MINISTRY OF ENVIRONMENT, LANDS AND PARKS

ENVIRONMENTAL PROTECTION

File No. PE-4088

CALL FORM

Date of Call Jan. 12/12

Person Contacted Ken Tang Telephone No.

Address of Person Contacted District of Sechelt (DoS)

Nature of Call DoS Rec'd $8M from Gas Tax Fund for the construction of a new WWTP. The design flow will be 5000 m³/d and an ultimate flow of 10 000 m³/d. Technology will be moving bed membrane filtration (MBMF). Completion of plant anticipated in 3 years. EIS + Op Plan to be done for MSR registration process.

Received by SB Referred to

Follow-up

#304 - 1353 Ellis Street, Kelowna BC V1Y 1Z9
Telephone: 250-762-2517

URBANSYSTEMS.

PE-4688

AGENDA

subject:	**Sechelt MSR Registration**
meeting date:	February 28, 2012
time:	10:30 am
location:	MoE office Surrey
file:	1592.0000.00

Attendees	Company	E-mail
Sisto Bosa	Ministry of Environment	sisto.bosa@gov.bc.ca
Ken Tang	District of Sechelt	ktang@sechelt.ca
Joanne Harkness	Urban Systems	jharkness@urban-systems.com
Peter Gigliotti	Urban Systems	pgigliotti@urban-systems.com

Suggested topic list for discussion

1. Brief update on STP project status and financing
2. District of Sechelt approach to project implementation
3. Public consultation: to date and proposed
4. Environmental assessment triggers
5. The outfall
6. MSR Registration procedures
7. Next steps

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Peter Gigliotti, P.Eng.

/pg

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Bosa, Sisto ENV:EX

File : PE-4088

Correspondence

From: Joanne Harkness [jharkness@urbansystems.ca]
Sent: Friday, June 1, 2012 3:22 PM
To: Ken Tang (KTang@sechelt.ca); Peter Gigliotti; Bosa, Sisto ENV:EX
Subject: Re. Minutes - Project update and pre-registration meeting with the District of Sechelt
Attachments: 2012-06-01 Minutes pre-registration with moe - updated draft with District comments.pdf

Please find attached the minutes from our meeting to discuss the status and regulatory pathway for the District's sewage treatment facility upgrades. Please do not hesitate to contact me if you have any questions or comments.

Regards,

Joanne

Dr. Joanne Harkness, R.P.Bio
Water and Wastewater Specialist
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T: 250 374 8311 x 7246
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jharkness@urbansystems.ca
urbansystems.ca

URBAN systems

MEETING NOTES

subject:	**District of Sechelt Sewage System Upgrades**
date:	June 1, 2012
meeting date:	February 28th, 2012
location:	BC MoE offices - Surrey
file:	1592.0027.01
prepared by:	Dr. Joanne Harkness, R.P.Bio
distribution:	All attendees

attendees	company	e-mail
Sisto Bosa	BC Ministry of Environment	sbosa@gov.bc.ca
Ken Tang	District of Sechelt	ktang@sechelt.ca
Peter Gigliotti	Urban Systems Ltd.	pgigliotti@urban-systems.com
Joanne Harkness	Urban Systems Ltd.	jharkness@urban-systems.com

ITEM	DISCUSSION	ACTION BY

1. Update on STP Project Status and Funding

Additional funding has been received for the sewage system upgrades.
Approximately $3.2M was received through the Build Canada Fund for the biosolids portion.
An additional $8M has been received through the Gas Tax and Innovation funds. This money is allocated towards upgrades at the sewage treatment plant.
There is no funding for upgrades to the outfall.
The District has sufficient funds in reserves, and there will be no need to borrow money to complete the biosolids and sewage treatment components of this project.

2 District of Sechelt Approach to Implementation

A new Council was elected last November.
The Council still needs to confirm the location of the sewage treatment plant. There are three locations: Ebbtide, Dusty Road and Lot L. The last Council approved Lot L as the location for the sewage treatment plant and biosolids facility, but this may be amended, given the recent change in Council.
The direction which has been set by Council is to pursue the design-build approach.
The Expressions of Interest for the design-build closed 2 weeks ago and the submissions are currently under review by the District. There have been 12 submissions of which 6 were for equipment supply only. It is thought that the approach will be to select three to four proponents for the RFP for the design-build submission.
MHPM has been engaged as the Project Manager to co-ordinate the biosolids facility, and the contract will be amended to include the Wastewater Treatment Facilities.

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ITEM	DISCUSSION	ACTION BY

3 Public Consultation

There is the desire for public consent, but this is not needed as there will be no need for a borrowing by-law to fund the biosolids or sewage treatment plant upgrades.

Two public meetings were held in 2011 to discuss the projects, with the focus being biosolids. The outcome indicated that the public want to produce a Class A product, but there is an uncertainty of the technology which will be used to achieve this goal. The current preference is to heat dry to 90% solids content.

4 Environmental Assessment Triggers

Three environmental components were identified: the environmental impact study (EIS) needed for the MSR registration (discussed in Item 6 below), an environmental assessment (EA) under the BC Environmental Assessment Act (BCEAA) and an environmental assessment under the Canadian Environmental Assessment Act (CEAA). The BC MoE has jurisdiction over the EIS, but no jurisdiction over either of the EAs.

The BCEAA could be triggered based on population projections and flows. The current design flows are approximately 3,900 m^3/d and are expected to increase to between 5,000 and 6,000 m^3/d as a result of the sewage treatment plant upgrades.

The CEAA could be triggered if works are required on the outfall. The triggers could include navigational or fisheries concerns.

If both EA processes are triggered, the route would be to complete one EA under the BC process. However, it is important that a decision is made early in the sewage treatment plant process with respect to the need to complete an EA under CEAA, otherwise, this will have further impacts on the timescale of the project if it cannot be amalgamated with the BCEAA.

Confirmation is required as to whether the BCEAA process will be triggered.

5 The Outfall

It is not certain if work is needed on the outfall. The BC MoE confirmed that the outfall did not have to meet the same capacity as the sewage treatment plant design. The registration can focus on the part of the sewage treatment plant process where the flows are limiting, and the MSR registration flows can be amended in the future, once the outfall is upgraded, if the capacity of the outfall is lower than the sewage treatment plant.

However, there is the need to confirm that the outfall is able to comply with the MSR. This will require modelling and dispersion. The 1996 Seaconsult report will be reviewed as part of this assessment process. It was noted that this report was completed before the MSR was promulgated.

There will be the need to determine if the discharge location is embayed.

6 MSR Registration Procedures

For the regulatory pathway, the options are to complete a LWMP or registration under the MSR. Given the simplicity of the District's situation and the ease which compliance can be achieved, registration under the MSR is being advised by the BC MoE.

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ITEM	DISCUSSION	ACTION BY
	Registration under the MSR will also accommodate the aggressive timeframe for this project, compared with the LWMP approach. The BC MoE indicated that if the LWMP approach was pursued, the District would need to start from Stage 1 and would be looking at a multi-year process. The registration should be under the MSR for a marine discharge. The intent is also to meet the Federal wastewater regulation. The EIS needs to be updated and is to include discussion on the Federal wastewater regulation and information on compliance of the outfall. The registration package will need to include the registration form, the updated EIS, an outfall assessment/modelling, the operations plan, a request to waiver the phosphorus requirement and the $200 application fee. The package will also need to include a description of the sewage treatment plant, plant classification, monitoring requirements and discussion on redundancy/reliability. Design drawings are not needed for the MSR registration package. The operations plan can be updated at a later stage, once further clarification is received on the treatment process.	
7	**Next Steps** Update of the EIS and review of the outfall is required as the first steps of developing the MSR submission package.	District/USL

The preceding is the writer's interpretation of the proceedings and any discrepancies and/or omissions should be reported to the writer.

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Dr. Joanne Harkness, R.P.Bio

/jh

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Bosa, Sisto ENV:EX

PE-4088

Subject:	Sechelt STP project and MSR registration
Location:	MoE office - Surrey
Start:	Tue 2012-02-28 10:30 AM
End:	Tue 2012-02-28 12:00 PM
Show Time As:	Tentative
Recurrence:	(none)
Meeting Status:	Not yet responded
Organizer:	Peter Gigliotti

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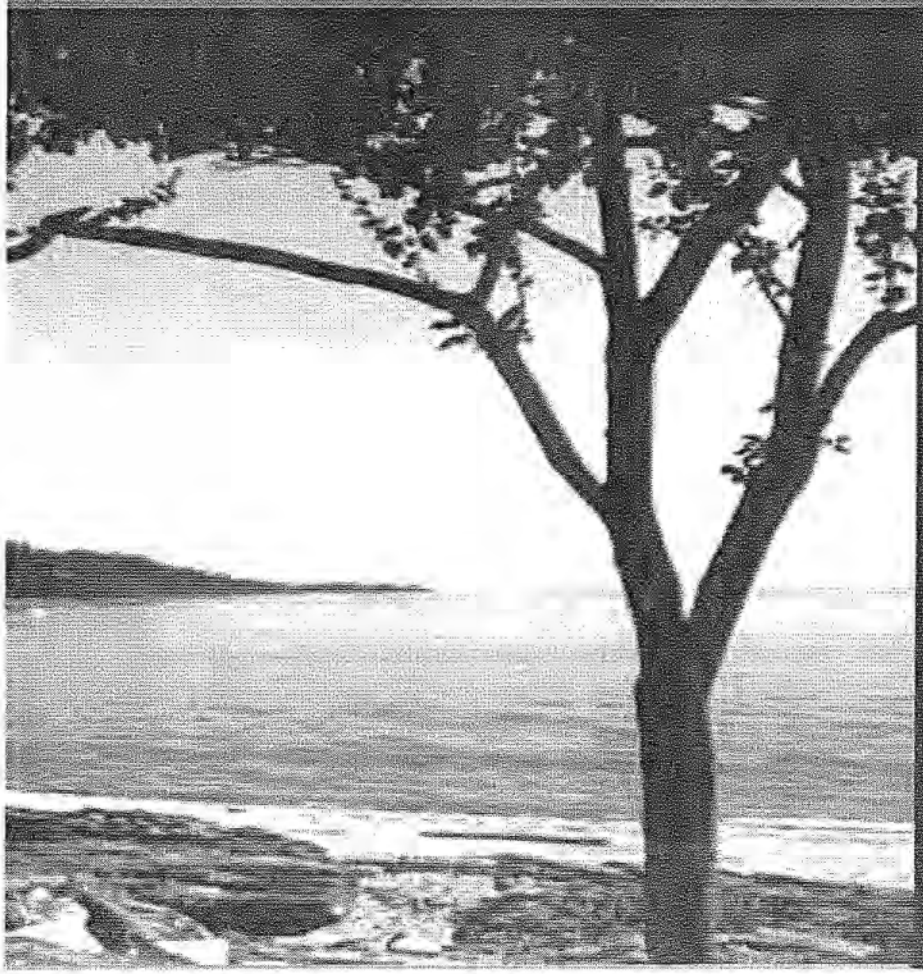
District of Sechelt

File: PE-4088
Correspondence

Environmental Impact Study

Effluent Discharge to Trail Bay – Updated Report

Draft Report



URBAN systems

1592.0027.02
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URBAN systems

September 17th, 2012

File: 1592.0027.02

District of Sechelt
2nd Floor, 5797 Cowrie Street
SECHELT, BC V0N 3A0

Attention: Ken Tang, P.Eng.

RE: ENVIRONMENTAL IMPACT STUDY UPDATE AND EFFLUENT DISPERSION MODELLING DRAFT REPORT

Please find attached the draft report for the environmental impact study update, which includes the outfall assessment. The updates to the environmental impact study were based on the discussion held with the BC Ministry of Environment dated February 28th, 2012. Most of these updates can be found in Sections 5 and 6 of the report which focus on the outfall assessment and effluent criteria. In addition to the updates discussed with the Ministry, as requested by the District of Sechelt, we have also included an assessment of the impacts of an effluent quality of 10 mg/L for BOD_5 and TSS. We have also incorporated the comments received from the District's technical consultant for the wastewater project.

The report indicates that for a discharge of 5,000 m^3/d using the existing outfall, the concentrations of all parameters at the end of the initial dilution zone will meet the required standards and guidelines, under the worst case dilution scenario (i.e. winter conditions with poor stratification). This is on the assumption that the current outfall is hydraulically capable of managing a flow of 5,000 m^3/d. However, there are two aspects of the current outfall location which do not meet the conditions of the Municipal Wastewater Regulation (MWR). These two conditions relate to effluent rising to the surface and movement towards the shore. In order to meet the two criteria identified, it is estimated that the current outfall would need to be extended 500 m (approximately) to a depth of at least 60 m. However, as the outfall does not need to be extended to meet water quality requirements, it is recommended that discussions be undertaken with the BC Ministry of Environment with respect to flexibility in the new MWR and the need to extend the outfall.

It is also recommended that discussions are undertaken with the BC Ministry of Environment with respect to flexibility in the MWR and the reliability category. The report recommendations focus on a reliability category of I for the disinfection process, which is where the public health and environmental vulnerabilities lie. A recommendation for reliability category II is made for all other parts of the sewage treatment plant, due to the lesser public health and environmental concerns. The need to comply with a reliability category I for all aspects of the sewage treatment plant can have significant capital cost implications to the District.

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As discussed, we will be pleased to forward a copy to the BC Ministry of Environment to allow for comments and input on the draft report, before it is finalised. Please do not hesitate to call if you have any questions or require clarification.

Sincerely,

URBAN SYSTEMS LTD.

Joanne Harkness

Dr. Joanne Harkness, R.P.Bio.
Water and Wastewater Specialist

/jh

Encls.

cc: Peter Gigliotti, Urban Systems Ltd.
Jeff Rice, Urban Systems Ltd.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Sewage produced by the District of Sechelt is currently treated by one of two sewage treatment plants, with the combined effluent released by a single outfall into Trail Bay. Upgrading and/or the construction of a new plant will be required in the future to accommodate the predicted population growth, existing residents who are not served by a community system and seasonal visitors.

The purpose of completing an environmental impact study is to determine appropriate effluent criteria for the continued discharge of the District's effluent into Trail Bay. In September, 2006, an environmental impact study was completed and submitted to the BC Ministry of Environment. The environmental impact study was completed as part of the regulatory requirement for the development of a new sewage treatment plant, although at the time it was not certain whether the study would be used as part of the District's Liquid Waste Management Plan process or for registration under the Municipal Sewage Regulation (MSR). Also, at the time of completing the 2006 environmental impact study, the District was not in the position to develop a new sewage treatment plant and, as such, no further action was taken on the regulatory aspect.

The District of Sechelt has recently received funding to build a new sewage treatment plant. From a meeting held with the BC Ministry of Environment on February 28th, 2012, the direction was set for the new facility to be registered under the MSR. As there have been changes with respect to effluent release to a surface water since the completion of the 2006 environmental impact study, an updated report is required as part of the registration package. The information presented in this report contains much of the 2006 environmental impact study document. However, the following information has been added to the original report:

- The influence of recent/proposed changes as a result of the Canadian Council of the Ministers of the Environment Wastewater Strategy and the draft Federal wastewater regulation.
- An assessment of acute and chronic ammonia toxicity, using methodologies which have been developed since the completion of the 2006 environmental impact study.
- Outline the status of the outfall and the ability to comply with the Municipal Wastewater Regulation (the old MSR has now been repealed and replaced with the Municipal Wastewater Regulation, effective April 20th, 2012).
- Undertake dilution zone calculations for ammonia and phosphorus.
- Update the monitoring recommendations.

This report indicates that there are two aspects of the current outfall location which do not meet the conditions of the Municipal Wastewater Regulation (MWR). These two conditions relate to effluent rising to the surface and movement towards the shore. In order to meet the two criteria identified, it is

estimated that the current outfall would need to be extended 500 m (approximately) to a depth of 60 m, possibly deeper. However, extending the outfall is only required to comply with the conditions of the MWR. The concentrations of all parameters at the end of the initial dilution zone meet required standards or guidelines. Therefore, the outfall does not need to be extended to meet water quality requirements. It is recommended that the need to extend the outfall is reviewed with the BC Ministry of Environment.

Effluent criteria have been developed based on the available dilution and the risk to public health and the environment. The following effluent criteria are recommended:

- Carbonaceous BOD_5 to be an average equal to or less than 25 mg/L, with a maximum of 45 mg/L, as required by the MWR for embayed marine waters. There is no public health or environmental advantage nor is there any regulatory requirement to meet a maximum effluent $CBOD_5$ concentration of 10 mg/L.
- TSS to be an average equal to or less than 25 mg/L, with a maximum of 45 mg/L, as required by the MWR for embayed marine waters. There is no public health or environmental advantage nor is there any regulatory requirement to meet a maximum effluent TSS concentration of 10 mg/L.
- Ammonia – assuming that the District selects a high rate (mechanical) sewage treatment process, there will be no requirement for ammonia treatment. This is based on the ability of the effluent to meet acute concentrations before discharge and chronic concentrations at the end of the initial dilution zone.
- Phosphorus – treatment is not required. There is no public health or environmental advantage nor is there any regulatory requirement to implement treatment for total phosphorus and orthophosphate.
- Disinfection will be required to maintain a faecal coliform concentration of less than or equal to 14/100 mL at the end of the initial dilution zone. It is recommended that the effluent faecal coliform concentration is 200/100 mL (as a geometric mean) immediately after disinfection as this will meet the end of initial dilution zone concentration and can be achieved by standard disinfection processes. If chlorine is the method of disinfection, dechlorination will be required in order to achieve an effluent total residual chlorine concentration of less than or equal to 0.02 mg/L before discharge.

Two monitoring programs are recommended. These programs have been designed to address two needs:

- Regulatory reporting (effluent and receiving environment); and
- The provision of a greater understanding of the current process and upgrade requirements.

The monitoring programs are outlined in Section 7 of the report. Depending on the design criteria and registration parameters, there may also be the requirement for an annual report to be submitted to the BC Ministry of Environment. The trigger criterion for a report to be submitted is a serviced population of 10,000 people or more. If the population is less than 10,000 people, the BC Ministry of Environment will indicate if a report still needs to be submitted.

The primary concerns with the effluent discharge from the District of Sechelt is the close proximity to recreational and shellfish areas. From the information presented above, the focus for reliability is to be the disinfection system to ensure that these receiving environment activities are protected. Therefore, it is recommended that the reliability category for the disinfection process is category I. For the remaining processes, relating to the quality of BOD_5, TSS and nutrients, a reliability category of II is recommended. Discussion with the BC Ministry of Environment is required with respect to the usage of two reliability categories for the same facility.

1.0 INTRODUCTION

Sewage produced by the District of Sechelt is currently treated by one of two sewage treatment plants: Dusty Road or Ebb Tide. The combined effluent is released by an existing outfall into Trail Bay. With the estimated capacity of these plants, upgrading and/or the construction of a new plant will be required in the future to accommodate the predicted population growth, existing residents who are not served by a community system and seasonal visitors.

