1.93	1.14	0.411	3.17	<0.197	0.93	<0.0612	6.85
McLoughlin Point														
MC0	5.23	1.19	30.7	1.25	3.85	25.6	7.98	4.24	1.74	10.8	<0.729	3.45	0.072	16.3
MC100NW	7.72	1.57	49.4	1.82	6.14	31.1	12.7	5.65	2.11	14.3	<0.513	4.56	<0.132	24.2
MC200E	13.4	3.35	82.7	2.25	10.8	40.7	19.2	13.4	4.39	25.1	<0.647	6.92	0.101	28.4
MC400E	12.8	2.49	71.1	2.32	9	36	13.3	11.5	3.21	23	<0.402	5.3	0.128	21.5
MC800SE	25.8	4.52	126	4.24	13.7	69.7	25.8	27	7.2	47.2	<1.66	11	<0.0607	50.9

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls													
Parameter	Pcb 147/149	Pcb 148	Pcb 150	Pcb 152	Pcb 153/168	Pcb 155	Pcb 156/157	Pcb 158	Pcb 159	Pcb 161	Pcb 162	Pcb 164	Pcb 165	Pcb 167
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	269	1.18	0.463	0.252	289	<0.147	48.7	38.8	3.66	<1.17	<1.44	25.4	<1.35	15.8
M100E	22,100	17.8	25.7	29.9	22,800	0.797	5,170	3,420	83.3	28.2	85.6	1,810	<9.22	1,480
M100N	194	1.25	0.449	<0.246	233	<0.284	35.7	29.1	2.34	<0.394	1.25	18.9	<0.455	13.1
M100NW	71.2	1.42	0.227	<0.0492	106	0.105	16.7	12.6	1.36	<0.354	0.566	6.6	<0.416	5.99
M100SE	244	1.13	0.288	0.307	263	0.349	40.9	32.2	<1.15	<0.977	<1.2	19.4	<1.13	13.9
M100S	182	1.5	0.401	0.22	235	1.16	49.8	32.4	2.84	<0.727	1.26	17.5	<0.84	14.3
M100SW	133	0.229	0.274	0.149	151	0.173	21.4	17.8	1.2	<0.436	0.59	10.1	<0.501	6.83
M100W	4,340	2.39	3.61	3.68	4,300	0.136	920	671	31.6	2.69	19.2	413	<2.92	289
M200E	764	1.83	1.53	1.09	914	0.352	208	135	4.09	<2.29	4.41	70.2	<2.63	64.3
M200NE	588	1.3	0.655	0.26	775	0.261	34.4	41.7	<1.87	<1.84	<2	26.5	<2.17	11.7
M200SE	872	2.92	1.53	1.12	836	3	147	114	7.87	<1.83	2.32	66.4	<2.09	47.6
M400E	231	1.04	0.474	0.309	306	0.154	40.1	36.2	1.48	<1.11	<1.2	20.5	<1.3	14.4
M400SE	1,210	1.43	0.936	0.448	1,400	0.334	60.5	91.2	44.5	<1.67	<1.65	63.9	<1.91	21.4
M800E	23,800	14.9	24.3	28.5	30,800	<0.455	4,870	3,820	745	<25.7	84.1	1,940	<30.1	1,460
AH5	32.6	0.536	0.111	<0.063	41	<0.063	5.02	3	0.455	<0.0885	0.138	2.11	<0.105	1.84
AH10	26.9	<0.24	0.187	<0.171	36.9	<0.189	4.79	3.22	<0.651	<0.553	<0.68	2.15	<0.639	1.92
FC4000ENE	10.4	0.608	<0.0985	<0.0955	19	<0.117	2.14	1.58	0.239	<0.144	<0.178	1.1	<0.167	0.833
PB1	24	0.818	<0.0596	<0.0596	34.8	<0.0596	3.98	3.01	0.384	<0.106	0.241	1.92	<0.121	1.62
PB2	19.9	0.532	<0.0612	<0.0612	27.8	<0.0612	3.54	2.24	0.23	<0.136	0.171	1.66	<0.155	1.34
McLoughlin Point														
MC0	63.7	0.95	0.199	0.064	90.9	0.167	10.7	7.84	0.736	<0.504	<0.542	4.75	<0.576	4
MC100NW	94.4	0.977	0.197	<0.12	109	<0.134	19.7	12.1	1.33	<0.355	0.396	7.01	<0.405	7.3
MC200E	149	0.848	0.272	0.17	150	0.11	28.1	20.6	0.894	<0.447	0.735	11.7	<0.511	9.02
MC400E	111	0.837	0.333	0.177	137	0.217	37.4	20.6	1.7	<0.278	1.68	12	<0.317	11.4
MC800SE	216	1.18	0.438	0.294	288	0.14	77.2	39.5	2.11	<1.15	1.69	20.8	<1.31	22.9

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls													
Parameter	Pcb 169	Pcb 170	Pcb 171/173	Pcb 172	Pcb 174	Pcb 175	Pcb 176	Pcb 177	Pcb 178	Pcb 179	Pcb 180/193	Pcb 181	Pcb 182	Pcb 183/185
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	<1.35	61.2	19.5	14.2	57.9	4.14	8.85	33.1	14.2	27.9	167	0.93	1.29	48.7
M100E	<9.51	2,720	895	496	2,170	103	311	1,050	373	1,000	5,600	64.7	22.2	1,760
M100N	<0.493	41.1	10	5.73	27.4	1.6	3.76	17.8	7.11	12.9	95.1	0.312	0.292	22.9
M100NW	<0.987	26.3	7.01	5.71	28.7	1.49	3.68	16.3	8.98	11.6	164	0.406	0.431	32.6
M100SE	<1.04	44.9	14.7	9.32	48.8	3.29	7.74	24.9	10.9	25.2	133	0.418	0.712	41.4
M100S	<0.88	45.3	13.4	9.35	46.3	2.65	6.27	23.6	11.5	20.6	157	0.369	0.416	42.1
M100SW	<0.88	25	9.75	5.36	28.7	2.14	5.16	18.9	9.12	18.9	71.1	0.389	0.588	26.8
M100W	<3.04	996	292	169	686	33.5	94.3	378	121	230	1,750	16.9	5.02	495
M200E	<2.23	133	45.8	26.1	113	7.07	18.1	67	25.8	48.1	282	2.35	1.37	100
M200NE	<2.09	92.1	36.9	20.3	300	15.5	70.3	126	107	437	734	0.481	0.866	344
M200SE	<1.73	154	48.9	28.7	153	7.47	24.6	83.8	40.3	72	412	2.06	1.4	117
M400E	<1.18	33.5	12.5	6.96	35.7	2.8	5.57	21.8	10.6	17.3	90.6	0.602	0.631	30.8
M400SE	3.29	734	195	127	837	29	109	384	134	353	2,310	0.541	1.48	594
M800E	<106	4,150	1,330	915	13,500	346	1,440	3,770	3,310	8,940	46,200	64.2	<0.739	13,500
AH5	<0.102	12.9	4.02	2.07	7.87	0.596	1.35	7	2.34	4.09	29.9	0.072	0.135	7.4
AH10	<0.643	8.1	2.79	1.39	6.87	0.522	0.978	5.18	2.5	3.28	19.6	<0.148	<0.133	5.82
FC4000ENE	<0.177	3.84	1.55	0.767	3.46	0.249	0.517	3.3	1.32	1.68	9.16	<0.0886	0.104	3.09
PB1	<0.117	7.96	2.23	1.47	6.77	0.316	0.89	4.75	2.25	3.3	18.2	<0.076	0.121	5.19
PB2	<0.143	5.98	2.16	1.2	5.81	0.29	0.806	3.94	1.86	2.71	13.9	<0.0612	0.114	4.21
McLoughlin Point														
MC0	<0.563	15.9	6.59	4.05	19.4	1.33	3.41	10.6	6.01	11.3	50.1	0.23	<0.132	17.6
MC100NW	<0.328	37.4	10.2	6.61	26.3	1.37	3.24	16.4	6.15	10.1	77.3	0.431	0.41	21.3
MC200E	<0.507	23.3	8.1	3.47	20.3	1.17	2.84	11.7	4.81	9.07	48.5	0.31	0.298	15.8
MC400E	<1.87	30.5	10.5	6.18	26.6	1.82	3.72	15.4	7.73	12.4	73.6	0.51	0.471	23
MC800SE	<1.19	77	19.5	10.9	51.4	3.24	6.32	28.7	11.8	20.8	151	0.69	0.902	43.6

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls													
Parameter	Pcb 184	Pcb 186	Pcb 187	Pcb 188	Pcb 189	Pcb 190	Pcb 191	Pcb 192	Pcb 194	Pcb 195	Pcb 196	Pcb 197/200	Pcb 198/199	Pcb 201
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	0.531	<0.123	96.7	0.29	2.89	12.3	2.78	0.362	51.9	15.4	24.1	7.26	53	6.96
M100E	4.92	1.49	3,810	4.27	103	493	114	25.2	1,210	268	645	226	1,950	210
M100N	0.144	<0.0728	49.3	0.244	1.83	5.86	1.5	<0.0945	33	14.7	12.2	4.23	29.7	3.03
M100NW	0.105	0.057	163	0.091	1.56	7.01	1.18	<0.0492	265	10.6	41.5	11	341	11.3
M100SE	0.45	<0.067	69.4	0.233	1.83	8.49	1.91	<0.087	41.9	15.9	20.6	7.24	45.8	5.88
M100S	0.612	<0.0622	92	0.312	2.13	8.74	1.88	<0.0808	76.7	22.8	31.3	9.61	77.3	9.44
M100SW	0.287	<0.0622	76.5	0.169	1.51	4.76	1.5	<0.0622	22.2	5.25	13.5	5.55	35.3	4.97
M100W	0.846	0.379	896	0.576	41.5	170	39.6	1.49	334	92.7	117	32.5	205	17.6
M200E	0.689	0.109	209	0.329	5.95	28.3	5.66	1.62	45.6	13.9	25.5	9.24	63.6	6.59
M200NE	0.742	<0.12	901	0.425	2.82	24.7	4.11	0.721	277	72.1	173	88.6	577	121
M200SE	3.35	<0.126	238	0.384	7.52	32.3	5.61	0.357	71.5	28.7	36.7	14	107	11.6
M400E	0.364	<0.0593	51.1	0.337	2.48	6.7	1.9	<0.0593	26	4.42	14.3	3.91	44.6	5.64
M400SE	0.313	<0.0804	1,160	0.452	17.6	132	23	4.88	623	286	243	108	522	66.3
M800E	<0.522	<0.578	41,900	3.09	91.1	1,420	163	<0.749	37,000	7,860	17,500	6,390	60,600	5,850
AH5	<0.063	<0.063	16.7	0.092	0.575	2.45	0.449	<0.063	7.32	3.01	3.1	0.969	8.39	0.985
AH10	0.107	<0.104	14.8	<0.116	0.389	1.88	<0.124	<0.135	5.67	2.19	2.95	1.07	6.2	1.08
FC4000ENE	<0.0581	<0.0622	9	<0.0658	0.186	0.847	0.15	<0.0809	2.76	0.985	1.19	0.472	3.68	0.537
PB1	<0.0596	<0.0596	13.9	0.076	0.353	1.47	0.21	<0.0669	5.5	2.2	2.29	0.704	5.81	0.873
PB2	<0.0612	<0.0612	12.7	<0.0612	0.253	1.16	0.271	<0.0612	4.93	1.95	2	0.687	4.45	0.645
McLoughlin Point														
MC0	0.36	<0.107	46.2	0.121	0.752	3.37	0.718	<0.127	19.9	4.56	9.33	3.78	26.3	4.22
MC100NW	0.107	<0.0623	46.5	0.221	1.95	6.18	1.19	0.066	20.8	8.82	7.77	2.93	18.1	2.31
MC200E	0.223	<0.0652	31.8	0.122	0.89	3.92	0.794	<0.0775	11.6	3.67	5.95	2.03	14	1.77
MC400E	0.255	0.076	39.8	0.315	2.96	6.76	1.68	0.519	24.5	7.41	12.7	4.05	38.1	4.3
MC800SE	0.224	<0.129	82.5	0.367	3.38	11.7	2.57	<0.153	52.5	14.3	24.3	5.71	53.5	6.93

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls													
Parameter	Pcb 202	Pcb 203	Pcb 204	Pcb 205	Pcb 206	Pcb 207	Pcb 208	Pcb 209	PCBs Total	Decachloro Biphenyl	Total Dichloro Biphenyls	Total Heptachloro Biphenyls	Total Hexachloro Biphenyls	Total Monochloro Biphenyls
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL									189,000					
BC CSR Typical									230,000					
WSDoE 2nd Lowest AET									1,000,000,000					
Macaulay Point														
M0	21.8	39.2	0.076	1.92	63.1	5.95	25.2	42.9	7,020	42.9	241	573	1,630	109
M100E	562	1,280	1.34	33.9	1,040	134	334	211	512,000	211	833	21,100	140,000	508
M100N	10	15.6	<0.0625	1.49	28.6	3.46	12.6	34.9	5,390	34.9	178	298	1,240	45.5
M100NW	49.8	211	<0.0492	2.34	1150	46.6	200	239	5,020	239	108	476	510	33
M100SE	15.9	30	0.053	1.74	42.2	4.86	17.4	54.5	7,600	54.5	233	444	1,420	110
M100S	30.4	44.9	<0.0556	2.22	49.2	6.53	17.4	28.6	5,600	28.6	194	471	1,290	317
M100SW	11.1	20	0.082	1.31	23.8	3.76	9.61	17.1	3,950	17.1	183	292	826	84.9
M100W	32	147	0.068	17.7	103	9	18.3	25.3	66,100	25.3	158	6,400	28,800	80.1
M200E	18.1	36.5	0.162	2.22	49	6.25	20.4	42.7	20,400	42.7	421	1,120	5,430	140
M200NE	319	327	0.113	7.75	314	46.1	118	44.7	14,000	44.7	187	3,220	2,880	95.2
M200SE	28.3	52.2	0.299	4.26	107	9.7	42.8	90.7	20,700	90.7	341	1,420	5,020	175
M400E	12.5	24.4	<0.0593	1.35	38.9	5.36	13	21.1	5,880	21.1	138	332	1,440	56.8
M400SE	136	290	0.122	25.3	166	25.9	49.1	204	20,900	204	250	7,150	5,940	139
M800E	12,000	39,400	<0.776	920	25,800	3,240	6,250	1,350	867,000	1350	197	141,000	156,000	36.8
AH5	2.35	4.38	<0.063	0.328	5.74	0.691	2.13	6.22	950	6.22	73.3	99.8	187	25
AH10	2.27	3.27	<0.0589	0.28	4.38	0.546	2.44	5.03	972	5.03	84.4	67.1	159	30.8
FC4000ENE	1.25	1.68	<0.0581	0.117	2.36	0.274	0.944	2.3	434	2.3	34.8	36.6	75	15
PB1	1.81	3.4	<0.0596	0.286	4.35	0.524	1.62	3.86	886	3.86	72.6	69.3	161	28.6
PB2	1.78	3.01	<0.0612	0.229	3.53	0.385	1.12	3.77	738	3.77	60.7	56.7	131	23.5
McLoughlin Point														
MC0	9.41	16.4	<0.055	0.839	33	4.93	13.2	41.5	2,170	41.5	94.4	198	406	48.1
MC100NW	6.47	9.26	<0.0623	0.914	17.3	1.87	7.44	20.4	2,730	20.4	96.2	273	587	32.2
MC200E	4.9	7.88	<0.0617	0.47	20.5	1.65	7.87	23.2	4,130	23.2	119	187	913	43.5
MC400E	11.8	19.8	0.109	1.57	47.9	7.51	19.3	66.8	4,000	66.8	153	265	799	76.5
MC800SE	18.2	38.2	<0.0607	1.72	71.1	7.32	24.5	55.4	6,260	55.4	198	526	1,620	85.1

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Biphenyls					Polychlorinated Dibenzodioxins								
Parameter	Total Nonachloro Biphenyls	Total Octachloro Biphenyls	Total Pentachloro Biphenyls	Total Tetrachloro Biphenyls	Total Trichloro Biphenyls	1,2,3,4,6,7,8-HPCDD	1,2,3,4,6,7,8-HPCDF	1,2,3,4,7,8,9-HPCDF	1,2,3,4,7,8-HXCDD	1,2,3,4,7,8-HXCDF	1,2,3,6,7,8-HXCDD	1,2,3,6,7,8-HXCDF	1,2,3,7,8,9-HXCDD	1,2,3,7,8,9-HXCDD
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL														
BC CSR Typical						260	260							
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	94.3	222	2,310	1,150	646	23	5.46	0.388	0.403	1.25	1.76	0.92	1.91	1.94
M100E	1,510	6,390	261,000	77,000	4,250	20.5	11.1	0.594	0.38	1.91	1.94	1.2	1.61	1.53
M100N	44.7	122	1,770	1,130	526	10.6	4.02	0.237	0.186	0.362	1.04	0.185	1.17	0.875
M100NW	1,400	941	612	461	239	6.52	2.95	0.152	0.223	0.579	0.888	0.43	0.706	0.621
M100SE	64.5	179	2,840	1,720	529	25	4.33	0.159	0.261	0.489	1.08	0.392	1.09	1.01
M100S	73.1	302	1,660	845	425	11.4	3.6	0.232	0.336	0.65	1.31	0.617	1.29	1.15
M100SW	37.2	119	1,330	691	369	33.4	29.7	2.37	1.04	3.4	2.61	3.26	2.08	3.09
M100W	130	996	25,100	4,120	324	11.7	4.53	0.673	0.277	1.29	1.42	0.618	1.21	1.02
M200E	69.4	221	8,580	3,290	1,090	19.7	11.9	0.855	1.16	5.04	2.81	5.01	2.17	3.71
M200NE	478	1,960	2,190	2240	721	18.6	17.3	0.971	0.511	2.56	2.03	1.81	1.75	1.98
M200SE	150	354	8,770	3670	754	19.9	20.1	2.97	0.816	7.4	2.25	3.89	2.12	2.33
M400E	57.3	137	2,290	1100	312	23.2	22.1	3.21	1.57	8.08	4.36	5.38	3.39	4.42
M400SE	241	2300	2,510	1,410	742	15.9	7.15	0.719	0.462	1.57	1.26	1.09	1.37	1.34
M800E	35,300	188,000	270,000	74,200	1,220	8.72	9.58	0.735	0.242	1.54	0.997	0.698	1.25	1.02
AH5	7.87	27.5	238	182	103	5.87	1.61	0.098	0.207	0.133	0.567	0.108	0.925	0.501
AH10	<-999	14	219	239	153	6.48	2.07	0.086	0.182	0.216	0.724	0.13	0.842	0.664
FC4000ENE	3.58	6.82	101	101	58.7	3.73	0.92	<0.0581	0.104	0.1	0.589	<0.0581	0.727	0.459
PB1	6.49	22	195	212	115	5.9	1.47	0.084	0.205	0.154	0.642	0.095	0.86	0.654
PB2	5.04	19	151	186	102	6.27	1.43	0.077	0.124	0.157	0.567	0.08	0.767	0.527
McLoughlin Point														
MC0	51.1	94.7	598	430	212	8.71	6.39	<0.314	0.415	0.895	1.01	1.07	1.27	1.2
MC100NW	26.6	77.4	887	518	208	9.35	3.52	0.219	0.303	0.766	1.3	0.51	1.17	1.17
MC200E	30	52.3	1,590	913	257	11.4	3.44	0.21	0.232	0.593	1.27	0.481	1.84	1.21
MC400E	74.7	124	1,310	763	363	14	14.6	1.34	1.98	11.6	3.66	11.1	3.07	5.94
MC800SE	103	215	1,690	1,250	524	13.1	5.17	0.438	0.452	1.09	1.42	0.851	0.929	1.15

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Dibenzodioxins												
Parameter	1,2,3,7,8,9-HXCDF	1,2,3,7,8-PECDD	1,2,3,7,8-PECDF	2,3,4,6,7,8-HXCDF	2,3,4,7,8-PECDF	2,3,7,8-TCDD	2,3,7,8-TCDF	2,3,7,8-TCDF	OCDD	OCDF	TOTAL HEPTA-DIOXINS	TOTAL HEPTA-FURANS	TOTAL HEXA-DIOXINS
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry
CCME PEL													
BC CSR Typical													
WSDoE 2nd Lowest AET													
Macaulay Point													
M0	0.134	0.572	0.905	0.804	1.08	0.27	1.56	4.82	229	4.98	50.8	11.4	18.5
M100E	0.157	0.51	0.891	1.14	1.43	0.346	1.53	4.81	152	6.45	49.1	21.1	20.2
M100N	0.106	0.297	0.247	0.226	0.305	0.195	0.707	1.5	76	10.4	23.6	11.3	10.2
M100NW	0.081	0.33	0.474	0.448	0.652	0.163	1.04	3.12	40.3	2.75	14.7	5.81	7.43
M100SE	<0.0655	0.33	0.398	0.425	0.562	0.098	0.922	2.42	304	5.28	53.5	10.1	10.2
M100S	0.103	0.381	0.613	0.496	0.833	0.222	1.38	4.34	72.1	5.32	27.2	8.22	13
M100SW	0.369	0.916	1.69	4.07	3.45	0.345	1.97	7.15	166	56	60.7	78.9	26.1
M100W	0.084	0.36	0.284	0.419	0.623	0.114	0.736	1.73	68.6	5.91	25	11.2	11.4
M200E	0.386	1.77	5.32	4.71	8.54	0.734	7.83	36.6	101	7.18	41.7	22.4	31.9
M200NE	<0.365	0.857	2.14	1.47	2.79	0.45	3.49	13.6	89.3	14.9	40	44.1	19.1
M200SE	0.389	1.13	3.68	2.38	3.41	0.565	3.68	15	123	27.1	40.9	37	21.8
M400E	0.409	1.62	3.37	5.96	6.23	0.562	3.47	15	62.6	10.4	51.5	42.8	42.4
M400SE	<0.217	0.675	1.16	1.23	1.33	0.326	1.81	6.45	97.3	6.02	32.9	15	16.3
M800E	0.118	0.359	0.62	0.494	0.662	0.237	1.18	3.26	52.3	6.86	24.3	14.1	9.2
AH5	<0.063	0.161	0.1	0.093	0.094	0.11	0.31	0.488	38.1	2.76	14.1	3.53	6.31
AH10	0.066	0.24	0.111	0.073	0.08	0.076	0.341	0.538	35.7	1.99	14.7	4.09	7
FC4000ENE	<0.0581	0.086	<0.0581	<0.0581	0.091	0.067	0.276	0.346	21.8	1.29	8.57	2	4.56
PB1	0.101	0.268	0.101	0.071	0.145	0.115	0.36	0.557	31.1	2.29	13.5	3.44	6.27
PB2	<0.0612	0.198	0.114	0.084	0.096	0.101	0.251	0.405	36.9	1.96	17	3.1	5.31
McLoughlin Point													
MC0	<0.159	0.498	0.829	1	1.42	0.197	1.26	4.42	51.4	3.28	22.3	11.2	11.8
MC100NW	0.079	0.528	0.539	0.504	0.862	0.211	1.11	3.21	49.2	4.4	23.3	8.1	12.7
MC200E	0.095	0.516	0.541	0.398	0.677	0.285	1.29	3.65	65.6	3.99	28.2	8.07	22.7
MC400E	0.952	5.31	16.5	9.82	24.2	2.25	24.9	102	42.1	4.18	30.1	23.5	46.2
MC800SE	0.213	0.727	0.727	0.714		0.22	1.1	3.53	65.8	5.75	30.8	11.3	16.6

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Polychlorinated Dibenzodioxins					Pesticides									
Parameter	Total Hexa-Furans	Total Penta-Dioxins	Total Penta-Furans	Total Tetra-Dioxins	Total Tetra-Furans	1,2,3,4-Tetrachlorobenzene	1,2,4,5-/1,2,3,5-Tetrachlorobenzene	2,4-DDD	2,4-DDE	2,4-DDT	4,4-DDD	4,4-DDE	4,4-DDT	Aldrin
Units	pg/g dry	pg/g dry	pg/g dry	pg/g dry	pg/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL								7.81	374	4.77	7.81	374	4.77	
BC CSR Typical								9.4	450	5.7	9.4	450	5.7	
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	11.6	7.17	13.2	5.23	28.4	0.505	0.499	40.4	0.024	<0.014	2.89	0.42	NDR	0.004
M100E	17.1	6.19	14.5	4.57	24.6	0.57	0.553	5.47	0.051	<0.0156	10.5	1.09	NDR	0.008
M100N	4.57	2.5	2.66	1.89	5	NDR	NDR	0.232	0.018	0.021	0.299	0.286	0.046	0.015
M100NW	5.28	1.69	7.54	2.14	14.6	0.135	0.111	0.291	0.014	<0.0196	0.152	0.223	<0.0212	<0.0031
M100SE	6.75	1.86	4.79	1.33	11.8	0.24	0.223	0.769	0.019	0.023	0.354	0.344	0.069	<0.0032
M100S	7.32	4.52	8.45	3.17	21.5	0.301	0.233	0.267	0.023	<0.0765	0.484	0.391	NDR	<0.0035
M100SW	36.2	9.21	28.3	4.01	31.1	0.221	0.183	0.729	0.024	0.085	3.65	0.424	0.054	<0.0044
M100W	9.5	3.85	5.55	5.83	10	0.21	0.166	0.28	0.022	0.027	0.33	0.326	0.038	0.005
M200E	49.1	23.5	96.7	23.8	181	0.337	0.319	0.443	0.03	0.031	0.985	0.526	0.054	<0.0033
M200NE	30.4	8.46	33.8	6.67	66.4	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
M200SE	35.5	10.3	44.4	10.3	69.4	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
M400E	56.4	17.1	57.2	5.7	46.2	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
M400SE	12.7	6.96	15.3	3.3	21.9	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
M800E	6.04	2.84	4.89	1.61	12.2	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
AH5	1.7	0.39	0.578	0.404	0.88	NDR	NDR	0.029	0.01	<0.0084	0.088	0.159	0.014	0.036
AH10	0.309	1.12	0.414	0.512	1.89	NDR	NDR	0.029	0.014	<0.012	0.107	0.201	0.017	0.005
FC4000ENE	0.508	0.237	0.332	0.232	0.563	NDR	NDR	0.011	0.005	0.054	0.033	0.076	<0.0118	0.008
PB1	0.641	1.07	0.353	0.38	1.69	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
PB2	1.42	0.976	0.812	0.142	1.62	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
McLoughlin Point														
MC0	9.64	5.46	10	2.05	17.5	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
MC100NW	5.53	4.16	7.2	1.57	11.7	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
MC200E	4.62	11.7	6.64	2.63	18.7	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
MC400E	88.1	59.2	226	48.2	425	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR
MC800SE	12	7.94	15.8	5.19	23.3	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR	NDR

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Pesticides													
Parameter	Alpha Chlordane	Alpha-Endosulfan	Alpha-Hch	Beta-Endosulfan	Beta-Hch	Cis-Nonachlor	Delta-Hch	Dieldrin	Endosulfan Sulfate	Endrin	Endrin Aldehyde	Endrin Ketone	Hch, Gamma	Heptachlor
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL	4.79							4.3		62.4				2.74
BC CSR Typical	5.7							5.2		75			1.2	3.3
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	0.082	0.019	0.449	0.063	0.185	0.032	0.014	0.202	0.026	0.015	<0.0337	<0.0283	<0.0405	NDR
M100E	0.082	0.047	1.68	0.065	0.355	0.022	0.145	0.423	0.039	<0.0075	<0.0787	<0.0432	0.079	NDR
M100N	0.01	0.034	0.093	0.045	0.08	0.009	0.065	0.023	0.017	<0.0097	<0.032	<0.0129	0.052	<0.0039
M100NW	0.012	0.03	0.075	0.057	0.063	0.005	0.031	0.027	0.011	<0.0077	<0.0113	<0.0081	<0.0235	<0.0031
M100SE	0.066	0.041	0.155	0.066	0.145	0.027	0.06	0.162	0.068	<0.008	<0.0233	<0.0114	<0.0283	<0.0036
M100S	0.02	0.031	0.648	0.048	0.303	0.014	0.737	0.067	0.018	<0.0087	<0.0249	<0.0102	0.124	<0.0035
M100SW	0.032	<0.0098	0.228	0.076	0.148	0.012	0.204	0.087	0.052	<0.0098	<0.0256	<0.0157	0.087	<0.0042
M100W	0.026	0.01	0.517	0.041	0.199	0.013	0.733	0.063	<0.0085	<0.0085	<0.0311	<0.0105	0.551	<0.0034
M200E	0.067	0.054	0.361	0.059	0.231	0.018	0.217	0.219	0.033	0.009	<0.0184	<0.0087	0.06	0.004
M200NE	NDR	0.066	NDR	0.094	NDR	NDR	0.28	0.146	0.071	<0.0131	<0.0285	<0.0147	NDR	NDR
M200SE	NDR	0.063	NDR	0.066	NDR	NDR	3.03	0.525	0.073	0.011	<0.022	<0.0102	NDR	NDR
M400E	NDR	<0.0329	NDR	<0.0708	NDR	NDR	0.568	0.064	<0.0584	<0.0149	<0.0215	<0.011	NDR	NDR
M400SE	NDR	<0.0538	NDR	<0.103	NDR	NDR	0.102	0.084	<0.0848	<0.0242	<0.0211	<0.0115	NDR	NDR
M800E	NDR	0.017	NDR	0.065	NDR	NDR	0.013	0.023	<0.026	<0.0092	<0.0497	<0.0144	NDR	NDR
AH5	0.005	0.021	0.02	0.041	0.022	0.009	<0.0099	<0.0099	0.038	<0.0099	<0.0269	<0.0099	<0.0175	0.004
AH10	0.005	<0.0092	0.034	<0.0105	<0.0405	0.005	<0.0105	0.013	<0.0102	<0.0092	<0.0264	<0.0115	<0.0347	<0.0037
FC4000ENE	<0.0037	0.017	<0.0307	<0.0091	<0.0459	0.006	<0.0097	<0.0091	0.018	<0.0091	<0.0214	<0.0091	<0.0367	0.005
PB1	NDR	0.017	NDR	0.068	NDR	NDR	<0.0187	0.014	<0.0318	<0.0094	<0.0307	<0.012	NDR	NDR
PB2	NDR	0.017	NDR	0.025	NDR	NDR	<0.0175	0.013	<0.0197	<0.0096	<0.0191	<0.0119	NDR	NDR
McLoughlin Point														
MC0	NDR	<0.0314	NDR	<0.0693	NDR	NDR	0.029	0.028	<0.0572	<0.0139	<0.0342	<0.0114	NDR	NDR
MC100NW	NDR	<0.0247	NDR	0.075	NDR	NDR	0.024	0.017	<0.0431	<0.0103	<0.0272	<0.0129	NDR	NDR
MC200E	NDR	<0.0209	NDR	0.053	NDR	NDR	0.051	0.036	<0.0279	<0.0097	<0.0097	<0.0097	NDR	NDR
MC400E	NDR	0.017	NDR	<0.0176	NDR	NDR	0.346	0.037	<0.0156	<0.0078	<0.0188	<0.0082	NDR	NDR
MC800SE	NDR	<0.0313	NDR	<0.0583	NDR	NDR	0.035	0.036	<0.0516	<0.0147	<0.016	<0.0083	NDR	NDR

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Pesticides									Fluorinated Compounds				
Parameter	Heptachlor Epoxide	Hexachlorobenzene	Methoxyclor	MIREX	Octachlorostyrene	Oxy-Chlordane	Pentachlorobenzene	Trans-Chlordane	Trans-Nonachlor	PFBA	PFBS	PFDA	PFDoA	PFHpA
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL	2.74							4.79						
BC CSR Typical	3.3							5.7						
WSDoE 2nd Lowest AET		70												
Macaulay Point														
M0	0.019	0.212	NDR	0.006	0.001	0.01	0.266	0.104	0.047	<0.0902	<0.18	<0.0902	<0.0902	<0.0902
M100E	0.032	0.246	NDR	0.05	0.001	<0.0065	0.297	0.108	0.046	<0.096	<0.192	<0.096	<0.096	<0.096
M100N	<0.0097	0.125	<0.0583	<0.0039	<0.0007	<0.0808	0.097	0.015	0.009	<0.0933	<0.187	<0.0933	<0.0933	<0.0933
M100NW	<0.0077	0.086	<0.0605	<0.0031	0.002	0.004	0.088	0.016	0.009	<0.093	<0.186	<0.093	<0.093	<0.093
M100SE	0.025	0.163	0.159	0.017	0.002	<0.008	0.113	0.065	0.049	<0.0772	<0.154	<0.0772	<0.0772	<0.0772
M100S	<0.0087	0.163	<0.601	<0.0035	0.001	<0.0045	0.138	0.023	0.013	<0.0863	<0.173	<0.0863	<0.0863	<0.0863
M100SW	<0.0098	0.15	<0.0998	0.006	<0.0019	<0.0112	0.125	0.035	0.015	<0.0928	<0.186	<0.0928	<0.0928	<0.0928
M100W	<0.0085	0.137	<0.199	<0.0034	<0.0007	<0.0044	0.119	0.038	0.025	<0.0991	<0.198	<0.0991	<0.0991	<0.0991
M200E	0.011	0.172	<0.262	0.007	<0.0009	<0.006	0.159	0.095	0.038	<0.0966	<0.193	<0.0966	<0.0966	<0.0966
M200NE	0.014	NDR	0.366	NDR	NDR	NDR	NDR	NDR	NDR	<0.0944	<0.189	<0.0944	<0.0944	<0.0944
M200SE	0.012	NDR	0.276	NDR	NDR	NDR	NDR	NDR	NDR	<0.0914	<0.183	<0.0914	<0.0914	<0.0914
M400E	<0.0093	NDR	<0.0949	NDR	NDR	NDR	NDR	NDR	NDR	<0.102	<0.205	<0.102	<0.102	<0.102
M400SE	<0.0097	NDR	<0.0797	NDR	NDR	NDR	NDR	NDR	NDR	<0.103	<0.206	<0.103	<0.103	<0.103
M800E	<0.0092	NDR	<0.268	NDR	NDR	NDR	NDR	NDR	NDR	<0.09	<0.18	<0.09	<0.09	<0.09
AH5	<0.0099	0.092	<0.0418	<0.004	<0.0003	<0.004		0.006	0.006	<0.0921	<0.184	<0.0921	<0.0921	<0.0921
AH10	<0.0092	0.123	<0.0469	<0.0037	0.001	<0.0037	0.072	0.006	0.007	<0.0968	<0.194	<0.0968	<0.0968	<0.0968
FC4000ENE	<0.0091	0.039	<0.0183	<0.0037	<0.0006	<0.0037	0.03	0.004	<0.0037	<0.0844	<0.169	<0.0844	<0.0844	<0.0844
PB1	<0.0094	NDR	<0.0446	NDR	NDR	NDR	NDR	NDR	NDR	<0.088	<0.176	<0.088	<0.088	<0.088
PB2	<0.0096	NDR	<0.022	NDR	NDR	NDR	NDR	NDR	NDR	<0.0925	<0.185	<0.0925	<0.0925	<0.0925
McLoughlin Point														
MC0	<0.009	NDR	<1.43	NDR	NDR	NDR	NDR	NDR	NDR	<0.0979	<0.196	<0.0979	<0.0979	<0.0979
MC100NW	<0.0098	NDR	<0.0666	NDR	NDR	NDR	NDR	NDR	NDR	<0.106	<0.211	<0.106	<0.106	<0.106
MC200E	<0.0097	NDR	<0.0819	NDR	NDR	NDR	NDR	NDR	NDR	<0.0995	<0.199	<0.0995	<0.0995	<0.0995
MC400E	<0.0078	NDR	<0.118	NDR	NDR	NDR	NDR	NDR	NDR	<0.0891	<0.178	<0.0891	<0.0891	<0.0891
MC800SE	<0.0083	NDR	<0.0722	NDR	NDR	NDR	NDR	NDR	NDR	<0.0914	<0.183	<0.0914	<0.0914	<0.0914

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Fluorinated Compounds								Pharmaceuticals & Personal Care Products					
Parameter	PFHxA	PFHxS	PFNA	PFOA	PFOS	PFOSA	PFPeA	PFUnA	1,7-Dimethylxanthine	2-Hydroxy-Ibuprofen	4-Epianhydrochlortetracycline	4-Epianhydrotetracycline	4-Epichlortetracycline	4-Epioxytetracycline
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	<0.0902	<0.18	<0.0902	<0.0902	<0.18	<0.0902	<0.0902	<0.0902	<73.6	<83	<199	<49.8	<49.8	<19.9
M100E	<0.096	<0.192	<0.096	<0.096	<0.192	<0.096	<0.096	<0.096	---	<81.5	---	---	---	---
M100N	<0.0933	<0.187	<0.0933	<0.0933	<0.187	<0.0933	<0.0933	<0.0933	---	<80	---	---	---	---
M100NW	<0.093	<0.186	<0.093	<0.093	<0.186	<0.093	<0.093	<0.093	---	<76	---	---	---	---
M100SE	<0.0772	<0.154	<0.0772	<0.0772	<0.154	<0.0772	<0.0772	0.089	---	<72.1	---	---	---	---
M100S	<0.0863	<0.173	<0.0863	<0.0863	<0.173	<0.0863	<0.0863	<0.0863	---	<83.3	---	---	---	---
M100SW	<0.0928	<0.186	<0.0928	<0.0928	<0.186	<0.0928	<0.0928	<0.0928	---	<77.4	---	---	---	---
M100W	<0.0991	<0.198	<0.0991	<0.0991	<0.198	<0.0991	<0.0991	<0.0991	---	<78.9	---	---	---	---
M200E	<0.0966	<0.193	<0.0966	<0.0966	<0.193	<0.0966	<0.0966	<0.0966	---	<102	---	---	---	---
M200NE	<0.0944	<0.189	<0.0944	<0.0944	<0.189	<0.0944	<0.0944	<0.0944	---	<76.7	---	---	---	---
M200SE	<0.0914	<0.183	<0.0914	<0.0914	<0.183	<0.0914	<0.0914	<0.0914	---	<78.9	---	---	---	---
M400E	<0.102	<0.205	<0.102	<0.102	<0.205	<0.102	<0.102	<0.102	---	<75.7	---	---	---	---
M400SE	<0.103	<0.206	<0.103	<0.103	<0.206	<0.103	<0.103	<0.103	---	<83.2	---	---	---	---
M800E	<0.09	<0.18	<0.09	<0.09	<0.18	<0.09	<0.09	<0.09	---	<71.5	---	---	---	---
AH5	<0.0921	<0.184	<0.0921	<0.0921	<0.184	<0.0921	<0.0921	<0.0921	---	<76.1	---	---	---	---
AH10	<0.0968	<0.194	<0.0968	<0.0968	<0.194	<0.0968	<0.0968	<0.0968	---	<80.9	---	---	---	---
FC4000ENE	<0.0844	<0.169	<0.0844	<0.0844	<0.169	<0.0844	<0.0844	<0.0844	---	<76.1	---	---	---	---
PB1	<0.088	<0.176	<0.088	<0.088	<0.176	<0.088	<0.088	<0.088	<81	<69.7	NDR	NDR	NDR	NDR
PB2	<0.0925	<0.185	<0.0925	<0.0925	<0.185	<0.0925	<0.0925	<0.0925	---	<75	---	---	---	---
McLoughlin Point														
MC0	<0.0979	<0.196	<0.0979	<0.0979	<0.196	<0.0979	<0.0979	<0.0979	<54.4	<72.5	<54.4	<13.6	<13.6	<5.44
MC100NW	<0.106	<0.211	<0.106	<0.106	<0.211	<0.106	<0.106	<0.106	---	<74.3	---	---	---	---
MC200E	<0.0995	<0.199	<0.0995	<0.0995	<0.199	<0.0995	<0.0995	<0.0995	---	<76.8	---	---	---	---
MC400E	<0.0891	<0.178	<0.0891	<0.0891	<0.178	<0.0891	<0.0891	<0.0891	---	<70	---	---	---	---
MC800SE	<0.0914	<0.183	<0.0914	<0.0914	<0.183	<0.0914	<0.0914	<0.0914	---	<76.9	---	---	---	---

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Pharmaceuticals & Personal Care Products												
Parameter	4-Epitetracycline [Etc]	Acetaminophen	Albuterol	Alprazolam	Amitriptyline	Amphetamine	Anhydro-chlortetracycline	Anhydro-tetracycline	Atenolol	Atorvastatin	Benzoylecgonine	Betamethasone	Bisphenol A
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL													
BC CSR Typical													
WSDoE 2nd Lowest AET													
Macaulay Point													
M0	<19.9	<15.6	<0.311		NDR	4.12	<49.8	<49.8	12.5	<1.55	NDR	NDR	<519
M100E	---	---	---	---	---	---	---	---	---	---	---	---	<509
M100N	---	---	---	---	---	---	---	---	---	---	---	---	<500
M100NW	---	---	---	---	---	---	---	---	---	---	---	---	<475
M100SE	---	---	---	---	---	---	---	---	---	---	---	---	<451
M100S	---	---	---	---	---	---	---	---	---	---	---	---	<521
M100SW	---	---	---	---	---	---	---	---	---	---	---	---	<484
M100W	---	---	---	---	---	---	---	---	---	---	---	---	<493
M200E	---	---	---	---	---	---	---	---	---	---	---	---	<635
M200NE	---	---	---	---	---	---	---	---	---	---	---	---	<479
M200SE	---	---	---	---	---	---	---	---	---	---	---	---	<493
M400E	---	---	---	---	---	---	---	---	---	---	---	---	<473
M400SE	---	---	---	---	---	---	---	---	---	---	---	---	<520
M800E	---	---	---	---	---	---	---	---	---	---	---	---	<447
AH5	---	---	---	---	---	---	---	---	---	---	---	---	<476
AH10	---	---	---	---	---	---	---	---	---	---	---	---	<506
FC4000ENE	---	---	---	---	---	---	---	---	---	---	---	---	<475
PB1	NDR	<13.1	<0.26	<0.262	<1.61	4.81	NDR	NDR	<0.519	<1.3	NDR	<4.36	<436
PB2	---	---	---	---	---	---	---	---	---	---	---	---	<469
McLoughlin Point													
MC0	<5.44	<13.6	<0.292	<0.272	<2.02	11.6	<13.6	<13.6	<0.585	<1.46	<0.272	<4.53	<453
MC100NW	---	---	---	---	---	---	---	---	---	---	---	---	<465
MC200E	---	---	---	---	---	---	---	---	---	---	---	---	<480
MC400E	---	---	---	---	---	---	---	---	---	---	---	---	<438
MC800SE	---	---	---	---	---	---	---	---	---	---	---	---	<481

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Pharmaceuticals & Personal Care Products													
Parameter	Caffeine	Carbadox	Carbamazepine	Cefotaxime	Chlortetracycline	Cimetidine	Ciprofloxacin	Clarithromycin	Clinafloxacin	Clonidine	Cloxacillin	Cocaine	Codeine	Cotinine
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	136	NDR	41.7	NDR	<19.9	6.7	NDR	<1.56	NDR	<1.55	NDR	NDR	12.9	<1.55
M100E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100N	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100NW	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100SE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100S	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100SW	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100W	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M200E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M200NE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M200SE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M400E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M400SE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M800E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
AH5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
AH10	---	---	---	---	---	---	---	---	---	---	---	---	---	---
FC4000ENE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
PB1	<26.9	NDR	<1.31	NDR	NDR	<0.519	NDR	<1.31	NDR	<1.3	NDR	<0.131	<2.6	<1.3
PB2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
McLoughlin Point														
MC0	17.8	NDR	2.07	NDR	<5.44	<0.585	NDR	<1.36	NDR	<1.46	NDR	<0.136	<2.92	<1.46
MC100NW	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MC200E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MC400E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MC800SE	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Pharmaceuticals & Personal Care Products													
Parameter	Deet	Demeclocycline	Desmethyldiltiazem	Diazepam	Doxycycline	Enalapril	Erythromycin-H2O	Fluocinonide	Fluoxetine	Furosemide	Gemfibrozil	Glipizide	Glyburide	Hydrochlorothiazide
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	NDR	<49.8	NDR	NDR	<19.9	<0.311	NDR	NDR	NDR	<41.5	<1.56	<6.23	<3.11	<69.2
M100E	---	---	---	---	---	---	---	---	---	<40.7	<1.53	<6.11	<3.06	<67.9
M100N	---	---	---	---	---	---	---	---	---	<40	<1.5	<6	<3	<66.7
M100NW	---	---	---	---	---	---	---	---	---	<38	<1.43	<5.7	<2.85	<63.4
M100SE	---	---	---	---	---	---	---	---	---	<36.1	<1.35	<5.41	<2.7	<60.1
M100S	---	---	---	---	---	---	---	---	---	<41.6	<1.56	<6.25	<3.12	<69.4
M100SW	---	---	---	---	---	---	---	---	---	<38.7	<1.45	<5.8	<2.9	<64.5
M100W	---	---	---	---	---	---	---	---	---	<39.4	<1.48	<5.91	<2.96	<65.8
M200E	---	---	---	---	---	---	---	---	---	<50.8	<1.9	<7.62	<3.81	<84.7
M200NE	---	---	---	---	---	---	---	---	---	<38.4	<1.44	<5.75	<2.88	<64
M200SE	---	---	---	---	---	---	---	---	---	<39.4	<1.48	<5.91	<2.96	<65.8
M400E	---	---	---	---	---	---	---	---	---	<37.9	<1.42	<5.68	<2.84	<63.1
M400SE	---	---	---	---	---	---	---	---	---	<41.6	<1.56	<6.24	<3.12	<69.4
M800E	---	---	---	---	---	---	---	---	---	<35.8	<1.34	<5.36	<2.68	<59.6
AH5	---	---	---	---	---	---	---	---	---	<38.1	<1.43	<5.71	<2.86	<63.5
AH10	---	---	---	---	---	---	---	---	---	<40.5	<1.52	<6.07	<3.03	<67.5
FC4000ENE	---	---	---	---	---	---	---	---	---	<38	<1.43	<5.71	<2.85	<63.4
PB1	1.21	NDR	<0.131	<0.262	NDR	<0.26	<6.46	<5.23	<1.31	<34.9	<1.31	<5.23	<2.62	<58.1
PB2	---	---	---	---	---	---	---	---	---	<37.5	<1.41	<5.63	<2.81	<62.5
McLoughlin Point														
MC0	0.738	<13.6	<0.834	<0.272	<5.44	<0.292	5.95	<5.44	<1.36	<36.3	<1.36	<5.44	<2.72	<60.5
MC100NW	---	---	---	---	---	---	---	---	---	<37.2	<1.39	<5.58	<2.79	<62
MC200E	---	---	---	---	---	---	---	---	---	<38.4	<1.44	<5.76	<2.88	<64
MC400E	---	---	---	---	---	---	---	---	---	<35	<1.31	<5.25	<2.63	<58.4
MC800SE	---	---	---	---	---	---	---	---	---	<38.4	<1.44	<5.77	<2.88	<64.1

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Pharmaceuticals & Personal Care Products													
Parameter	Hydrocodone	Hydrocortisone	Ibuprofen	Isochlortetracycline	Metformin	Methylprednisolone	Metoprolol	Minocycline	Naproxen	Norfluoxetine	Oxycodone	Oxytetracyclin	Paroxetine	Paroxetine
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	<4.57	NDR	<15.6	<19.9	9.72	NDR	NDR	<199	<3.11	NDR	<0.621	<19.9	<129	NDR
M100E	---	---	<15.3	---	---	---	---	---	<3.06	---	---	---	---	---
M100N	---	---	<15	---	---	---	---	---	<3	---	---	---	---	---
M100NW	---	---	<14.3	---	---	---	---	---	<2.85	---	---	---	---	---
M100SE	---	---	<13.5	---	---	---	---	---	<2.7	---	---	---	---	---
M100S	---	---	<15.6	---	---	---	---	---	<3.12	---	---	---	---	---
M100SW	---	---	<14.5	---	---	---	---	---	<2.9	---	---	---	---	---
M100W	---	---	<14.8	---	---	---	---	---	<2.96	---	---	---	---	---
M200E	---	---	<19	---	---	---	---	---	<3.81	---	---	---	---	---
M200NE	---	---	<14.4	---	---	---	---	---	<2.88	---	---	---	---	---
M200SE	---	---	<14.8	---	---	---	---	---	<2.96	---	---	---	---	---
M400E	---	---	<14.2	---	---	---	---	---	<2.84	---	---	---	---	---
M400SE	---	---	<15.6	---	---	---	---	---	<3.12	---	---	---	---	---
M800E	---	---	<13.4	---	---	---	---	---	<2.68	---	---	---	---	---
AH5	---	---	<14.3	---	---	---	---	---	<2.86	---	---	---	---	---
AH10	---	---	<15.2	---	---	---	---	---	<3.03	---	---	---	---	---
FC4000ENE	---	---	<14.3	---	---	---	---	---	<2.85	---	---	---	---	---
PB1	<1.3	<49.9	<13.1	---	---	---	---	---	<2.62	<4	<0.519	NDR	NDR	<3.52
PB2	---	---	<14.1	---	---	---	---	---	<2.81	---	---	---	---	---
McLoughlin Point														
MC0	<1.46	<51.9	<13.6	<5.44	3.02	<3.66	NDR	<54.4	<2.72	<1.36	<0.585	<5.44	NDR	<3.66
MC100NW	---	---	<13.9	---	---	---	---	---	<2.79	---	---	---	---	---
MC200E	---	---	<14.4	---	---	---	---	---	<2.88	---	---	---	---	---
MC400E	---	---	<13.1	---	---	---	---	---	<2.63	---	---	---	---	---
MC800SE	---	---	<14.4	---	---	---	---	---	<2.88	---	---	---	---	---