The purpose of completing an environmental impact study is to determine appropriate effluent criteria for the continued discharge of the District's effluent into Trail Bay. The effluent criteria are developed in order to protect public health and the environment. In September, 2006, an environmental impact study was completed and the final report submitted to the BC Ministry of Environment. The terms of reference for the 2006 environmental impact study were developed with input from the Federal and Provincial government agencies. The environmental impact study was completed as part of the regulatory requirement for the development of a new sewage treatment plant, although at that time it was not certain whether the study would be used as part of the District's Liquid Waste Management Plan process or for registration under the Municipal Sewage Regulation (MSR). Also, at the time of completing the 2006 environmental impact study, the District was not in the position to develop a new sewage treatment plant and, as such, no further action was taken on the regulatory aspect.

The District of Sechelt has recently received funding under the Gas Tax program to build a new sewage treatment plant. From a meeting held with the BC Ministry of Environment on February 28th, 2012, the direction was set for the new facility to be registered under the MSR. As there have been changes with respect to effluent release to a surface water since the completion of the 2006 environmental impact study, an updated report is required as part of the MSR registration package. The information presented in this report contains much of the 2006 environmental impact study document. However, the following information has been added to the original report:

- The influence of recent/proposed changes as a result of the Canadian Council of the Ministers of the Environment (CCME) Wastewater Strategy and the draft Federal wastewater regulation.
- An assessment of acute and chronic ammonia toxicity, using methodologies which have been developed since the completion of the 2006 environmental impact study.
- Outline the status of the outfall and the ability to comply with the MSR.
- Undertake dilution zone calculations for ammonia and phosphorus.

- Update the monitoring recommendations to also consider the concepts from the CCME Wastewater Strategy and the draft Federal wastewater regulation.

In April 2012, the MSR was repealed and replaced with the Municipal Wastewater Regulation (MWR). It is intended that the updated information presented in this report will be consistent with the requirement for registration under the MWR.

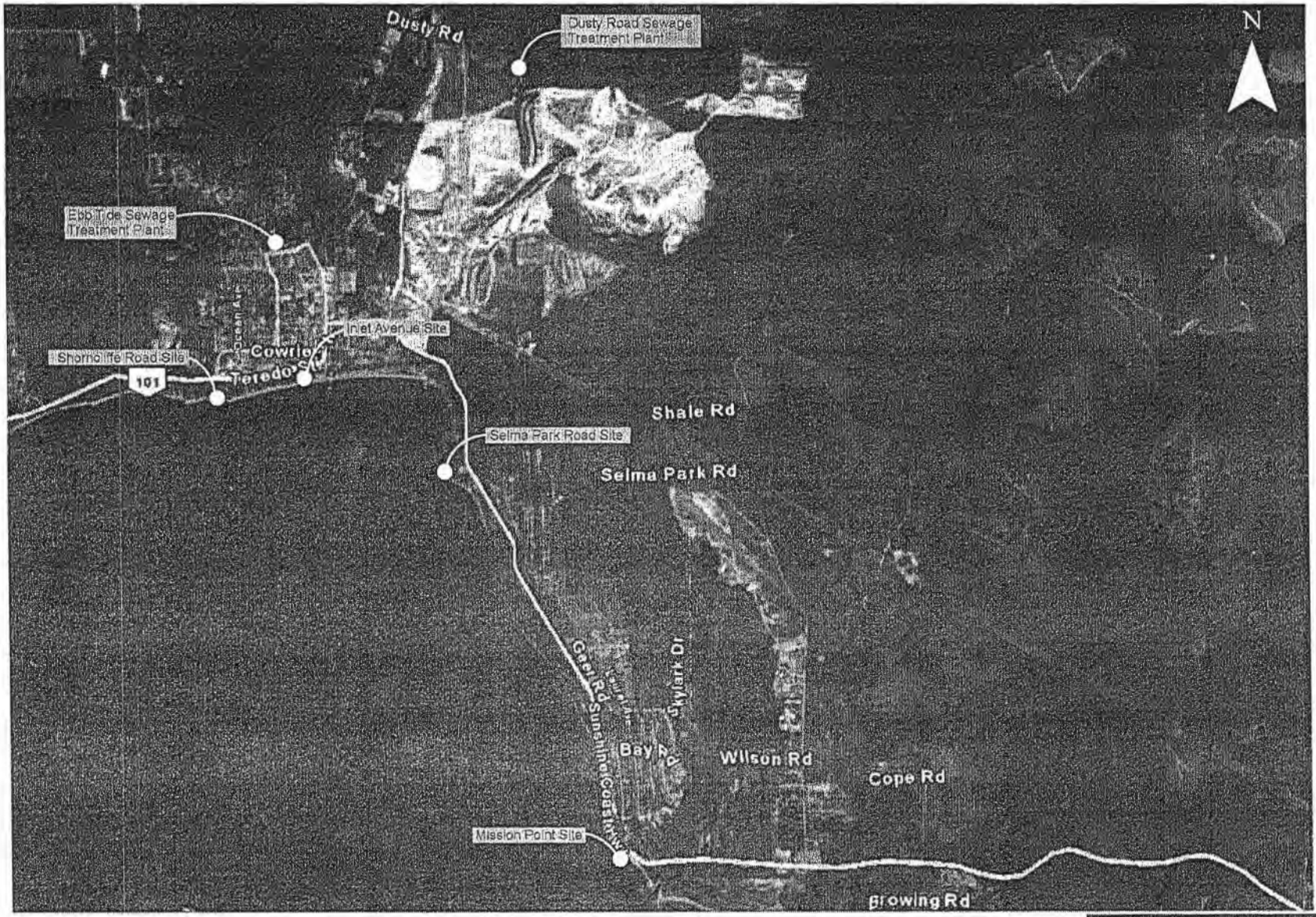
2.0 METHODOLOGIES AND INFORMATION COLLECTION

Information was requested and collated from the District of Sechelt archives and from Federal and Provincial agencies. With regards to the receiving environment data, these were limited to Howe Sound and Sechelt Inlet, both of which bear little relevance to the effluent discharge in Trail Bay. Therefore, monitoring of the receiving environment was completed, along with additional effluent monitoring. The sample sites are summarised in Table 2.1 and Figure 2.1.

Table 2.1: Summary of Sample Sites

Site Description	EMS Reference
Receiving Environment	
Trail Bay at Inlet Avenue	E219508
Trail Bay at Selma Park Road	E219509
Trail Bay at Shorncliffe Road	E219510
Trail Bay at Mission Point	E219511
Sewage Treatment Plant	
Effluent from Ebb Tide sewage treatment plant	-
Effluent from Dusty Road sewage treatment plant	-
Combined Ebb Tide/Dusty Road effluent taken from the manhole at Inlet Avenue	E100781

The monitoring was initiated on January 17th, 2006. Table 2.2 summarises the monitoring which was completed for each site, along with the frequency of sampling. The parameters for monitoring were selected after reviewing the available information and based on an understanding of parameters which are likely to be of concern with respect to health and the environment. Increased monitoring was completed for ammonia and chlorine, both of which are of concern with respect to aquatic toxicity. No toxicity bioassays (LC50 96 hour rainbow trout) were completed. All estimations of toxicity were based on the water chemistry data and calculations using either the BC Water Quality Guidelines (BC Ministry of Environment, 2006) and the methodologies outlined in the CCME Wastewater Strategy/the draft Federal wastewater regulation (CCME, 2008; Department of Environment, 2010). Parameters which were measured in the field were pH, temperature, dissolved oxygen (DO) and total residual chlorine. The pH was measured using a Hach Senslon 1, model 51910. The DO was measured using a Hach DO175, model 50175. Both the pH and DO meter are capable of measuring temperature. The total residual chlorine was measured in the field using a Hach colorimetric free and total chlorine test kit, range 0 to 0.7 mg/L and 0 to 3.5 mg/L, respectively. All laboratory analyses were completed by ALS, Vancouver.



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Client/Project		
District of Sechelt		
Scale	**Date**	**Figure No.**
NTS	March, 2006	Figure 2.1
Title		
Sample Site Location		

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Table 2.2: Summary of Monitoring Completed

Site	Sample	Frequency
Ebb Tide effluent	BOD_5, conductivity, TSS, total nitrogen (total Kjeldahl nitrogen, nitrate, nitrite), faecal coliforms, total coliforms, total metals	1 grab sample
	Total ammonia, total phosphorus, orthophosphate, pH, temperature, dissolved oxygen, chlorine residual	4 grab samples
Dusty Road effluent	BOD_5, conductivity, TSS, total nitrogen (total Kjeldahl nitrogen, nitrate, nitrite), faecal coliforms, total coliforms, total metals	1 grab sample
	Total ammonia, total phosphorus, orthophosphate, pH, temperature, dissolved oxygen, chlorine residual	4 grab samples
Combined Ebb Tide/Dusty Road effluents	Total ammonia, pH, temperature, dissolved oxygen, chlorine residual	4 grab samples
Environmental sites: Inlet Avenue, Selma Park Road, Shorncliffe Road, Mission Point	Conductivity, TSS, total ammonia, total nitrogen (total Kjeldahl nitrogen, nitrate, nitrite), faecal coliforms, total coliforms	1 grab sample
	Total phosphorus, orthophosphate, pH, dissolved oxygen, temperature	4 grab samples

3.0 RECEIVING ENVIRONMENT

3.1 Background Information

The District of Sechelt is located 32 km north of Vancouver, BC on the mainland of British Columbia in an area known as the Sunshine Coast. Although the region is situated on the mainland, it is surrounded by the Pacific Ocean and is, practically speaking, only accessible by boat. The Sechelt area experiences a marine climate typical of many areas of the west coast of British Columbia. It is a region of high rainfall, in part due to its close proximity to the Coast Mountain range. In general, the area has mild, wet winters and cool summers. The District boundaries encompass an area of 4,829 hectares with an approximate population of 9,300 people (2011 census). Local resource industries include forestry, mining, aquaculture and agriculture. Tourism and the manufacturing sector also play a part in the local economy.

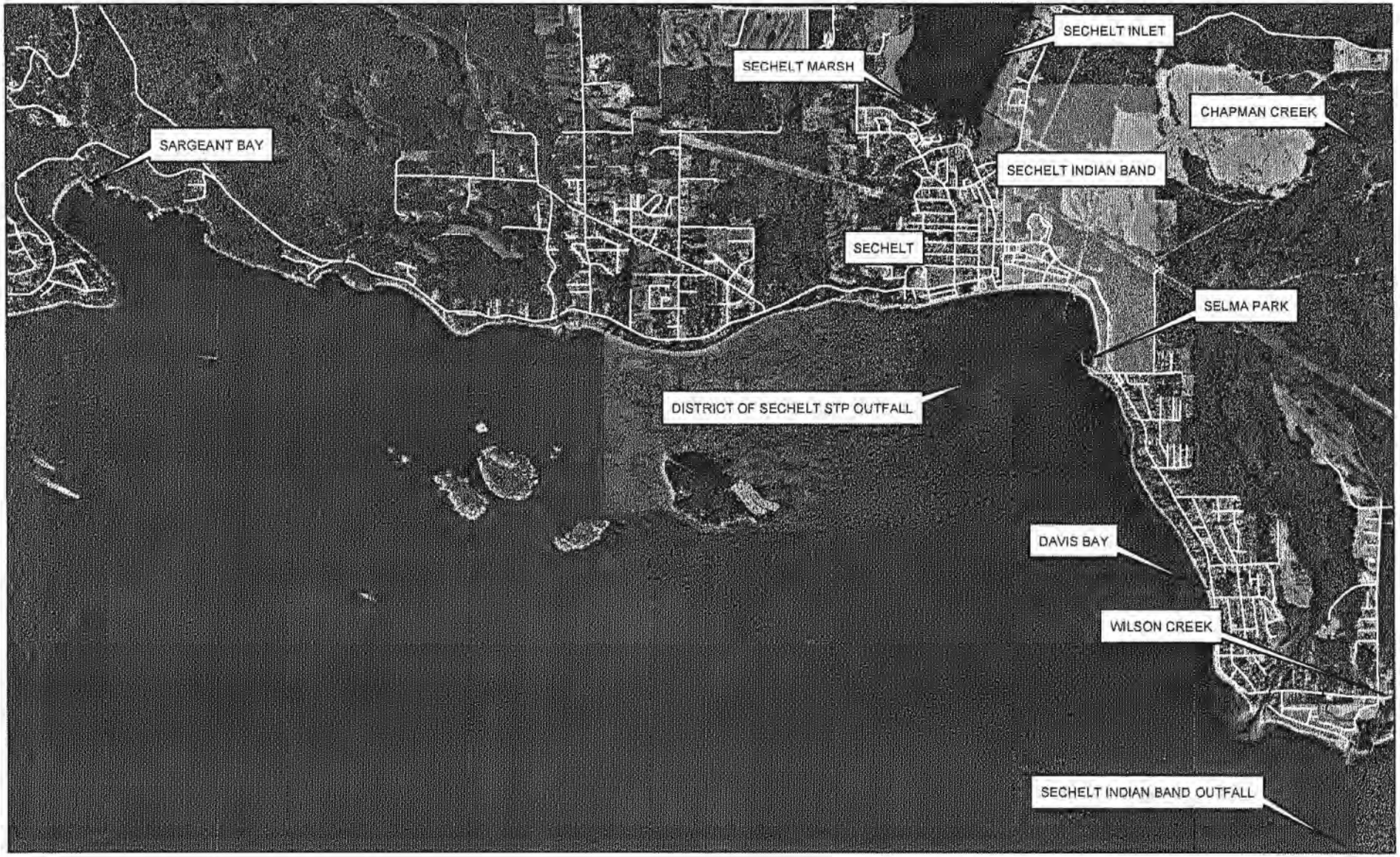
3.1.1 Terrestrial Environment

The Biogeoclimatic Ecosystem Classification system is used by natural resource practitioners to describe the general terrestrial ecosystem characteristics. The Sechelt area, at an elevation near sea level, lies within the Coastal Western Hemlock Very Dry Maritime biogeoclimatic zone. Precipitation in this area is regarded as very high compared to other areas of the province, and ranges from 1,000 to 4,400 mm annually, with mean annual temperatures ranging from 5.2 to 10.5 °C. Vegetation can vary depending on local conditions, but in general undisturbed areas are dominated by forests comprised of large tree species such as western hemlock, western red-cedar and Douglas-fir. Understory vegetation in dryer areas can include species such as *Gaultheria shallon*, *Mahonia nervosa* (dull Oregon-grape) and *Vaccinium parvifolum*. Mosses are also common, as a result of the wet climate. Individual species found in dryer locales include *Kindbergia oregana*, *Hylocomium splendens*, *Rhytidiadelphus loreus* and *Plagiothecium undulatum* (Anon., 1991).

3.1.2 Marine Environment

There are two distinct marine environments in the Sechelt area: Sechelt Inlet and the Strait of Georgia. Figure 3.1 indicates the key aquatic environments in the Sechelt area.

Sechelt Inlet is located to the north of the District of Sechelt. Sechelt Inlet is a large inland fjord located on the opposite side of the isthmus to Trail Bay/Strait of Georgia, with the entrance being at the Skookumchuck Narrows. Although geographically close to the District of Sechelt and Trail Bay, the Inlet and Trail Bay are two distinct water bodies. Sechelt Inlet is characterised by narrow channels with poor circulation of water. The Inlet is also subject to multiple use pressures (Section 3.3).



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Client/Project		
District of Sechelt		
Scale	**Date**	**Figure No.**
1:45,000	March, 2006	Figure 3.1
Title		
Area Water Resources		

This area is known to have several marine resources, for example, shellfish and fisheries values and wildlife, with the emphasis being on birds in areas around Sechelt Marsh. This marsh is a blend of freshwater and saltwater. Sechelt Inlet is located within Area 16, which is defined by the Federal Government, based on fisheries resources and the harvesting of marine resources, primarily shellfish harvesting. Although there are closure notices for shellfish harvesting within this area, this does not bear a direct relationship with Trail Bay and this environmental impact study.

Trail Bay is located on the south west shores of the District of Sechelt, and forms an embayed part of the Strait of Georgia. The shoreline is a gently sloped, pebble/cobblestone beach, with tidal reaches being in the order of 4.5 m. The marine life which can be found in this general area is consistent with that of the Strait of Georgia: for example seals, otters, porpoises, salmon and orcas. There are limited marine resources within Trail Bay itself. Currently there are no leases for shellfish harvesting in the Trail Bay area, however, shellfish are harvested by the local First Nation, commercial diggers and recreational harvesters. Geoducks (a large saltwater clam) are also harvested in the general area. Although there are shellfish activities in the Trail Bay, this area is not recognised as having specific shellfish values and there are no shellfish farms in the immediate vicinity.

There are other beaches located close to Trail Bay. Davis Bay, located south of Trail Bay, is a long accessible pebble/sandy beach which has both recreational and fisheries activities. Sargeant Bay is located to the northwest of Sechelt. This area has been designated as a Provincial Park, with water resources including a cattail marsh and saltwater bay. This area has been used for shellfish resources, but has been described as subject to pressures from septic systems in the immediate vicinity (Environment Canada, 2005).

3.1.3 Additional Aquatic Environments

Two important freshwater streams are located in the District of Sechelt and enter the Strait of Georgia south of Trail Bay: Chapman Creek and Wilson Creek (Figure 3.1).

Chapman Creek is a stream with three tributaries and contains many fish species including chinook salmon, chum salmon, coho salmon, cuttroat trout, dolly varden, pink salmon, rainbow trout and steelhead (Fish Wizard, 2006). Chapman Creek Fish Hatchery is also located along this creek. The hatchery rears and releases a number of salmon species and cutthroat trout into Chapman Creek, Halfmoon Bay and Sechelt Inlet. Chapman Creek also provides 90% of the drinking water for the Sunshine Coast Regional District. The creek enters the Trail Bay area in the vicinity of the District's Selma Park Road monitoring site, to the north west of Davis Bay.

Wilson Creek is an important fish bearing stream and is home to species such as chum salmon, coho salmon, cutthroat trout, lamprey, rainbow trout, sculpin and steelhead. It is designated as having two named tributaries, East Wilson Creek and Hudson Creek. The Wilson Creek area consists of a large rural and residential development. Industrial development includes the airport, a fish processing facility and sawmill operations. Wilson Creek enters the Trail Bay area in the vicinity of Davis Bay.

Due to the location of the District's outfall in relation to these creeks, it is unlikely that there would be any direct impacts on the integrity of these creeks as a result of the effluent release by the District of Sechelt. Any impacts which may occur would relate to the anadromous fish species which may pass through the Trail Bay area to access these creeks. The potential for impacts will be considered in relation to the effluent characteristics, location of the outfall and dilution/dispersion potential (Sections 5 and 6).

3.2 Environmental Monitoring

The historical water quality data which relate to this area focus primarily on Sechelt Inlet and Howe Sound, not Trail Bay. The data for Howe Sound are from the 1970's/early 1980's, with limited further monitoring in the 1990's. In 1993, ambient water quality objectives were developed by the BC Ministry of Environment for Sechelt Inlet, which is a fjord, with poor water circulation. Due to the location of both monitoring areas, these data have little relevance to this environmental impact study for the District of Sechelt study and will not be discussed further.

The monitoring which has been completed through Environment Canada relates to the environmental effects monitoring programs which are conducted by pulp mills throughout Canada. The mills are required by law to monitor for sublethal toxicity and a range of biological parameters in the receiving environment. The mills closest to Sechelt are located at Powell River and Howe Sound (Port Mellon). However, due to the distance of these mills from the Sechelt outfall, these data have little relevance to the District of Sechelt environmental impact study.

There is monitoring of shellfish (e.g. oysters, clams, mussels, shrimp and crabs) along this coastal area. This is used to determine the harvesting activities which are permitted and is based on:

- The need for developing and implementing conservation measures;
- The identification of health risks associated with bacterial contamination, for example as a result of the presence of sewage/sewage effluents; and,
- Fisheries closures and health risks due to the presence of biotoxins (e.g. paralytic shellfish poisoning, red tide).

Geographically, the Sechelt area is located within Areas 16 and 29, as defined by Environment Canada. Area 29 is of direct relevance to this report, as it covers the Strait of Georgia in the Trail Bay area (Environment Canada, 2005). There are a total of 15 monitoring stations in this area, which have been developed based on an understanding of the need to classify areas where clams are harvested. The monitoring which has been completed has focused on the presence of faecal coliforms. As a result of the monitoring which has been completed over the last 10 years, there have been 3 recommendations for shellfish closures in this monitoring area. The closures relate to areas at the mouth of Wilson Creek, the mouth of Wakefield Creek and the head of Sargeant Bay.

There are general closure requirements, which can be applied to any area. These are areas where shellfish harvesting is not permitted unless a special licence has been awarded. These closure areas are:

- Within 300 m radius of an industrial, municipal and sewage treatment plant outfall discharge;
- Within a 125 m radius of a marina; and
- Areas where there is contamination in the growing waters. A contamination is defined as faecal material or a poisonous or deleterious substance.

Although not stated in the Environment Canada report, the general closure requirement would apply to the Trail Bay area, in the vicinity of the District's outfall and the Sechelt Indian Band outfall, which is located to the south east of Trail Bay.

3.3 Existing Water Uses

Forestry is the primary industry on the Sunshine Coast, along with the associated secondary activities. The main forestry activities are focused on the Sechelt Peninsula (Sechelt Inlet, Salmon Inlet, Howe Sound, Egmont and Jervis Inlet), which is located away from Trail Bay, the study area of this report. Primary and secondary forestry industries have the potential to impact the water resources. The largest secondary industries in the area are Catalyst Paper Corporation in Powell River, located approximately 112 km north of Sechelt, and Howe Sound Pulp & Paper, located in Port Mellon, approximately 39 km south of Sechelt. The receiving water bodies for the mills are Malaspina Strait and Lower Howe Sounds. Again, these areas are located away from Trail Bay.

In the Sechelt area, the main water resource pressures are associated with Sechelt Inlet. This is located on the opposite side of the isthmus to Trail Bay. If this area is impacted by effluent discharges, this would relate solely to the seepage of septic systems into the Inlet, not due to the

release by the District of Sechelt into Trail Bay. There are multiple water uses in the Inlet, which can result in water resource pressures. These uses include:

- Forestry;
- Marine and Provincial Parks (e.g. Skookumchuck Narrows, Mount Richardson, Spipiyus, Porpoise Bay, Sechelt Inlets Marine Park);
- Shellfish harvesting (oysters and clams) for human consumption;
- Primary and secondary recreational uses (e.g. fishing, kayaking, boating, hiking, swimming); and
- Commercial fishing, processing and hatcheries.

The multiple water uses, potential inputs of pollution and poor water circulation in this area have resulted in an increased awareness of the water resource issues for Sechelt Inlet.

The main focus of this report is Trail Bay and the determination of potential impacts due to the effluent release from the District of Sechelt. The developed area surrounding this bay is largely residential in nature, with limited industrial activities. One industrial activity is the operation of a local gravel pit on land owned by the Sechelt Indian Band. Excavated material is transported from the pit to barges which moor in the bay. Trail Bay has a year round recreational use, with the primary usage being during the summer months, although minor bathing does occur during the winter months. The bathing is focused on the shore zone area. Davis Bay, situated to the south of Trail Bay, is the location of the annual Polar Bear Swim, which occurs during the winter months. Other primary recreational use in the Sechelt area during the winter months is restricted to an individual basis. This bay is a popular recreational beach during the summer months. Non-contact recreational use is also common in this area, again with the major use being during the warmer season as a factor of increased tourism. There is a boulevard which runs along the shore of Trail Bay. This is bordered by residential housing. Therefore, there is an existing year-round access to the beach.

Although there are several discharge permits in the Sechelt area, only two discharge to a receiving environment which is relevant to this report (i.e. Trail Bay). The approximate outfall locations are shown in Figure 3.1. The District's sewage treatment plant is permitted to discharge to Trail Bay under Permit PE-4088. The second discharge is from the Sechelt Indian Band. This is a small sewage treatment facility which serves approximately 100 household units within the Reserve area. The facility operates under Permit-11933 and releases effluent to the Strait of Georgia, to the south east of Trail Bay, in the vicinity of Wilson Creek. The existing Sechelt Indian Band sewage treatment plant has a maximum capacity of 113 m^3/d, and is permitted a maximum discharge of:

- 5 day biochemical oxygen demand < 45 mg/L;
- Total suspended solids < 60 mg/L; and
- Non-toxic effluent, based on a 96 hour LT50 bioassay.

The treatment plant is a secondary facility, with additional effluent filtration and disinfection. The outfall is located > 1,000 m from the shore at a depth of > 60 m.

In addition to the point source discharges, there is the potential for non-point sources of pollution in the area. These would include septic fields in the areas where connection to sewer is currently not available, storm outfalls, and recreational activities such as boating.

4.0 2006 ENVIRONMENTAL IMPACT STUDY EFFLUENT DISCHARGE AND RECEIVING ENVIRONMENT STUDY

4.1 Current Sewage Treatment Facilities

The District operates its sanitary sewer systems under BC Ministry of Environment Permit PE-04088. This permit covers the operation and release of effluent from the District's two sewage treatment plants: Dusty Road and Ebb Tide.

The Dusty Road sewage treatment plant consists of:

- An aerated basin (6,000 m^3 capacity);
- A secondary sedimentation basin;
- A chlorine contact tank, where chlorine gas is used for disinfection;
- Dechlorination facilities, which are currently not used in the standard operation of the plant; and
- An aerobic digester and sludge holding pond for solids management.

The Ebb Tide sewage treatment plant consists of:

- Two primary sedimentation tanks;
- A trickling filter;
- A re-aeration tank;
- A secondary clarifier;
- Chlorination facilities, using chlorine gas;
- Dechlorination facilities, using sulphur dioxide; and
- An aerobic digester for solids management.

Under the PE-04088, the following release is permitted to Trail Bay via a single outfall:

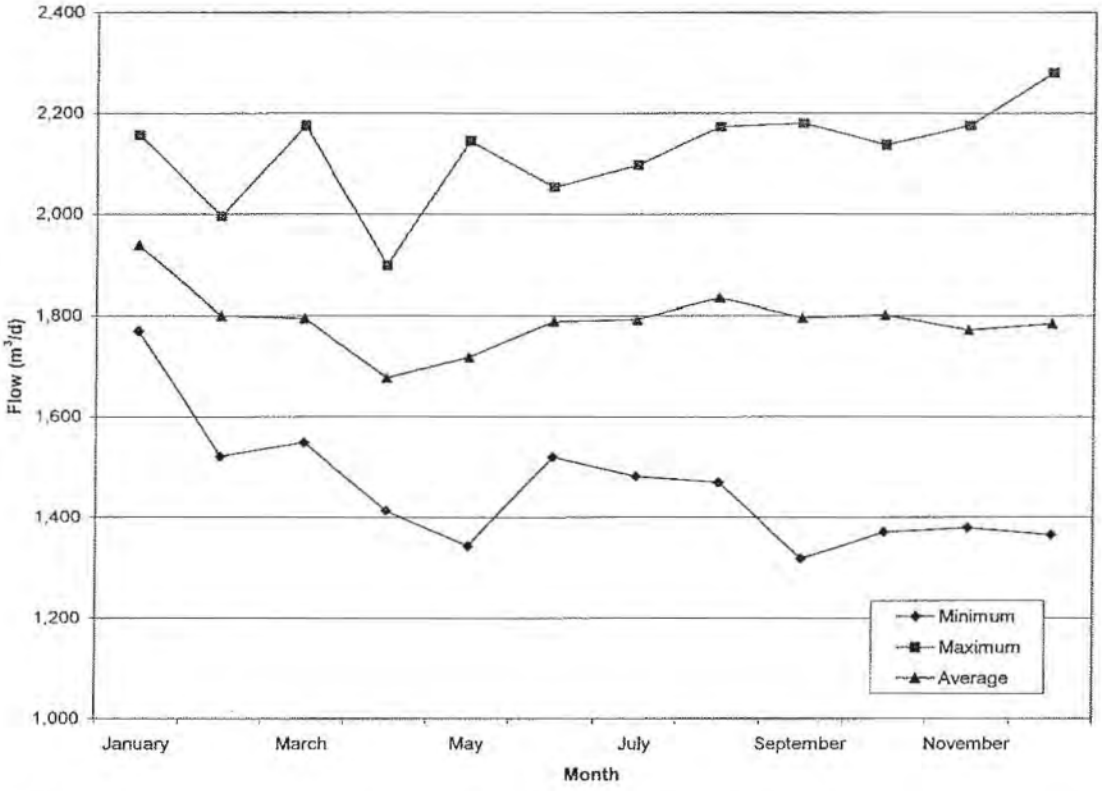
- A maximum discharge of 3,400 m^3/d;
- Maximum 5 day biochemical oxygen demand (BOD_5) of 30 mg/L;
- Maximum total suspended solids (TSS) of 40 mg/L;
- Effluent chlorine residual to be non-detectable; and

- A non-acutely toxic effluent, as defined by the 96 hour LT50 rainbow trout bioassay.

4.2 Flow Data

Figure 4.1 summarises the minimum, maximum and average monthly flows from 2001 to 2005. These data indicate that the average monthly flow is approximately 1,800 m^3/d, as a combined flow from both sewage treatment plants. In terms of compliance conditions, it is the daily maximum flow which must not exceed the permit value of 3,400 m^3/d.

Figure 4.1: Average Monthly Flow Data (2001 to 2005)



Although the current permit maximum is 3,400 m^3/d, the combined total capacity of the existing sewage treatment plants is 4,000 m^3/d, with the individual capacities being 2,300 m^3/d and 1,700 m^3/d, for Dusty Road and Ebb Tide, respectively. Based on data from 2005 and 2006, the Ebb Tide plant is receiving most of the sewage flows from the area. As a proportion, the contributing flows from the Dusty Road and Ebb Tide sewage treatment plants are approximately 18% and 82%, although data indicate that at times the Ebb Tide plant has received over 90% of the incoming flows for the day. Therefore, *on average*, the Ebb Tide plant is receiving 1,476 m^3/d

raw sewage, which equates to 87% of the design flows for this plant. By contrast, the Dusty Road plant is receiving 324 m^3/d raw sewage, which equates to 14% of the design flows for this plant. Therefore, there is the potential for the Ebb Tide plant to be overloaded, and the Dusty Road plant to be significantly underloaded. Both scenarios can impact the effluent quality from each plant.

It is intended that the future design for the District of Sechelt will result in sewage treatment facilities which are capable of treating up to 5,000 m^3/d. The current and future treatment capacities are summarised in Table 4.1. Further information on the upgrades is presented in Section 4.4.

Table 4.1: Treatment Capabilities Summary

Scenario	Flow (m^3/d)
Current discharge	1,800
Current permit maximum	3,400
Current design	4,000
Future design	5,000

4.3 Treatment Capacity and Effluent Quality

The following parameters are monitored in the effluent:

- 5 day biochemical oxygen demand (BOD_5) is monitored on a monthly basis;
- Total suspended solids (TSS) is monitored on a monthly basis;
- Faecal coliforms are monitored on a monthly basis; and
- Effluent toxicity, as an LT50 96 hour rainbow trout bioassay, is completed each quarter.

The samples represent a composite of grab samples from the effluents from the Ebb Tide and Dusty Road sewage treatment plants.

4.3.1 Organic Matter and Suspended Solids

Historical data for the effluent BOD_5 and TSS are summarised in Table 4.2, along with the permit requirements. The historical TSS data indicate that the combined effluent is consistently below the permit requirement, however, for the BOD_5, the historical data indicate that the concentration in the combined effluent is close to the permit requirements, with one instance of the permit being exceeded in July, 2003.

Table 4.2: Historical Effluent BOD_5 and TSS Summary

Parameter (mg/L)	Effluent Quality (mg/L)		Permit Maximum (mg/L)
	Average	Range	
BOD_5	25.1	20 - 31	30
TSS	27.0	23 - 30	40

4.3.2 Bacteriological Content

The effluents from both plants are disinfected using chlorine prior to discharge to Trail Bay. However, dechlorination is only practiced at the Ebb Tide plant. Therefore, maintaining a low final effluent total residual chlorine concentration relies on blending an effluent which has been dechlorinated (Ebb Tide) with one which has not been dechlorinated (Dusty Road). The need for maintaining a non-toxic effluent with respect to a chlorine residual is discussed further in Section 4.3.3.

Historical data from December 2002 were reviewed. For all receiving environment monitoring sites (Inlet Avenue, Mission Point, Selma Park Road and Shorncliffe Road), very low concentrations of faecal coliforms were recorded. These sites are monitored quarterly and are representative of each season, including the summer months when increased bather activity occurs. These data are summarised in Table 4.3. The data indicate that there were very low concentrations of faecal coliforms at all monitoring sites. These data were within the BC Water Quality Guidelines for faecal coliforms, for shellfish harvesting (< 43/100 mL based on the 90th percentile; ≤ 14/100 mL, based on the median) and primary contact recreational use (≤ 200/100 mL, based on the geometric mean).

Table 4.3: Environmental Monitoring Sites – Faecal Coliform Concentration

Site	Data Range (counts/100 mL)	Number of Non-detect Data Points
Inlet Avenue	< 2 – 4.5	3
Mission Point	< 2 – 12	3
Selma Park Road	< 2 – 13	4
Shorncliffe	< 2 – 7.8	4

Under the permit requirements, monthly monitoring of the combined effluent for faecal coliforms is required. Historical data from December 2002 were reviewed. Variability in the data points was observed. The data ranged from < 2 to 6,800 counts/100 mL. For the data which were reviewed,

there were 7 recorded events when the faecal coliform concentration in the combined effluent was below the detection limit (< 2 counts/100 mL) and 3 events when the discharge exceeded 200 counts/100 mL. The highest value (6,800 counts/100 mL) was recorded in January, 2004. This was significantly higher than the other values on record and may have been a reflection of a process upset or erroneous data point rather than a true representation of the effluent quality.

The faecal coliform concentration in the samples of the individual effluents was evaluated based on limited sampling undertaken in January, 2006. The data indicate that the faecal coliforms were below the detection limit. The low bacteriological content in these and the historical samples was consistent with the chlorination activities and the observations which have been made regarding the effluent residual chlorine concentration (Section 4.3.3).

4.3.3 Toxicity Assessment

Out of a total of 7 samples taken from June 2002 to March 2004, there was a consistent pass rate for the LT50 bioassay, with one test failure on record, which occurred in September 2003. During this event, 90% of the rainbow trout died before the end of the test, with 70% mortality within the first 24 hours. The reason for this failure is unknown, but failures with a sewage treatment plant effluent are typically a factor of the presence of ammonia. However, in some cases, the test parameters can result in a test failure. In such an event, the failure is a result of the nature of the test and is not necessarily a reflection of the effluent quality.

The toxicity of ammonia is related to pH, with the aquatic toxicity increasing significantly as the pH increases. For each toxicity bioassay, the pH was observed to increase over the duration of the test for the effluent samples, but not for the control samples, which would have consisted of 100% water. For the effluent samples, the pH at the initiation of the test was typically 6.9 to 7.0, increasing to approximately 7.8 at the end of the test. There was no indication as to how quickly the pH increase occurred. It is possible that this increase could occur within the first few hours of the test. By contrast, the pH of the control remained at a consistent pH value throughout the test duration. This was approximately pH 7.4.

The increase in pH over the test duration and potential impact that this can have on ammonia toxicity has been recognised by Environment Canada. The increase in the pH occurs as a factor of the test procedure and can result in a toxicity failure which may not be representative of the nature of the effluent. It is possible that this effect could have resulted in the September 2003 failure of the LT50 bioassay for the District of Sechelt. A pH suppression method has been developed by Environment Canada, whereby the pH of the test is maintained at a representative level throughout the test duration using carbon dioxide gas. This eliminates the occurrence of an inaccurate failure due to the presence of ammonia. The pH suppression test (EPS 1/RM/50) is

now recognised as an acceptable test compared with the original LC50 bioassay methodology (EPS 1/RM/13).

Based on the monitoring data collated during January and February, 2006, an assessment of the potential for the effluent to result in a toxic event was completed using the methodology outlined in the draft Federal wastewater regulation and the National Performance Standards. The aquatic toxicity of ammonia is related to the type of ammonia which is present and the environmental conditions (mainly temperature and pH). There are two forms of ammonia, which exist in equilibrium in water: ionised ammonium (NH_4^+) and un-ionised ammonia (NH_3). Un-ionised ammonia is the form which is toxic to fish. This form becomes more predominant as the pH increases. The draft Federal wastewater regulation stipulates that the maximum concentration of un-ionised ammonia in an effluent must be less than 1.25 mg/L (expressed as nitrogen at 15 °C ± 1 °C), as this concentration of un-ionised ammonia will result in acute lethality of rainbow trout under the conditions which are experienced during the LC50 96 hour rainbow trout bioassay.

The monitoring data and effluent status with respect to acute ammonia toxicity are summarised in Table 4.4. In all cases, the effluent would be classed as non-toxic with respect to ammonia. This is a factor of the low ammonia concentrations and very low pH. The Dusty Road sewage treatment plant was able to reduce ammonia significantly, even during the winter months, which is typically the time period when nitrification (biological ammonia removal) is reduced as a factor of the lower ambient temperatures. Although the Ebb Tide plant was less efficient, the potential for ammonia toxicity is rare, based on the low effluent pH. Based on the information reviewed, there was no concern regarding ammonia toxicity and the effluents produced by the District of Sechelt. As long as the pH remains low, this would still be the case if no nitrification occurred at either plant. The low potential for aquatic toxicity, as a result of ammonia, would also be anticipated if a new facility was constructed. The exception would be if the new facility was a lagoon-based system which was subject to daily changes in the pH as a result of algal activity.