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Pharmaceuticals & Personal Care Products													
Parameter	Penicillin G	Penicillin V	Promethazine	Propoxyphene	Propranolol	Ranitidine	Ranitidine	Roxithromycin	Simvastatin	Sulfachloropyridazine	Sulfadiazine	Sulfadimethoxine	Sulfamerazine	Sulfamethazine
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	NDR	NDR	NDR	NDR	NDR	NDR	<0.621	<0.337	NDR	<2.12	<1.56	<0.797	<0.942	<2.32
M100E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100N	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100NW	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100SE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100S	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100SW	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M100W	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M200E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M200NE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M200SE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M400E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M400SE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
M800E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
AH5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
AH10	---	---	---	---	---	---	---	---	---	---	---	---	---	---
FC4000ENE	---	---	---	---	---	---	---	---	---	---	---	---	---	---
PB1	NDR	NDR	<0.349	<0.262	<2.6	<0.519	<0.519	<0.262	NDR	<1.99	<1.31	<0.262	<0.655	<0.523
PB2	---	---	---	---	---	---	---	---	---	---	---	---	---	---
McLoughlin Point														
MC0	NDR	NDR	<0.363	<0.272	<17.8	NDR	<0.585	<0.272	<18.1	<1.36	<1.36	<0.272	<0.544	<0.544
MC100NW	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MC200E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MC400E	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MC800SE	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Pharmaceuticals & Personal Care Products													
Parameter	Sulfamethizole	Sulfamethoxazole	Sulfanilamide	Sulfathiazole	Tetracycline	Theophylline	Thiabendazole	Trenbolone	Trenbolone Acetate	Triamterene	Triclocarban	Triclosan	Trimethoprim	Tylosin
Units	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry	ng/g dry
CCME PEL														
BC CSR Typical														
WSDoE 2nd Lowest AET														
Macaulay Point														
M0	<1.03	<0.623	<19.2	<1.56	<19.9	<62.3	NDR	<4.19	<0.736	7.05	52.1	<62.3	<1.56	<6.23
M100E	---	---	---	---	---	---	---	---	---	---	<28.4	<61.1	NDR	NDR
M100N	---	---	---	---	---	---	---	---	---	---	<3	<60	NDR	NDR
M100NW	---	---	---	---	---	---	---	---	---	---	<2.85	<57	NDR	NDR
M100SE	---	---	---	---	---	---	---	---	---	---	7.56	<54.1	NDR	NDR
M100S	---	---	---	---	---	---	---	---	---	---	5.49	<62.5	NDR	NDR
M100SW	---	---	---	---	---	---	---	---	---	---	9.89	<58	NDR	NDR
M100W	---	---	---	---	---	---	---	---	---	---	<2.96	<59.1	NDR	NDR
M200E	---	---	---	---	---	---	---	---	---	---	20	<76.2	NDR	NDR
M200NE	---	---	---	---	---	---	---	---	---	---	11.5	58.3	NDR	NDR
M200SE	---	---	---	---	---	---	---	---	---	---	12.1	69.2	NDR	NDR
M400E	---	---	---	---	---	---	---	---	---	---	<2.84	<56.8	NDR	NDR
M400SE	---	---	---	---	---	---	---	---	---	---	8	<62.4	NDR	NDR
M800E	---	---	---	---	---	---	---	---	---	---	<2.68	<53.6	NDR	NDR
AH5	---	---	---	---	---	---	---	---	---	---	<2.86	<57.1	NDR	NDR
AH10	---	---	---	---	---	---	---	---	---	---	<3.03	<60.7	NDR	NDR
FC4000ENE	---	---	---	---	---	---	---	---	---	---	<2.85	<57.1	NDR	NDR
PB1	<0.523	<0.523	<14.4	<1.31	NDR	<52.3	<3.83	<3.52	<0.335	<0.26	<2.62	<52.3	<1.31	<5.23
PB2	---	---	---	---	---	---	---	---	---	---	<2.81	<56.3	NDR	NDR
McLoughlin Point														
MC0	<0.544	<0.544	<13.6	<1.36	<5.44	<54.4	<1.36	<3.66	<0.335	0.411	<2.72	<54.4	<1.36	<5.44
MC100NW	---	---	---	---	---	---	---	---	---	---	2.84	<55.8	NDR	NDR
MC200E	---	---	---	---	---	---	---	---	---	---	<2.88	<57.6	NDR	NDR
MC400E	---	---	---	---	---	---	---	---	---	---	3.88	<52.5	NDR	NDR
MC800SE	---	---	---	---	---	---	---	---	---	---	4.91	<57.7	NDR	NDR

Appendix D4 Sediment Chemistry Results (AXYS), cont'd

	Pharmaceuticals & Personal Care Products		
Parameter	Valsartan	Verapamil	Warfarin
Units	ng/g dry	ng/g dry	ng/g dry
CCME PEL			
BC CSR Typical			
WSDoE 2nd Lowest AET			
Macaulay Point			
M0	NDR	NDR	<1.56
M100E	---	---	<1.53
M100N	---	---	<1.5
M100NW	---	---	<1.43
M100SE	---	---	<1.35
M100S	---	---	<1.56
M100SW	---	---	<1.45
M100W	---	---	<1.48
M200E	---	---	<1.9
M200NE	---	---	<1.44
M200SE	---	---	<1.48
M400E	---	---	<1.42
M400SE	---	---	<1.56
M800E	---	---	<1.34
AH5	---	---	<1.43
AH10	---	---	<1.52
FC4000ENE	---	---	<1.43
PB1	NDR	<0.451	<1.31
PB2	---	---	<1.41
McLoughlin Point			
MC0	<14.7	<1.27	<1.36
MC100NW	---	---	<1.39
MC200E	---	---	<1.44
MC400E	---	---	<1.31
MC800SE	---	---	<1.44

***Note:**
Method detection limits (MDL) are not given for high-resolution data as they are result specific rather than sample specific
NDR: dta not quantifiable

Appendix D5 Bioaccumulation Chemistry Results – 2014

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				**Reference**	**Far**	**Mid**	**Near**	**Near**	**Outfall**
Moisture and Lipids									
Lipids	%	0.0992	0.0744	0.105	0.115	0.164	0.174	0.181	0.176
Moisture	%	3.26	3.84	3.16	3.32	3.91	3.84	4.48	5.21
PCB									
Pcb 1	pg/g dry	6.04	4.72	23.3	15.7	31.1	53.1	49.6	11.6
Pcb 2	pg/g dry	---	---	0.84	4.28	7.44	2.23	3	2.73
Pcb 3	pg/g dry	110	72.6	80.6	316	277	647	266	540
Pcb 4	pg/g dry	46.7	20.9	35.2	156	122	245	110	243
Pcb 5	pg/g dry	64.4	32.8	48.9	274	160	324	154	374
Pcb 6	pg/g dry	---	---	---	---	---	---	---	---
Pcb 7	pg/g dry	---	---	---	---	---	---	---	---
Pcb 8	pg/g dry	165	155	161	1490	1760	1170	1440	1700
Pcb 9	pg/g dry	---	---	---	---	---	---	---	---
Pcb 10	pg/g dry	10.6	6.62	22.2	22.3	49.5	63.8	40.3	28.4
Pcb 11	pg/g dry	3.84	2.22	7.8	25.1	28.4	29.4	32.2	36.6
Pcb 12/13	pg/g dry	---	---	---	---	---	---	---	---
Pcb 14	pg/g dry	---	---	---	---	---	---	---	---
Pcb 15	pg/g dry	0.734	---	2.31	27.9	48.8	13.5	19.8	17
Pcb 16	pg/g dry	12.3	8.86	29.5	363	545	148	205	187
Pcb 17	pg/g dry	---	---	---	---	---	---	---	---
Pcb 18/30	pg/g dry	---	---	---	---	---	---	---	---
Pcb 19	pg/g dry	8.94	7.16	23.1	99.8	178	66.5	73.8	68
Pcb 20/28	pg/g dry	---	---	---	---	---	---	---	---
Pcb 21/33	pg/g dry	---	---	---	---	---	---	---	---
Pcb 22	pg/g dry	---	---	---	---	---	---	---	---
Pcb 23	pg/g dry	6.66	6.73	23.3	35.8	144	36.4	49.6	49.2
Pcb 24	pg/g dry	2.98	2.3	12.2	19.1	76.6	20.9	22.8	21.5
Pcb 25	pg/g dry	6.07	5.1	16.4	31.6	142	37.4	47.1	42.4
Pcb 26/29	pg/g dry	---	---	---	---	---	---	---	---
Pcb 27	pg/g dry	18.3	16	47.4	87.6	380	97.2	145	129
Pcb 31	pg/g dry	5.83	4.6	13.7	24.3	97.5	26	36.7	36
Pcb 32	pg/g dry	---	---	---	---	---	---	---	---
Pcb 34	pg/g dry	---	---	---	---	---	---	---	0.49
Pcb 35	pg/g dry	---	---	1.14	1.82	6.93	1.87	1.81	2.72
Pcb 36	pg/g dry	6.56	7.14	20.3	53	112	43	89.8	80.1
Pcb 37	pg/g dry	1.97	1.32	3.08	7.32	19.7	8.25	10.6	11.5

Appendix D5 Bioaccumulation Chemistry Results – 2014, cont'd

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Outfall
Pcb 38	pg/g dry	5.44	4.58	8.74	26.2	45.5	23	43.2	39.4
Pcb 39	pg/g dry	7.89	7.1	18.1	61.8	84.1	75.8	57.6	72
Pcb 40/41/71	pg/g dry	---	---	---	---	---	---	---	---
Pcb 42	pg/g dry	0.782	---	---	4.09	2.8	2.85	1.19	2.35
Pcb 43	pg/g dry	5.68	2.59	4.57	19.5	25	29.1	15	30.5
Pcb 44/47/65	pg/g dry	---	---	---	---	---	---	---	---
Pcb 45/51	pg/g dry	---	---	---	---	---	---	---	---
Pcb 46	pg/g dry	---	---	---	---	---	---	---	---
Pcb 48	pg/g dry	12.4	5.75	9.62	14	12.3	12.4	10.4	12.3
Pcb 49/69	pg/g dry	---	---	---	---	---	---	---	---
Pcb 50/53	pg/g dry	---	---	---	---	---	---	---	---
Pcb 52	pg/g dry	3.04	1.52	1.78	2.43	4.16	5.65	4.64	9.39
Pcb 54	pg/g dry	1.4	1.74	1.74	1.72	1.89	1.71	1.9	2.59
Pcb 55	pg/g dry	8.94	5.1	5.5	23.8	20.8	52.9	22	60
Pcb 56	pg/g dry	---	---	---	---	---	0.824	---	0.998
Pcb 57	pg/g dry	0.802	---	0.822	6.14	5.66	3.78	2.41	4.67
Pcb 58	pg/g dry	13.2	4.12	11	19.2	22.6	18.3	17.1	22.2
Pcb 59/62/75	pg/g dry	---	---	---	---	---	---	---	---
Pcb 60	pg/g dry	22	19	24.3	184	131	129	97.9	158
Pcb 61/70/74/76	pg/g dry	---	---	---	---	---	---	---	---
Pcb 63	pg/g dry	22.2	9.17	13.7	164	95.1	74.7	45.3	82.8
Pcb 64	pg/g dry	2.91	1.44	3.02	42	33.9	20.2	12.9	24.7
Pcb 66	pg/g dry	19.5	12.5	21.4	230	206	130	82.2	140
Pcb 67	pg/g dry	62.6	43.2	61	653	632	425	396	478
Pcb 68	pg/g dry	---	---	---	---	---	---	---	---
Pcb 72	pg/g dry	---	---	---	18.1	35.8	7.37	3.91	3.83
Pcb 73	pg/g dry	2.82	1.34	2.9	20.1	12.2	11.4	8.7	13.2
Pcb 77	pg/g dry	11.6	8.44	9.12	64.9	56	49.2	33.8	55.4
Pcb 78	pg/g dry	13	2.46	8.6	14.9	16.9	15.6	13.7	21.8
Pcb 79	pg/g dry	38.4	41.8	31.4	168	129	157	123	205
Pcb 80	pg/g dry	---	---	---	---	---	---	---	---
Pcb 81	pg/g dry	4.76	5.51	4.82	28.2	29.1	23.6	23	33
Pcb 82	pg/g dry	51.5	45.4	49.5	398	307	303	289	395
Pcb 83/99	pg/g dry	---	---	---	---	---	---	---	---
Pcb 84	pg/g dry	76.5	77	73.5	561	507	391	392	532
Pcb 85/116/117	pg/g dry	---	---	---	---	---	---	---	---
Pcb 86/87/97/108/119/125	pg/g dry	---	---	---	---	---	---	---	---

Appendix D5 Bioaccumulation Chemistry Results – 2014, cont'd

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				**Reference**	**Far**	**Mid**	**Near**	**Near**	**Outfall**
Pcb 88/91	pg/g dry	---	---	---	---	---	---	---	---
Pcb 89	pg/g dry	---	---	---	---	---	---	---	---
Pcb 90/101/113	pg/g dry	---	---	---	---	---	---	---	---
Pcb 92	pg/g dry	---	---	---	---	---	---	---	---
Pcb 93/95/98/100/102	pg/g dry	---	---	---	---	---	---	---	---
Pcb 94	pg/g dry	---	---	---	---	---	---	---	---
Pcb 96	pg/g dry	---	---	---	---	---	0.822	---	---
Pcb 103	pg/g dry	595	---	1140	1570	2600	1560	1230	1300
Pcb 104	pg/g dry	37.8	14	37.4	95.2	121	113	104	134
Pcb 105	pg/g dry	---	---		3	1.6		1.82	1.97
Pcb 106	pg/g dry	---	---			1.22			
Pcb 107/124	pg/g dry	---	---	---	---	---	---	---	---
Pcb 109	pg/g dry	50.7	16	61.4	215	366	392	374	438
Pcb 110/115	pg/g dry	---	---	---	---	---	---	---	---
Pcb 111	pg/g dry	3.21	---	3.51	23.2	39.1	29	35.7	37.7
Pcb 112	pg/g dry	7.62	3.08	6.54	17.4	30.6	22.4	31.9	43.4
Pcb 114	pg/g dry	3.11	---	2.99	26.4	30	30.3	30.7	22.8
Pcb 118	pg/g dry	---	---	---	---	---	---	---	---
Pcb 120	pg/g dry	---	---	---	---	---	---	---	---
Pcb 121	pg/g dry	3.83	1.68	2.68	22.1	32.7	17	17.3	14.9
Pcb 122	pg/g dry	---	---	---	---	0.867	---	0.517	---
Pcb 123	pg/g dry	49.9	48.9	67.2	1030	1340	413	743	590
Pcb 126	pg/g dry	---	---	---	---	---	---	---	---
Pcb 127	pg/g dry	14.2	11.3	16.6	182	250	80.1	128	107
Pcb 128/166	pg/g dry	---	---	---	---	---	---	---	---
Pcb 129/138/160/163	pg/g dry	---	---	---	---	---	---	---	---
Pcb 130	pg/g dry	1.32	---	2.12	15.1	15.5	6.55	9.8	5.67
Pcb 131	pg/g dry	---	---	---	---	---	---	---	---
Pcb 132	pg/g dry	3.07	2.47	4.03	71.7	95.3	31.5	58.7	61.1
Pcb 133	pg/g dry	---	---	---	---	---	---	---	---
Pcb 134/143	pg/g dry	---	---	---	---	---	---	---	---
Pcb 135/151/154	pg/g dry	---	---	---	---	---	---	---	---
Pcb 136	pg/g dry	136	110	169	3070	3980	1200	1970	1660
Pcb 137	pg/g dry	---	---	---	---	---	---	---	---
Pcb 139/140	pg/g dry	---	---	---	---	---	---	---	---
Pcb 141	pg/g dry	2.07	2.2	3.24	43	52.2	16.2	23.3	22.6
Pcb 142	pg/g dry	---	---	---	---	---	---	---	---

Appendix D5 Bioaccumulation Chemistry Results – 2014, cont'd

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Outfall
Pcb 144	pg/g dry	0.567	0.518	---	---	---	---	---	---
Pcb 145	pg/g dry	---	---	---	7.33	8.85	---	3.29	2.21
Pcb 146	pg/g dry	28.4	23.1	51.5	559	818	219	347	238
Pcb 147/149	pg/g dry	---	---	---	---	---	---	---	---
Pcb 148	pg/g dry	---	---	---	---	---	---	---	---
Pcb 150	pg/g dry	32.1	23.7	69.5	895	1410	433	645	554
Pcb 152	pg/g dry	3.89	2.58	8.71	81.5	145	40.1	65	51.6
Pcb 153/168	pg/g dry	---	---	---	---	---	---	---	---
Pcb 155	pg/g dry	4.71	3.41	9.34	197	243	53.5	84.4	58.9
Pcb 156/157	pg/g dry	---	---	---	---	---	---	---	---
Pcb 158	pg/g dry	---	---	---	---	---	---	---	---
Pcb 159	pg/g dry	---	---	---	---	---	---	---	---
Pcb 161	pg/g dry	---	---	---	---	---	---	---	---
Pcb 162	pg/g dry	5.49	4.19	10.5	96.5	177	59.5	79.4	78.2
Pcb 164	pg/g dry	34.4	23.2	45.8	242	400	136	173	169
Pcb 165	pg/g dry	131	76.9	204	1650	2800	895	1150	1080
Pcb 167	pg/g dry	---	---	---	---	---	---	---	---
Pcb 169	pg/g dry	1.05	---	0.756	3.3	4.48	2.08	2.63	2.01
Pcb 170	pg/g dry	0.514	---	---	1.44	3.07	1.17	1.68	1.41
Pcb 171/173	pg/g dry	---	---	---	---	---	---	---	---
Pcb 172	pg/g dry	---	---	---	---	---	---	---	---
Pcb 174	pg/g dry	10.4	8.32	21.4	415	540	117	212	154
Pcb 175	pg/g dry	---	---	---	---	---	---	---	---
Pcb 176	pg/g dry	11.7	8.72	19.8	323	482	135	205	172
Pcb 177	pg/g dry	0.877	0.592	2.17	6.19	19.8	5.44	6.34	7.05
Pcb 178	pg/g dry	19.1	3.96	13.5	64.1	40.7	56.5	34.1	72
Pcb 179	pg/g dry	---	---	---	---	---	---	---	---
Pcb 180/193	pg/g dry	---	---	---	---	---	---	---	---
Pcb 181	pg/g dry	---	---	---	---	---	---	---	---
Pcb 182	pg/g dry	6.05	4.54	12.2	109	187	53.4	81.5	69
Pcb 183/185	pg/g dry	---	---	---	---	---	---	---	---
Pcb 184	pg/g dry	---	---	---	---	---	---	---	---
Pcb 186	pg/g dry	---	---	---	---	---	---	---	---
Pcb 187	pg/g dry	---	---	---	---	---	---	---	---
Pcb 188	pg/g dry	33.1	8.95	28.5	127	121	165	81.9	138
Pcb 189	pg/g dry	17.4	12.9	50	209	375	111	151	122
Pcb 190	pg/g dry	3.23	3.22	9.11	26.1	53.4	19.5	25.2	23.6

Appendix D5 Bioaccumulation Chemistry Results – 2014, cont'd

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				**Reference**	**Far**	**Mid**	**Near**	**Near**	**Outfall**
Pcb 191	pg/g dry	---	---	---	---	---	---	---	---
Pcb 192	pg/g dry	13.9	12.1	47.8	155	483	127	145	150
Pcb 194	pg/g dry	3	2.41	7.34	25.8	77.1	22.2	25.2	26.9
Pcb 195	pg/g dry	19.8	12.7	44.7	120	278	94	108	107
Pcb 196	pg/g dry	10.2	7.21	17.3	34.9	104	38.3	41.4	46.5
Pcb 197/200	pg/g dry	---	---	---	---	---	---	---	---
Pcb 198/199	pg/g dry	---	---	---	---	---	---	---	---
Pcb 201	pg/g dry	21.7	16.6	42.4	137	445	122	144	134
Pcb 202	pg/g dry	---	---	---	1.19	1.74	1.11	1.48	1.6
Pcb 203	pg/g dry	---	---	---	---	---	---	---	---
Pcb 204	pg/g dry	75.5	52.4	131	270	952	260	298	296
Pcb 205	pg/g dry	0.74	---	---	0.749	0.981	0.67	0.866	0.961
Pcb 206	pg/g dry	---	---	2.02	8.44	10.7	2.92	5.75	4.34
Pcb 207	pg/g dry	5.27	1.33	4.51	58.9	93.4	21.6	12.4	20.2
Pcb 208	pg/g dry	3.49	2.21	11.9	51.8	109	32.9	41.5	36.4
Pcb 209	pg/g dry	0.9	---	1.51	6.63	14.6	5.1	6.64	6.2
Pcb Teq 3	pg/g dry	22.1	14	29.4	338	462	199	296	222
Pcb Teq 3	pg/g dry	22.1	14	29.4	338	462	199	296	222
Pcb Teq 4	pg/g dry	1.92	1.6	2.75	22.3	27	12.3	18.8	19.2
Pcb Teq 4	pg/g dry	1.92	1.6	2.75	22.3	27	12.3	18.8	19.2
PCBs Total	pg/g dry	64.6	3580	4540	4100	61200	23800	31100	29800
Decachloro Biphenyl	pg/g dry	32.8	12.1	41.4	157	302	323	351	456
Total Dichloro Biphenyls	pg/g dry	---	---	---	---	---	---	---	---
Total Heptachloro Biphenyls	pg/g dry	---	---	---	---	---	---	---	---
Total Hexachloro Biphenyls	pg/g dry	27.5	20	37.9	403	597	243	389	346
Total Monochloro Biphenyls	pg/g dry	74.2	50.7	120	1590	2480	1090	1760	1460
Total Nonachloro Biphenyls	pg/g dry	0.783	---	---	8.92	10.9	5.16	6.45	7.49
Total Octachloro Biphenyls	pg/g dry	---	---	---	---	---	---	---	---
Total Pentachloro Biphenyls	pg/g dry	1.13	---	1.27	14	15.6	9.14	11.6	10.2
Total Tetrachloro Biphenyls	pg/g dry	---	---	---	---	---	---	---	---
Total Trichloro Biphenyls	pg/g dry	---	---	---	---	---	---	---	---
Metals									
Aluminum	mg/kg dry	15.8	11.8	12.4	9.83	7.16	11.3	8.8	9.19
Antimony	mg/kg dry	87	86	86	88	87	87	87	85
Arsenic	mg/kg dry	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Barium	mg/kg dry	---	---	---	---	---	---	---	---
Beryllium	mg/kg dry	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Appendix D5 Bioaccumulation Chemistry Results – 2014, cont'd

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				**Reference**	**Far**	**Mid**	**Near**	**Near**	**Outfall**
Bismuth	mg/kg dry	---	---	---	---	---	---	---	---
Boron	mg/kg dry	---	---	---	---	---	---	---	---
Cadmium	mg/kg dry	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Calcium	mg/kg dry	---	---	---	---	---	---	---	---
Chromium	mg/kg dry	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Cobalt	mg/kg dry	---	---	---	---	---	---	---	---
Copper	mg/kg dry	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Iron	mg/kg dry	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Lead	mg/kg dry	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Magnesium	mg/kg dry	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Manganese	mg/kg dry	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Mercury	mg/kg dry	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Molybdenum	mg/kg dry	---	---	---	---	---	---	---	---
Nickel	mg/kg dry	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Phosphorus	mg/kg dry	---	---	---	---	---	---	---	---
Potassium	mg/kg dry	---	---	---	---	---	---	---	---
Selenium	mg/kg dry	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Silver	mg/kg dry	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Sodium	mg/kg dry	---	---	---	---	---	---	---	---
Strontium	mg/kg dry	---	---	---	---	---	---	---	---
Thallium	mg/kg dry	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Tin	mg/kg dry	---	---	---	---	---	---	---	---
Titanium	mg/kg dry	---	---	---	---	---	---	---	---
Uranium	mg/kg dry	---	---	---	---	---	---	---	---
Vanadium	mg/kg dry	---	---	---	---	---	---	---	---
Zinc	mg/kg dry	962	75.5	1520	1370	1110	853	978	765
PAH									
1-Methylphenanthrene	ng/g dry	---	---	---	---	---	---	---	---
2,3,5-trimethylnaphthalene	ng/g dry	---	---	---	---	---	---	---	---
2,6-dimethylnaphthalene	ng/g dry	795	383	592	2500	1940	3460	1650	3470
2-Methylnaphthalene	ng/g dry	---	---	---	---	---	---	---	---
Acenaphthene	ng/g dry	1990	1420	2440	31200	43400	15800	24500	20200
Acenaphthylene	ng/g dry	373	299	943	3160	8290	2270	2800	2560
Anthracene	ng/g dry	0.0829	0.0739	0.0374	0.661	0.859	0.24	0.412	0.338
Benzo(A)Anthracene	ng/g dry	0.0854	0.0763	0.135	0.864	1.13	0.35	0.512	0.464
Benzo(A)Pyrene	ng/g dry	3580	2400	4540	41000	58000	23800	31100	29800
Benzo(B)Fluoranthene	ng/g dry	0.112	0.113	0.106	0.128	0.13	0.12	0.112	0.145