Table 4.4: Toxicity Assessment – Effluent Ammonia Concentration

Date	Total Ammonia Concentration (mg/L)	pH	Un-ionised Ammonia Concentration (mg/L)	Effluent Status
Dusty Road Plant				
January 17, 2006	0.70	6.5	0.0006	Not toxic
February 2, 2006	0.10	6.1	0.00001	Not toxic
February 8, 2006	0.09	6.4	0.0001	Not toxic
February 15, 2006	0.56	6.5	0.0005	Not toxic

Table 4.4: Toxicity Assessment – Effluent Ammonia Concentration *(continued . . .)*

Date	Total Ammonia Concentration (mg/L)	pH	Un-ionised Ammonia Concentration (mg/L)	Effluent Status
Ebb Tide Plant				
January 17, 2006	13.3	7.0	0.0365	Not toxic
February 2, 2006	11.6	6.6	0.0127	Not toxic
February 15, 2006	16.5	6.9	0.0360	Not toxic
Combined Effluents				
January 17, 2006	7.6	6.7	0.0105	Not toxic
February 2, 2006	8.0	6.5	0.0070	Not toxic
February 8, 2006	6.5	6.4	0.0045	Not toxic
February 15, 2006	6.5	6.6	0.0071	Not toxic

The presence of chlorine can result in effluent toxicity. There is often a risk of a chlorine residual in sewage effluents at sites where pathogen destruction is achieved by chlorination. The chlorine residual was monitored twice monthly in the combined effluent before discharge. The historical data indicate that the total chlorine residual in the combined effluent was consistently below the analytical detection limit. The data for the January/February 2006 monitoring events are summarised in Table 4.5, below. During these events, the concentration of chlorine was assessed in both the combined and separate effluents. Although chlorination was practiced at both plants, dechlorination was only practiced at the Ebb Tide plant. Therefore, maintaining a low total residual chlorine concentration in the combined effluent relied on blending of the effluents followed by natural dechlorination.

Table 4.5: Toxicity Assessment – Effluent Chlorine Residual Summary

Date	Total Residual Chlorine Concentration (mg/L)		
	Ebb Tide	Dusty Road	Combined
January 17, 2006	2.20	1.50	0.01
February 2, 2006	1.35	0.71	0.00
February 8, 2006	0.67	0.48	0.00
February 15, 2006	0.82	0.90	0.00

These data were compared with the BC Water Quality Guidelines for the protection of aquatic life in a marine environment. These guidelines recommend a maximum concentration for total residual chlorine of 0.04 mg/L, regardless of either duration or exposure. For all of the above monitoring events, this was exceeded in the Ebb Tide and Dusty Road effluents but not in the combined effluent, which would be sampled after dechlorination of the effluent at the Ebb Tide plant.

Changes to the management of sewage effluents in Canada are being pursued and will be discussed further in Section 6. One of the changes is the implementation of a new National Performance Standard which indicates that the effluent total residual chlorine concentration is to be ≤0.02 mg/L. For all of the above monitoring events, this was exceeded in the Ebb Tide and Dusty Road effluents but not in the combined effluent.

Although the combined effluent does not exceed the BC criteria or the National Performance Standard, there is the risk that the effluent(s) prior to blending may exceed both of these water quality criteria. This could expose the District to a risk of charges under the Fisheries Act, which is based on the end of pipe and does not recognise the influence of dispersion and dilution in the receiving environment. Where chlorine is used for disinfection, dechlorination should be implemented to ensure that aquatic toxicity is not a concern.

4.4 Additional Effluent Monitoring

In addition to those parameters monitored under the permit conditions, further sampling of the effluent and receiving environment was completed in January/February, 2006. The frequency, sites and parameters are summarised in Section 2.0, with the data outcomes being summarised below.

4.4.1 Miscellaneous Parameters

Temperature, pH, dissolved oxygen and conductivity were monitored during the January/February period for all sites. These data are summarised by the following points:

- The pH of the effluent (approximately pH 6.5), either separate or combined was less than that monitored for all receiving environment sites (approximately 7.6). The lower pH in the effluent was likely a factor of the nitrification. Significant nitrification was being achieved at the Dusty Road plant, with the potential for minor nitrification at the Ebb Tide plant.
- The dissolved oxygen (DO) concentration of the effluents was less than that of the receiving environment, which is in the range 7.75 to 8.25 mg/L. The effluent DO concentration appeared to be a factor of the sewage treatment plant. The DO in the Ebb Tide effluent was consistently less than that of Dusty Road (average 2.75 mg/L and 4.90

mg/L, respectively). There was an increase in the DO concentration for the combined effluents (5.10 mg/L), which was likely a factor of turbulence in the pipe network prior to discharge.

- The temperature of the effluents was higher than that measured in the receiving environment (approximately 12°C, compared with 9°C in Trail Bay). The higher temperature is a typical factor of a sewage treatment plant, in a temperate climate, with a low hydraulic retention time. Maintaining a temperature of at least 12°C will enable nitrification to occur at a reasonable rate.
- As expected, the conductivity in the receiving environment was significantly higher than that measured in the effluents (approximately 33,000 µS/cm compared with approximately 475 µS/cm for the effluents). This was expected due to the receiving environment being marine in nature.

4.4.2 Phosphorus

Phosphorus was not monitored in the effluent or receiving environment as part of the permit requirements. Therefore, the data were limited to the four sampling events in January/February, 2006.

As expected, the concentration of total phosphorus and orthophosphate in the effluent was higher than that recorded in the receiving environment. The average concentrations of total phosphorus and orthophosphate for the Dusty Road effluent were 1.34 mg/L and 0.53 mg/L, respectively. For this effluent, only 40% of the total phosphorus was in the form of orthophosphate. This is the form of phosphorus which is readily biologically available and can result in excessive algal growth in a surface water, depending on the characteristics of the receiving environment. Higher concentrations of total phosphorus and orthophosphate were observed in the Ebb Tide effluent (2.29 mg/L and 1.92 mg/L, respectively). There were also differences in the nature of the total phosphorus in this effluent, with approximately 84% being in the form of orthophosphate.

The concentrations in the receiving environment at all sites were in the order of 0.069 mg/L for total phosphorus and 0.066 mg/L for orthophosphate. A review of both effluent and receiving environment data sets indicated that there was no correlation between the concentrations of phosphorus released from the outfall and that measured in Trail Bay (Figures 4.2 to 4.5). In other words, it is not possible to show that the effluent is causing increases in the phosphorus concentrations in the receiving environment waters.

4.4.3 Nitrogen

Differences were observed in the nitrogen composition of the effluent between the two sewage treatment plants. For Dusty Road, most (73%) of the nitrogen which was being released was in the form of nitrate/nitrite, with nitrate being the primary component. Only 6% of the nitrogen in

this effluent was in the form of ammonia. By contrast, the nitrogen in the effluent from the Ebb Tide plant was mainly in the form of ammonia (approximately 92%), with the remaining being in the form of nitrate and nitrite. Both plants released a similar concentration of total nitrogen: approximately 11 mg/L for Dusty Road and 14.5 mg/L for Ebb Tide. The impact of the increased flow being directed to the Ebb Tide plant, with minimum flow being directed to the Dusty Road plant was contributing to the observed differences in the ammonia concentration and nitrogen composition in these effluents.

By contrast, the concentration of total nitrogen in the receiving environment was low (approximately 0.5 mg/L for all sites). Similarities were observed between the sites at Inlet Avenue, Mission Point and Shorncliffe; approximately 60 to 70% of the total nitrogen was in the form of nitrate/nitrite, with approximately 5% of the total nitrogen being in the form of ammonia. Differences were observed at Selma Park Road, where the total nitrogen was composed of total Kjeldahl nitrogen (50%) and nitrate/nitrite (50%). With the low concentrations recorded, the influence of analytical and field variability was more likely to impact this observation than the effluent discharge. The concentrations recorded were close to the analytical detection limit, which did result in some data irregularities (e.g. total ammonia concentrations > TKN). This is typical for these concentrations due to analytical variability. Figure 4.6 summarises the composition of nitrogen for the different sample sites.

The protection of aquatic life, due to ammonia concentrations has been addressed in Section 4.3.3, with further discussions in Section 6. There are no guidelines for nitrite and total nitrogen for the protection of aquatic life in marine waters, but there are now guidelines for nitrate. The BC Water Quality Guideline for the protection of aquatic life in marine waters recommends a nitrate concentration of 3.7 mg/L, as a 30 day average concentration. This guideline relates to chronic concentrations and it is an interim guideline. There are no proposed guideline concentrations for acute concentrations of nitrate.

Figure 4.2
Effluent Total Phosphorus Concentration

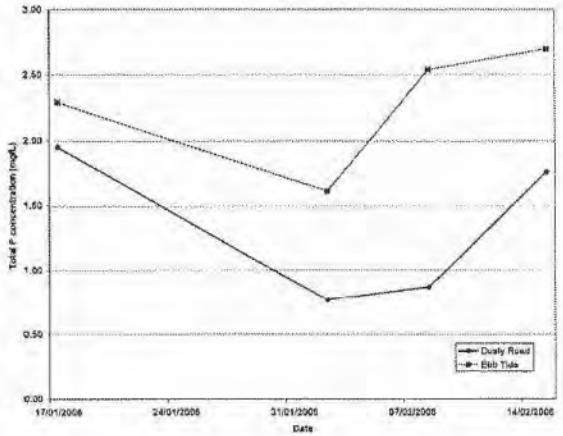


Figure 4.3
Receiving Environment Total Phosphorus Concentration

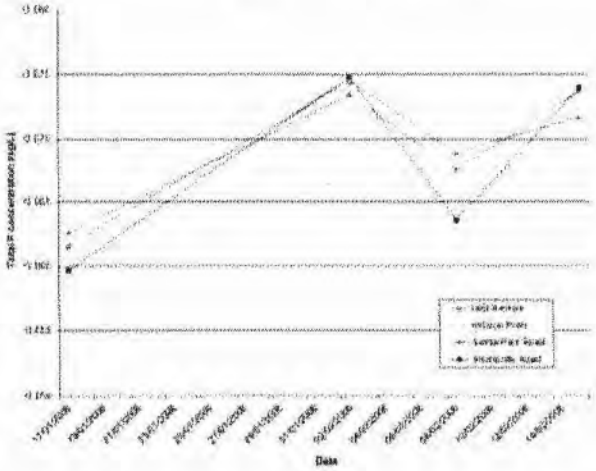


Figure 4.4
Effluent Orthophosphate Concentration

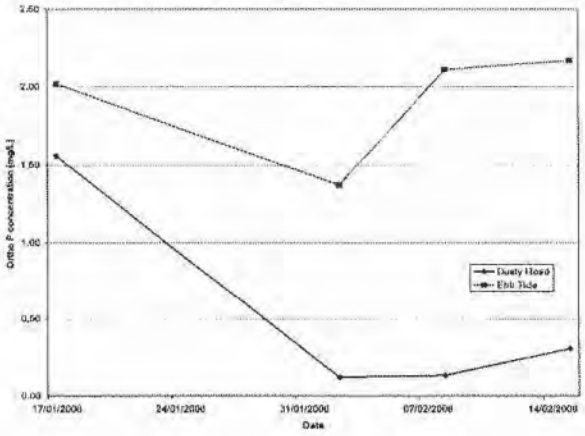


Figure 4.5
Receiving Environment Orthophosphate Concentration

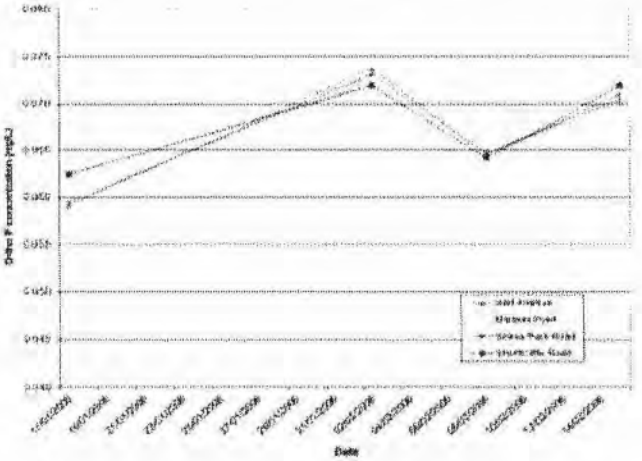
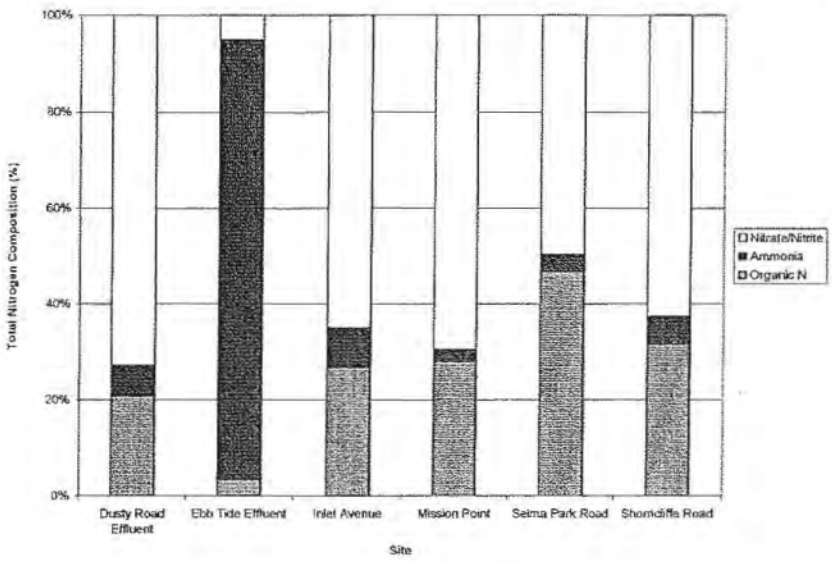


Figure 4.6: Total Nitrogen Composition Summary



4.4.4 Metals

Unless there is significant industrial input to a sewage treatment plant, it is unlikely that the presence of metals in an effluent would be of concern. In addition, a significant proportion of the metals which are present in the incoming sewage are removed during the treatment process by adsorption onto the biosolids. As a result, a single effluent sample from each plant was analysed for the metal content (event January 17th, 2006). These samples represent the Ebb Tide and Dusty Road effluents prior to being combined. The data for these samples are summarised in Table 4.6 in terms of BC Water Quality Guidelines for the protection of aquatic life.

Table 4.6: Summary of Metal Data

Element	Concentration (mg/L)		BC Water Quality Guideline
	Dusty Road Effluent	Ebb Tide Effluent	
Aluminium	0.21	< 0.2	No guideline
Arsenic	< 0.1	< 0.1	0.0125 mg/L interim
Boron	0.13	0.12	1.2 mg/L
Cobalt	< 0.01	< 0.01	No guideline
Copper	0.013	0.032	0.003 mg/L maximum 0.002 mg/L average

Table 4.6: Summary of Metal Data *(continued . . .)*

Element	Concentration (mg/L)		BC Water Quality Guideline
	Dusty Road Effluent	Ebb Tide Effluent	
Lead	< 0.05	< 0.05	≤ 0.140 mg/L maximum ≤ 0.002 mg/L average
Manganese	0.0349	0.0297	None set
Molybdenum	< 0.03	< 0.03	No guideline
Selenium	< 0.2	< 0.2	0.002 mg/L mean
Silver	< 0.01	0.014	< 0.003 mg/L maximum < 0.015 mg/L average
Zinc	0.0328	0.0249	0.01 mg/L

Most of the parameters were below the analytical detection limit. For those where a value was recorded, copper (both plants), silver (Ebb Tide) and zinc (both plants) exceeded the water quality guidelines for the marine environment. This was representative of the end of pipe concentration, and does not consider the impact of dilution within the initial dilution zone.

4.5 Outline of Sewage Treatment Plant Upgrades

The intent is for the two sewage treatment plants to be replaced with a single sewage treatment plant. The new facility will be at a new location ("Lot L"), but it is currently uncertain what type of facility will be developed, however, the effluent criteria outlined in this report will form the basis of the performance for the future sewage treatment plant. The new sewage treatment plant is expected to be designed with a capacity of 5,000 m^3/d, with the ability for expansion to treat flows of up to 10,000 m^3/d.

The current facilities are allowed to discharge up to 3,740 m^3/d, under the current permit. The effluent is discharged into Trail Bay through a 200 mm diameter pipe, with an estimated gravity flow capacity of 4,000 m^3/d.

5.0 EFFLUENT DISPERSION PREDICTIONS

5.1 Current Outfall Summary

The current outfall consists of a 200 mm diameter pipe, which extends 455 m into Trail Bay (Dayton and Knight, 1993). There are five 64 mm diffusers ports, spaced 3.05 m apart, through which the effluent is released. This outfall is located at an approximate depth of 30 m. The effluent is discharged horizontally into the receiving environment (Seaconsult Marine Research Ltd., 1996). Historical information indicates that the outfall is capable of discharging a maximum volume of 4,000 m^3/d, by gravity, but this needs to be reviewed and confirmed.

5.2 Historical Documentation and Reports

5.2.1 Summary – Dayton and Knight 1993 Report

This report was completed as part of the Liquid Waste Management Plan process to review the existing treatment plant capabilities and aimed to form a basis for developing the direction for upgrades and development. The study and report were completed before the construction of the new sewage treatment plant at Dusty Road.

In 1979, an initial study was completed to verify the feasibility of expanding the current sewage treatment system to accommodate a population of 6,000. This report has not been reviewed, but from the information presented in the 1993 report, it is assumed that a population of 6,000 would equate to a flow of 3,400 m^3/d. The outcomes of the 1979 report are indicated to correlate with the findings of the 1993 study (Dayton and Knight, 1993).

After determining tidal and current patterns from drogue studies, modelling and measurement of faecal coliform dispersion and accumulation was undertaken. These studies were completed initially during the month of September, however, an inadequate bacterial count in the effluent resulted in a repeat of the study in November, 1993. The concentration of faecal coliforms was monitored at the following locations:

- Prior to release from the sewage treatment plant;
- Effluent manhole, prior to release into Trail Bay; and
- In the effluent plume at two different depths (surface and 30 m, which is just above the outfall. It would be reasonable to assume that the data from the 30 m sample would present the worst case scenario in the initial dilution zone).

For the failed September study, additional samples were also taken at the Selma Park Road, Shorncliffe Road and Davis Bay shoreline monitoring sites.