Appendix D5 Bioaccumulation Chemistry Results – 2014, cont'd

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				**Reference**	**Far**	**Mid**	**Near**	**Near**	**Outfall**
Benzo(E)Pyrene	ng/g dry	5.69	3.85	12.6	15.6	13.6	14.1	11	11.5
Benzo(G,H,I)Perylene	ng/g dry	18.6	14.7	15.6	24.3	31.1	43.6	45.9	158
Benzo[J,K]Fluoranthenes	ng/g dry	9.84	35.3	11.3	29.8	89	95.6	87.4	215
Chrysene	ng/g dry	759	534	1250	11100	17200	5170	7130	6290
Dibenzo(A,H)Anthracene	ng/g dry	318	79.6	218	336	346	347	338	518
Dibenzothiophene	ng/g dry	221	163	484	1500	4190	1200	1410	1370
Fluoranthene	ng/g dry	42	144	58.2	140	253	355	299	648
Fluorene	ng/g dry	39.4	26.6	29.6	51.4	62.5	81	82.8	212
Indeno(1,2,3-C,D)Pyrene	ng/g dry	29.4	4.79	12.3	23.2	30.1	31.3	26.2	30.8
Naphthalene	ng/g dry	14	13	32.1	86.5	177	74.3	144	131
Octachlorostyrene	ng/g dry	0.131	0.159	0.187	0.234	0.107	0.164	0.155	0.222
Perylene	ng/g dry	44.1	37.2	145	261	1210	298	410	373
Phenanthrene	ng/g dry	81.4	170	87.8	191	315	436	382	860
Pyrene	ng/g dry	985	724	1320	18700	26300	9560	15500	12600
PBDE									
Pbde 7	pg/g dry	7.86	2.76	4.72	5	5.02	5	0.708	4.35
Pbde 8/11	pg/g dry	---	---	---	---	---	---	---	---
Pbde 10	pg/g dry	---	---	---	---	---	---	---	---
Pbde 12/13	pg/g dry	---	---	---	---	---	---	---	---
Pbde 15	pg/g dry	5.59	0.9	3.76	3.36	3.36	3.11	3.62	2.92
Pbde 17/25	pg/g dry	---	---	---	---	---	---	---	---
Pbde 28/33	pg/g dry	---	---	---	---	---	---	---	---
Pbde 30	pg/g dry	---	---	---	---	---	---	---	---
Pbde 32	pg/g dry	2.21	1.19	2.53	4.22	6.8	5.94	0.864	8.25
Pbde 35	pg/g dry	8050	6890	7120	8380	7440	7550	971	6340
Pbde 37	pg/g dry	16.9	7	23.7	20.9	16.2	13.7	1.97	12.3
Pbde 47	pg/g dry	0.109	0.075	0.141	0.13	0.106	0.103	0.0109	0.089
Pbde 49	pg/g dry	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Pbde 51	pg/g dry	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Pbde 66	pg/g dry	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Pbde 71	pg/g dry	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Pbde 75	pg/g dry	<0.1	0.14	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Pbde 77	pg/g dry	---	---	---	---	---	---	---	---
Pbde 79	pg/g dry	---	---	---	---	---	---	---	---
Pbde 85	pg/g dry	0.199	0.164	0.139	0.251	0.188	0.251	0.0327	0.215
Pbde 99	pg/g dry	0.0294	0.006	0.012	0.0115	0.0138	0.0139	0.00218	0.0142
Pbde 100	pg/g dry	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Appendix D5 Bioaccumulation Chemistry Results – 2014, cont'd

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				**Reference**	**Far**	**Mid**	**Near**	**Near**	**Outfall**
Pbde 105	pg/g dry	---	---	---	---	---	---	---	---
Pbde 116	pg/g dry	---	---	---	---	---	---	---	---
Pbde 119/120	pg/g dry	---	---	---	---	---	---	---	---
Pbde 126	pg/g dry	<1	<1	<1	<1	<1	<1	<1	<1
Pbde 128	pg/g dry	<10	<10	<10	<10	<10	<10	<10	<10
Pbde 138/166	pg/g dry	---	---	---	---	---	---	---	---
Pbde 140	pg/g dry	0.502	0.317	0.366	0.379	0.419	0.43	0.437	0.401
Pbde 153	pg/g dry	18.4	18.7	19.4	20.5	19.1	23	33.7	20.6
Pbde 154	pg/g dry	4.8	5.4	3.4	5.1	4.4	5.3	4.3	2.7
Pbde 155	pg/g dry	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Pbde 181	pg/g dry	---	---	---	---	---	---	---	---
Pbde 183	pg/g dry	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35	<0.35
Pbde 190	pg/g dry	---	---	---	---	---	---	---	---
Pbde 203	pg/g dry	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Pbde 206	pg/g dry	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Pbde 207	pg/g dry	<1	<1	<1	<1	<1	<1	<1	<1
Pbde 208	pg/g dry	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Pbde 209	pg/g dry	1960	500	2840	2590	2340	2200	292	1850
Pesticides									
1,2,3,4-Tetrachlorobenzene	ng/g dry	0.58	0.63	0.65	0.62	0.54	0.62	0.62	0.82
1,2,3-Trichlorobenzene	ng/g dry	0.58	0.63	0.65	0.62	0.54	0.62	0.62	0.82
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ng/g dry	87.4	86.7	86.3	88.8	88.3	89	87.7	87.2
1,2,4-trichlorobenzene	ng/g dry	87.4	86.7	86.3	88.8	88.3	89	87.7	87.2
1,2-dichlorobenzene	ng/g dry	87.4	86.7	86.3	88.8	88.3	89	87.7	87.2
1,3,5-Trichlorobenzene	ng/g dry	87.4	86.7	86.3	88.8	88.3	89	87.7	87.2
1,3-dichlorobenzene	ng/g dry	87.4	86.7	86.3	88.8	88.3	89	87.7	87.2
1,4-dichlorobenzene	ng/g dry	---	---		---	---	---	---	---
2,4-DDD	ng/g dry	---	---		---	---	---	---	---
2,4-DDE	ng/g dry	---	---		---	---	---	---	---
2,4-DDT	ng/g dry	0.205	---	0.203	0.204	---	---	---	---
4,4-DDE	ng/g dry	---	---		---	---	---	---	---
4,4-DDT	ng/g dry	0.315	0.228	0.678	0.329	0.462	0.439	0.453	0.417
4,4-DDD	ng/g dry	0.697	0.676	0.576	0.362	0.334	0.38	0.308	0.303
Aldrin	ng/g dry	5.28	4.05	4.09	3.37	3.77	8.03	4.12	6.12
Alpha Chlordane	ng/g dry	4.32	2	4.08	5.55	5.93	6.59	6.87	18.6
Alpha-Endosulfan	ng/g dry	4.08	1.15	5.34	6.85	6.44	6.03	6.3	9.85
Alpha-Hch Or Alpha-Bhc	ng/g dry	0.07	---	0.105	0.349	1.02	0.784	1.5	1.04

Appendix D5 Bioaccumulation Chemistry Results – 2014, cont'd

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				**Reference**	**Far**	**Mid**	**Near**	**Near**	**Outfall**
Beta-Endosulfan	ng/g dry	0.042	---	0.035	0.047	0.107	0.043	---	0.062
Beta-Hch Or Beta-Bhc	ng/g dry	---	---		0.053	---	---	---	---
Cis-Nonachlor	ng/g dry	4.73	1.48	5.99	9.56	6.79	6.51	5.67	10.4
Delta-Hch Or Delta-Bhc	ng/g dry	---	---		---	---	---	---	---
Dieldrin	ng/g dry	7.54	3.66	8.05	13.6	8.99	9.3	7.18	10.2
Endosulfan Sulfate	ng/g dry	0.32	0.134	0.33	0.661	2.16	1.24	1.61	0.995
Endrin	ng/g dry	---	---		---	---	---	---	---
Endrin Aldehyde	ng/g dry	---	---		---	---	---	---	---
Endrin Ketone	ng/g dry	---	---		---	---	---	---	---
Hch, Gamma	ng/g dry	---	---		---	---	---	---	---
Heptachlor	ng/g dry	0.04	---	0.045	0.078	---	---	0.106	---
Heptachlor Epoxide	ng/g dry	---	---		---	---	---	---	---
Hexachlorobenzene	ng/g dry	---	---		---	---	---	---	---
Hexachlorobutadiene	ng/g dry	5.89	2	4.91	6.83	8.14	8.39	8.82	11.8
Methoxyclor	ng/g dry	---	---	---	---	---	---	---	---
MIREX	ng/g dry	0.049	0.039	0.073	0.107	0.361	0.257	0.178	0.231
Oxy-Chlordane	ng/g dry	0.097	0.16	0.092	0.13	0.127	0.133	0.131	0.153
Trans-Chlordane	ng/g dry	1.57	5.91	3.05	8.45	15.3	26.4	21.9	40.6
Trans-Nonachlor	ng/g dry	---	---		---	---	---	---	---
Chlorinated Phenolics									
2,4,6-trichlorophenol	µg/g dry	0.048	0.046	0.036	0.068	---	0.101	0.077	0.097
2,4-dichlorophenol	µg/g dry	---	---		---	---	---	---	---
2-Chlorophenol	µg/g dry	2.14	1.29	1.75	2.5	3.34	4.13	4.52	11.8
4-Chloro-3-Methylphenol	µg/g dry	10	59.2	11.5	31.3	54	83.8	78.9	215
Pentachlorophenol	µg/g dry	---	---		---	---	---	---	---
Semivolatile Organics									
1,2,4-trichlorobenzene	µg/g dry	87.4	86.7	86.3	88.8	88.3	89	87.7	87.2
2,4-dinitrotoluene	µg/g dry	7.89	7.1	18.1	61.8	84.1	75.8	57.6	72
2,6-dinitrotoluene	µg/g dry	0.252	0.403	0.328	0.877	1.22	2.61	1.79	2.32
3,3-dichlorobenzidine	µg/g dry	0.191	0.252	0.268	0.492	0.825	1.86	0.995	1.42
4-Bromophenyl Phenyl Ether	µg/g dry	---	---			0.107		0.1	0.159
4-Chlorophenyl Phenyl Ether	µg/g dry	5.52	2.4	4.56	6.16	7.52	6.82	7.23	12.8
Bis(2-Chloroethoxy)Methane	µg/g dry	0.214	0.346	0.268	0.27	0.311	0.285	0.289	0.431
Bis(2-Chloroethyl)Ether	µg/g dry	---	---	---	---	---	---	---	---
Bis(2-Chloroisopropyl)Ether	µg/g dry	---	---	---	---	---	---	---	---
Hexachlorobenzene	µg/g dry	---	---	---	---	---	---	---	---
Hexachlorobutadiene	µg/g dry	5.89	2	4.91	6.83	8.14	8.39	8.82	11.8

Appendix D5 Bioaccumulation Chemistry Results – 2014, cont'd

Parameter		Control	T=0	PB1	M100NW	M200E	M100 E	M100SE	M0
Station Grouping				**Reference**	**Far**	**Mid**	**Near**	**Near**	**Outfall**
Hexachlorocyclopentadiene	µg/g dry	---	2.85	2.82	4.71	4.1	5.57	3.46	5.5
Hexachloroethane	µg/g dry	1.98	---	1.56	3.66	4.19	4.3	4.51	4.3
Pentachlorobenzene	ng/g dry	1.36	1.52	1.3	3.12	6.28	10.5	11	16.5
Isophorone	µg/g dry	---	---			1.53			
N-Nitrosodi-N-Propylamine	µg/g dry	---	---			3.29	8.21		
Nitrobenzene	µg/g dry	12.9	1.86	7.92	22.8	28.6	29.5	32.7	28.2
Nitrosodiphenylamine/Diphenylamine	µg/g dry	---	---	---	---	---	---	---	---
Bis(2-Ethylhexyl)Phthalate	µg/g dry	0.989	1.66	1.61	4.03	4.7	11.4	6.89	9.92
Butylbenzyl Phthalate	µg/g dry	---	---	---	---	---	---	---	0.036
Di-N-Butyl Phthalate	µg/g dry	---	---			0.254	0.226		3.29
Di-N-Octyl Phthalate	µg/g dry	---	---	---	---	---	---	---	---
Diethyl Phthalate	µg/g dry	7.34	7.25	7.23	9.93	8.33	10.7	8.72	8.87
Dimethyl Phthalate	µg/g dry	---	---	---	---	---	---	---	---

Appendix D6 Bioaccumulation Chemistry Results – 2017

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Moisture and Lipids											
Lipids	%	0.8	1.05	0.75	0.81	0.78	0.74	0.73	0.66	0.73	0.77
Moisture	%	87.7	83.8	87.5	87.7	88	88.2	88.1	88.4	87.9	87.8
Dioxins and Furans											
1,2,3,4,6,7,8-HPCDD	pg/g dry	1.42	0.672	3.05	3.35	2.91	6	4.89	3.14	2.99	4.03
1,2,3,4,6,7,8-HPCDF	pg/g dry	<0.396	0.306	1.01	0.681	1.51	2.35	2.42	1.85	1.47	1.4
1,2,3,4,7,8,9-HPCDF	pg/g dry	<0.396	<0.305	0.401	<0.403	<0.41	0.426	<0.414	<0.434	<0.407	<0.4
1,2,3,4,7,8-HXCDD	pg/g dry	<0.396	<0.305	0.696	<0.403	<0.481	<0.423	<0.414	<0.434	<0.407	<0.574
1,2,3,4,7,8-HXCDF	pg/g dry	<0.396	<0.305	0.787	<0.403	<0.41	0.822	<0.414	<0.434	<0.407	<0.4
1,2,3,6,7,8-HXCDD	pg/g dry	<0.396	<0.305	0.89	0.476	0.626	1.75	0.907	0.916	0.576	<0.574
1,2,3,6,7,8-HXCDF	pg/g dry	<0.396	<0.305	<0.4	<0.403	<0.41	<0.423	<0.414	<0.434	<0.407	<0.4
1,2,3,7,8,9-HXCDD	pg/g dry	<0.396	<0.305	<0.607	<0.403	<0.481	0.757	0.447	<0.434	<0.407	<0.4
1,2,3,7,8,9-HXCDD	pg/g dry	<0.396	<0.305	<0.607	<0.403	<0.481	0.757	0.447	<0.434	<0.407	<0.4
1,2,3,7,8,9-HXCDF	pg/g dry	<0.396	<0.305	0.853	<0.403	<0.41	<0.423	<0.414	<0.434	<0.407	<0.4
1,2,3,7,8-PECDD	pg/g dry	<0.396	<0.305	<0.4	<0.403	<0.431	0.65	<0.628	<0.434	<0.407	<0.4
1,2,3,7,8-PECDF	pg/g dry	<0.396	<0.305	0.693	<0.403	<0.41	0.456	0.465	<0.434	<0.407	<0.432
2,3,4,6,7,8-HXCDF	pg/g dry	<0.396	<0.305	0.769	<0.403	<0.41	<0.423	<0.414	<0.434	<0.407	<0.4
2,3,4,7,8-PECDF	pg/g dry	<0.396	<0.305	<0.4	<0.403	<0.41	0.724	<0.414	<0.434	<0.407	<0.432
2,3,7,8-TCDD	pg/g dry	<0.396	<0.305	<0.4	<0.403	<0.41	<0.423	<0.414	<0.434	<0.407	<0.4
2,3,7,8-TCDF	pg/g dry	<0.396	<0.305	<0.4	0.455	0.602	0.858	0.834	0.479	0.444	1.01
2,3,7,8-TCDF	pg/g dry	<0.396	<0.305	<0.4	0.455	0.602	0.858	0.834	0.479	0.444	1.01
OCDD	pg/g dry	5	3.88	19.7	16.3	17.2	20.7	18.1	11.7	15.3	17.9
OCDF	pg/g dry	0.439	0.322	2.76	1.78	1.59	2.14	1.62	1.43	2.31	1.39
TOTAL HEPTA-DIOXINS	pg/g dry	<0.396	0.672	8.88	6.94	7.15	6	<0.414	6.19	2.99	7.69
TOTAL HEPTA-FURANS	pg/g dry	<0.396	<0.305	<0.4	<0.403	<0.41	4.99	2.7	4.47	1.47	1.84
TOTAL HEXA-DIOXINS	pg/g dry	<0.396	<0.305	2.28	3.28	<0.481	6.2	3.23	2.82	<0.407	2.6
TOTAL HEXA-FURANS	pg/g dry	<0.396	<0.305	0.718	0.949	1.84	3.08	<0.414	0.923	0.958	1.14
TOTAL PENTA-DIOXINS	pg/g dry	<0.396	<0.305	<0.4	<0.403	<0.431	1.74	<0.628	<0.434	<0.407	<0.4
TOTAL PENTA-FURANS	pg/g dry	<0.396	<0.305	<0.4	<0.403	1.17	3.66	0.465	<0.434	0.822	<0.432
TOTAL TETRA-DIOXINS	pg/g dry	<0.396	<0.305	<0.4	0.451	0.509	<0.423	0.948	<0.434	<0.407	0.636
TOTAL TETRA-FURANS	pg/g dry	<0.396	<0.305	<0.4	1.1	1.6	4.71	3.78	2.16	1.3	6.82
PCB											
Pcb 1	pg/g dry	<0.589	<0.439	<0.58	10.9	16.3	<2.6	<3.36	<1.41	7.44	40.6
Pcb 2	pg/g dry	14.7	30.2	50	128	444	3.58	<3.49	11.1	19.6	242

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 3	pg/g dry	16.1	8.2	245	55.1	883	149	36	843	1.11	101
Pcb 4	pg/g dry	<0.734	150	2.27	29.4	7050	1090	160	365	14	59.2
Pcb 5	pg/g dry	<0.665	176	0.654	<0.574	24800	231	1850	54	5.59	24.5
Pcb 6	pg/g dry	0.946	272	<0.58	0.8	16900	329	22.8	907	65.1	169
Pcb 7	pg/g dry	7.52	489	360	9.57	3790	793	232	220	3.04	<2.04
Pcb 8	pg/g dry	<0.752	575	0.659	12.5	584	224	619	70.6	1.07	45.3
Pcb 9	pg/g dry	8.1	171	18.9	8.11	139	22.2	13.1	347	183	<0.586
Pcb 10	pg/g dry	<0.758	190	20.5	73.2	81.1	1520	5.14	1010	5.68	150
Pcb 11	pg/g dry	22.5	270	1.98	36.5	54700	223	7.96	198	0.826	843
Pcb 12/13	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 14	pg/g dry	3.01	2350	1.48	3.5	0.964	6.6	23.6	8.91	33.1	1.41
Pcb 15	pg/g dry	16	0.0158	12.5	2.33	12.2	8.81	<3.48	<5.48	58.1	0.785
Pcb 16	pg/g dry	1.67	0.0431	<0.89	9.25	4.11	17.8	45.4	890	59.8	953
Pcb 17	pg/g dry	3.04	5.63	8.39	<0.574	8.19	<0.599	<3.18	<4.92	10.9	1.31
Pcb 18/30	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 19	pg/g dry	13.5	3.78	50.2	172	3.64	<1.97	366	99.6	100	158
Pcb 20/28	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 21/33	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 22	pg/g dry	<0.589	5.24	43.2	150	130	1450	874	60	1.13	<1.49
Pcb 23	pg/g dry	<0.589	5.89	3.23	35.9	7.33	<1.05	2570	829	14.5	64.1
Pcb 24	pg/g dry	22	23.4	7.96	13.4	2.9	<1	446	1760	23.9	<1.63
Pcb 25	pg/g dry	<0.589	1.44	44.8	56.8	173	30.8	26.7	25.3	9.73	35.7
Pcb 26/29	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 27	pg/g dry	115	94.1	24	70.5	<0.599	4.45	621	7.01	49.8	121
Pcb 31	pg/g dry	0.869	2.38	102	367	32.8	<1.09	1620	<0.619	1.25	83.4
Pcb 32	pg/g dry	<0.589	0.703	<0.58	6.96	38.2	12.5	8.6	84	4.64	17.6
Pcb 34	pg/g dry	4.32	6.71	<0.58	1.65	83.1	20	8.85	<5.1	2.2	116
Pcb 35	pg/g dry	<0.589	8.48	40.9	60.5	70.7	1.44	26.8	37.7	20.9	6.69
Pcb 36	pg/g dry	<0.589	12.1	0.649	<0.581	17.2	<2.04	1.37	<4.66	<0.591	19.2
Pcb 37	pg/g dry	8.49	15	<0.58	1.13	223	332	1990	<5.02	2.27	77.9
Pcb 38	pg/g dry	11.4	3.49	126	23.1	103	2610	<4.89	402	176	39.6
Pcb 39	pg/g dry	380	57.6	0.588	45.1	56.7	71.8	144	2580	71.9	52.1
Pcb 40/41/71	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 42	pg/g dry	571	10.9	9.68	10.8	1.09	509	4910	882	190	2.08
Pcb 43	pg/g dry	925	<0.439	1.04	96.1	17	16.6	1.89	2350	40.4	1.14

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 44/47/65	pg/g dry	---	---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---	---	---
38.9	4.65	9.89	6.19	149	132	5610	3830	209	<0.586	---	---
19.3	2.04	264	6.63	61.7	55.5	5.33	686	54.4	323	---	---
---	---	---	---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---	---	---
0.0305	<0.439	1100	<0.597	1.81	<2.28	47.2	16	2.63	30	---	---
0.0641	2.44	1400	14.7	17.5	66.8	<3.75	21.7	102	3.79	---	---
6.87	2.07	501	<0.574	0.803	<0.599	11.9	0.886	1.03	<0.586	---	---
4.5	3.44	154	0.796	3.1	225	1170	1530	1.08	34.2	---	---
7.34	<0.439	108	97.7	320	1100	7950	<3.31	24.3	13	---	---
16.1	<0.439	30.3	999	119	5.69	218	99.1	81.3	463	---	---
---	---	---	---	---	---	---	---	---	---	---	---
15	8.23	0.0314	250	622	1.28	1480	4470	12.3	9850	---	---
---	---	---	---	---	---	---	---	---	---	---	---
62.9	22.6	5.83	188	16.7	1.05	119	<1.59	199	5960	---	---
2.53	4.25	4.06	10.6	94.3	160	592	107	6.52	1210	---	---
<1.23	1.22	5.95	1430	591	173	274	3930	4.6	230	---	---
261	5.8	15.4	199	120	10.9	313	3.4	3.63	60.6	---	---
6.14	20	1.16	727	1920	<1.61	87.7	<1.73	<0.591	34.2	---	---
<1.36	4.03	10.9	5.1	9.41	4.32	586	36.1	12.1	31800	---	---
17.4	36.2	4.51	6.71	3.23	78.4	<3.1	44.2	<0.775	0.322	---	---
19.5	<0.439	48.6	19.5	201	<1.81	134	<2.92	7.74	0.431	---	---
35.8	<0.548	2.3	<0.574	<1.83	46.7	1.92	4.87	<0.7	8.33	---	---
30.8	15.1	<0.849	376	<1.83	<1.76	510	630	0.898	4.63	---	---
5.38	<0.492	166	<1.38	33.9	223	2490	4350	71.6	7.63	---	---
110	<0.51	3.71	37.2	110	135	7.41	119	466	24.7	---	---
48.9	3.37	<0.872	81.8	1940	28.6	4.72	29.4	132	1.63	---	---
---	---	---	---	---	---	---	---	---	---	---	---
<0.894	66.3	15	<0.574	313	11.3	3150	20.4	466	7.75	---	---
---	---	---	---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	---	---	---	---
Pcb 89	pg/g dry	3.84	1.25	78.9	4.53	6.89	96	12.8	130	124	213
Pcb 90/101/113	pg/g dry	---	---	---	---	---	---	---	---	---	---

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 92	pg/g dry	26.8	1.22	18.8	8.72	14.3	2.81	11	269	3.77	<0.913
Pcb 93/95/98/100/102	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 94	pg/g dry	4.41	3.29	<0.58	<1.33	43.4	186	<2.48	89.5	10.9	132
Pcb 96	pg/g dry	2.57	<0.51	5.04	3.24	<1.7	1.08	167	0.829	<0.591	261
Pcb 103	pg/g dry	7.45	1.02	8.86	304	<1.76	<0.599	<2.5	241	216	223
Pcb 104	pg/g dry	<0.869	<0.466	3.65	1940	373	583	382	1580	<1.26	24.1
Pcb 105	pg/g dry	0.896	<0.495	49.6	80.7	2430	1.82	214	2.92	19	1270
Pcb 106	pg/g dry	31.2	5.78	20.5	15.5	679	7.26	44.2	2.76	43.6	517
Pcb 107/124	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 109	pg/g dry	2.59	7.92	2.68	18	2730	7.58	16.5	1880	0.659	<1.09
Pcb 110/115	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 111	pg/g dry	12	36.8	5.38	326	26.1	82.1	179	348	14	45.2
Pcb 112	pg/g dry	2.4	8.95	<0.58	144	4390	12.8	84.8	329	576	92
Pcb 114	pg/g dry	13.6	<0.439	0.605	93.1	596	613	107	8.79	2.65	31.3
Pcb 118	pg/g dry	45.9	83.8	38.4	35.3	2680	4970	585	<1.71	0.644	858
Pcb 120	pg/g dry	8.7	20.8	16.9	193	11	8860	7.97	5.2	5.74	250
Pcb 121	pg/g dry	80.7	31.1	2.67	<3.23	16.2	8860	4.88	111	6.42	2.75
Pcb 122	pg/g dry	<0.589	0.577	55.1	60.3	26	7640	233	<1.93	<1.33	6.51
Pcb 123	pg/g dry	<1.31	0.508	13.7	0.886	0.87	2190	1.17	81.2	<1.25	<1.03
Pcb 126	pg/g dry	28.2	1.42	2.59	190	1300	539	<0.604	<1.97	123	89.9
Pcb 127	pg/g dry	<1.17	<0.439	14.5	1130	<3.25	160	661	208	763	1.85
Pcb 128/166	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 129/138/160/163	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 130	pg/g dry	27.2	2.65	87.8	1.34	4420	0.277	73.6	164	266	277
Pcb 131	pg/g dry	130	8.67	<0.58	1490	<1.58	0.357	10.2	10.5	10.3	36.1
Pcb 132	pg/g dry	3.51	63	<0.775	0.919	<1.55	8.25	<0.604	28.4	28.8	506
Pcb 133	pg/g dry	29.8	<0.439	22.6	215	82.6	4.52	92.9	108	213	155
Pcb 134/143	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 135/151/154	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 136	pg/g dry	2.83	82.9	6.99	<2.27	<1.61	1.69	1200	323	15.6	656
Pcb 137	pg/g dry	1.16	0.796	22.1	4.23	32.1	68	5650	3.32	77.9	136
Pcb 139/140	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 141	pg/g dry	6.32	0.724	3.25	<2.54	<3.38	166	20900	149	34.3	4.24
Pcb 142	pg/g dry	<1.21	1.38	32.7	57.1	7.5	4.56	2910	0.881	<0.591	17.9
Pcb 144	pg/g dry	2.18	<0.475	51.1	<2.34	723	1.63	603	<0.619	91.8	645

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 145	pg/g dry	<1.11	<0.567	2.05	170	4740	237	185	419	592	3.85
Pcb 146	pg/g dry	<1.06	24	2.44	69.9	194	15.5	102	0.803	2.9	<3.4
Pcb 147/149	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 148	pg/g dry	152	6.77	<0.58	119	1390	57.1	1.22	46.6	0.596	539
Pcb 150	pg/g dry	14	<0.81	4.1	8.48	28	90.8	1.42	7.37	651	2640
Pcb 152	pg/g dry	41	19.1	<0.75	23.8	135	404	9.73	<0.619	1.25	53.5
Pcb 153/168	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 155	pg/g dry	20.7	2.64	<0.678	35.4	344	131	8.97	12.7	70.6	1120
Pcb 156/157	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 158	pg/g dry	157	6.22	16.9	305	72.4	376	1.33	3930	<0.862	5.03
Pcb 159	pg/g dry	27.9	2.21	155	3.67	609	266	16.9	14700	0.969	5.77
Pcb 161	pg/g dry	68.2	1.51	19.3	1.72	<3.04	<1.82	6.37	24400	34.8	<0.586
Pcb 162	pg/g dry	0.704	6.05	45.6	125	151	2.56	76	12000	<0.967	53.5
Pcb 164	pg/g dry	<0.589	<0.787	102	1.22	2.16	88.7	2.98	1750	15.2	<3.4
Pcb 165	pg/g dry	2.73	3.42	27	<0.574	382	218	1.05	320	<0.876	19.7
Pcb 167	pg/g dry	<0.589	<0.439	1.79	255	2610	175	194	34.2	66.4	<3.1
Pcb 169	pg/g dry	53.1	28.3	195	0.887	6.56	833	6.55	59.8	32.9	<3.26
Pcb 170	pg/g dry	<0.691	72.5	32.6	6.21	4.03	505	<0.772	57700	10.9	191
Pcb 171/173	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 172	pg/g dry	16	<0.439	0.884	5.09	3240	11.6	35.6	0.94	5.06	238
Pcb 174	pg/g dry	135	<0.439	1.07	0.737	1.61	<1.72	100	8.64	15.6	407
Pcb 175	pg/g dry	<0.589	157	2.83	46.4	513	112	81.5	4.03	61.8	1000
Pcb 176	pg/g dry	<0.589	<0.439	<0.58	11	434	<1.77	22	8.81	25.7	224
Pcb 177	pg/g dry	3.07	7.4	56	319	18.2	12.3	354	22.6	44.5	27.7
Pcb 178	pg/g dry	156	8.31	<0.58	488	<2.13	419	125	<1.49	160	1470
Pcb 179	pg/g dry	1.57	0.658	5.29	2040	9.75	214	70.5	18.4	1.22	226
Pcb 180/193	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 181	pg/g dry	1.35	<0.577	175	7100	<2.39	578	1.07	99.6	82.6	8.1
Pcb 182	pg/g dry	1.54	4.44	<0.58	1340	128	175	22.8	3.69	1.04	8.24
Pcb 183/185	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 184	pg/g dry	<0.712	4.2	3.17	75.4	628	340	22.8	265	153	<0.586
Pcb 186	pg/g dry	39.2	<0.66	143	34.4	212	840	198	7.6	0.769	615
Pcb 187	pg/g dry	400	11.2	1.64	19700	52.9	284	90.9	<1.39	1.89	<2.48
Pcb 188	pg/g dry	10.1	<0.439	<0.58	0.285	390	1320	2.52	35.2	16.6	46
Pcb 189	pg/g dry	1.46	2.99	1.94	0.364	18.3	21.1	4.83	127	2.2	93.4

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 190	pg/g dry	41.1	10.7	2.32	6.79	58.2	12.4	1.58	227	<0.591	1790
Pcb 191	pg/g dry	3.54	0.875	<0.592	4.24	280	461	22.5	321	27	<0.848
Pcb 192	pg/g dry	4.44	1.95	<0.58	7.14	73.6	<2.75	<0.622	29.3	10.8	<0.807
Pcb 194	pg/g dry	41.9	9.8	51.4	17.2	136	<2.85	4.01	1080	320	53.4
Pcb 195	pg/g dry	10.3	9.05	366	1.11	922	67.5	289	484	861	1540
Pcb 196	pg/g dry	5.54	6.07	16	13	6.66	354	110	289	2460	3.13
Pcb 197/200	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 198/199	pg/g dry	---	---	---	---	---	---	---	---	---	---
Pcb 201	pg/g dry	<0.943	0.695	5.51	2.64	1.85	467	60.1	31.9	760	17.6
Pcb 202	pg/g dry	5.83	14.9	8.7	1.03	<0.599	1060	19.5	77.4	203	<2.02
Pcb 203	pg/g dry	<0.589	<0.439	77.9	194	528	30	109	29.7	102	<2.56
Pcb 204	pg/g dry	45.2	<0.439	22.9	4.7	1.65	6.6	422	892	66.6	295
Pcb 205	pg/g dry	137	75.8	7.99	<0.574	17	7.68	114	200	12500	2050
Pcb 206	pg/g dry	<0.589	<0.439	6.62	16.4	118	<0.599	960	2.19	0.115	64.4
Pcb 207	pg/g dry	0.655	0.469	27	21.7	15.3	73.4	12.7	5.27	0.186	15.6
Pcb 208	pg/g dry	<0.589	2.41	<1.13	44.5	<0.599	<2.85	6.13	2.06	6.98	478
Pcb 209	pg/g dry	273	<0.439	10.7	40.4	102	16.2	243	119	3.78	15.7
PPCP											
1,7-Dimethylxanthine	ng/g dry	---	<150	<188	---	---	---	---	---	---	<196
10-Hydroxy-Amitriptyline	ng/g dry	---	<0.375	<0.47	---	---	---	---	---	---	<0.49
2-Hydroxy-Ibuprofen	ng/g dry	<262	<200	<251	<264	<266	<265	<247	<264	<246	<262
4-Epianhydrochlortetracycline [Eactc]	ng/g dry	---	<150	<188	---	---	---	---	---	---	<196
4-Epianhydrotetracycline [Eatc]	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
4-Epichlortetracycline [Ectc]	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
4-Epioxytetracycline [Eotc]	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
4-Epitetracycline [Etc]	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Acetaminophen	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
Albuterol	ng/g dry	---	<1.78	<2.07	---	---	---	---	---	---	<2.31
Alprazolam	ng/g dry	---	<0.75	<0.94	---	---	---	---	---	---	<0.98
Amitriptyline	ng/g dry	---	<0.75	<0.94	---	---	---	---	---	---	7.02
Amlodipine	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Amphetamine	ng/g dry	---	<8.88	<10.4	---	---	---	---	---	---	<11.6
Anhydrochlortetracycline [Actc]	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
Anhydrotetracycline [Atc]	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
Atenolol	ng/g dry	---	<3.55	<4.15	---	---	---	---	---	---	<4.63

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Atorvastatin	ng/g dry	---	<8.88	<10.4	---	---	---	---	---	---	<11.6
Azithromycin	ng/g dry	---	<4.41	<8.36	---	---	---	---	---	---	<6.41
Benzoylecgonine	ng/g dry	---	<0.75	<0.94	---	---	---	---	---	---	<0.98
Benztropine	ng/g dry	---	<1.25	<1.57	---	---	---	---	---	---	<1.63
Betamethasone	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Bisphenol A	ng/g dry	<1640	<1250	<1570	<1650	<1670	<1650	<1550	<1650	<1540	<1630
Caffeine	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
Carbadox	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Carbamazepine	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Chlortetracycline [Ctc]	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Cimetidine	ng/g dry	---	<3.55	<4.15	---	---	---	---	---	---	<4.63
Ciprofloxacin	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Clarithromycin	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Clinafloxacin	ng/g dry	---	<33.8	<25.7	---	---	---	---	---	---	<39.2
Clonidine	ng/g dry	---	<8.88	<10.4	---	---	---	---	---	---	<11.6
Cloxacillin	ng/g dry	---	<7.5	<9.4	---	---	---	---	---	---	<9.8
Cocaine	ng/g dry	---	<0.375	0.651	---	---	---	---	---	---	0.563
Codeine	ng/g dry	---	<17.8	<20.7	---	---	---	---	---	---	<23.1
Cotinine	ng/g dry	---	<8.88	<10.4	---	---	---	---	---	---	<11.6
Deet	ng/g dry	---	5.55	5.34	---	---	---	---	---	---	5.86
Dehydronifedipine	ng/g dry	---	<1.5	<1.88	---	---	---	---	---	---	<1.96
Demeclocycline	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
Desmethyldiltiazem	ng/g dry	---	<0.375	<0.47	---	---	---	---	---	---	<0.49
Diazepam	ng/g dry	---	<0.75	<0.94	---	---	---	---	---	---	<0.98
Digoxigenin	ng/g dry	---	<54.9	<85.2	---	---	---	---	---	---	<52.2
Digoxin	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Diltiazem	ng/g dry	---	<0.75	<0.94	---	---	---	---	---	---	1.51
Diphenhydramine	ng/g dry	---	<1.5	<1.88	---	---	---	---	---	---	5.31
Doxycycline	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Enalapril	ng/g dry	---	<1.78	<2.07	---	---	---	---	---	---	<2.31
Enrofloxacin	ng/g dry	---	<7.5	<9.4	---	---	---	---	---	---	<9.8
Erythromycin-H2O	ng/g dry	---	<5.75	<7.21	---	---	---	---	---	---	<7.52
Flumequine	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Fluocinonide	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Fluoxetine	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Fluticasone Propionate	ng/g dry	---	<5	<6.27	---	---	---	---	---	---	<6.54
Furosemide	ng/g dry	<131	<100	<125	<132	<133	<132	<124	<132	<123	<131
Gemfibrozil	ng/g dry	<4.91	<3.75	<4.7	<4.94	<5	<4.96	<4.64	<4.95	<4.62	<4.9
Glipizide	ng/g dry	<19.7	<15	<18.8	<19.8	<20	<19.9	<18.5	<19.8	<18.5	<19.6
Glyburide	ng/g dry	<9.83	<7.5	<9.4	<9.89	<9.99	<9.93	<9.27	<9.9	<9.24	<9.81
Hydrochlorothiazide	ng/g dry	<65.5	<50	<62.7	<65.9	<66.6	<66.2	<61.8	<66	<61.6	<65.4
Hydrocodone	ng/g dry	---	<8.88	<10.4	---	---	---	---	---	---	<11.6
Hydrocortisone	ng/g dry	---	<143	<180	---	---	---	---	---	---	<187
Ibuprofen	ng/g dry	<49.1	<37.5	<47	<49.4	<50	<49.6	<46.4	<49.5	<46.2	<49
Isochlortetracycline [Ictc]	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Lincomycin	ng/g dry	---	<7.5	<9.4	---	---	---	---	---	---	<9.8
Lomefloxacin	ng/g dry	---	<8.32	<9.4	---	---	---	---	---	---	<14
Meprobamate	ng/g dry	---	<10.1	<12.7	---	---	---	---	---	---	<13.2
Metformin	ng/g dry	---	<17.8	<20.7	---	---	---	---	---	---	<23.1
Methylprednisolone	ng/g dry	---	<10.1	<12.7	---	---	---	---	---	---	<13.2
Metoprolol	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Miconazole	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	29.6
Minocycline	ng/g dry	---	<150	<188	---	---	---	---	---	---	<196
Naproxen	ng/g dry	<13.4	<7.5	<9.4	<9.89	<12.3	<10.1	<9.27	<9.9	<16.7	<9.81
Norfloxacin	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
Norfluoxetine	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Norgestimate	ng/g dry	---	<11.5	<9.4	---	---	---	---	---	---	<9.8
Norverapamil	ng/g dry	---	<0.375	<0.47	---	---	---	---	---	---	<0.49
Ofloxacin	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Ormetoprim	ng/g dry	---	<1.5	<1.88	---	---	---	---	---	---	<1.96
Oxacillin	ng/g dry	---	<7.5	<9.4	---	---	---	---	---	---	<9.8
Oxolinic Acid	ng/g dry	---	<3.48	<3.13	---	---	---	---	---	---	<1.96
Oxycodone	ng/g dry	---	<3.55	<4.15	---	---	---	---	---	---	<4.63
Paroxetine	ng/g dry	---	<10.1	<12.7	---	---	---	---	---	---	<13.2
Penicillin G	ng/g dry	---	<7.5	<9.4	---	---	---	---	---	---	<9.8
Penicillin V	ng/g dry	---	<7.5	<9.4	---	---	---	---	---	---	<9.8
Prednisolone	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Prednisone	ng/g dry	---	<62.3	<62.7	---	---	---	---	---	---	<65.4
Promethazine	ng/g dry	---	<1	<1.25	---	---	---	---	---	---	<1.31
Propoxyphene	ng/g dry	---	<0.75	<0.94	---	---	---	---	---	---	<0.98

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Propranolol	ng/g dry	---	<5	<6.27	---	---	---	---	---	---	<6.54
Ranitidine	ng/g dry	---	<3.55	<4.15	---	---	---	---	---	---	<4.63
Roxithromycin	ng/g dry	---	<0.75	<0.94	---	---	---	---	---	---	<0.98
Sarafloxacin	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
Sertraline	ng/g dry	---	<1	<1.25	---	---	---	---	---	---	13.1
Simvastatin	ng/g dry	---	<50	<62.7	---	---	---	---	---	---	<65.4
Sulfachloropyridazine	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Sulfadiazine	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Sulfadimethoxine	ng/g dry	---	<1.87	<0.94	---	---	---	---	---	---	<0.98
Sulfamerazine	ng/g dry	---	<2.31	<2	---	---	---	---	---	---	<1.96
Sulfamethazine	ng/g dry	---	<2.86	<6.5	---	---	---	---	---	---	<3.05
Sulfamethizole	ng/g dry	---	<2.14	<2.31	---	---	---	---	---	---	<2.79
Sulfamethoxazole	ng/g dry	---	<1.5	<1.88	---	---	---	---	---	---	<1.96
Sulfanilamide	ng/g dry	---	<37.5	<47	---	---	---	---	---	---	<49
Sulfathiazole	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Tetracycline [Tc]	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Theophylline	ng/g dry	---	<150	<188	---	---	---	---	---	---	<196
Thiabendazole	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Trenbolone	ng/g dry	---	<10.1	<12.7	---	---	---	---	---	---	<13.2
Trenbolone Acetate	ng/g dry	---	<0.859	<0.979	---	---	---	---	---	---	<0.98
Triamterene	ng/g dry	---	<1.93	<2.07	---	---	---	---	---	---	6.15
Triclocarban	ng/g dry	<9.83	<7.5	<9.4	<9.89	<9.99	<9.93	<9.27	<9.9	<9.24	<9.81
Triclosan	ng/g dry	<197	<150	<188	<198	<200	<199	<185	<198	<185	<196
Trimethoprim	ng/g dry	---	<3.75	<4.7	---	---	---	---	---	---	<4.9
Tylosin	ng/g dry	---	<15	<18.8	---	---	---	---	---	---	<19.6
Valsartan	ng/g dry	---	<10.1	<12.7	---	---	---	---	---	---	<13.2
Verapamil	ng/g dry	---	<0.375	<0.47	---	---	---	---	---	---	<0.49
Warfarin	ng/g dry	<4.91	<3.75	<4.7	<4.94	<5	<4.96	<4.64	<4.95	<4.62	<4.9
PAH											
1-Methylphenanthrene	ng/g dry	3.56	1.03	3.33	3.45	6.01	4.99	4.44	25.4	5.13	7.49
2,3,5-trimethylnaphthalene	ng/g dry	2.42	1.04	3.77	3.58	5.29	4.58	4.19	4.44	3.86	4.98
2,6-dimethylnaphthalene	ng/g dry	3.1	1.41	4.03	3.69	4.44	4.1	4.02	5.85	3.31	5.49
2-Methylnaphthalene	ng/g dry	5.05	3.54	6.04	5.86	6.54	5.17	6.27	10.1	4.93	9.32
Acenaphthene	ng/g dry	2.61	2.27	2.43	2.55	3.95	3.37	3.24	97	3.12	5.9
Acenaphthylene	ng/g dry	0.357	0.522	0.472	0.652	0.645	0.786	0.876	2.71	0.698	1.15

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
Anthracene	ng/g dry	1.68	1.27	2.1	2.93	7.26	5.65	5.53	177	6.44	18.3
Benzo(A)Anthracene	ng/g dry	0.984	0.969	1.58	4.89	14.7	13.1	14.2	289	15.4	33.8
Benzo(A)Pyrene	ng/g dry	0.837	0.438	1.74	3.94	11.7	10.2	11.8	277	10.4	27.6
Benzo(B)Fluoranthene	ng/g dry	1.9	1.57	2.94	5.98	12.8	12	14.6	239	10.8	24.5
Benzo(E)Pyrene	ng/g dry	1.81	1.31	2.96	5.82	12	11.4	13.8	206	10.1	22.5
Benzo(G,H,I)Perylene	ng/g dry	1.25	0.587	2.1	2.9	6.29	5.8	7.01	219	5.46	13.7
Benzo[J,K]Fluoranthenes	ng/g dry	0.893	1.34	2.03	4.35	12	12.5	14.4	230	11.5	24.1
Chrysene	ng/g dry	4.41	3.4	3.95	7.43	17	15.1	16.9	290	18.8	36.5
Dibenzo(A,H)Anthracene	ng/g dry	0.228	0.0981	0.257	0.468	1.35	1.07	1.19	34.2	0.995	2.46
Dibenzothiophene	ng/g dry	2.19	0.987	1.71	2.17	3.04	3.03	2.82	35.1	2.83	5.61
Fluoranthene	ng/g dry	6.72	14.5	8.05	15.8	40.8	36.4	36.2	986	52.8	125
Indeno(1,2,3-C,D)Pyrene	ng/g dry	0.801	0.506	1.18	2.01	5.78	4.54	5.36	210	5.23	12.9
Naphthalene	ng/g dry	3.5	3.18	4.91	4.88	5.93	4.45	5.47	14.3	4.57	6.97
Perylene	ng/g dry	4.82	6.85	12	11.4	12.8	11.2	12.4	93.9	9.17	15
Phenanthrene	ng/g dry	21.4	9.01	15.5	19.4	33.3	26	24.5	838	27.3	51.8
Pyrene	ng/g dry	6.63	11.3	8.29	23	60.4	57.9	65.3	838	64.6	139
PBDE											
PBDE 7	pg/g dry	55.6	0.902	126	<1.15	<1.42	<1.2	49.5	1.74	2.43	<1.17
PBDE 8/11	pg/g dry	---	---	---	---	---	---	---	---	---	---
PBDE 10	pg/g dry	74.2	<0.877	3.37	2.65	2.46	<1.2	1.45	28.3	1.94	132
PBDE 12/13	pg/g dry	---	---	---	---	---	---	---	---	---	---
PBDE 15	pg/g dry	2.78	1.81	<1.16	40.9	<1.2	110	<1.21	1.39	2.07	74.8
PBDE 17/25	pg/g dry	---	---	---	---	---	---	---	---	---	---
PBDE 28/33	pg/g dry	---	---	---	---	---	---	---	---	---	---
PBDE 30	pg/g dry	1.73	<0.877	32.4	21	83.9	1640	245	8.7	5.48	26.9
PBDE 32	pg/g dry	13	<0.877	34.8	<1.15	47.6	28.7	184	69.5	<1.18	<1.17
PBDE 35	pg/g dry	57.7	<0.877	<1.16	16.4	10.2	22.3	2680	115	24.1	5.42
PBDE 37	pg/g dry	59.8	0.882	<1.16	123	<1.2	<1.2	26.7	83.7	<1.18	38.5
PBDE 47	pg/g dry	<1.18	263	<1.16	163	13	4.31	19	1120	13.9	275
PBDE 49	pg/g dry	<1.18	18.4	1.3	104	<1.2	30.1	<1.21	18.7	153	99.7
PBDE 51	pg/g dry	<1.18	2.23	569	1990	15.3	264	3.52	14.4	219	<1.17
PBDE 66	pg/g dry	1.53	8.26	49	12.8	134	87.7	18.7	<1.24	152	4.39
PBDE 71	pg/g dry	1150	2.99	7.07	12.3	150	<1.2	232	2.82	2420	<1.17
PBDE 75	pg/g dry	114	<0.877	13.9	<1.15	106	<1.2	76.4	26.3	38.4	2.4
PBDE 77	pg/g dry	6.52	<0.877	5.31	2.64	2250	1.79	<1.21	187	20.9	1340

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
PBDE 79	pg/g dry	31.7	14.9	1.7	18	20.6	2.52	2.78	129	<1.18	390
PBDE 85	pg/g dry	15	11.2	<1.16	82.3	16.4	1280	<1.21	<1.31	4.55	25.8
PBDE 99	pg/g dry	<1.18	287	23.6	67.6	<1.2	361	2.19	2.27	29.6	42.5
PBDE 100	pg/g dry	<1.18	60.6	16.1	<1.15	2.39	28.9	1280	<1.24	227	25.4
PBDE 105	pg/g dry	21.5	<0.877	526	<1.15	16.3	40.1	330	2.15	85.3	1.91
PBDE 116	pg/g dry	50.1	<0.877	110	<1.15	169	22.5	25.4	1260	<1.18	<1.17
PBDE 119/120	pg/g dry	---	---	---	---	---	---	---	---	---	---
PBDE 126	pg/g dry	171	<0.877	3.46	890	<1.2	<1.2	17.2	18.1	<1.18	22.6
PBDE 128	pg/g dry	<1.18	<0.877	1.95	138	<1.2	25.4	2.74	36.3	1.45	803
PBDE 138/166	pg/g dry	---	---	---	---	---	---	---	---	---	---
PBDE 140	pg/g dry	2.21	1.43	<1.16	26.8	2.19	904	21.9	3.22	293	<1.17
PBDE 153	pg/g dry	<1.18	26.8	5.43	8.78	1320	162	31.5	<1.24	22.3	3.49
PBDE 154	pg/g dry	<1.18	22.4	1.77	2.95	265	<1.27	1000	22.4	30.8	3.03
PBDE 155	pg/g dry	9.1	2.24	54.3	<1.15	23.2	<1.57	170	21	19.5	<1.17
PBDE 181	pg/g dry	3.23	<0.877	33.4	18.9	36	3.4	<1.58	708	1.92	<1.17
PBDE 183	pg/g dry	129	3.12	5.79	18.9	15	<1.2	<1.95	129	<1.18	5.01
PBDE 190	pg/g dry	44.9	<0.877	<1.16	653	3.76	<1.2	3.36	<1.24	20.6	2.07
PBDE 203	pg/g dry	3.41	1.79	25.2	148	<1.2	4.44	1.54	<1.27	16.6	64.5
PBDE 206	pg/g dry	<1.18	10.5	<1.16	<1.15	23.2	3.13	1.97	2.42	596	38.8
PBDE 207	pg/g dry	11.8	26	11.2	<1.15	30	73.1	7.85	<1.24	141	6.96
PBDE 208	pg/g dry	<1.18	13.5	91.5	2.88	1050	40	3.52	2.12	<1.44	<1.17
PBDE 209	pg/g dry	6.45	195	148	<1.15	181	9.5	90.4	5.1	<1.85	17
Pesticides											
1,2,3,4-Tetrachlorobenzene	ng/g dry	<0.19	<0.139	<0.185	<0.185	<0.192	<0.193	<0.193	<0.199	<0.19	<0.188
1,2,3-Trichlorobenzene	ng/g dry	<0.19	<0.139	<0.185	<0.185	<0.192	<0.193	<0.193	<0.199	<0.19	<0.188
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ng/g dry	<0.19	<0.139	<0.185	<0.185	<0.192	<0.193	<0.193	<0.199	<0.19	<0.188
1,2,4-trichlorobenzene	ng/g dry	<0.19	<0.139	<0.185	<0.185	0.236	<0.193	<0.193	0.956	<0.19	<0.188
1,2-dichlorobenzene	ng/g dry	---	0.462	<0.332	---	0.388	<0.307	<0.439	0.687	<0.326	---
1,3,5-Trichlorobenzene	ng/g dry	<0.19	<0.139	<0.185	<0.185	<0.192	<0.193	<0.193	<0.199	<0.19	<0.188
1,3-dichlorobenzene	ng/g dry	---	0.235	<0.335	---	<0.235	<0.31	<0.443	<0.296	<0.329	---
1,4-dichlorobenzene	ng/g dry	---	1.95	0.993	---	3.54	3.73	4.34	7.06	3.95	---
2,4-DDD	ng/g dry	<0.139	<0.103	<0.246	0.943	1.01	1.13	1.22	1.2	2.07	1.55
2,4-DDE	ng/g dry	0.041	<0.0441	<0.0899	<0.0566	<0.074	0.074	0.057	<0.0667	0.064	0.051
2,4-DDT	ng/g dry	<0.187	<0.146	<0.318	<0.204	<0.435	<0.157	<0.202	<0.23	<0.212	<0.215
4,4-DDE	ng/g dry	2.19	0.459	1.15	1.68	2.1	2.57	2.39	1.75	1.65	2.09