From the actual data which were presented in the report, the following were observed:

- There was a significant reduction in the faecal coliform concentration at the manhole site, compared with the release from the sewage treatment plant. There was no discussion on this observation in the Dayton and Knight report, although the authors of the report indicated that a 3 hour residence time in the outfall pipe (between the sewage treatment plant release point and the manhole sample point) had resulted in the die-off of 2 out of every 3 faecal coliforms.
- Although the release of faecal coliforms was very low (average 29 counts/100 mL), little difference was observed at the shoreline monitoring sites (range < 1 to 64 counts/100 mL). There was no indication as to whether these data were a realistic representation of the actual effluent or whether other contributing factors, e.g. non-point source pollution, were impacting these outcomes.
- During the November event, when the average faecal coliform concentration released in the effluent was 215,000 counts/100 mL, there were no significant impacts to the receiving waters immediately above the outfall. For both the deep site (assumed to be in the initial dilution zone) and surface site, the faecal coliform counts ranged from < 1 to 11/100 mL.

Based on the measured currents and tidal data, modelling of bacterial dispersion and die-off was completed for two different scenarios: normal currents coupled with unchlorinated effluent and a worst case scenario coupled with chlorinated effluent, which provides a lower dispersion capability. The estimated dilution for the two scenarios was 3,000:1 and 1,000:1, respectively, while the estimated dilution plus die-off was 120,000:1[1] and 10,000:1, respectively. These reductions apply at shellfish depths, not at the edge of the IDZ.

The authors identified the following conclusions from this study:

- Sufficient bacterial die-off and dispersion was achieved under normal and worst case currents. With no disinfection and taking the worst case currents scenario, the faecal coliform count in the shellfish depths would be 60/100 mL. If disinfection was utilised at the sewage treatment plant for this scenario, the counts would be further reduced to 1.5/100 mL.
- It was considered unlikely that the situation of worst case currents and lack of disinfection would ever occur. As such, the authors indicated that it should not be considered further.

[1] Reported as 162,000:1 in the report, however, based on the information listed in the report, this should have been 120,000:1.

- There were no clear advantages to moving the outfall further away from the shore, unless this distance is significant. The concept of such a distance was not quantified in the report.

5.2.2 Summary – Seaconsult Marine Research Ltd. 1996 Report

This report was not based on actual measured data, but uses predictive modelling to assess the effluent dispersion at points around Trail Bay. The dispersion of effluent in the receiving environment was modelled for different scenarios, and different dilution zones. The scenarios included:

- The current effluent release (in 1996, this equated to 1,800 m^3/d) with the existing outfall;
- The potential impacts for increased effluent flow rates (7,130 m^3/d);
- Different outfall lengths and locations. The alternative depths were 73 m and 94 m, being extended to 1,200 m and 2,200 m, respectively.

The primary focus of the report was the dispersion characteristics during the winter months, as this represented the worst case scenario. Although the winter was not the time period for high bather numbers and increased primary recreational contact, stratification of the water column in Trail Bay is weak over this time period, which could lead to effluent rising to the surface if the point of discharge is < 40 m deep. (The current outfall is at a depth of approximately 27 m.) The rising effluent could come into contact with the shoreline, although this would be after dilution. The rate of dilution would be dependent on the characteristics of Trail Bay, including tidal current and wind patterns.

After the modelling had been completed, the following conclusions were drawn:

- Under the worst case scenario developed by assumptions in the model, the indicated outcome was that the plume from the existing outfall will surface under certain winter conditions. This would be the case for the current (2,040 m^3/d) and future (7,130 m^3/d) flows. Under this scenario, the initial dilution would be approximately 425:1 for the 2,040 m^3/d release and approximately 240:1, once the maximum flows of 7,130 m^3/d have been achieved.
- The above dilution ratios only considered the effect of the initial dilution. Secondary dilution was predicted to be significant. For example, taking the release of 2,040 m^3/d through the existing outfall, secondary dilution would result in a total dilution factor of 4,250:1 at the shoreline.
- Locating the outfall at the depths of 73 m or 94 m resulted in no surfacing of the effluent, and consequently no tracking of the diluted effluent to the shoreline. The model indicated that if the outfall is located at a depth > 70 m, there would be no surfacing of effluent even

during periods of weak winter stratification. For an effluent release of 7,130 m^3/d, the initial dilution ratio would be 512:1 and 770:1 for the 73 m and 94 m deep outfalls, respectively.

- Again, the above dilution ratios only considered the effect of the initial dilution. This would be increased significantly when the secondary dilution was also considered. For the current outfall alignment, at a length of 1,200 m and depth of 73 m, the total dilution at the shoreline would be 15,000:1. This would further increase to 250,000:1 for a similar outfall alignment at a length of 2,200 m and a depth of 94 m.
- Extending the outfall in the current alignment would result in a decrease in the possible dilution at Sargeant Bay, located to the west of Trail Bay. The resulting dilution at the shoreline for Sargeant Bay would be 13,000:1, compared with approximately 100,000:1 for the existing outfall length and depth.
- If a new outfall is located at Mission Point, this would need to be at least 1 km off-shore to prevent the diluted discharge from tracking back into Trail Bay.
- For the existing alignment, as the outfall is moved further off-shore, there was an increase in the potential dilution of effluent which could reach the Trail Bay shoreline.

5.3 Outfall Assessment

Both reports were completed before the promulgation of the MSR in 1999, which was repealed and replaced with the MWR in April, 2012. The MWR is the standard legislation for regulating sewage discharges in British Columbia. The District of Sechelt will be required to register the new sewage treatment plant under the MWR, and the BC Ministry of Environment will expect compliance with the MWR once the upgrades are complete. The MWR also outlines the expectations with respect to outfall conditions and design. The conditions with respect to outfall design include:

- The definition of the initial dilution zone, which is the area located immediately around an outfall where a zone of degradation of water quality is acceptable.
- The outfall is to be located to maximise mixing and minimise the surfacing of effluent or the tendency to move towards a shoreline.
- A minimum depth below the mean low water level for outfalls which are located in marine environments.
- Each diffuser is to provide a minimum dilution ratio of 10:1 within the initial dilution zone.

Although modelling on the outfall and effluent dispersion has been completed, this was undertaken before the promulgation of the MSR and the more recent MWR. Additional assessment is required in order to determine if the outfall is compliant with the MWR and, in the

case where the outfall is not compliant, there is the need to indicate what would be potentially required in order to achieve compliance. The results of the outfall assessment are outlined below.

In order to undertake the assessment, hydrometric and bathymetric data from the Environment Canada database were used, along with videos of the outfall inspections. Two outfall locations were assessed: the current location and a second location, which is an extension out into deeper waters.

5.3.1 Definition of Embayment

The MWR defines embayment within a marine environment as:

a. Marine waters located within a bay from which the access to the sea, by any route, has a maximum width of < 1.5 km,

b. Located, if a line less than 6 km long is drawn between any two points on a continuous coastline, on the shore side of the line, or

c. In which flushing action is identified in a notice given by the BC Ministry of Environment to be inadequate.

Based on the wording in the MWR, Figure 5.1 indicates the area around Trail Bay where the definition of embayment would apply. Taking the conditions indicated in Items a and b, the outfall is located within an embayed area. Therefore, criteria which relate to an embayed area in the MWR apply to the District's outfall.

5.3.2 Initial Dilution Zone

The MWR defines an initial dilution zone as a 3-dimensional zone around a point of discharge where mixing of the effluent and receiving water occurs. The MWR also indicates where the initial dilution zone is to be located with respect to other water uses. For the Trail Bay area, recreational areas and shellfish harvesting areas apply, and the MWR indicates that the edge of the initial dilution zone must be located at least 300 m away from recreational areas and shellfish harvesting areas. The bathing areas, which are the main consideration with respect to public health issues, are located in the shore zone area. With respect to shellfish harvesting, there are periodic closures for this area and shellfish harvesting is not permitted within 300 m of an outfall.

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The MWR indicates how the initial dilution zone is to be defined. Using the concepts in the regulation, the initial dilution zone for the current outfall location and diffuser configuration is oval in plan view with approximate dimensions of 212 m by 200 m. The initial dilution zone is 100 m away from the ports on the diffuser at all points. Therefore, all five diffusers ports, spaced at approximately 3.05 m for a total effective diffuser length of 12.2 m, have been used when defining the initial dilution zone. Figure 5.2 shows the approximate location of the initial dilution zone for the current outfall.

For an embayed area, the MWR indicates that the initial dilution zone must not extend closer to shore than the mean low water. The current outfall extends approximately 400 m from mean low water to the shallow end of the diffuser. As a result, the edge of the initial dilution zone is located approximately 300 m from mean low water. Therefore, the current outfall complies with the requirement in the MWR for the initial dilution zone and its proximity to the mean low water mark.

5.3.3 Outfall Design

The MWR indicates the following key points with respect to outfall design in a marine environment:

a. The outfall design must meet the following requirements:

   i. Meet the definition of the initial dilution zone

   ii. Prevent air entrapment

   iii. Have adequate weighting to prevent movement

   iv. Protect the outfall from corrosion

   Inspection videos of the existing outfall taken during underwater surveys in 2007, 2009 and 2011 were reviewed. From these, the outfall pipe generally appears to be in good condition and without breaks; it is encrusted with marine life. As of April 2011, some concrete collars have been tipped, some parts of the outfall no longer rest on the floor of the Bay and the outfall was kinked at one location not far from the diffuser. As stated in the inspection report the observed irregularities appear to be the result of the outfall having been snagged and moved. The outfall kink was repaired in 2011; it is not clear whether the diffuser location was adjusted at the same time.

b. The outfall diffusers must be located at a sufficient depth to maximise the frequency of trapping of the effluent below the surface of the water body.

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It is questionable as to whether this clause of the MWR is being met at the existing outfall location. There are time periods when the effluent will rise to the surface of the bay. This is primarily a function of the outfall location rather than the effluent discharge rate, that is, Trail Bay is only weakly stratified in winter, thus potentially allowing the effluent plume to surface. Extending the outfall further into the bay to deepen the diffusers from the current depth of approximately 30 m to a depth of 60 m should reduce the frequency of surfacing. Figure 5.2 provides an example of what such an extension would be in terms of the current outfall location.

c. The outfall location must intercept the predominant current and avoid small currents that tend to move in toward the shore.

   The location of the current outfall is not optimum and will result in the movement of effluent towards the shore, in particular Sargeant Bay, at certain times of the year. This is a factor of the location of the current outfall, rather than the discharge rate. Extending the outfall will increase the compliance with this clause of the MWR.

d. The diffuser is to be designed to provide a minimum 10:1 dilution ratio within the initial dilution zone.

   There are no concerns with the current outfall location and the ability to meet this criterion for flows of 5,000 m^3/d.

e. The discharge is not to cause water quality parameters outside of the initial dilution zone to exceed known water quality guidelines.

   For the current outfall, the computations indicate that for a discharge rate of 5,000 m^3/d, the dilution ratio is > 250:1 during the winter when stratification is weakest in the bay, and may be as high as 500:1 under certain conditions. Lengthening the outfall will result in an increase in the dilution potential to approximately 725:1. Further evaluation on the resulting water quality is discussed in Section 6 of this report.

f. At the shallowest diffuser port which is also the diffuser port closest to shore, the minimum depth of the outfall below the mean water mark should be 10 m.

   There are no concerns with meeting this criterion for the existing outfall.

g. The distance to the mean low water mark must be ≥ 30 m from the diffuser.

   There are no concerns with meeting this criterion.

5.4 Summary

There are two aspects of the current outfall location which do not meet the conditions of the MWR. These two conditions relate to effluent rising to the surface and movement towards the shore. The study has used basic modelling to make these determinations, but the conclusions are consistent with historical information and studies. It is possible that a different outcome may be found if more sophisticated modelling is completed, however, the costs to complete this type of modelling pose a significant risk considering that the outcome is likely to remain unchanged – i.e. the two criteria are not met. In order to meet the two criteria identified, it is estimated that the current outfall would need to be extended to a depth of 60 m, possibly deeper. This would require extending the current outfall an additional 500 m (approximately).

Unlike the old MSR, there is flexibility in the MWR. Clause 8 of the MWR allows the BC Ministry of Environment to substitute a different requirement from one identified in the regulation. Depending on the outcomes of the assessment for potential environmental impacts (Section 6), the ability for flexibility on the need to move the outfall location may be worthwhile pursuing with the BC Ministry of Environment.

6.0 EFFLUENT DISCHARGE CRITERIA

6.1 Regulatory Changes

The District's two sewage treatment plants are regulated by a BC Ministry of Environment permit PE-04088. The BC Ministry of Environment has indicated that the proposed upgrades to the District's sewage treatment facilities are too extensive to allow a permit amendment. Therefore, registration under the MWR is required. The MWR replaces the MSR which was promulgated in 1999, and indicates the effluent quality standards and discharge requirements for sewage treatment plants in British Columbia. Upon the upgrades being completed, the District's sewage treatment facility will have to comply with all aspects of the MWR.

Over the past few years, there have been changes in the management of sewage effluents in Canada. These changes relate to the development and finalisation of a Canada-wide Municipal Wastewater Strategy and the subsequent development of the Federal Wastewater Systems Effluent Regulations, which is currently only available as a draft.

In February 2009, the Canada-wide Municipal Wastewater Strategy was approved by the Canadian Council of the Ministers of the Environment (CCME). This Strategy is the first step in a country-wide approach to managing sewage, and focuses on discharges to surface waters. As a member of the CCME, by signing off on the Strategy, the Province of BC has agreed to implement the Canada-wide Municipal Wastewater Strategy. In addition, the Strategy is the basis of a new Federal wastewater regulation, which is being developed by Environment Canada under the Federal Fisheries Act.

The draft Federal wastewater regulation was published in March, 2010, and the final version is expected to be published in the near future. The new Federal wastewater regulation will apply to any surface water discharges in Canada. Therefore, the current and future discharges from the District's sewage facilities to Trail Bay will need to comply with the Federal wastewater regulation, once it is finalised. There are National Performance Standards which are outlined in the CCME Strategy and will be enforced through the regulation. The Standards are:

- Average carbonaceous BOD_5 ($CBOD_5$) ≤ 25 mg/L
- Average TSS ≤ 25 mg/L
- Average total residual chlorine concentration ≤ 0.02 mg/L
- Maximum concentration of un-ionised ammonia to be < 1.25 mg/L

With respect to the management of ammonia, an effluent that complies with the National Performance Standard of 1.25 mg/L for an un-ionised ammonia concentration will also be able to comply with the MWR requirements for ammonia, as any concentration of un-ionised ammonia that is < 1.25 mg/L should result in passing the LC50 96 hour rainbow trout bioassay. The draft Federal wastewater regulation also indicates that if an effluent exceeds the National Performance Standard for un-ionised ammonia, the discharger does not necessarily have to implement appropriate treatment as long as the concentration at the end of the initial dilution zone does not exceed 0.016 mg/L (as un-ionised ammonia). This concept is consistent with the direction outlined in the CCME Municipal Wastewater Strategy.

The draft regulation also defines the monitoring frequency and time period for calculating the average and maximum values stipulated in the Standards. Both the frequency and the time period are based on the size of the facility, which is determined using the average annual daily flows from the sewage treatment plant. This approach is also consistent with the principles set out in the Canada-wide Municipal Wastewater Strategy. Based on the District's future design flow of 5,000 m^3/d (assumed maximum day flow), the sewage treatment plant would be classified as a medium sized facility. For a medium sized facility, monitoring for $CBOD_5$, TSS and ammonia would be required once every two weeks. Testing for total residual chlorine would be required on a daily basis if chlorine is used as part of the sewage treatment plant process. The time period for calculating the average and maximum concentrations is quarterly. In addition, toxicity testing would be required (LC50 96 hour rainbow trout bioassay) on a quarterly basis.

The above comments refer to the conditions outlined in the draft version of the regulation. It is possible that changes may occur before the regulation is finalised.

6.2 Modelling of Potential Effluent Impacts

Modelling is required to determine the potential resulting concentrations at the end of the initial dilution zone. The concept of an initial dilution zone is to allow an area where there will be deterioration in water quality, as a result of an effluent release. However, through dilution and dispersion, the expectation is that the water quality will be consistent with the appropriate guidelines or objectives outside of the initial dilution zone.

Three dilution ratio scenarios have been used in order to predict the potential for impacts outside of the initial dilution zone. These three dilution ratios have focused on an effluent discharge rate of 5,000 m^3/d, and are summarised below:

- A dilution ratio of 290:1. This is a scenario for the existing outfall where there is the potential for effluent to surface under weakly stratified conditions which can occur in Trail Bay during the winter (mainly January). This is an extreme worst case scenario but would

increase the risk of health impacts, in particular, through direct contact with the diluted effluent if a person is in the water at the time when the weakly stratified conditions occur. As the weakly stratified conditions would occur during the coldest winter months, the risk associated with direct bather contact is low.

- A dilution ratio of 480:1. This is a scenario for the existing outfall and is based on the typical dispersion conditions experienced in Trail Bay. From the computations which have been summarised in Section 5.3, it is reasonable to achieve a minimum dilution ratio of 480:1 for most conditions throughout the year. This is a conservative number and the reality is that the actual dilution will likely be higher than this value.

- A dilution ratio of 725:1. This is a scenario for an extended outfall, which is located at an approximate depth of 60 m. To achieve this depth, it is estimated that the current outfall would need to be extended by approximately 500 m.

6.3 5 Day Biochemical Oxygen Demand

For a surface water discharge, such as Trail Bay, which is defined as embayed, the following quality criteria apply:

- Under the MWR the maximum $CBOD_5$ concentration must be less than or equal to 45 mg/L.
- Under the Federal wastewater regulation, the average $CBOD_5$ concentration must be less than or equal to 25 mg/L. The average is calculated on a quarterly basis, with samples being collected and analysed once every two weeks.

In addition, the Wastewater Treatment Facilities Project Steering Committee for Sechelt had also indicated an interest in the potential benefits to releasing a higher quality effluent, with a maximum $CBOD_5$ concentration of 10 mg/L.

6.3.1 Assessment of Impact Potential

The $CBOD_5$ concentrations at the end of the initial dilution zone for the three dilution scenarios and the three effluent concentrations are summarised in Table 6.1. For all three scenarios and for all three dilution ratios, there would be an increase in the $CBOD_5$ concentration at the end of the initial dilution zone, but the magnitude of this increase would not be detectable analytically. Therefore, there would be no resulting change in the quality of water at the edge of the initial dilution zone, compared with another location in Trail Bay which is not influenced by the discharge from the sewage treatment plant.

Table 6.1: Predicted Change in Conditions - $CBOD_5$

Effluent $CBOD_5$ Concentration	Increase in $CBOD_5$ Concentration at the Edge of the Initial Dilution Zone (mg/L)		
	290:1	480:1	725:1
10 mg/L	0.034	0.021	0.014
25 mg/L	0.086	0.052	0.034
45 mg/L	0.155	0.094	0.062

There are no BC Water Quality Guidelines for $CBOD_5$, but there are guidelines for dissolved oxygen concentrations, which can be impacted by the presence of $CBOD_5$. However, given the predicted resulting concentrations of $CBOD_5$ as a result of the three discharge scenarios, the potential for a change in the dissolved oxygen concentration in Trail Bay is highly unlikely.

Given the information above, the impacts to public health or the environment as a result of the effluent release would not be detectable. Therefore, all three effluent scenarios have a very low risk and there is no public health or environmental advantage to producing an effluent with a $CBOD_5$ concentration of 10 mg/L, compared with one which has a concentration of 45 mg/L. In addition, there is no public health/environmental advantage to extending the outfall, with respect to the resulting concentrations at the end of the initial dilution zone.

6.3.2 Conclusions

Given the low potential risk to public health and the environment, it is recommended that the effluent $CBOD_5$ concentrations for the future sewage treatment plant be set at an average of 25 mg/L and a maximum of 45 mg/L, which will allow compliance with the future Federal wastewater regulation and the existing BC MWR.

6.4 Total Suspended Solids

For a surface water discharge, such as Trail Bay, which is defined as embayed, the following quality criteria apply:

- Under the MWR the maximum TSS concentration must be less than or equal to 45 mg/L.
- Under the Federal wastewater regulation, the average TSS concentration must be less than or equal to 25 mg/L. The average is calculated on a quarterly basis, with samples being collected and analysed once every two weeks.

The MWR indicates a maximum TSS concentration of 45 mg/L for release to an embayed environment, however, the definitions in the regulation also indicate that a maximum TSS concentration of 60 mg/L is acceptable for a lagoon system. It is possible that there may also be a similar allowance for lagoons under the Federal wastewater regulation. Although the draft version of the Federal regulation indicates an average effluent TSS concentration of 25 mg/L, there is a discrepancy between the National Performance Standards for lagoons and the TSS criteria outlined in the draft wastewater regulation. In the National Performance Standards, this discrepancy allows for increases in effluent TSS concentrations from lagoon systems, as long as the increase in TSS concentration is due to algal growth. It is possible that this discrepancy may be addressed before the Federal wastewater regulation is finalised.

In addition, the Wastewater Treatment Facilities Project Steering Committee for Sechelt had also indicated an interest in the potential benefits to releasing a higher quality effluent, with a maximum TSS concentration of 10 mg/L.

6.4.1 Assessment of Impact Potential

The TSS concentrations at the end of the initial dilution zone for the three dilution scenarios and the three effluent concentrations are summarised in Table 6.2. In all cases, there would be an increase in the TSS concentration at the end of the initial dilution zone, but the magnitude of this increase would not be detectable analytically. Therefore, there would be no resulting change in the quality of water at the edge of the initial dilution zone, compared with another location in Trail Bay which is not influenced by the discharge from the sewage treatment plant.

Table 6.2: Predicted Change in Conditions - TSS

Effluent TSS Concentration	Increase in TSS Concentration at the Edge of the Initial Dilution Zone (mg/L)		
	290:1	480:1	725:1
10 mg/L	0.034	0.021	0.014
25 mg/L	0.086	0.052	0.034
45 mg/L	0.155	0.094	0.062

For marine environments, the BC Water Quality Guidelines for TSS focus on the protection of aquatic life, and are based on an increase in the TSS compared with the background concentration. The predicted changes in the TSS concentration at the edge of the initial dilution zone for all three scenarios and all three effluent TSS concentrations are within what is identified as being acceptable in the BC Water Quality Guidelines.

Given the information above, there would be no measureable impacts to public health or the environment as a result of the effluent release. Therefore, all three effluent scenarios have a very low risk, and there is also no public health or environmental advantage to producing an effluent with a TSS concentration of 10 mg/L, compared with one which has a concentration of 45 mg/L. In addition, there is no public health or environmental advantage to extending the outfall, with respect to the resulting concentrations at the end of the initial dilution zone.

6.4.2 Conclusions

Given the low potential risk to public health and the environment, it is recommended that the effluent TSS concentrations for the future sewage treatment plant be set at an average of 25 mg/L and a maximum of 45 mg/L, which will allow compliance with the future Federal wastewater regulation and the existing BC MWR.

6.5 Nitrogen

Ammonia is the key parameter of concern with respect to sewage effluents and a surface water discharge. It is the form of nitrogen which is most predominant in raw sewage, and in effluents where there is no design for nitrification (biological ammonia treatment). Ammonia is one of the key parameters of concern with respect to sewage effluent and aquatic toxicity. Ammonia is present in two forms: ionised and un-ionised, the proportion of which is dependent on pH and temperature. It is the un-ionised form of ammonia which is of particular interest, as this is the form which is toxic to fish.

There are three regulatory criteria for ammonia, all of which have a direct relevance to each other.

1. The draft Federal wastewater regulation indicates a National Performance Standard for ammonia in the effluent of < 1.25 mg/L, as un-ionised ammonia. This concept is also consistent with the Canada-wide Municipal Wastewater Strategy.
2. The draft Federal wastewater regulation indicates that the concentration of un-ionised ammonia at the end of the initial dilution zone must be ≤ 0.016 mg/L. This concept is also consistent with the Canada-wide Municipal Wastewater Strategy.
3. The MWR indicates that the concentration of ammonia in the effluent is to be back calculated from the edge of the initial dilution zone and must consider ambient temperature and pH of the receiving water and water quality guidelines for chronic ammonia.

An effluent that complies with the National Performance Standard of 1.25 mg/L of un-ionised ammonia will be considered as not acutely toxic for ammonia, as any concentration that is < 1.25 mg/L should result in passing the LC50 96 hour rainbow trout bioassay. The draft Federal

wastewater regulation also indicates that if an effluent exceeds the National Performance Standard for un-ionised ammonia, the discharger does not necessarily have to implement appropriate treatment as long as the concentration at the end of the initial dilution zone does not exceed 0.016 mg/L (as un-ionised ammonia). This concept is consistent with the direction outlined in the CCME Municipal Wastewater Strategy and the MWR.

6.5.1 Acute Toxicity

Acute toxicity refers to a rapid and extreme response to environmental conditions – i.e. death normally occurs within a short period of time. The standard test for determining acute toxicity in an aquatic environment is the LC50 96 hour rainbow trout bioassay. In this test, 10 young rainbow trout are used per test. If 6 fish die within 96 hours, the test solution is determined to be acutely toxic and has failed the toxicity test.

Table 6.3 summarises the concentration of total ammonia and the corresponding pH which would be required to create acutely toxic conditions to fish for a temperature of 15 °C (this is the temperature at which the LC50 bioassays are conducted). The information in Table 6.3 presents three different scenarios: a pH range of 7.0 to 8.0, which is a typical pH range for a mechanical sewage treatment plant, and an effluent ammonia concentration of 25 mg/L, which is the standard defined ammonia concentration associated with a medium strength sewage (Metcalf and Eddy, 2003). Based on these conditions, if the District selects a high rate sewage treatment plant as the new process, there will be no concerns with respect to acute toxicity and the ammonia concentration in the effluent. This would not be the case if the District selects a lagoon-based process. Lagoon processes are vulnerable to pH swings throughout the day, as a result of algal growth. This is a natural phenomenon, rather than being treatment related.

Table 6.3: Thresholds for Acute Ammonia Toxicity

Total Ammonia Concentration for Acute Toxicity (mg/L)	Corresponding pH for Acute Toxicity
455	7.0
47	8.0
25	8.3

6.5.2 Chronic Toxicity

Chronic toxicity is less easy to define than acute toxicity as this type of toxicity refers to effects which may be observed over a long time period and which may be subtle in nature. The Federal government defines chronic toxicity as "the ability of a substance or mixture of substances to

cause harmful effects over an extended period, usually upon repeated or continuous exposure sometimes lasting for the entire life of the exposed organism" (Environment Canada, 2011). Chronic toxicity could equate to impacts on off-spring of exposed individuals, metabolic differences or subtle changes in the ability to survive or reproduce. Due to the complexity of chronic toxicity, acute toxicity has historically been the primary focus for legislation and the regulatory government agencies.

In the case of ammonia and sewage effluents, the effluent total ammonia concentration is to be calculated based on a concentration at the end of the initial dilution zone which would result in chronic toxicity. This methodology for determining effluent ammonia concentrations is consistent with the MWR and the draft Federal wastewater regulation. However, there are differences between the approaches which are outlined by the two levels of government.

The CCME Canadian Water Quality Guidelines refer to a maximum un-ionised ammonia concentration which was used as a basis to define chronic aquatic toxicity as a result of ammonia in the *Ammonia Guidelines* which were developed under the Canadian Environmental Protection Act (Environment Canada, 2011). This concentration is a conservative number as it is intended to apply to all surface waters throughout Canada. The development of a chronic ammonia concentration at the end of the initial dilution zone is included in the draft Federal wastewater regulation. This regulation is intended to uphold the principles set out in the Canada-wide Municipal Wastewater Strategy and its origins are based on the direction which was set under the Canadian Environmental Protection Act for the management of ammonia in sewage effluents. The draft Federal wastewater regulation indicates a maximum concentration of un-ionised ammonia of 0.016 mg/L for the end of the initial dilution zone.

For the BC approach, a more site-specific concentration can be derived using available data and a comparison with the BC Water Quality Guidelines (BC Ministry of Environment, 2006; Meays, 2009).

The chronic ammonia concentrations have been calculated using existing data for the Trail Bay area, and are based on typical conditions which can occur. The focus on typical conditions is a more realistic approach given the nature of a chronic effect, compared with an acute response. Temperature and pH are required under the Federal approach for assessing chronic ammonia toxicity. Using published data (Davenne and Masson, 2001), the average temperature and pH for Trail Bay are 9.2 °C and 7.73, respectively. Using the Federal definition of the ammonia chronic concentration as 0.016 mg/L, the corresponding total ammonia concentration was calculated using the temperature and pH data. This is the concentration of total ammonia which must be achieved at the end of the initial dilution zone for the effluent not to cause conditions which are chronically toxic. Using the BC approach, the published temperature and pH data were rounded up to the next value presented in the BC Water Quality Guideline tables. Therefore, the chronic

ammonia concentration was based on a temperature and pH of 10.2 °C and 7.80, respectively. This is a more conservative approach compared with the Federal methodology, as ammonia toxicity increases with increasing temperature and pH. In addition, the concept of salinity was also used in developing an appropriate ammonia concentration under the BC Water Quality Guidelines. A salinity of 20 g/kg was selected, as there were no salinity data available from the 2006 monitoring event, but there is a consistency between the selected value and the limited available conductivity data, based on a loose relationship (a factor of 0.65) between salinity and conductivity (APHA, AWWA and WEF, 1998).

The outcomes of the evaluations are summarised in Table 6.4. Using the end of dilution zone concentration, the corresponding effluent concentration was calculated for the three different dilution ratios. In each case, there is no need to treat for ammonia in order to meet the chronic criteria at the end of the initial dilution zone.

Table 6.4: Effluent Total Ammonia Concentration Based on End of Dilution Zone Chronic Criteria

Dilution Ratio	Federal Approach		Provincial Approach	
	End of Dilution Zone Concentration (mg/L) (Note 1)	Discharge Concentration (mg/L)	End of Dilution Zone Concentration (mg/L) (Note 2)	Discharge Concentration (mg/L)
290:1	1.7	506	3.4	986
480:1	1.7	838	3.4	1,632
725:1	1.7	1,266	3.4	2,465

Note 1: Total ammonia concentration calculated based on the un-ionised ammonia concentration of 0.016 mg/L at the end of the initial dilution zone.

Note 2: Resulting total ammonia concentration using the tables provided in the BC Water Quality Guidelines, with an adjustment for salinity.

6.5.3 Conclusions

Regardless of the location of the outfall or the reduced dilution which can be experienced in winter conditions during periods of weak stratification, there is no requirement to treat for ammonia. The discharge from a standard high rate sewage treatment plant will meet both acute ammonia concentrations before discharge and chronic ammonia concentrations at the end of the initial dilution zone.

6.6 Phosphorus

Phosphorus is a nutrient essential for biological life. However, too much phosphorus can result in nutrient enrichment in aquatic environments, which can result in algal growth. Under conditions when algal growth becomes excessive, this can cause concerns both with respect to recreational water use (primarily in terms of aesthetics, rather than public health issues) and the need to protect aquatic life (through the potential for the algal growth to smother fish habitat and a decrease in available dissolved oxygen when the algal biomass decays). The BC Water Quality Guidelines recommend parameters with respect to phosphorus and/or algal biomass concentrations for streams and lakes. There are no guidelines for marine environments.

Under the MWR, both total phosphorus and orthophosphate are identified as parameters which can require treatment before discharge. However, for a marine environment, whether it is open water or embayed, there is no requirement for the concentrations of either total phosphorus or orthophosphate to be reduced prior to discharge. In addition, phosphorus is not included as one of the National Performance Standards, nor is it identified as a parameter to be regulated in the draft Federal wastewater regulation. Therefore, there are no Federal or Provincial requirements for phosphorus to be treated at the Sechelt facility before discharge to Trail Bay.

The resulting increase in the concentration of total phosphorus and orthophosphate is outlined in Table 6.5, below. Two different effluent criteria have been evaluated for the three different dilution ratios: 290:1 for the current outfall under winter conditions with no stratification, 480:1 for the current outfall under typical conditions and 725:1 for an outfall which has been extended to a depth of approximately 60 m. With respect to the two different effluent concentrations, these criteria are:

- No phosphorus treatment. The concentrations of total phosphorus and orthophosphate represent a balance between the effluent quality data from 2006 and what is typically achieved from a sewage treatment plant.
- Phosphorus treatment to a maximum of 1.0 mg/L total phosphorus and 0.5 mg/L orthophosphate, which is the standard treatment requirement in the MWR for discharges to lakes and rivers/streams. This standard does not apply to marine discharges, such as the discharge to Trail Bay.

Table 6.5: Predicted Change in Conditions – Phosphorus

Parameter	Effluent Concentration (mg/L)	Increase in Concentration at the Edge of the Initial Dilution Zone (mg/L)		
		290:1	480:1	725:1
Total Phosphorus	1.8	0.0062	0.0038	0.0025
	1.0	0.0034	0.0021	0.0014
Orthophosphate	1.2	0.0041	0.0025	0.0017
	0.5	0.0017	0.0010	0.0007

Given that the typical analytical deviation for these analyses is ± 0.002 mg/L, the estimations indicate that, for the current outfall and a dilution ratio of 290:1, all of the resulting concentrations at the end of the initial dilution zone except for an effluent orthophosphorus concentration of 0.5 mg/L would be potentially measureable over background conditions. For the current outfall and a dilution ratio of 480:1, only the effluent total phosphorus concentration of 1.8 mg/L would be potentially measureable at the end of the initial dilution zone, compared with background conditions. All other effluent concentrations would not be measureable, given the analytical deviation. In the case of the extended outfall, it is expected that none of the resulting concentrations would be measureable, compared with background conditions.

However, in all cases, given the factors which affect field variability, it is likely that little, if any, change in the resulting phosphorus concentration would be measured regardless of whether phosphorus treatment is practiced at the sewage treatment plant, the location of the outfall or the dilution ratio which is achieved.

In addition, in all cases, given the low magnitude for the increase in the phosphorus concentration in Trail Bay as a result of the release, it is reasonable to expect that there would be no measureable effects nor would nutrient enrichment occur in Trail Bay.

6.6.1 Conclusions

The implementation of phosphorus treatment would result in both capital and operation costs which cannot be balanced by any measurable benefit to public health or the environment. In addition, there is no Federal or Provincial regulation which would require phosphorus treatment to be implemented for a discharge to Trail Bay.

Therefore, there is no recommendation for phosphorus treatment at the sewage treatment plant, regardless of the outfall location. The information presented in this report has assumed that there is a standard uptake of phosphorus through natural biological processes, which is standard for

the treatment of sewage. Therefore, there will be a natural reduction in the concentration of total phosphorus and orthophosphate in the effluent, compared with the incoming sewage. However, as the reduction in the concentration will be natural, there is no expectation that sewage treatment plant operations will be able to control and maintain a concentration of phosphorus in the effluent. This is reasonable, given that there is no measureable public health or environmental benefit to implementing phosphorus treatment.

6.7 Bacteriological Concentrations and Disinfection

6.7.1 Effluent Bacteriological Concentrations

The potential for pathogenic micro-organisms to be present as a result of a sewage effluent release is determined by measuring the concentration of faecal coliforms. Faecal coliforms are a sub-group of total coliforms that are associated with faecal material. The development of the use of faecal coliforms as an indicator of faecal contamination was based on the ubiquitous nature of total coliforms in the natural environment and that the presence of total coliforms did not necessarily relate to faecal contamination. The test for faecal coliforms allows the focus to be on the presence of coliforms which are predominantly present in the intestines of humans and/or warm blooded animals. While faecal coliforms may not necessarily result in public health issues, this group of bacteria provide a good indication as to whether there may be other enteric micro-organisms present which may have the potential to cause sickness or disease.

The MWR indicates that the effluent must be disinfected to meet water quality guidelines which are applicable based on the uses of the receiving environment. In the case of a discharge to Trail Bay, the following criteria apply:

- If the discharge is to a shellfish bearing water, the faecal coliform concentration at the edge of the initial dilution zone must be less than 14/100 mL, measured as a median or geometric mean, not as an absolute value. Not more than 10% of the samples must have a concentration > 43/100 mL at the end of the initial dilution zone.
- If the discharge is to a recreational water, the faecal coliform concentration at the edge of the initial dilution zone must be less than or equal to 200/100 mL, measured as a geometric mean, not as an absolute value.

Given the uses of Trail Bay, the criterion which would apply in this case relates to the shellfish restrictions, which is the more stringent of the two criteria. The criteria which are outlined in the MWR are consistent with the recommended faecal coliform concentrations in the BC Water Quality Guidelines.

There are no requirements for disinfection in the National Performance Standards, nor is disinfection a parameter to be regulated in the draft Federal wastewater regulation. Therefore, there are no Federal requirements for disinfection prior to a sewage effluent discharge from the Sechelt facility to Trail Bay.

The information in Table 6.6 indicates the effluent faecal coliform required to maintain a concentration of 14/100 mL at the edge of the initial dilution zone. Modelling to meet a concentration of 14/100 mL focuses on a more stringent criterion, as the assumption is to maintain an absolute concentration at the end of the initial dilution, rather than a geometric mean. In all cases, it is not possible to meet these faecal coliform concentrations as a guarantee before discharge without disinfection. Therefore, disinfection will be required.

The information in Table 6.6 also indicates the resulting increase in the faecal coliform concentration at the end of the initial dilution zone on the assumption that disinfection is practiced to produce an effluent faecal coliform concentration of 200 counts/100 mL. An effluent concentration of 200/100 mL is a common standard when designing a UV disinfection process, and is also taken as a geometric mean, not as an absolute value. The information presented indicates that, regardless of the dilution factor, the increase in the faecal coliform concentration at the end of the initial dilution zone would not be measureable, compared with background conditions in Trail Bay. Achieving the 200/100 mL faecal coliform limit in the effluent is expected to keep the faecal coliform concentration well below the requirement of 14/100 mL at the end of the initial dilution zone.