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
4,4-DDT	ng/g dry	<0.239	<0.178	<0.367	<0.269	<0.452	0.484	<0.253	<0.323	<0.254	<0.256
4,4-DDD	ng/g dry	0.28	<0.137	<0.326	0.562	1.54	4.31	1.95	3.34	0.921	1.05
Aldrin	ng/g dry	<0.038	<0.0278	<0.0371	<0.0369	<0.0384	<0.0386	<0.0386	<0.0399	<0.0379	<0.0375
Alpha Chlordane	ng/g dry	---	---	---	---	---	---	---	---	---	---
Alpha-Endosulfan	ng/g dry	0.113	0.167	0.165	0.274	0.243	0.217	0.209	0.126	0.21	0.223
Alpha-Hch Or Alpha-Bhc	ng/g dry	0.067	0.089	<0.0498	0.048	0.085	<0.0495	<0.0386	<0.0622	0.054	0.16
Beta-Endosulfan	ng/g dry	0.418	0.2	0.411	0.342	0.308	0.289	0.308	0.4	0.218	0.31
Beta-Hch Or Beta-Bhc	ng/g dry	0.102	0.17	0.089	0.102	0.144	0.121	0.096	0.109	0.112	0.129
Cis-Nonachlor	ng/g dry	0.087	0.031	0.06	0.071	0.119	0.102	0.127	0.105	0.084	0.078
Delta-Hch Or Delta-Bhc	ng/g dry	<0.0949	<0.0696	<0.0927	<0.0923	<0.0959	<0.0965	<0.0964	<0.0996	<0.0949	<0.0938
Dieldrin	ng/g dry	0.178	0.159	0.194	0.556	0.884	1.08	2	3.36	0.574	1.01
Endosulfan Sulfate	ng/g dry	<0.0949	<0.0696	<0.0927	<0.0923	<0.106	<0.0965	<0.0964	0.164	<0.0949	<0.0938
Endrin	ng/g dry	<0.0949	<0.0696	<0.0927	<0.0923	<0.0959	<0.0965	<0.0964	<0.0996	<0.0949	<0.0938
Endrin Aldehyde	ng/g dry	<0.0949	<0.0696	<0.0927	<0.0923	<0.0959	<0.0965	<0.0964	<0.0996	<0.0949	<0.0938
Endrin Ketone	ng/g dry	<0.0949	<0.0696	<0.0927	<0.0923	<0.0959	<0.0965	<0.0964	<0.0996	<0.0949	<0.0938
Hch, Gamma	ng/g dry	<0.0522	<0.0464	<0.0576	<0.0475	<0.098	<0.0572	<0.0442	<0.072	<0.052	<0.0505
Heptachlor	ng/g dry	<0.038	<0.0278	<0.0371	<0.0369	<0.0384	<0.0386	<0.0386	<0.0399	<0.0379	<0.0375
Heptachlor Epoxide	ng/g dry	<0.0949	<0.0696	<0.0927	<0.0923	<0.0959	<0.0965	<0.0964	<0.0996	<0.0949	<0.0938
Hexachlorobenzene	ng/g dry	0.155	0.191	0.167	0.163	0.217	0.169	0.163	0.192	0.189	0.213
Hexachlorobutadiene	ng/g dry	0.285	0.219	0.166	0.208	0.293	0.23	0.242	0.981	0.16	0.229
Methoxyclor	ng/g dry	<0.19	<0.139	<0.185	<0.185	0.353	<0.193	<0.193	<0.199	<0.19	0.604
MIREX	ng/g dry	<0.038	<0.0278	<0.0371	<0.0369	<0.0384	<0.0386	<0.0386	<0.0399	<0.0379	<0.0375
Oxy-Chlordane	ng/g dry	<0.0553	<0.0397	<0.0667	<0.0693	<0.136	<0.0594	<0.0645	<0.0645	0.063	<0.0515
Trans-Chlordane	ng/g dry	0.065	<0.0278	<0.0371	0.101	0.134	0.206	0.22	0.183	0.168	0.237
Trans-Nonachlor	ng/g dry	0.06	0.055	0.044	0.069	0.103	0.093	0.095	0.12	0.109	0.123
PFOS											
PFBA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07
PFBS	ng/g dry	<7.85	<6.09	<7.71	<8.03	<8.33	<8.31	<8.4	<8.6	<8.09	<8.13
PFDA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07
PFDoA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07
PFHpA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07
PFHxA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07
PFHxS	ng/g dry	<7.85	<6.09	<7.71	<8.03	<8.33	<8.31	<8.4	<8.6	<8.09	<8.13
PFNA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07
PFOA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07

Appendix D6 Bioaccumulation Chemistry Results – 2017, cont'd

Parameter	units	Control	T=0	PB1	M100NW	M200E	M100 E Field Replicate	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	Far	Mid	Near	Near	Near	Near	Outfall
PFOS	ng/g dry	<7.85	<6.09	<7.71	<8.03	<8.33	<8.31	<8.4	<8.6	<8.09	<8.13
PFOSA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07
PFPeA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07
PFUnA	ng/g dry	<3.92	<3.05	<3.86	<4.01	<4.16	<4.15	<4.2	<4.3	<4.05	<4.07
Nonylphenols											
4-Nonylphenol Diethoxylates	ng/g dry	8.86	4.18	6.82	9.22	10.7	10.7	14.3	10.1	14.1	21.5
4-Nonylphenol Monoethoxylates	ng/g dry	<34	<9.79	<37.2	<12.3	<73.6	<28.3	<64.6	<25.7	<53.6	92.6
Nonylphenol	ng/g dry	1290	369	1790	1330	1490	1350	1770	1500	1550	1300
Octylphenol	ng/g dry	<20.3	<14.4	<16.3	<11.9	<14	<11.4	<10.9	<11.2	<8.46	<14.3

Appendix D7 Bioaccumulation Chemistry Results – 2019

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Moisture and Lipids												
Lipids	%	91	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.5
Moisture	%	0.4	88	89	89	91	90	91	89	89	91	90
Dioxins and Furans												
1,2,3,4,6,7,8-HPCDD	pg/g dry	<0.805	1.74	3.27	2.97	2.3	2.84	11.7	2.96	3.61	1.95	2.3
1,2,3,4,6,7,8-HPCDF	pg/g dry	<0.647	<0.57	0.807	1.68	0.912	1.52	2.36	1.68	1.54	0.878	0.72
1,2,3,4,7,8,9-HPCDF	pg/g dry	<0.647	<0.57	<0.621	0.725	<0.608	<0.612	<0.635	<0.629	<0.63	<0.605	<0.644
1,2,3,4,7,8-HXCDD	pg/g dry	<1.19	<0.57	<0.698	<0.655	<0.608	<0.612	1.22	<0.629	<0.63	<0.605	<0.644
1,2,3,4,7,8-HXCDF	pg/g dry	<0.971	<0.57	<0.621	<0.655	<0.608	<0.612	4.18	<0.629	<0.63	<0.605	<0.644
1,2,3,6,7,8-HXCDD	pg/g dry	<1.19	<0.57	<0.698	<0.655	0.723	0.916	15.7	<0.629	0.888	<0.605	<0.644
1,2,3,6,7,8-HXCDF	pg/g dry	<0.971	<0.57	<0.621	<0.655	<0.608	<0.612	2.23	<0.629	<0.63	<0.605	<0.644
1,2,3,7,8,9-HXCDD	pg/g dry	---	---	---	---	---	---	5.34	---	---	---	---
1,2,3,7,8,9-HXCDD	pg/g dry	<1.19	<0.57	<0.698	<0.655	<0.608	<0.612	4.01	<0.629	<0.63	<0.605	<0.644
1,2,3,7,8,9-HXCDF	pg/g dry	<0.971	<0.57	<0.621	0.736	<0.608	<0.612	0.866	<0.629	<0.63	<0.605	<0.644
1,2,3,7,8-PECDD	pg/g dry	<1.08	<0.57	<0.621	<0.655	<0.608	<0.612	4.36	<0.629	<0.63	<0.605	<0.644
1,2,3,7,8-PECDF	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.608	<0.612	2.81	<0.629	<0.63	<0.605	<0.644
2,3,4,6,7,8-HXCDF	pg/g dry	<0.971	<0.57	<0.621	<0.655	<0.608	<0.612	1.67	<0.629	<0.63	<0.605	<0.644
2,3,4,7,8-PECDF	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.608	<0.612	4.8	<0.629	<0.63	<0.605	<0.644
2,3,7,8-TCDD	pg/g dry	<0.79	<0.57	<0.621	<0.655	<0.608	<0.612	1.99	<0.629	<0.63	<0.605	<0.644
2,3,7,8-TCDF	pg/g dry				<0.655		<0.612	4.89	<0.629	0.643	<0.605	<0.644
2,3,7,8-TCDF	pg/g dry	<0.647	<0.57	<0.621	1.31	<0.608	1.28	15.8	1.19	1.89	0.915	1.01
OCDD	pg/g dry	2.06	11	16.2	14.7	13	16.1	11.3	17.9	12.7	8.58	10.8
OCDF	pg/g dry	1.09	<0.57	1.72	1.84	1	1.46	1.35	4.1	2.5	0.728	0.874
TOTAL HEPTA-DIOXINS	pg/g dry	<0.805	3.53	6.61	7.56	2.3	6.37	21.6	<1.08	3.61	3.99	2.3
TOTAL HEPTA-FURANS	pg/g dry	<0.647	<0.57	<0.621	<0.655	1.72	1.68	4.74	3.55	<0.63	0.878	<0.644
TOTAL HEXA-DIOXINS	pg/g dry	<1.19	<0.57	1.34	<0.655	<0.608	<0.612	45.4	2.68	4.18	<0.605	<0.644
TOTAL HEXA-FURANS	pg/g dry	<0.971	<0.57	<0.621	0.736	<0.608	0.887	14.7	1.22	<0.63	<0.605	<0.644
TOTAL PENTA-DIOXINS	pg/g dry	<1.08	<0.57	<0.621	<0.655	<0.608	<0.612	28.8	<0.629	<0.63	<0.605	<0.644
TOTAL PENTA-FURANS	pg/g dry	<0.647	<0.57	<0.621	0.968	<0.608	0.986	97.9	0.903	0.99	0.647	<0.644
TOTAL TETRA-DIOXINS	pg/g dry	<0.79	<0.57	<0.621	<0.655	<0.608	0.64	12.8	<0.629	<0.63	<0.605	<0.644
TOTAL TETRA-FURANS	pg/g dry	1.54	<0.57	<0.621	0.935	<0.608	2.12	128	3.76	4.26	0.893	<0.644
PCB												
Pcb 1	pg/g dry	4.55	4.23	5.18	5.08	5.63	5.08	6.42	16	5.44	6.23	6.77
Pcb 2	pg/g dry	6.5	4.91	6.02	6.41	5.92	4.99	5.28	4.98	4.9	5.92	6.52

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 3	pg/g dry	15.8	15.8	18.2	17.4	12.9	10.4	11.4	14.5	15.6	17.5	15.5
Pcb 4	pg/g dry	7.45	7.2	8.23	10	12.8	11.7	10.5	14.8	11.3	10.7	12.2
Pcb 5	pg/g dry	<2.17	<1.84	<2.21	<2.98	<1.78	<1.43	<1.92	<1.6	<1.83	<1.86	<2.28
Pcb 6	pg/g dry	10.5	7.57	9.26	10.1	12.9	12	12.4	12.5	11.5	12.8	14.8
Pcb 7	pg/g dry	44.4	9.55	22.7	39.6	36.6	26.3	37.8	30.7	16	23.7	51.1
Pcb 8	pg/g dry	41.3	28.5	36.6	45.5	51.9	75.3	53.9	56.8	60	56.8	68.4
Pcb 9	pg/g dry	<1.91	<1.64	<1.96	<2.65	2.15	1.39	2.41	2.6	2.27	1.75	<2.01
Pcb 10	pg/g dry	<1.96	<1.71	<2.05	<2.76	<1.6	<1.29	<1.73	<1.44	<1.69	<1.72	<2.06
Pcb 11	pg/g dry	245	168	177	209	219	162	181	171	174	236	244
Pcb 12/13	pg/g dry	4.05	3.22	3.44	4.07	2.36	5.63	4.31	4.45	5.89	6.28	9.82
Pcb 14	pg/g dry	<2.02	<1.71	<2.05	<2.77	<1.65	<1.33	<1.79	<1.49	<1.7	<1.72	<2.13
Pcb 15	pg/g dry	15.7	11.2	12.2	15.5	16.2	25.9	19.2	20.1	20.8	20	32.3
Pcb 16	pg/g dry	10.1	8.58	11.1	18.1	23	41.5	30.8	23.9	34.2	21.5	31.8
Pcb 17	pg/g dry	19.4	11.3	19.5	32.9	35.4	115	56.8	49.6	70.4	44	59.7
Pcb 18/30	pg/g dry	18.9	15.8	19	28.7	45	79.3	60.1	42.6	60.4	35	47.8
Pcb 19	pg/g dry	3.09	2.53	4.54	6.72	8.99	23.6	12.5	11.4	14.4	7.37	6.58
Pcb 20/28	pg/g dry	87.1	61.8	78.1	120	131	560	240	209	276	213	302
Pcb 21/33	pg/g dry	34.6	23.1	31.4	49.2	58.5	228	98.9	77.4	111	84.7	129
Pcb 22	pg/g dry	23.2	16.2	19.8	30	36	132	57.3	49.3	66.5	57.9	89.3
Pcb 23	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.607	<0.668	<0.635	1.11	<0.63	<0.605	<0.644
Pcb 24	pg/g dry	<0.647	<0.57	<0.621	<0.655	0.68	1.02	1.05	<0.629	0.731	0.986	0.866
Pcb 25	pg/g dry	5	2.94	4.83	7.45	8.63	29.7	14.3	13	16.6	12.8	18.6
Pcb 26/29	pg/g dry	7.18	5.41	7.51	10.5	14.5	34.5	24.7	18.3	25.4	19.5	30.3
Pcb 27	pg/g dry	2.28	2.09	2.49	4.67	5.7	24.4	13.1	10.2	13.2	8	10.8
Pcb 31	pg/g dry	48.9	36.8	45.7	67.9	81.3	305	143	115	164	129	190
Pcb 32	pg/g dry	17.8	11.7	17.7	29.2	32.7	112	56.8	44.8	65.6	41.2	53.7
Pcb 34	pg/g dry	<0.647	<0.57	<0.621	<0.655	0.724	1.45	0.961	1.85	0.964	0.749	0.709
Pcb 35	pg/g dry	4.19	2.89	3.24	4.01	3.77	6.14	5.14	4.58	5.89	6.3	8.34
Pcb 36	pg/g dry	2.54	2.14	2.12	2.46	2.33	1.72	2.62	1.82	2.05	3.08	3.31
Pcb 37	pg/g dry	7.1	5.48	6.15	9.85	9.27	36.4	21.1	18	24.2	21.6	31.6
Pcb 38	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.607	1.17	0.844	<0.629	1.01	<0.605	0.804
Pcb 39	pg/g dry	0.795	<0.57	0.859	1.92	1.78	8.14	3.65	2.54	4	2.63	1.96
Pcb 40/41/71	pg/g dry	30.6	21.9	41.1	100	103	594	268	212	285	164	182
Pcb 42	pg/g dry	15.1	9.29	20.2	42	42.7	229	96.7	84.3	107	67.6	80.6
Pcb 43	pg/g dry	1.79	1.06	2.41	5.2	6.54	23.4	11.2	8.17	9.06	8.11	8.63

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 44/47/65	pg/g dry	52.6	31.4	56	110	101	437	248	218	255	171	192
Pcb 45/51	pg/g dry	9.44	6.29	10.2	21.3	24.1	114	48.8	39.6	45.1	29.6	35.7
Pcb 46	pg/g dry	1.32	1.77	2.05	6.36	7.48	36.1	17	13.1	15.2	8.29	8.48
Pcb 48	pg/g dry	11	8.08	15	37.9	40.5	214	86.4	65.1	86	54.4	63.9
Pcb 49/69	pg/g dry	38.8	25.8	46.3	119	110	685	319	333	445	245	217
Pcb 50/53	pg/g dry	6.7	5.55	8.63	26.8	28.9	183	79	63.7	81.7	41.3	43.8
Pcb 52	pg/g dry	66.7	54.3	88.9	260	210	1420	758	802	1150	558	453
Pcb 54	pg/g dry	<0.647	<0.57	<0.621	2.65	1.58	12.2	5.09	5.96	5.56	1.79	1.74
Pcb 55	pg/g dry	0.663	<0.57	<1.14	<1.71	1.84	7.52	3.64	3.2	<2.7	2.48	4.16
Pcb 56	pg/g dry	20	14.4	22.5	57.8	53.5	337	156	144	202	112	147
Pcb 57	pg/g dry	<0.647	<0.57	<1.04	<1.57	<1.23	1.54	<1.56	<1.92	<2.48	<1.16	0.929
Pcb 58	pg/g dry	<0.647	<0.57	<1	<1.51	<1.24	2.36	<1.58	<1.95	<2.38	<1.11	<0.897
Pcb 59/62/75	pg/g dry	5.7	5.01	6.43	12.9	13.5	65.2	35.9	28.5	37.7	22.2	26.7
Pcb 60	pg/g dry	22.7	14.8	23.3	45.7	44.8	261	120	113	156	89.7	128
Pcb 61/70/74/76	pg/g dry	105	73.9	122	388	270	2020	1060	1260	2100	796	736
Pcb 63	pg/g dry	2.75	2.04	3.27	7.36	6.54	40.2	20.4	17.8	24.9	13.4	15
Pcb 64	pg/g dry	29.6	19.9	33.9	85.6	74	503	228	225	326	172	176
Pcb 66	pg/g dry	48.5	31	53	136	116	706	350	368	516	231	291
Pcb 67	pg/g dry	1.74	1.33	1.58	3.44	3.67	14.8	8.59	5.51	11.3	5.8	7.97
Pcb 68	pg/g dry	2.15	1.11	2.08	3.04	1.82	8.34	5.02	4.17	4.31	3.96	4.35
Pcb 72	pg/g dry	<0.647	<0.57	<0.991	3.12	<1.16	13.6	5.72	4.69	5.96	3.08	2.46
Pcb 73	pg/g dry	<0.647	<0.57	<0.621	0.842	0.959	3.82	2.11	2.42	2.08	0.969	1.82
Pcb 77	pg/g dry	3.85	2.84	3.34	5.17	5.72	23.8	13.3	12.7	15.1	11.1	13.7
Pcb 78	pg/g dry	<0.647	<0.57	<1.05	<1.59	<1.28	<1.31	<1.63	<2.01	<2.5	<1.17	<0.925
Pcb 79	pg/g dry	1.78	1.04	2.85	10.2	5.55	38.7	18.7	24.8	48.4	14.7	8.8
Pcb 80	pg/g dry	<0.647	<0.57	<0.962	<1.45	<1.15	<1.17	<1.47	<1.81	<2.28	<1.06	<0.832
Pcb 81	pg/g dry	<0.647	<0.57	<0.989	<1.47	<1.11	1.43	<1.43	<1.82	<2.25	<1.07	<0.965
Pcb 82	pg/g dry	8.83	6.7	17.7	68.2	40.5	300	150	208	353	111	69.8
Pcb 83/99	pg/g dry	88.7	62.8	145	512	278	1940	912	1200	2450	705	378
Pcb 84	pg/g dry	10.8	9.79	23.5	116	69.8	397	275	273	544	165	97.4
Pcb 85/116/117	pg/g dry	27.7	19.4	41.3	163	81.5	637	323	449	846	239	152
Pcb 86/87/97/108/119/125	pg/g dry	58	37.1	98.9	421	242	1940	1000	1360	2340	733	450
Pcb 88/91	pg/g dry	14.4	10.2	27.9	98.5	61	409	192	259	438	145	92.7
Pcb 89	pg/g dry	<0.647	0.653	1.25	7.51	4.64	30.9	15.7	13.4	26.1	9.01	6.87
Pcb 90/101/113	pg/g dry	96.6	64.6	167	693	405	2990	1440	1930	3520	1130	685

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 92	pg/g dry	17.7	14.2	32.7	108	67.2	442	244	298	485	181	117
Pcb 93/95/98/100/102	pg/g dry	46.9	39.2	97.7	394	257	1630	962	1160	1690	661	442
Pcb 94	pg/g dry	0.752	<0.57	1.56	3.53	2.02	13	5.56	6.49	9.75	3.43	2.72
Pcb 96	pg/g dry	<0.647	<0.57	0.824	3.64	2.53	13.5	7.09	6.61	10.6	3.79	2.87
Pcb 103	pg/g dry	1.96	1.15	2.1	10.4	6.7	32.3	16.2	16.7	26.8	10.8	6.79
Pcb 104	pg/g dry	<0.647	<0.57	<0.621	0.659	<0.607	0.697	<0.635	0.911	<0.63	<0.605	<0.644
Pcb 105	pg/g dry	31.8	23.3	49.3	205	98.9	906	468	643	1330	324	219
Pcb 106	pg/g dry	<0.647	<0.57	<0.621	<0.994	<0.607	<1.92	<1.43	<1.65	<2.96	<1.97	<0.883
Pcb 107/124	pg/g dry	3.77	2.27	5.01	21.2	11.1	86.8	45.7	57.8	112	32.3	20.3
Pcb 109	pg/g dry	8.45	6.49	12.8	38.5	21.6	166	80.7	99.7	203	58.8	36.7
Pcb 110/115	pg/g dry	100	65.2	170	744	417	3560	1840	2480	4740	1400	792
Pcb 111	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.607	0.989	<0.635	<0.629	<0.63	<0.605	<0.644
Pcb 112	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.607	<0.827	<0.635	<0.629	<0.63	<0.605	<0.644
Pcb 114	pg/g dry	1.83	1.53	2.81	13.4	6.01	67	36.8	41.9	107	23.4	16.1
Pcb 118	pg/g dry	82.2	58.6	124	530	260	2540	1200	1640	3960	900	546
Pcb 120	pg/g dry	0.933	<0.57	1.4	2.88	1.72	6.45	3.46	2.89	4.64	1.8	1.71
Pcb 121	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.607	0.954	<0.635	0.711	<0.63	<0.605	<0.644
Pcb 122	pg/g dry	0.965	<0.57	1.97	5.28	2.9	21.7	11.2	14.8	29	7.95	6.12
Pcb 123	pg/g dry	1.9	0.926	2.41	7.37	4.65	25.5	14	19.7	38.2	10.2	6.64
Pcb 126	pg/g dry	<0.647	<0.57	<0.621	<1.28	<0.607	<2.26	<1.75	<2.25	<3.62	<2.82	<1.05
Pcb 127	pg/g dry	<0.647	<0.57	<0.621	<1.03	0.726	6.24	2.59	3.17	8.18	<2.05	<0.978
Pcb 128/166	pg/g dry	17	12.4	41.1	130	77.5	514	240	301	635	162	96
Pcb 129/138/160/163	pg/g dry	105	65.7	246	700	443	2200	1080	1310	2700	766	451
Pcb 130	pg/g dry	6.5	3.93	15.7	38.1	25.2	128	68.7	77.8	150	48.3	29.9
Pcb 131	pg/g dry	0.988	<0.57	1.86	8.32	4.89	32.3	15.3	19.5	30.9	8.85	6.75
Pcb 132	pg/g dry	25.8	16.3	75.2	244	164	1050	513	629	1210	345	211
Pcb 133	pg/g dry	3.08	1.84	4.8	11.5	7.05	23	13.8	15.7	26.9	32	7.47
Pcb 134/143	pg/g dry	1.66	1.76	9.27	25.9	16.4	81.4	44.7	51.1	90.3	30.2	18.8
Pcb 135/151/154	pg/g dry	31.6	18.5	76.9	217	136	566	304	339	588	250	163
Pcb 136	pg/g dry	6.66	5.5	20.7	74.4	50	204	124	133	263	80.3	44
Pcb 137	pg/g dry	2.53	1.54	6.87	27.7	14.1	133	54.9	68	146	35.2	21
Pcb 139/140	pg/g dry	1.92	1.73	6.18	19.1	11.2	61.9	28.9	36.6	68.1	21.4	11.6
Pcb 141	pg/g dry	5.89	3.87	24.9	75.4	47.2	293	145	159	313	97.2	75.6
Pcb 142	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.622	<2.82	<1.69	<1.37	<2.37	<0.958	<0.644
Pcb 144	pg/g dry	3.5	2.34	8.57	31.7	21.5	102	54.7	62	111	39.9	28.1