Table 6.6: Effluent Criteria – Faecal Coliforms

Dilution Ratio	Effluent Concentration to Meet 14/100 mL at the Edge of the Initial Dilution Zone (counts/100 mL)	Resulting Increase in Concentration – Effluent Release 200/100 mL
290:1	4,100	0.7
480:1	6,700	0.4
725:1	10,100	0.3

6.7.2 Use of Chlorine

Disinfection can be achieved using different processes. The most common process for sewage effluents are chlorination and UV light. Due to the potential for chlorine to be toxic to aquatic life, there are conditions for chlorine residuals in both the MWR and the draft Federal wastewater regulation, in addition to the recommendations in the Canada-wide Municipal Wastewater Strategy.

The MWR indicates that chlorination must not be used unless other disinfection alternatives have first been considered. In the event where chlorination is used for disinfection, the resulting effluent must be dechlorinated and the effluent total residual chlorine concentration must be less than 0.02 mg/L.

The effluent total residual chlorine concentration is also a National Performance Standard and, therefore, is recognised in the guidance municipal wastewater strategy and in the draft Federal wastewater regulation. In both cases, the effluent total residual chlorine concentration must be less than or equal to 0.02 mg/L.

Therefore, in the case that chlorination is used for disinfection, dechlorination will be required to ensure that the effluent total residual chlorine concentration does not exceed 0.02 mg/L.

6.7.3 Conclusions

In recognition of the shellfish resources in Trail Bay, a faecal coliform concentration of 14/100 mL will be required at the end of the initial dilution zone. This concentration can only be maintained through disinfection. Therefore, disinfection will be required for effluent discharge to Trail Bay. It is recommended that the effluent immediately after the disinfection process achieve levels of 200/100 mL (as a geometric mean), which is a standard practice within the wastewater industry.

There is no advantage to extending the outfall with respect to the need for disinfection or the concentration of faecal coliforms which is achieved at the end of the initial dilution zone.

If chlorine is the preferred method for disinfection, dechlorination will be required in order to achieve an effluent total residual chlorine concentration of less than 0.02 mg/L before discharge.

6.8 Miscellaneous Parameters

The BC Water Quality Guidelines also list a number of other substances. The resulting increase in the concentration of these substances is outlined in Table 6.7, based on effluent data collected in 2006 for the original environmental impact study report. Given that the nature of the current sewage is still primarily domestic in nature, it is expected that the data from 2006 would still be representative of the effluent today. As it is expected that the future sewage will still be domestic in nature, it is also reasonable to assume that the data from 2006 will also represent future effluent characteristics through to the design flow of 5,000 m^3/d. The predicted resulting concentrations have been compared with the most stringent guideline (or working guideline) for the following categories: recreational use, aesthetics or the protection of marine aquatic life. For several parameters, there were no guidelines identified in the BC Water Quality Guidelines. Where guidelines exist, the calculations indicate that the guideline concentrations will be met at

the end of the initial dilution zone, regardless of whether the dilution ratio is 290:1 or 480:1 for the current outfall, or 725:1 for an extended outfall.

Table 6.7: Predicted Change in Conditions – Miscellaneous Substances

Parameter	Increase in Concentration at the Edge of the Initial Dilution Zone (mg/L)			Comment
	290:1	480:1	725:1	
Aluminium	0.0005	0.0003	0.0002	Meets 0.2 mg/L – recreational use/aesthetics
Antimony	0.0003	0.0002	0.0001	No guideline
Arsenic	0.0003	0.0002	0.0001	Meets 0.0125 mg/L – protection of marine aquatic life
Barium	0.00003	0.00002	0.00001	Meets 0.002 mg/L – protection of aquatic life (bivalves)
Beryllium	0.000009	0.000005	0.000003	Meets 0.1 mg/L – minimal risk to marine aquatic life and 1.5 mg/L – hazardous risk to marine aquatic life
Bismuth	0.0003	0.0002	0.0001	No guideline
Boron	0.0004	0.0003	0.0002	Meets 1.2 mg/L – protection of marine aquatic life
Cadmium	0.00002	0.00001	0.00001	No guideline
Calcium	0.037	0.022	0.015	No guideline
Chromium	0.00002	0.00001	0.00001	Meets 0.0015 mg/L for Cr (VI) and 0.056 mg/L for Cr (III) – protection of marine aquatic life
Cobalt	0.00002	0.00001	0.00001	No guideline
Copper	0.00008	0.00005	0.00003	Meets 0.003 mg/L – protection of marine aquatic life
Iron	0.0007	0.0004	0.0003	No guideline
Lead	0.00009	0.00005	0.00003	Meets 0.05 mg/L – recreational use/aesthetics
Lithium	0.00002	0.00001	0.00001	No guideline
Magnesium	0.014	0.009	0.006	No guideline
Manganese	0.00011	0.00007	0.00004	No guideline
Molybdenum	0.00005	0.00003	0.00002	No guideline
Nickel	0.00009	0.00005	0.00003	Meets 0.0083 mg/L – protection of marine aquatic life

Table 6.7: Predicted Change in Conditions – Miscellaneous Substances *(continued . . .)*

Parameter	Increase in Concentration at the Edge of the Initial Dilution Zone (mg/L)			Comment
	290:1	480:1	725:1	
Potassium	0.031	0.019	0.012	No guideline
Selenium	0.0003	0.0002	0.0001	Meets 0.002 mg/L – protection of marine aquatic life
Silicon	0.015	0.009	0.006	No guideline
Silver	0.00003	0.00002	0.00001	Meets 0.003 mg/L – protection of marine aquatic life
Sodium	0.189	0.114	0.076	No guideline
Strontium	0.0002	0.0001	0.0001	No guideline
Thallium	0.0003	0.0002	0.0001	No guideline
Tin	0.00005	0.00003	0.00002	No guideline
Titanium	0.00003	0.00002	0.00001	No guideline
Vanadium	0.00005	0.00003	0.00002	Meets 0.05 mg/L – protection of marine aquatic life
Zinc	0.00010	0.00006	0.00004	Meets 0.01 mg/L – protection of marine aquatic life

6.8.1 Conclusions

The release of the effluent is not anticipated to result in a condition which would exceed the BC Water Quality Guidelines outside of the initial dilution zone, regardless of the outfall location or the winter stratification conditions.

6.9 Summary of Recommended Effluent Criteria

Based on the information presented above, the following recommendations are made regarding the discharge to Trail Bay from the District of Sechelt:

- Carbonaceous BOD_5 to be an average equal to or less than 25 mg/L, with a maximum of 45 mg/L, as required by the MWR for embayed marine waters. There is no public health or environmental advantage nor is there any regulatory requirement to meet a maximum effluent $CBOD_5$ concentration of 10 mg/L.
- TSS to be an average equal to or less than 25 mg/L, with a maximum of 45 mg/L, as required by the MWR for embayed marine waters. There is no public health or environmental advantage nor is there any regulatory requirement to meet a maximum effluent TSS concentration of 10 mg/L.

- Ammonia – assuming that the District selects a high rate (mechanical) sewage treatment process, there will be no requirement for ammonia treatment. This is based on the ability of the effluent to meet acute concentrations before discharge and chronic concentrations at the end of the initial dilution zone.
- Phosphorus – treatment is not required. There is no public health or environmental advantage nor is there any regulatory requirement to implement treatment for total phosphorus and orthophosphate.
- Disinfection will be required to maintain a faecal coliform concentration of 14/100 mL at the end of the initial dilution zone. It is recommended that the effluent faecal coliform concentration is 200/100 mL (as a geometric mean) immediately after disinfection as this will meet the end of initial dilution zone concentration and can be achieved by standard disinfection processes. If chlorine is the method of disinfection, dechlorination will be required in order to achieve an effluent total residual chlorine concentration of less than or equal to 0.02 mg/L before discharge.

7.0 MONITORING REQUIREMENTS

There are three main purposes for monitoring at a wastewater facility:

1. To provide valuable information on the process performance, allowing treatment issues to be identified in order to optimise operations. This information also provides valuable information with respect to the scope and timing of any future upgrades.
2. To confirm that effluent quality has been achieved. This is important both in respect to confirming that the facility is operating within the design specification and that it is able to meet the regulatory requirements.
3. To provide valuable information on the actual or potential for environmental impacts. This understanding has both legal ramifications and provides guidance as to whether adequate treatment is being achieved or whether further treatment is required in order to protect public health and the environment.

The monitoring recommendations and requirements are outlined in Sections 7.1 and 7.2, with respect to the effluent quality and receiving environment. Additional monitoring for process performance should be based on the process of choice, with the monitoring outlined in an operations plan, or similar document which is prepared specifically for the wastewater facility.

7.1 Effluent Monitoring Requirements

Monitoring requirements/recommendations are outlined in the MWR, the CCME Strategy (CCME, 2009) and the draft wastewater regulation (Department of Environment, 2010). The focus of the monitoring requirements is to ensure that the effluent criteria are being met, and to establish the performance of the sewage treatment plant.

The proposed scope of the effluent monitoring program outlined in Table 7.1 has been based on:

- The outcomes of this environmental impact study and related data;
- The potential for environmental impacts as a result of this release;
- The magnitude of the current and projected sewage treatment plant facilities and the consequent releases;
- Basic requirements of the MWR, for flows < 5,000 m^3/d, which is the category that this facility will be operating under until the next upgrades are required; and
- The monitoring requirements for a medium facility size > 2,500 m^3/d to 17,500 m^3/d, as defined in the draft Federal wastewater regulation. It is recognised that this regulation is

only available as a draft document. Although there are consistencies between the draft regulation monitoring requirements and those outlined in the Canada-wide Municipal Wastewater Strategy, it is recommended that the scope of the monitoring program be reviewed once the regulation is available as a final document, in order to confirm any changes in the parameters and frequencies.

Table 7.1: Effluent Monitoring Requirements

Parameter	Frequency
Flow	Daily
$CBOD_5$	Once every two weeks
TSS	Once every two weeks
Ammonia	Once every two weeks
Total Phosphorus	Quarterly
Orthophosphate	Quarterly
Faecal Coliforms	Once every two months
pH	Once every two weeks
Residual Chlorine	Daily (if chlorine is used for disinfection)
Toxicity Test	Once every two years

In addition to the information in Table 7.1, the following should be noted:

- A daily frequency is recommended for flow measurement, compared with the twice weekly requirement in the MWR. This is based on the ability of standard flow monitoring devices.
- The frequencies of monitoring $CBOD_5$, TSS and ammonia are based on the draft Federal wastewater regulation, and are higher than that required in the MWR. If the District prefers, the monitoring frequency can be reduced to monthly until the Federal wastewater regulation is published as a final document.
- The monitoring for pH should be taken at the same time as a sample for ammonia. This is required to enable the un-ionised ammonia concentration to be calculated.
- Residual chlorine should only be monitored if chlorine is used on site for disinfection.
- Clarification should be sought as to whether toxicity testing will be needed. Section 58 of the MWR indicates that toxicity testing may not be required if certain effluent conditions are met. In the case of the discharge from the Sechelt facility, the dilution ratio clause will be met. If toxicity testing is not required under the MWR, it is recommended that it be

removed from the monitoring program outlined in Table 7.1, unless there is a requirement for such testing under the Federal wastewater regulation, once it is published as a final document.

- The toxicity test is defined as the LC50 or LT50 96 hour rainbow trout bioassay. In the case where the District is required to undertake such testing, it is recommended that the pH stabilisation method (Reference Method EPS 1/RM/50) is used rather than the standard test method (Reference Method EPS 1/RM/13), which can result in pH failures due to pH drift during the test and are not related to the effluent at the time of sampling. Clarification is required with respect to wording (MWR reference 59(1)) in the recently published MWR with respect to the test procedure. It is not certain if this wording will accept the pH stabilised method without also undertaking the standard toxicity test.
- The frequency for the toxicity test is once every two years, which is consistent with the MWR, if testing is to be required under this regulation. However, when the Federal wastewater regulation is finalised, this frequency may need to be increased to quarterly.

In addition, it is recommended that influent samples are also monitored for a period of time to allow baseline data to be defined. It is recommended that influent monitoring be undertaken for $CBOD_5$, TSS, ammonia, total phosphorus, orthophosphate and pH once every two months for the first year. This can then be decreased to twice annually after the first year. Temperature should be taken on a more regular basis, e.g. daily, for process considerations. Monitoring of the influent is for process understanding only and the data do not need to be reported to the BC Ministry of Environment.

7.2 Receiving Environment Monitoring Program

Under the MWR, the receiving environment monitoring program is supposed to be defined in the environmental impact study and must address the following aspects:

- Provide at least one control sample location which is outside the influence of the initial dilution zone.
- Obtain data which will assess the potential impact of the discharge.
- Obtain data which demonstrates that the discharge will not cause water quality parameters outside the initial dilution zone to exceed water quality guidelines.

There are also comments on the need for pre-discharge data. The ability to collect pre-discharge data, as in the representation of the water quality in Trail Bay before any discharge from the District, is not possible in this case. However, it is recommended that the environmental monitoring program is initiated before the new sewage treatment plant comes on line. This will

assist in any deliberations for changes in the environment with the current facility and then with the new facility.

Concepts for monitoring a receiving environment are outlined in the CCME Strategy (2008), and the data should allow for risk-based decisions to be made in the future with respect to treatment upgrades in order to protect public health and the environment. In the draft Federal wastewater regulation, receiving environment monitoring is not a standard requirement for all discharges, but would be completed through an Environmental Effects Monitoring (EEM) program, if the discharge triggers the need to enter the EEM process.

The proposed receiving environment monitoring program is outlined in Table 7.2. In the event that the discharge triggers the EEM process, the need to complete additional environmental monitoring should be re-evaluated. In addition, it is recommended that a review of the monitoring program be undertaken 3 years after the new sewage treatment plant has been constructed. It is important that the monitoring program has the flexibility to be amended to ensure that the monitoring is focusing on potential issues and concerns with the effluent discharge.

Table 7.2: Recommended Receiving Environment Monitoring Program

Parameter (Note 1)	Sample Site (Note 2)	Frequency (Note 3)
Ammonia Orthophosphate Faecal Coliforms Temperature pH	One sample from each of the following locations: • Effluent at a location immediately before the discharge to the outfall • Mission Point Site • Selma Park Road Site • Inlet Avenue Site • Shorncliffe Road Site • One sample to be taken by boat from an area at the edge of the initial dilution zone.	Twice annually, with one sample event to occur in the summer and one sample to be taken in the middle of winter

Note 1: All parameters except temperature are to be measured at an accredited laboratory. Temperature is to be measured with appropriately calibrated equipment in the field. Samples are to be taken using standard procedures and forwarded for analysis within the appropriate holding times. Operator training is recommended before the sampling program is initiated.

Note 2: It is assumed that the Mission Point Site will be representative of an area outside of the influence of the discharge. With the exception of the initial dilution zone sample, all samples are to be taken from the shoreline.

Note 3: For consistency, the samples are all to be taken on the same day, where possible.

For discharges where the contributory population is at least 10,000 people, an annual report will be required, under the MWR. The sewage flows of 5,000 m^3/d, to which the District facility is being designed, will accommodate an ultimate population of 12,500 people. For discharges that represent a population < 10,000 people, an annual report is not required unless the BC Ministry of Environment indicates otherwise.

8.0 RELIABILITY CATEGORIES

There are three categories outlined in the MWR:

Category I relates to receiving environments which could be permanently or unacceptably damaged through the release of inadequate effluent over the short term. This includes discharges near shellfish waters and recreational waters in which direct human contact occurs.

Category II relates to receiving environments which could be permanently or unacceptably damaged through the continued release of inadequate effluent over a period of several days. This includes recreational waters.

Category III relates to treatment works not otherwise designated as Category I or Category II.

The primary concerns with the District of Sechelt is the close proximity to recreational and shellfish areas. From the information presented above, the focus for reliability is to be the disinfection system to ensure that these receiving environment activities are protected. Therefore, it is recommended that the reliability category for the disinfection process is category I. For the remaining processes, relating to the quality of BOD_5, TSS and nutrients, a reliability category of II is recommended.

9.0 SUMMARY AND RECOMMENDATIONS

There are two aspects of the current outfall location which do not meet the conditions of the MWR. These two conditions relate to effluent rising to the surface and movement towards the shore. Although it is possible that additional more sophisticated modelling may result in a different outcome, the costs to complete this type of modelling pose a significant risk considering that the outcome is likely to remain unchanged – i.e. the two criteria are still not met. In order to meet the two criteria identified, it is estimated that the current outfall would need to be extended an additional 500 m (approximately) to a depth of 60 m, possibly deeper. However, extending the outfall would only be required to comply with the specific conditions of the MWR. The concentrations of all parameters at the end of the initial dilution zone meet required standards or guidelines. Therefore, the outfall does not need to be extended to meet water quality requirements. It is recommended that the need to extend the outfall in order to meet the MWR criteria is reviewed with the BC Ministry of Environment.

Effluent criteria have been developed based on the available dilution and the risk to public health and the environment. From the evaluations, the following effluent criteria are recommended:

- Carbonaceous BOD_5 to be an average equal to or less than 25 mg/L, with a maximum of 45 mg/L, as required by the MSR for embayed marine waters. There is no public health or environmental advantage nor is there any regulatory requirement to meet a maximum effluent $CBOD_5$ concentration of 10 mg/L.
- TSS to be an average equal to or less than 25 mg/L, with a maximum of 45 mg/L, as required by the MSR for embayed marine waters. There is no public health or environmental advantage nor is there any regulatory requirement to meet a maximum effluent TSS concentration of 10 mg/L.
- Ammonia – assuming that the District selects a high rate (mechanical) sewage treatment process, there will be no requirement for ammonia treatment. This is based on the ability of the effluent to meet acute concentrations before discharge and chronic concentrations at the end of the initial dilution zone.
- Phosphorus – treatment is not required. There is no public health or environmental advantage nor is there any regulatory requirement to implement treatment for total phosphorus and orthophosphate.
- Disinfection will be required to maintain a faecal coliform concentration of less than or equal to 14/100 mL at the end of the initial dilution zone. It is recommended that the effluent faecal coliform concentration is 200/100 mL (as a geometric mean) immediately after disinfection as this will meet the end of initial dilution zone concentration and can be

achieved by standard disinfection processes. If chlorine is the method of disinfection, dechlorination will be required in order to achieve an effluent total residual chlorine concentration of less than or equal to 0.02 mg/L before discharge.

Two monitoring programs are recommended. These programs have been designed to address two needs:

- Regulatory reporting (effluent and receiving environment); and
- The provision of a greater understanding of the current process and upgrade requirements.

The monitoring programs are outlined in Section 7 of the report. Depending on the design criteria and registration parameters, there may also be the requirement for an annual report to be submitted to the BC Ministry of Environment. The trigger criterion for a report to be submitted is a serviced population of 10,000 people or more. If the population is less than 10,000 people, the BC Ministry of Environment will indicate if a report still needs to be submitted.