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 145	pg/g dry	<0.647	<0.57	<0.621	0.745	<0.607	1.62	<0.635	1.13	2	<0.605	<0.644
Pcb 146	pg/g dry	23.7	14.5	44.7	101	62.7	244	129	146	273	135	64.3
Pcb 147/149	pg/g dry	85.1	54.3	225	618	402	1830	945	1140	2140	707	450
Pcb 148	pg/g dry	<0.647	<0.57	4.35	6.7	3.13	6.02	3.94	4.97	7.49	5.27	1.41
Pcb 150	pg/g dry	<0.647	<0.57	0.675	2.41	1.29	3.89	1.56	2.56	4.03	2.25	1.01
Pcb 152	pg/g dry	<0.647	<0.57	<0.621	0.738	<0.607	2.17	1.16	1.3	2.37	0.618	<0.644
Pcb 153/168	pg/g dry	140	93.1	306	715	458	1950	982	1160	2410	772	488
Pcb 155	pg/g dry	<0.647	<0.57	0.699	1.03	0.926	1.12	<0.635	1.42	1.05	1.17	0.827
Pcb 156/157	pg/g dry	6.59	4.01	17.4	56.3	31.1	270	124	148	381	82.3	49.5
Pcb 158	pg/g dry	6.93	4.65	16.2	66.7	38.9	271	144	159	352	92.2	56.1
Pcb 159	pg/g dry	0.673	<0.57	3.51	6.4	3.57	11.7	7.26	5.09	13.6	6.63	4.29
Pcb 161	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.607	<1.9	<1.13	<0.917	<1.53	<0.619	<0.644
Pcb 162	pg/g dry	<0.647	<0.57	0.862	1.5	1.07	3.84	2.26	3.24	4.64	1.51	1.1
Pcb 164	pg/g dry	4.25	2.97	13.1	30.4	21.6	103	52.5	67.4	122	41.3	27.2
Pcb 165	pg/g dry	<0.647	<0.57	0.939	<0.655	0.837	<2.19	1.31	1.32	<1.75	2.8	<0.644
Pcb 167	pg/g dry	3.34	1.92	6.95	19.2	11.7	67.9	36.7	41.4	85.4	22.4	15.5
Pcb 169	pg/g dry	<0.647	<0.57	<0.621	<0.9	<0.607	<2	<1.17	<1.1	<1.54	<0.62	<0.644
Pcb 170	pg/g dry	10.1	5.28	44	78.8	52.1	196	117	100	184	75.6	60.5
Pcb 171/173	pg/g dry	4.71	2.48	16.3	27.4	30.3	83	48.8	30.8	72	23.5	22.1
Pcb 172	pg/g dry	1.84	0.921	6.73	11.4	6.53	24.2	19.7	14	26.3	15.9	12
Pcb 174	pg/g dry	9.66	7.14	47.8	100	59.2	208	135	107	240	92.2	80.7
Pcb 175	pg/g dry	0.696	<0.57	2.78	8.43	3.66	13.5	8.99	5.93	11.7	16.8	4.76
Pcb 176	pg/g dry	2.34	0.775	6.62	21.9	12.6	40.9	25	22.3	42.9	20.2	14.8
Pcb 177	pg/g dry	10.3	6.16	40.5	74	48.6	134	84.8	75.4	157	81	47.7
Pcb 178	pg/g dry	6.88	3.39	15.6	38.8	20.5	41.4	35	29.4	57.8	79	20.9
Pcb 179	pg/g dry	6.53	4.33	22.6	62.4	33.2	109	76.8	59.8	119	65	44
Pcb 180/193	pg/g dry	19.4	11	90.4	181	109	359	247	189	450	206	153
Pcb 181	pg/g dry	<0.647	<0.57	<0.621	<0.655	0.619	3.29	<0.635	2.56	2.98	1.55	1.13
Pcb 182	pg/g dry	<0.647	<0.57	<0.621	<0.655	1.05	2.37	0.93	1.88	1.96	1.35	<0.644
Pcb 183/185	pg/g dry	12.6	8.31	44	106	62.2	200	136	110	246	120	78.5
Pcb 184	pg/g dry	<0.647	<0.57	0.688	1.07	0.971	1.46	<0.635	1.41	1.86	1.53	1.02
Pcb 186	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.607	<0.612	<0.635	<0.629	<0.63	<0.605	<0.644
Pcb 187	pg/g dry	41.1	21.9	107	231	135	326	226	186	480	242	134
Pcb 188	pg/g dry	<0.647	<0.57	<0.621	2.5	<0.607	1.16	0.716	1.69	1.45	2.1	0.699
Pcb 189	pg/g dry	<0.647	<0.57	1.42	2.27	1.08	4.3	3.38	2.82	4.15	1.48	1.65

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Pcb 190	pg/g dry	2.6	0.68	9.51	16.5	10.7	46.6	30.4	22.9	43.1	17.4	16.5
Pcb 191	pg/g dry	<0.647	<0.57	1.54	3.17	2.24	6.9	9.43	4.55	7.19	3.12	2.49
Pcb 192	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.607	<0.612	<0.635	<0.629	<0.63	<0.605	<0.644
Pcb 194	pg/g dry	2.93	2	17.4	37.6	18.7	46.4	47.9	25.4	82.5	42	26.2
Pcb 195	pg/g dry	1.87	0.757	11.1	18.5	10.3	31.1	24.1	15.6	46.3	25.1	14.9
Pcb 196	pg/g dry	2.83	2.21	11.5	35.3	16.5	49.3	33.8	24.7	80.4	36.4	21.7
Pcb 197/200	pg/g dry	0.97	1	6.21	13	5.05	16	12.9	9.66	30.9	14	8.32
Pcb 198/199	pg/g dry	10.9	6.02	37.8	98.6	46.6	129	106	77	272	98.4	68.4
Pcb 201	pg/g dry	2.03	0.972	5.55	14.1	6.88	18.3	13.9	9.38	32.4	17.2	8.03
Pcb 202	pg/g dry	4.33	2.15	13.4	34.3	14.4	36.6	30.1	23.9	75	37.2	19
Pcb 203	pg/g dry	5.05	2.32	15.6	37	20.7	61.6	54.8	33.5	133	57.5	31.1
Pcb 204	pg/g dry	<0.647	<0.57	<0.621	<0.655	<0.607	<0.612	<0.635	<0.629	<0.63	<0.605	<0.644
Pcb 205	pg/g dry	<0.647	<0.57	0.903	2.13	0.807	2.7	2.55	2.01	4.3	1.59	1.13
Pcb 206	pg/g dry	4.56	3.16	18.3	66.1	19.8	73.2	53.2	43.5	97.8	55.7	31.5
Pcb 207	pg/g dry	<0.647	<0.577	2.76	9.52	3.22	8.94	7.72	4.88	13.1	7.68	3.63
Pcb 208	pg/g dry	2.67	2.06	7.83	33.7	12.7	35.4	29.6	23	43.5	19.4	13.1
Pcb 209	pg/g dry	5.48	4.88	18.9	101	21.5	84.6	55.1	50.4	62.1	30.2	24.2
Pcb Teq 3	pg/g dry	0.0129	0.00847	0.0278	0.11	0.0526	0.519	0.251	0.327	0.78	0.178	0.111
Pcb Teq 3	pg/g dry	0.000206	0.0185	0.0343	0.105	0.0334	0.03	12.2	0.019	0.126	0.0283	0.0241
Pcb Teq 4	pg/g dry	0.0487	0.0402	0.062	0.178	0.0862	0.642	0.344	0.445	0.968	0.322	0.167
Pcb Teq 4	pg/g dry	1.53	0.979	1.09	1.18	1.05	1.06	12.3	1.08	1.16	1.04	1.11
PCBs Total	pg/g dry	2360	1460	3700	11000	7190	40700	21100	24600	45600	16000	11700
Decachloro Biphenyl	pg/g dry	5.48		18.9	101	21.5	84.6	55.1	50.4	62.1	30.2	24.2
Total Dichloro Biphenyls	pg/g dry	368	232	269	330	352	320	319	310	299	366	418
Total Heptachloro Biphenyls	pg/g dry	118	45	408	927	576	1800	1180	942	2140	1060	688
Total Hexachloro Biphenyls	pg/g dry	457	286	1070	3210	2040	10200	5100	6080	12100	3780	2310
Total Monochloro Biphenyls	pg/g dry	15.8	15.8	23.4	22.5	5.63	15.5	11.4	30.5	21	23.7	6.77
Total Nonachloro Biphenyls	pg/g dry	4.56	5.22	21.1	109	23	118	90.5	66.5	154	82.8	48.2
Total Octachloro Biphenyls	pg/g dry	18.7	5.33	76.7	275	90.2	391	310	194	722	328	198
Total Pentachloro Biphenyls	pg/g dry	603	383	1020	4150	2320	18200	9240	12200	23300	6850	4140
Total Tetrachloro Biphenyls	pg/g dry	477	299	537	1480	1270	7990	3930	4040	5910	2820	2840
Total Trichloro Biphenyls	pg/g dry	288	193	258	395	496	1700	836	687	957	708	1010
PPCP												
1,7-Dimethylxanthine	ng/g dry		<185	<204	<202	---	---	---	---	---	---	<214
10-Hydroxy-Amitriptyline	ng/g dry		<0.463	<0.51	<0.505	---	---	---	---	---	---	<0.534

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
2-Hydroxy-Ibuprofen	ng/g dry	<287	<247	<272	<269	<272	<274	<280	<267	<275	<263	<285
4-Epianhydrochlortetracycline [Eactc]	ng/g dry		<185	<204	<202	---	---	---	---	---	---	<214
4-Epianhydrotetracycline [Eatc]	ng/g dry		<46.3	<51	<50.5	---	---	---	---	---	---	<53.4
4-Epichlortetracycline [Ectc]	ng/g dry		<46.3	<51	<50.5	---	---	---	---	---	---	<53.4
4-Epioxytetracycline [Eotc]	ng/g dry		<18.5	<20.4	<20.2	---	---	---	---	---	---	<21.4
4-Epitetracycline [Etc]	ng/g dry		<18.5	<20.4	<20.2	---	---	---	---	---	---	<21.4
Acetaminophen	ng/g dry		<83.8	<53.6	<50.5	---	---	---	---	---	---	<139
Albuterol	ng/g dry		<2.31	<2.57	<2.54	---	---	---	---	---	---	<2.68
Alprazolam	ng/g dry		<0.925	<1.02	<1.01	---	---	---	---	---	---	<1.07
Amitriptyline	ng/g dry		<0.925	<1.21	<2.26	---	---	---	---	---	---	13.2
Amlodipine	ng/g dry		<4.63	<5.1	<5.05	---	---	---	---	---	---	<5.34
Amphetamine	ng/g dry		<11.6	<12.9	<12.7	---	---	---	---	---	---	<13.4
Anhydrochlortetracycline [Actc]	ng/g dry		<52.4	<54.3	<60.5	---	---	---	---	---	---	<63.1
Anhydrotetracycline [Atc]	ng/g dry		<48	<51	<54.9	---	---	---	---	---	---	<56.1
Atenolol	ng/g dry		14.1	<5.14	<5.08	---	---	---	---	---	---	<5.35
Atorvastatin	ng/g dry		<11.6	<12.9	<12.7	---	---	---	---	---	---	<13.4
Azithromycin	ng/g dry		<7.84	<6.09	<8.34	---	---	---	---	---	---	<19.7
Benzoylecgonine	ng/g dry		<0.925	<1.02	<1.01	---	---	---	---	---	---	<1.07
Benztropine	ng/g dry		<1.54	<1.7	<1.68	---	---	---	---	---	---	<1.78
Betamethasone	ng/g dry		<4.63	<5.1	<5.05	---	---	---	---	---	---	<5.34
Bisphenol A	ng/g dry	<1790	<1540	<1700	<1680	<1700	<1710	<1750	<1670	<1720	<1650	<1780
Caffeine	ng/g dry		<46.3	<51	<50.5	---	---	---	---	---	---	128
Carbadox	ng/g dry		<4.63	<5.1	<5.05	---	---	---	---	---	---	<5.34
Carbamazepine	ng/g dry		<4.63	<5.1	<5.05	---	---	---	---	---	---	<5.9
Chlortetracycline [Ctc]	ng/g dry		<18.5	<20.4	<20.2	---	---	---	---	---	---	<21.4
Cimetidine	ng/g dry		<4.63	<5.14	<5.08	---	---	---	---	---	---	<5.35
Ciprofloxacin	ng/g dry		<18.5	<23.5	27	---	---	---	---	---	---	<91.6
Clarithromycin	ng/g dry		<4.63	<5.1	<5.05	---	---	---	---	---	---	<5.34
Clinafloxacin	ng/g dry		<45	<62.9	<55.5	---	---	---	---	---	---	<165
Clonidine	ng/g dry		<11.6	<12.9	<12.7	---	---	---	---	---	---	<13.4
Cloxacillin	ng/g dry		<9.25	<10.2	<10.1	---	---	---	---	---	---	<10.7
Cocaine	ng/g dry		3.11	<0.51	<0.709	---	---	---	---	---	---	<0.59
Codeine	ng/g dry		<23.1	<25.7	<25.4	---	---	---	---	---	---	<26.8
Cotinine	ng/g dry		<11.6	<12.9	<12.7	---	---	---	---	---	---	<13.4
Deet	ng/g dry		5.57	4.81	4.15	---	---	---	---	---	---	5.33

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Dehydronifedipine	ng/g dry	---	<1.92	<3.47	<2.55	---	---	---	---	---	---	<12.7
Demeclocycline	ng/g dry	---	<46.3	<51	<50.5	---	---	---	---	---	---	<53.4
Desmethyldiltiazem	ng/g dry	---	<0.463	<0.51	<0.505	---	---	---	---	---	---	<0.534
Diazepam	ng/g dry	---	<0.925	<1.02	<1.01	---	---	---	---	---	---	<1.07
Digoxigenin	ng/g dry	---	<168	<272	<204	---	---	---	---	---	---	<396
Digoxin	ng/g dry	---	<18.5	<24.1	<24.5	---	---	---	---	---	---	<69.5
Diltiazem	ng/g dry	---	<1.36	<1.76	<1.01	---	---	---	---	---	---	<4.44
Diphenhydramine	ng/g dry	---	4.82	<2.04	<2.02	---	---	---	---	---	---	8.46
Doxycycline	ng/g dry	---	<18.5	<20.4	<20.2	---	---	---	---	---	---	<21.4
Enalapril	ng/g dry	---	<2.31	<2.57	<2.54	---	---	---	---	---	---	<2.68
Enrofloxacin	ng/g dry	---	<9.25	<10.8	<10.1	---	---	---	---	---	---	<33.5
Erythromycin-H2O	ng/g dry	---	<7.09	<7.82	<7.74	---	---	---	---	---	---	8.64
Flumequine	ng/g dry	---	<4.63	<7.04	<5.65	---	---	---	---	---	---	<23.5
Fluocinonide	ng/g dry	---	<18.5	<20.4	<21.3	---	---	---	---	---	---	<21.8
Fluoxetine	ng/g dry	---	<20.6	<49.2	<43.2	---	---	---	---	---	---	<55.5
Fluticasone Propionate	ng/g dry	---	<6.17	<7.84	<6.73	---	---	---	---	---	---	<7.97
Furosemide	ng/g dry	<143	<123	<136	<135	<136	<137	<140	<134	<138	<132	<142
Gemfibrozil	ng/g dry	<5.37	<4.63	<5.1	<5.05	<5.11	<5.14	<5.26	<5.01	<5.16	<4.94	<5.34
Glipizide	ng/g dry	<21.5	<18.5	<20.4	<20.2	<20.4	<20.6	<21	<20.1	<20.6	<19.8	<21.4
Glyburide	ng/g dry	<10.7	<9.25	<10.2	<10.1	<10.2	<10.3	<10.5	<10	<10.3	<9.87	<10.7
Hydrochlorothiazide	ng/g dry	<71.6	<61.7	<68	<67.3	<68.1	<68.5	<70.1	<66.8	<68.8	<65.8	<71.2
Hydrocodone	ng/g dry	---	<11.6	<12.9	<12.7	---	---	---	---	---	---	<13.4
Hydrocortisone	ng/g dry	---	<177	<195	<193	---	---	---	---	---	---	<246
Ibuprofen	ng/g dry	<53.7	<46.3	<51	<50.5	<51.1	<51.4	<52.6	<50.1	<51.6	<49.4	<53.4
Isochlortetracycline [Ictc]	ng/g dry	---	<18.5	<20.4	<20.2	---	---	---	---	---	---	<21.4
Lincomycin	ng/g dry	---	<9.25	<10.2	<10.1	---	---	---	---	---	---	<10.7
Lomefloxacin	ng/g dry	---	<22.7	<56.6	<55.3	---	---	---	---	---	---	<158
Meprobamate	ng/g dry	---	<12.5	<13.7	<13.6	---	---	---	---	---	---	<14.4
Metformin	ng/g dry	---	<23.1	<25.7	<25.4	---	---	---	---	---	---	<26.8
Methylprednisolone	ng/g dry	---	<12.5	<13.7	<29.6	---	---	---	---	---	---	<14.4
Metoprolol	ng/g dry	---	<6.29	<5.1	<6.17	---	---	---	---	---	---	<7.35
Miconazole	ng/g dry	---	<4.63	<5.1	<5.05	---	---	---	---	---	---	24.5
Minocycline	ng/g dry	---	<221	<219	<267	---	---	---	---	---	---	<310
Naproxen	ng/g dry	<10.7	<9.25	<10.2	<10.1	<10.2	<10.3	<10.5	<10	<10.3	<9.87	<10.7
Norfloxacin	ng/g dry	---	<46.3	<57.6	<75.2	---	---	---	---	---	---	<153

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Norfluoxetine	ng/g dry	---	<4.63	<5.1	<5.05	---	---	---	---	---	---	<5.34
Norgestimate	ng/g dry	---	<40.8	<109	<64.4	---	---	---	---	---	---	<84.4
Norverapamil	ng/g dry	---	<0.463	<0.51	<0.505	---	---	---	---	---	---	0.546
Ofloxacin	ng/g dry	---	<6.67	<10.2	<8.5	---	---	---	---	---	---	<19.3
Ormetoprim	ng/g dry	---	<1.85	<2.04	<2.02	---	---	---	---	---	---	<2.14
Oxacillin	ng/g dry	---	<12.3	<14.3	<14.4	---	---	---	---	---	---	<51.1
Oxolinic Acid	ng/g dry	---	<2.83	<3.54	<4.58	---	---	---	---	---	---	<7.75
Oxycodone	ng/g dry	---	<4.63	<5.14	<5.08	---	---	---	---	---	---	<5.35
Oxytetracyclin [Otc]	ng/g dry	---	<18.5	<20.4	<20.2	---	---	---	---	---	---	<21.4
Paroxetine	ng/g dry	---	<12.5	<13.7	<13.6	---	---	---	---	---	---	<14.4
Penicillin G	ng/g dry	---	<9.25	<29.4	<10.1	---	---	---	---	---	---	<95.1
Penicillin V	ng/g dry	---	<10.1	<18.3	<18.2	---	---	---	---	---	---	<42.9
Prednisolone	ng/g dry	---	<18.5	<20.4	<20.2	---	---	---	---	---	---	<21.4
Prednisone	ng/g dry	---	<61.7	<68	<67.3	---	---	---	---	---	---	<71.2
Promethazine	ng/g dry	---	<1.23	<1.36	<1.35	---	---	---	---	---	---	<1.42
Propoxyphene	ng/g dry	---	<0.925	<1.02	<1.01	---	---	---	---	---	---	<1.07
Propranolol	ng/g dry	---	<6.17	<6.8	<6.73	---	---	---	---	---	---	21.3
Ranitidine	ng/g dry	---	<4.63	<5.14	<5.08	---	---	---	---	---	---	<5.35
Roxithromycin	ng/g dry	---	<0.925	<1.61	<1.01	---	---	---	---	---	---	<1.5
Sarafloxacin	ng/g dry	---	<60	<78.9	<86.6	---	---	---	---	---	---	<231
Sertraline	ng/g dry	---	1.84	<1.45	2.1	---	---	---	---	---	---	38.5
Simvastatin	ng/g dry	---	<61.7	<68	<67.3	---	---	---	---	---	---	<71.2
Sulfachloropyridazine	ng/g dry	---	<4.63	<5.1	<5.05	---	---	---	---	---	---	<5.34
Sulfadiazine	ng/g dry	---	<4.63	<5.1	<5.05	---	---	---	---	---	---	<6.82
Sulfadimethoxine	ng/g dry	---	<6.86	<13.3	<10.8	---	---	---	---	---	---	<43
Sulfamerazine	ng/g dry	---	<3.2	<11.3	<4.72	---	---	---	---	---	---	<14.6
Sulfamethazine	ng/g dry	---	<1.85	<2.04	<2.02	---	---	---	---	---	---	<2.14
Sulfamethizole	ng/g dry	---	<3.63	<7.84	<3.15	---	---	---	---	---	---	<43.6
Sulfamethoxazole	ng/g dry	---	<7.19	<8.36	<7.21	---	---	---	---	---	---	<44.7
Sulfanilamide	ng/g dry	---	<46.3	<51	<50.5	---	---	---	---	---	---	<86.6
Sulfathiazole	ng/g dry	---	<6.32	<9.93	<8.79	---	---	---	---	---	---	<30.1
Tetracycline [Tc]	ng/g dry	---	<18.5	<20.4	<20.2	---	---	---	---	---	---	<21.4
Theophylline	ng/g dry	---	<185	<204	<202	---	---	---	---	---	---	<214
Thiabendazole	ng/g dry	---	<4.63	<5.1	<5.05	---	---	---	---	---	---	<12.7
Trenbolone	ng/g dry	---	<12.5	<13.7	<13.6	---	---	---	---	---	---	<14.4

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Trenbolone Acetate	ng/g dry	---	<1.36	<1.43	<1.54	---	---	---	---	---	---	<1.39
Triamterene	ng/g dry	---	<2.31	<2.57	<2.54	---	---	---	---	---	---	27.3
Triclocarban	ng/g dry	<10.7	<9.25	<10.2	<10.1	<10.2	<10.3	<10.5	<10	<10.3	<9.87	<10.7
Triclosan	ng/g dry	<215	<185	<204	<202	<204	<206	<210	<201	<206	<198	<214
Trimethoprim	ng/g dry	---	<4.63	<5.1	<5.05	---	---	---	---	---	---	<5.34
Tylosin	ng/g dry	---	<18.5	<20.4	<20.2	---	---	---	---	---	---	<21.4
Valsartan	ng/g dry	---	<12.5	<13.7	<13.6	---	---	---	---	---	---	<14.4
Verapamil	ng/g dry	---	<0.463	<0.51	<0.505	---	---	---	---	---	---	<0.622
Virginiamycin	ng/g dry	---	<9.25	<10.8	<10.1	---	---	---	---	---	---	<10.7
Warfarin	ng/g dry	<5.37	<4.63	<5.1	<5.05	<5.11	<5.14	<5.26	<5.01	<5.16	<4.94	<5.34
Metals												
Aluminum	mg/kg dry	519	102	1240	1200	1250	1050	824	983	803	803	510
Antimony	mg/kg dry	0.116	0.111	0.114	0.178	0.182	0.218	0.213	0.18	0.192	0.163	0.18
Arsenic	mg/kg dry	32.5	30.2	28	30	37.6	34.4	34.2	32	31.6	41.7	42
Barium	mg/kg dry	3.17	2	13.6	6.72	7.75	13	9.68	10.6	8.18	5.03	4.99
Beryllium	mg/kg dry	0.016	<0.0085	0.0341	0.0292	0.034	0.0294	0.022	0.0251	0.0215	0.024	0.0178
Bismuth	mg/kg dry	0.045	0.0408	0.0685	0.061	0.075	0.0796	0.062	0.0845	0.0672	0.074	0.0885
Boron	mg/kg dry	11.3	8.9	8.7	9.4	9.6	9.3	9.1	8.8	9	10.3	8.1
Cadmium	mg/kg dry	0.375	0.418	0.321	0.292	0.382	0.343	0.401	0.365	0.385	0.483	0.385
Calcium	mg/kg dry	4480	3660	4330	5190	5430	4740	5020	4470	4520	6150	4200
Chromium	mg/kg dry	2.25	1.26	2.63	2.32	2.62	2.29	1.79	2.32	1.7	1.74	1.41
Cobalt	mg/kg dry	1.63	1.19	1.91	1.7	2.08	1.83	1.8	1.82	1.53	1.93	1.54
Copper	mg/kg dry	7.5	9.18	8.82	11.1	11.3	12.6	20.4	12.2	13.2	14.9	123
Iron	mg/kg dry	1290	518	2250	2220	2250	2090	2080	2260	1790	1990	1530
Lead	mg/kg dry	1.08	0.831	1.73	3.92	2.44	7.71	29.5	4.58	10.5	4.38	3.71
Magnesium	mg/kg dry	9630	7230	8980	9040	10600	9300	9750	8790	8820	10900	8570
Manganese	mg/kg dry	10.1	3.69	18.5	18.3	17.9	14.6	11.4	13.4	10.9	12.1	11.7
Mercury	mg/kg dry	0.072	0.057	0.084	0.066	0.086	7.8	0.059	0.056	0.044	0.043	0.039
Molybdenum	mg/kg dry	3.73	3.73	3.41	3.89	4.56	5.32	6.22	5.01	5.67	7.52	6.04
Nickel	mg/kg dry	3.92	2.08	3.94	3.95	4.16	4.5	4.98	4.59	3.93	4.38	3.4
Phosphorus	mg/kg dry	8750	9520	8240	8440	10500	8850	9030	8310	7770	10400	8340
Potassium	mg/kg dry	15600	16200	14700	15100	18800	15300	16200	14400	14000	18800	14600
Selenium	mg/kg dry	2.13	2.14	2.06	2.19	2.69	2.3	2.52	2.31	2.18	2.9	2.23
Silver	mg/kg dry	0.18	0.16	0.136	0.171	0.227	1.55	0.19	0.158	0.152	0.227	0.249
Sodium	mg/kg dry	68500	51800	61900	64100	76500	68400	72000	63200	64100	76700	65300

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Strontium	mg/kg dry	73.9	58.1	64.4	77.5	84.2	82.3	82.6	71.8	72.9	94.6	78.5
Thallium	mg/kg dry	0.0077	<0.0034	0.0097	0.0083	0.0096	0.012	0.0094	0.0131	0.0106	0.0142	0.0111
Tin	mg/kg dry	<0.22	0.25	0.24	1.75	0.47	6.65	5.37	6.9	3.13	0.88	0.61
Titanium	mg/kg dry	20.3	3.3	44.4	38.7	43.7	29.5	24.8	36.1	23.1	24.5	15.7
Uranium	mg/kg dry	0.6	0.471	0.596	0.679	0.711	0.709	0.951	0.768	0.747	0.904	0.682
Vanadium	mg/kg dry	2.65	1.39	4.79	4.51	4.93	4.25	3.73	4.31	3.83	4.17	2.97
Zinc	mg/kg dry	110	121	99.8	101	138	117	117	126	114	127	117
PAH												
1-Methylphenanthrene	ng/g dry	2.23	1.44	2.86	3.14	2.86	3.38	5.21	4.51	3.57	3.83	6.23
2,3,5-trimethylnaphthalene	ng/g dry	2.05	1.39	4.13	3.88	3.59	3.39	3.62	3.89	3.12	2.88	3.33
2,6-dimethylnaphthalene	ng/g dry	2.04	1.21	4.67	4.48	3.47	3.44	3.29	3.26	3.45	3.3	3.19
2-Methylnaphthalene	ng/g dry	3.39	2.46	6.33	6.54	4.87	4.94	4.53	5.4	4.69	4.25	4.27
Acenaphthene	ng/g dry	2.78	3.51	2.96	3.21	2.82	3	3.44	3.86	3.73	4.87	4.96
Acenaphthylene	ng/g dry	0.425	0.532	0.507	0.855	0.577	0.626	1.06	0.601	0.609	0.964	0.644
Anthracene	ng/g dry	1.89	1.39	1.27	2.04	2.08	3.87	6.68	7.57	6.15	7.25	15.1
Benzo(A)Anthracene	ng/g dry	1.14	1.23	2.25	5.41	3.79	8.78	18.2	15.8	15.7	13.6	24.6
Benzo(A)Pyrene	ng/g dry	0.527	0.739	1.96	5.08	3.06	9.65	20	13.5	12.5	8.54	10.2
Benzo(B)Fluoranthene	ng/g dry	1.78	2.98	3.48	6.84	5.02	12	19.2	13.9	14	9.49	10.2
Benzo(E)Pyrene	ng/g dry	1.6	2.37	3.69	7.45	5.05	12.5	23	13.9	15.8	9.43	10.2
Benzo(G,H,I)Perylene	ng/g dry	0.823	0.711	2.31	3.61	2.44	5.41	16.8	7.48	5.98	5.33	4.51
Benzo[J,K]Fluoranthenes	ng/g dry	0.662	1.84	2.35	5.92	3.19	10.8	18.8	13.1	12.7	9.65	9.58
Chrysene	ng/g dry	4.37	4.8	4.2	8.63	7.3	13.3	28.9	19.9	20.2	18.3	27.8
Dibenzo(A,H)Anthracene	ng/g dry	<0.362	<0.214	0.341	0.578	0.433	1.15	1.42	1.52	1.36	0.954	1.02
Dibenzothiophene	ng/g dry	1.93	1.81	1.67	2.08	1.95	1.88	3.53	2.75	2.6	3.24	4.22
Fluoranthene	ng/g dry	6.58	14.5	7.42	15.9	13.6	25.9	76	51.3	47.2	59.5	125
Fluorene	ng/g dry	9.88	6.44	5.08	6.32	6.32	5.38	7.63	6.27	5.52	7.15	7.05
Indeno(1,2,3-C,D)Pyrene	ng/g dry	0.575	0.598	1.43	2.65	1.71	4.19	7.57	6.3	5.21	4.48	3.79
Naphthalene	ng/g dry	3.82	3	5.41	5.8	4.79	4.97	5.05	5.44	5.53	5.31	14
Octachlorostyrene	ng/g dry	0.005	0.012	0.01	<0.004	0.01	0.008	<0.0034	0.016	0.019	<0.0044	0.007
Perylene	ng/g dry	3.44	2.26	12.6	10.2	11.1	9.74	11.4	10.5	10.2	8.03	6.47
Phenanthrene	ng/g dry	19.2	20.2	17.2	22.4	20.5	20.3	34.7	25.4	25.2	34.1	46.5
Pyrene	ng/g dry	5.85	8.94	7.92	23.6	20.8	49.9	156	68.6	65.4	62	110
PBDE												
Pbde 7	pg/g dry	2.89	0.912	2.45	14.7	23.2	15.6	28.5	28	27	28.3	30.3
Pbde 8/11	pg/g dry	3.47	1.37	3.02	11.4	15.7	14	16.6	17.8	20.5	28.2	17

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Pbde 10	pg/g dry	<0.517	<0.456	<0.497	<0.524	<0.486	<0.489	<0.508	0.53	<0.504	<0.484	<0.515
Pbde 12/13	pg/g dry	2.03	0.909	1.33	2.04	2.45	2.26	2.89	3.41	2.82	6.56	4.8
Pbde 15	pg/g dry	13	5.36	8.92	14.5	18.9	16.3	17.9	18.3	19.7	45.1	32.9
Pbde 17/25	pg/g dry	30.2	13.6	27.1	101	86.5	147	177	207	207	221	269
Pbde 28/33	pg/g dry	54.1	28.1	35.6	72.9	69.8	74	64	74.2	76.5	96.7	91.6
Pbde 30	pg/g dry	<0.517	<0.456	<0.497	<0.744	<0.534	<0.93	<0.686	<1.04	<0.964	<0.675	<0.999
Pbde 32	pg/g dry	<0.517	<0.456	<0.497	1.16	1.85	1.31	1.12	1.56	1.1	1.72	0.909
Pbde 35	pg/g dry	0.746	<0.456	0.643	0.646	0.704	1.16	<0.508	1.54	0.924	0.864	<0.736
Pbde 37	pg/g dry	4.96	5.06	6.39	5.17	5.81	6.11	5.01	5.93	6.58	4.86	5.15
Pbde 47	pg/g dry	647	308	532	997	784	1050	790	1010	1150	1190	1180
Pbde 49	pg/g dry	34.4	15.2	49	140	106	251	208	310	324	422	318
Pbde 51	pg/g dry	3.03	1.93	7.43	14.6	14.6	16.6	15.9	23.8	21.7	26.2	20.1
Pbde 66	pg/g dry	14.3	4.9	12.5	24.7	18.6	24.5	17.8	22.1	23.4	24.6	24.5
Pbde 71	pg/g dry	4.51	1.55	4.4	13.4	8.86	18.3	16.1	23.4	22.5	27.6	24.2
Pbde 75	pg/g dry	1.26	0.875	1.46	2.47	2.48	2.73	1.82	3.28	2.51	2.83	2.7
Pbde 77	pg/g dry	<0.517	<0.456	<0.497	<0.524	<0.486	<0.489	<0.508	0.571	<0.504	<0.484	<0.515
Pbde 79	pg/g dry	20.3	20.4	23.1	22.7	19.7	24.6	22.5	23.2	22.8	23.6	19.9
Pbde 85	pg/g dry	15.8	5.83	12.8	25.1	14	18.9	9.86	16.3	16.3	21.7	18.4
Pbde 99	pg/g dry	397	143	362	702	485	583	356	501	568	623	497
Pbde 100	pg/g dry	80	33.3	83.1	134	109	112	94.6	120	116	130	135
Pbde 105	pg/g dry	<0.919	<0.998	<1.63	<2.36	<1.41	<1.21	<0.963	<1.59	<1.78	<2.09	<1.85
Pbde 116	pg/g dry	<1.14	<1.31	2.36	<3.09	<1.75	<1.58	<1.19	<2.08	7.65	<2.74	<2.43
Pbde 119/120	pg/g dry	0.952	<0.809	1.54	3.46	2.22	2.42	2.21	3.7	3.05	2.74	2.35
Pbde 126	pg/g dry	<0.517	<0.515	1.21	1.26	1.06	1.06	0.75	1.58	<0.847	0.999	<0.835
Pbde 128	pg/g dry	<2.55	<6.18	<3.05	<11.3	<6.1	<0.489	<9.45	<8.58	<7.96	<6.98	<8.75
Pbde 138/166	pg/g dry	2.42	1.91	3.26	5.64	3.11	2.93	4.27	4.5	2.65	5.01	2.76
Pbde 140	pg/g dry	1.65	0.59	1.5	2.25	1.43	1.54	<1.08	1.79	1.4	1.94	1.49
Pbde 153	pg/g dry	24.5	13.7	37.5	63.8	36.3	44.9	23.8	39.2	44.9	58.3	41.4
Pbde 154	pg/g dry	14.6	9.24	26.2	35.9	26	26	18.2	28.2	28.5	37.6	30.8
Pbde 155	pg/g dry	2.17	1.15	6.17	6.99	9.16	6.09	4.28	6.43	6.08	4.79	5.81
Pbde 181	pg/g dry	<0.517	<0.456	<0.497	1.71	0.946	0.711	<0.639	1.41	<0.504	0.59	0.56
Pbde 183	pg/g dry	9.13	2.78	10.7	13.4	8.86	10.4	12.4	10.4	13.9	16.4	17.4
Pbde 190	pg/g dry	2.62	<0.456	0.967	1.75	1.38	1.67	2.24	2.1	<0.504	0.913	<0.515
Pbde 203	pg/g dry	12.6	5.06	9.03	19.3	15.9	14.6	25.8	16.3	14.2	14.2	13.3
Pbde 206	pg/g dry	86.2	43.1	90.1	173	121	109	209	104	157	101	200

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Pbde 207	pg/g dry	123	43.2	87.6	149	196	86.2	298	99.4	119	87.5	139
Pbde 208	pg/g dry	100	37.8	47.5	85	118	78.1	226	83.4	89.3	50.2	133
Pbde 209	pg/g dry	896	466	759	1890	1210	1080	2820	1230	1560	1070	2420
Pesticides												
1,2,3,4-Tetrachlorobenzene	ng/g dry	<0.196	<0.18	<0.195	<0.206	<0.191	<0.194	<0.191	<0.198	<0.197	<0.19	<0.2
1,2,3-Trichlorobenzene	ng/g dry	<0.196	<0.18	<0.195	<0.206	<0.191	<0.194	<0.191	<0.198	<0.197	<0.19	<0.2
1,2,4,5-/1,2,3,5-Tetrachlorobenzene	ng/g dry	<0.196	<0.18	<0.195	<0.206	<0.191	<0.194	<0.191	<0.198	<0.197	<0.19	<0.2
1,2,4-trichlorobenzene	ng/g dry	<0.196	<0.18	<0.195	<0.206	0.408	<0.194	<0.191	<0.198	<0.197	0.2	<0.2
1,2-dichlorobenzene	ng/g dry	0.628	0.23	0.487	0.409	0.712	0.345	0.397	0.311	0.492	0.693	0.491
1,3,5-Trichlorobenzene	ng/g dry	<0.196	<0.18	<0.195	<0.206	<0.191	<0.194	<0.191	<0.198	<0.197	<0.19	<0.2
1,3-dichlorobenzene	ng/g dry	0.432	<0.18	0.342	0.389	0.44	0.312	0.374	0.337	0.316	3.21	0.856
1,4-dichlorobenzene	ng/g dry	2.14	1.26	1.95	2.04	2.77	2.57	3.23	3.04	2.88	58.9	6.89
2,4-DDD	ng/g dry	0.122	0.049	0.178	1.04	1.12	2.08	2.06	3.78	2.8	2.68	4.26
2,4-DDE	ng/g dry	0.12	0.047	0.107	0.127	0.131	0.127	0.119	0.584	0.103	0.078	0.121
2,4-DDT	ng/g dry	<0.0754	<0.0635	<0.0859	<0.126	<0.0728	<0.098	<0.0857	0.103	0.081	<0.0579	<0.11
4,4-DDE	ng/g dry	0.992	0.409	1.04	1.25	1.31	2.08	1.45	1.94	2.02	1.62	0.961
4,4-DDT	ng/g dry	<0.0987	<0.0694	<0.11	<0.168	0.171	<0.124	<0.115	0.171	0.131	0.14	<0.171
4,4-DDD	ng/g dry	0.177	0.081	0.239	0.611	0.95	1.45	1.47	1.05	1.46	0.964	0.67
Aldrin	ng/g dry	<0.0391	<0.0361	<0.0389	<0.0413	<0.0381	<0.0389	<0.0383	0.049	<0.0393	<0.038	<0.0399
Alpha Chlordane	ng/g dry	0.04	<0.0361	0.045	0.065	0.071	0.12	0.23	0.14	0.178	0.084	0.119
Alpha-Endosulfan	ng/g dry	0.212	0.196	0.14	0.2	0.19	<0.0972	0.206	0.116	<0.0983	0.186	<0.0997
Alpha-Hch Or Alpha-Bhc	ng/g dry	<0.225	<0.0943	<0.256	<0.244	0.555	<0.176	<0.194	<0.161	0.11	0.114	<0.19
Beta-Endosulfan	ng/g dry	0.307	0.559	0.334	0.309	0.376	0.474	0.485	0.357	0.377	0.236	0.353
Beta-Hch Or Beta-Bhc	ng/g dry	0.461	<0.115	<0.31	<0.312	1.1	<0.22	<0.219	<0.191	0.19	0.157	0.297
Cis-Nonachlor	ng/g dry	0.049	<0.0361	0.047	<0.0413	0.052	0.081	0.084	0.063	0.085	0.06	0.084
Delta-Hch Or Delta-Bhc	ng/g dry	0.583	<0.0901	<0.0974	<0.103	2	<0.0972	<0.0956	<0.099	<0.0983	<0.0949	0.539
Dieldrin	ng/g dry	0.201	0.12	0.226	0.365	0.328	1.79	5.98	0.851	1.34	0.92	0.926
Endosulfan Sulfate	ng/g dry	<0.0979	0.107	<0.0974	<0.103	<0.0954	<0.0972	<0.0956	<0.099	<0.0983	<0.0949	<0.0997
Endrin	ng/g dry	<0.0979	<0.0901	<0.0974	<0.103	<0.0954	<0.0972	<0.0956	<0.099	<0.0983	<0.0949	<0.0997
Endrin Aldehyde	ng/g dry	<0.0979	<0.0901	<0.0974	<0.103	<0.0954	<0.0972	<0.0956	<0.099	<0.0983	<0.0949	0.13
Endrin Ketone	ng/g dry	<0.0979	<0.0901	<0.0974	<0.103	<0.0954	<0.0972	<0.0956	<0.099	<0.0983	<0.0949	<0.0997
Hch, Gamma	ng/g dry	<0.276	<0.117	<0.314	<0.299	<0.205	<0.216	<0.238	<0.197	<0.111	<0.13	<0.233
Heptachlor	ng/g dry	<0.0391	<0.0361	<0.0389	<0.0413	<0.0381	0.044	0.052	<0.0396	<0.0393	<0.038	0.055
Heptachlor Epoxide	ng/g dry	<0.0979	<0.0901	<0.0974	<0.103	<0.0954	<0.0972	<0.0956	<0.099	<0.0983	<0.0949	<0.0997
Hexachlorobenzene	ng/g dry	0.177	0.206	0.181	0.177	0.153	0.155	0.174	0.192	0.159	0.195	0.254

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Hexachlorobutadiene	ng/g dry	0.234	0.186	<0.0114	0.336	<0.0116	0.271	0.264	0.215	0.245	0.193	0.318
Methoxyclor	ng/g dry	<0.196	<0.18	<0.22	<0.206	<0.191	<0.194	<0.191	<0.198	<0.197	<0.19	<0.2
MIREX	ng/g dry	<0.0391	<0.0361	<0.0389	<0.0413	<0.0381	<0.0389	<0.0383	<0.0396	<0.0393	<0.038	<0.0399
Oxy-Chlordane	ng/g dry	<0.0391	<0.0361	<0.0389	<0.0413	0.075	0.04	0.057	0.041	<0.0393	0.048	0.041
Trans-Chlordane	ng/g dry	<0.0391	<0.0361	0.046	0.071	0.063	0.162	0.227	0.188	0.207	0.126	0.163
Trans-Nonachlor	ng/g dry	0.059	<0.0361	<0.0389	0.047	<0.0381	0.094	0.107	0.083	0.14	0.069	0.109
PFOS												
PFBA	ng/g dry	<7.13	<5.93	<6.69	<6.66	<6.58	<6.57	<6.91	<6.81	<6.64	<6.44	<6.95
PFBS	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFDA	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFDoA	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFHpA	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFHxA	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFHxS	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFNA	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFOA	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFOS	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFOSA	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
PFPeA	ng/g dry	<3.57	<2.97	<3.34	<3.33	<3.29	<3.28	<3.45	<3.41	<3.32	<3.22	<3.47
PFUnA	ng/g dry	<1.78	<1.48	<1.67	<1.66	<1.64	<1.64	<1.73	<1.7	<1.66	<1.61	<1.74
Nonylphenols												
4-Nonylphenol Diethoxylates	ng/g dry	9.28	4.83	16.7	12.4	12.3	14.9	19	20.2	14.8	19.1	29.4
4-Nonylphenol Monoethoxylates	ng/g dry	52.6	<13.3	<16.9	<47.6	73.4	92.8	111	94.7	47.7	93.1	124
Nonylphenol	ng/g dry	556	256	790	1030	1140	996	701	801	856	1170	860
Octylphenol	ng/g dry	4.34	9.02	3.9	4.69	5.27	5.23	5.27	5.27	3.98	5.34	3.84
Chlorinated Phenolics												
2,4,6-trichlorophenol	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2,4-dichlorophenol	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2-Chlorophenol	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
4-Chloro-3-Methylphenol	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Pentachlorophenol	µg/g dry	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Semivolatile Organics												
1,2,4-trichlorobenzene	µg/g dry	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
2,4-dinitrotoluene	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2,6-dinitrotoluene	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
3,3-dichlorobenzidine	µg/g dry	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
4-Bromophenyl Phenyl Ether	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
4-Chlorophenyl Phenyl Ether	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Bis(2-Chloroethoxy)Methane	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Bis(2-Chloroethyl)Ether	µg/g dry	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Bis(2-Chloroisopropyl)Ether	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Hexachlorobenzene	µg/g dry	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Hexachlorobutadiene	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Hexachlorocyclopentadiene	µg/g dry	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Hexachloroethane	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Pentachlorobenzene	ng/g dry	0.062	0.07	0.069	0.075	0.08	0.06	0.075	0.064	0.079	0.096	0.084
Isophorone	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
N-Nitrosodi-N-Propylamine	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Nitrobenzene	µg/g dry	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Nitrosodiphenylamine/Diphenylamine	µg/g dry	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Bis(2-Ethylhexyl)Phthalate	µg/g dry	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Butylbenzyl Phthalate	µg/g dry	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Di-N-Butyl Phthalate	µg/g dry	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Di-N-Octyl Phthalate	µg/g dry	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
Diethyl Phthalate	µg/g dry	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Dimethyl Phthalate	µg/g dry	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40	<40
Volatile Organics												
1,1,1,2-Tetrachloroethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,1,1-trichloroethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,1,2,2-tetrachloroethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,1,2-trichloroethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,1-dichloroethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,1-Dichloroethylene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,2-dichlorobenzene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,2-dichloroethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,2-dichloropropane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,3-dichlorobenzene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
1,4-dichlorobenzene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Benzene	µg/g dry	0.21	0.28	0.2	0.19	0.22	0.24	0.22	0.19	0.26	0.27	0.21
Bromodichloromethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35

Appendix D7 Bioaccumulation Chemistry Results – 2019, cont'd

Parameter		Control	T=0	PB1	MC0	M100NW	M200E	M100 E FR	M100 E Field Replicate	M100 E Field Replicate	M100SE	M0
Station Grouping				Reference	New	Far	Mid	Near	Near	Near	Near	Outfall
Bromomethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Chlorobenzene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Chlorodibromomethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Chloroethane	µg/g dry	<1.4	<1.2	<1.2	<1.2	<1.4	<1.2	<1.4	<1	<1.2	<1.6	<1.4
Chloroethene	µg/g dry	<0.14	<0.12	<0.12	<0.12	<0.14	<0.12	<0.14	<0.1	<0.12	<0.16	<0.14
Chloromethane	µg/g dry	<2.8	<2.4	<2.4	<2.4	<2.8	<2.4	<2.8	<2	<2.4	<3.2	<2.8
Cis-1,2-Dichloroethene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
cis-1,3-dichloropropene	µg/g dry	<0.21	<0.18	<0.18	<0.18	<0.21	<0.18	<0.21	<0.15	<0.18	<0.24	<0.21
Dichloromethane	µg/g dry	13	0.83	57	40	14	11	8.4	20	13	74	15
Dimethyl Ketone	µg/g dry	160	180	210	230	150	170	160	220	470	460	230
Ethylbenzene	µg/g dry	<0.14	<0.12	<0.12	<0.12	<0.14	<0.12	<0.14	<0.1	<0.12	<0.16	<0.14
M & P Xylenes	µg/g dry	<0.14	<0.12	<0.12	<0.12	<0.14	<0.12	<0.14	<0.1	<0.12	<0.16	<0.14
Methyl Ethyl Ketone	µg/g dry	<3.5	<3	<3	<3	<3.5	<3	<3.5	<2.5	<3	<4	<3.5
Methyl Isobutyl Ketone	µg/g dry	<3.5	<3	<3	<3	<3.5	<3	<3.5	<2.5	<3	<4	<3.5
Methyl Tertiary Butyl Ether	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
O-Xylene	µg/g dry	<0.14	<0.12	<0.12	<0.12	<0.14	<0.12	<0.14	<0.1	<0.12	<0.16	<0.14
Styrene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Tetrachloroethene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Tetrachloromethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Toluene	µg/g dry	7.4	0.61	18	15	3.3	1.6	1.6	1.9	6.5	29	0.9
Trans-1,2-Dichloroethene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
trans-1,3-dichloropropene	µg/g dry	<0.28	<0.24	<0.24	<0.24	<0.28	<0.24	<0.28	<0.2	<0.24	<0.32	<0.28
Tribromomethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Trichloroethene	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Trichlorofluoromethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Trichloromethane	µg/g dry	<0.35	<0.3	<0.3	<0.3	<0.35	<0.3	<0.35	<0.25	<0.3	<0.4	<0.35
Xylenes	µg/g dry	<0.14	<0.12	<0.12	<0.12	<0.14	<0.12	<0.14	<0.1	<0.12	<0.16	<0.14