The primary concerns with effluent discharge from the District of Sechelt is the close proximity to recreational and shellfish areas. From the information presented above, the focus for reliability is to be the disinfection system to ensure that these receiving environment activities are protected. Therefore, it is recommended that the reliability category for the disinfection process is a category I. For the remaining processes, relating to the quality of BOD_5, TSS and nutrients, a reliability category of II is recommended. Discussion with the BC Ministry of Environment is required with respect to the usage of two reliability categories for the same facility.

10.0 REFERENCES

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Bosa, Sisto ENV:EX

File: PE-408
Correspondence

From: Joanne Harkness [jharkness@urbansystems.ca]
Sent: Friday, October 5, 2012 12:05 PM
To: Bosa, Sisto ENV:EX
Subject: RE: District of Sechelt - Draft environmental impact study

Sisto,

Many thanks for the comments. Much appreciated.

I will update the EIS report based on the comments and have asked Ken to confirm whether Dusty Road continues to receive sludge from the Ebb Tide Plant. I also believe that the hydraulic capacity of the outfall has been assessed. If so, I will add this information to the final report.

I trust that you have a good weekend and look forward to connecting with you on Squamish.

Regards,

Joanne

Dr. Joanne Harkness, R.P.Bio
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jharkness@urbansystems.ca
urbansystems.ca

From: Bosa, Sisto ENV:EX [mailto:Sisto.Bosa@gov.bc.ca]
Sent: September-26-12 3:13 PM
To: Joanne Harkness
Subject: RE: District of Sechelt - Draft environmental impact study

Joanne,

As discussed today, I am providing comments to the District of Sechelt Draft EIS and three questions in your email dated June 20, 2012.

EIS

- In general the report provides useful information relating to the nearby sensitive receiving environment (recreational and shellfish areas), effluent dispersion predictions and effluent discharge criteria;
- The location of the existing outfall (455 metres offshore at mean low water) meets and exceeds the setback distance required for both recreational and shellfish areas, provides adequate dilution and all water quality guidelines should be met at the edge of the initial dilution zone;
- It is understood that the maximum capacity of the outfall may be 4000 m3/day and that the EIS is based on a flow of 5000 m3/day. Furthermore, should the MWR registration be applied for a flow of more than 4000 m3/day, that the District will need to assess the capacity of the existing outfall and if deemed inadequate that a new outfall will be installed;

- Page 15 – the current permit maximum of 3400 m3/day in Table 4.1 should be changed to 3740 m3/day; Question – Does the 324 m3/day influent flow at the Dusty Road plant include the sludge amount received from the Ebb Tide plant?

Three questions in your email dated June 20, 2012

Please see answers below each of your questions.

Sisto

From: Joanne Harkness [mailto:jharkness@urbansystems.ca]
Sent: Wednesday, September 19, 2012 4:03 PM
To: Bosa, Sisto ENV:EX
Cc: Ken Tang (KTang@sechelt.ca); Peter Gigliotti; Jeff Rice
Subject: RE: District of Sechelt - Draft environmental impact study

Sisto,

I hope you are well and that the summer has been enjoyable.

Back in the earlier part of the summer, we spoke about the District of Sechelt's environmental impact study for the release to Trail Bay. We discussed a couple of questions on the interpretation of the MWR and their relevance to the District's EIS (see email below), and you indicated that you would willing to review a copy of the report as a draft before it is submitted with the additional registration documentation. Please find attached a copy of the draft EIS report. Any comments that you have on the report or the questions below would be appreciated.

I look forward to touching base with you in the near future to discuss further.

Regards,

Joanne

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From: Joanne Harkness
Sent: June-20-12 2:51 PM
To: sisto.bosa@gov.bc.ca
Cc: Ken Tang (KTang@sechelt.ca)
Subject: Summary of discussion - District of Sechelt

Sisto,

Many thanks for taking the time to discuss the District of Sechelt and some questions/interpretations on the MWR. As promised, below is a summary of the questions.

- Outfall extension. The modelling which has been completed indicates that the outfall IDZ is in compliance with the MWR and the concentrations at the end of the IDZ are all below the BC Water Quality Guidelines. Therefore, for a standard secondary treatment plant (BOD and TSS of 45 mg/L max and 25 mg/L average, no ammonia treatment, no phosphorus treatment) with disinfection to achieve a faecal coliform concentration of 14/100 mL at the end of the IDZ, there are no concerns with respect to public health or the environment, even during the short time periods when poor stratification in the Bay may result in effluent moving to the surface. Dilution potential is estimated to be in the order of 250:1 during the poor stratification times and around 500:1 at other times. However, there are two clauses in the MWR where the wording in the regulation has raised concerns with the engineer who completed the outfall dispersion modelling. This relates to the use of the word "maximise" in Section 99(2)(a) and the avoidance of movement towards shore (Section 99(2)(b)). In order to meet these two sections of the MWR, an outfall extension would be required, but this would not provide any additional benefit with respect to protecting public health or the environment. Given our discussion, there is a strong confidence that an outfall extension may not be required for the MWR registration, as long as the protection of public health or the environment is being maintained, as demonstrated in the EIS.

ANS - As indicated in the bullet above, the location of the existing outfall provides more than adequate dilution, no significant changes are predicted at the edge of the IDZ and as a qualified professional you have assessed that extending the outfall will not provide any additional benefit in protecting public health or the environment. As a result, MoE has no concerns with the location of the existing outfall for a maximum discharge of 5000 m3/day, based on the outfall having the capacity to handle this maximum daily flow.

- Redundancy/reliability category. The risk with this site relates to the faecal coliform concentration and the draft EIS recommends that disinfection should be assigned a reliability category of I, as defined in Sections 34 to 36 of the MWR. However, the lower risk concerns related to the other sewage treatment plant components would lead to a Category II assignment, rather than expending what could be significant capital costs to upgrade all components to Category I. It is uncertain if there is the option of selecting two different reliability categories under the MWR. From our discussion, the indication is that further time is needed for the consideration of this approach, to determine if it is acceptable. We also discussed that the EIS could always be finalised as it stands, with further comment on the reliability and redundancy to be addressed in the operations plan.

ANS – For this part of the MWR there is no information on flexibility between Categories, therefore, it is strongly assumed that any part of a qualified professional assessment indicating the more stringent category, that the more stringent reliability category apply of all applicable components of the subject wastewater treatment plant. Therefore, in this case the Reliability Category 1 applies to the new plant for the District of Sechelt. Redundancy of key components and equipment of WWTPs is vitally important in the normal operation of WWTPs. As discussed, at this time it is difficult to fully determine what components of the WWTP will need to meet Reliability Category 1 since the type and design of the WWTP and associated components is not known.

- Toxicity testing. This was more a general discussion, as the draft EIS indicates the frequency of the testing, if it is required under the MWR. Section 58 of the MWR is the main point in question. From the wording, it is possible that regular toxicity testing may not be required if any one of four criteria outlined in Section 58(2)(a to d) apply to the facility. Any further input on this interpretation would be appreciated.

ANS – Yes, if any one of the four circumstances of Section 58 (2) (a to d) are met than toxicity sampling is not required.

I look forward to discussing this with you further.

Regards,

Joanne

Dr. Joanne Harkness, R.P.Bio
Water and Wastewater Specialist

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TABLE 1 – COMPONENT AND RELIABILITY REQUIREMENTS FOR WASTEWATER FACILITIES

	Reliability Category					
	I		II		III	
Components	Treatment System	Power Source	Treatment System	Power Source	Treatment System	Power Source
blowers or mechanical aerators	multiple units	yes	multiple units	optional	2 minimum	no
aeration basins	multiple units[b]	yes	multiple units[b]	optional	single unit	no
disinfection basins	multiple units[b]	yes	multiple units[a]	yes	multiple units[a]	no
trickling filters	multiple units[b]	yes	multiple units[b]	optional	no backup	no
primary sedimentation	multiple units[a]	yes	multiple units[a]	yes	2 minimum[a]	yes
chemical sedimentation	multiple units[b]	optional	no backup	optional	no backup	no
final sedimentation	multiple units[b]	yes	multiple units[a]	optional	2 minimum[a]	no
degritting	n/a	optional	n/a	no	n/a	no
chemical flash mixer	2 minimum or backup	optional	no backup	optional	no backup	no
flocculation	2 minimum[a]	optional	no backup	optional	no backup	no
aerobic digesters	2 minimum[a]	yes	2 minimum[a]	optional	single unit	no
anaerobic digesters	2 minimum[a]	yes	2 minimum[a]	optional	2 minimum	no
effluent filters	2 minimum[b]	yes	2 minimum[b]	yes	2 minimum[b]	yes
facultative lagoons	2 cells[b]	n/a	2 cells	n/a	2 cells	n/a
aerated lagoons	2 cells[b]	yes	2 cells	optional	2 cells	no
package treatment plants	multiple units[b] or ability to repair within 48 hours	yes	2 units or ability to repair within 48 hours	yes	single unit	no

Additional component and reliability requirements

36 (1) In respect of diffuser requirements, a qualified professional must ensure that

(a) diffusers must have multiple sections, and

(b) the maximum oxygen transfer capability must not be measurably impaired with the largest section out of service.

186 ← 612
PE-4088

Assessment re: last amendment indicates that existing and including outfall issues meets or is better than criteria of MSR (at that time)

update EIS eng

Toxicity

58(2) ←

Redundancy ←

MWR

All MSR
Reliability categories must be determined based on EIS results.
Cat. 1 most stringent
Cat. 2 med. "
Cat. 3 less stringent

a
b
c
d
e

(6) A person must not discharge effluent to the ground within 30m or within the zone of influence of, a water well, unless the effluent has been disinfected.

(7) For the purposes of subsection (6), chlorination must not be used unless

(a) dechlorination is provided,

(b) the water quality in the water well will not be adversely impacted, and

(c) written permission is obtained from a director.

(8) In this section, zone of influence means the zone around a water well that in the opinion of a qualified professional supplies water to the well.

[am. B.C. Regs. 321/2004, s. 31 (c); 305/2007, s. 3.]

Toxicity

9 (1) A person must not discharge effluent, unless

(a) the discharge passes a 96 hour LC50 bioassay test as defined by Environment Canada's Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout, Reference Method, EPS 1/RM/13, or

(b) if the discharge fails a bioassay test described in paragraph (a) that was conducted at a "Regular" time as specified in Schedule 6, Table 3, the discharge passes that test as conducted as a follow up under Column 5 in Schedule 6, Table 3.

(2) Subsection (1) does not apply if

(a) the discharge is to ground,

(b) the discharge quality meets a maximum BOD_5 not exceeding 10 mg/L and a maximum TSS not exceeding 10 mg/L,

(c) the discharge does not exceed a maximum daily flow of 5 000 m^3/d and the discharger demonstrates to the satisfaction of a director that the discharge does not adversely affect the receiving environment,

(d) the discharge is to open marine waters,

(e) the discharge is diluted such that at the outside boundary of the initial dilution zone the dilution ratio exceeds 100:1 and the discharger demonstrates to the satisfaction of a director that the discharge does not adversely affect the receiving environment,

(f) reclaimed water is being provided or used in accordance with this regulation, or

(g) the discharger demonstrates to the satisfaction of a director that the discharge does not adversely affect the receiving environment.

(3) If subsection (1) applies, a person must not discharge effluent unless the discharge is monitored for toxicity in accordance with the requirements of Schedule 6, Table 3.

File PE-4058
Correspondence

test method
with the exemption

PE-4088
Outfall - 455 m / 27.5 m into Trail Bay
- embayed
- sensitive areas → shellfish beds
→ recreation waters (swimming)

capable of handling a flow = 5000 m³/d

Concerns ① effluent rising to the surface
② effluent moving towards the shore (new change in new MWR - compare MSR to MWR)

Reliability category I or II ↳ for FC ↳ to all other

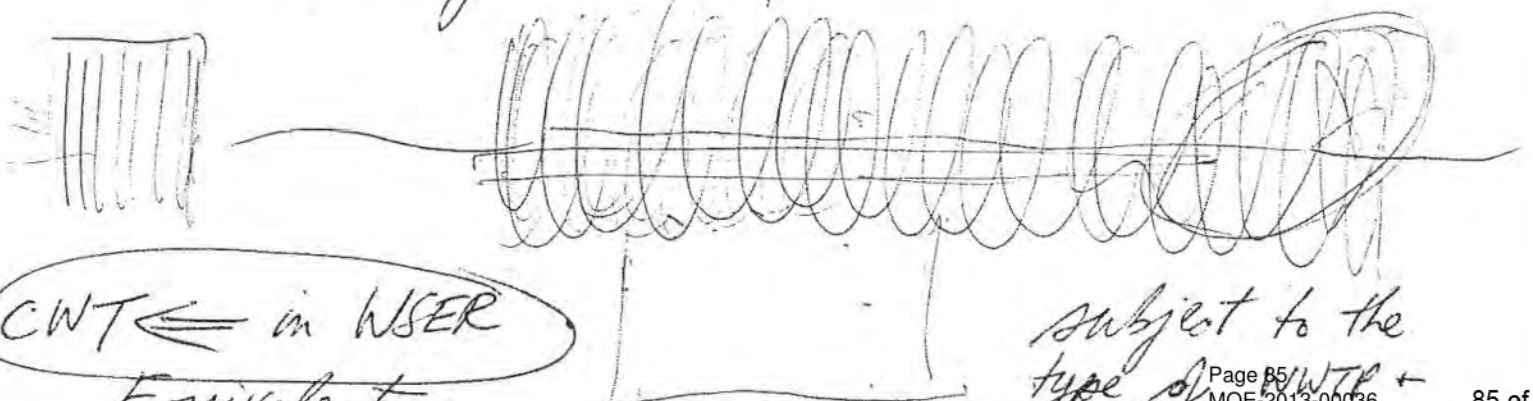
FC = 14 MPN/100 mL @ edge of IDZ
Annual rpt submitted to MoE (due to population) - refer to MWR
10,000 or more section.

Total NH3 is much greater @ Ebbtide than Dusty Rd. WWTP (due to different treatment process??)
Note un-ionized ammonia combined is more less than Fed Reg. of 1.25 mg/L @ 15°C ± 1°C
No Data @ Dusty Rd. only @ Ebbtide

Confirm max. discharge cap of outfall 4000 m³/d - Note that future MWR registration will be 5000 m³/d. ←

Monday

Don



CWT ⟸ in WSER
Equivalent -

subject to the type of WTP + associated components
→ based on

Bosa, Sisto ENV:EX

File: PE-4088

From: Braman, Jonn ENV:EX
Sent: Thursday, February 7, 2013 3:28 PM
To: Sundher, Avtar S ENV:EX; Bosa, Sisto ENV:EX
Subject: Sechelt's new WWTP

I'm guessing you guys know all about this:

http://www.civicinfo.bc.ca/302n.asp?newsid=5028&r=5034&r=5033&r=5032&r=5029&r=5030&r=5028&r=5031&r=5027&r=5026&r=5025&r=5022&r=5023&r=5024&r=5021&r=5020

Jonn Braman,
Regional Director, Tsunami Debris

BC Ministry of Environment
(604) 666-8108

Page 87 to/à Page 90

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BRITISH COLUMBIA

MINISTRY OF
ENVIRONMENT LANDS AND PARKS

POLLUTION PREVENTION PROGRAM

File: PE 4088 Correspondence

Permit No. PE-4088

Date of Inspection Mar. 27/12

PERMIT INSPECTION

Permittee District of Sechelt

Location Sechelt

A. SAMPLES TAKEN YES ☐ NO ☑

Sources Sampled

B. OBSERVATIONS AND COMMENTS:

- Inspected both Dusty Rd + Ebbtide plants
- No problems noted
- New plant near Dusty Rd is proposed by the end of 2014 - funding held.
- NW from both plants Cl_2 + ClO_2.
- Past effluent data in compliance.

C. PERMIT COMPLIANCE IN ☑ OUT ☐

Based on Site Observations.

COMMENTS:

D. ACTION REQUIRED BY PERMITTEE:

x Dave Kopp
Permittee or Representative's Signature

For Pollution Protection

Regional Office Follow-up: May 15/12 - entered on CMS SB

Insp # 2025
Lat 49.4783
Long 123.76

Original to File
Copy to Permittee

MUNICIPAL SEWAGE REGULATION
Record of Pre-Registration Meeting

http://www.env.gov.bc.ca/epd/epdpa/mpp/msrhome.html

Client Name: District of Sechelt
Project Name: New WWTP, Sechelt
Project Location:
Legal Address:

Date: Feb. 28/12
WASTE No. PE-4088

Site Address:

Attendees: see attached Agenda dated Feb. 28/12

Project Description: New WWTP to replace the 2 existing WWTPs (Chatelech + Dusty Rd.)

Municipal Sewage Regulation Review

The following sections of the MSR were reviewed with the client (check marks indicate recommended review and should be circled to verify the review was done):

MSR Section (* - optional)	Discharge to Ground	Discharge to Surface Water Course	Reclaimed Water Reuse
Section 5 - Initial Dilution Zone: Water bodies		✓	✓
Section 6 - Initial Dilution Zone: Ground	✓		✓
Section 8 - Effluent Disinfection		✓	✓
Section 9 - Toxicity		✓	
Section 10 - Use of Reclaimed Water			✓
Section 11 - Discharges to Water		✓	
Section 12 - Discharges to Ground	✓		
Section 13 - Advanced Treatment	✓	✓	
Section 14 - Design and Construction of Facility	✓	✓	✓
Section 16 - Operating Plan	✓	✓	✓
Section 22 - Operator Qualifications & Certification	✓	✓	✓
Section 26 - Discharge Monitoring	✓	✓	✓
Section 27 - Receiving Environment Monitoring	✓	✓	✓
Section 28 - Reporting Requirements	✓	✓	✓
Schedule 1: Condition 3 - Water Quality Standards	✓	✓	✓
Condition 5 & 6 - Security/Assurance Plan	✓*	✓*	✓*
Condition 8 - Environmental Impact Study	✓	✓	✓
Condition 10 -Sewage Facilities	✓	✓	✓
Condition 12 -Construction of a Facility	✓	✓	✓
Schedule 2: Standards for Reclaimed Water			✓
Schedule 3: Standards for Discharges to Water		✓	✓*
Schedule 4: Standards for Discharges into Ground	✓		✓*
Schedule 6: Monitoring Requirements	✓	✓	✓
Schedule 7: Design Standards for Sewage Facilities	✓	✓	✓
Appendix 1: Reliability Categories	✓	✓	✓
Appendix 2: Outfall Calculations		✓	✓*
Appendix 3: Health and Safety Criteria			✓

Other MSR Sections reviewed with client:

Site specific issues/concerns raised by Environmental Management to be addressed by discharger:
EIS/Op Plan/Reg Form req'd
Existing Outfall has limited capacity (≈ 5000 m³/d) - may need to be eventually replaced.

Questions raised by client:

Registration form and guidance documents provided to the client: ☐ yes ☒ no

Review done by: G. ROSA (print name) (signature)

Copy provided to: