Appendix D Environmental Risk Assessment, 2014

ENVIRONMENTAL RISK ASSESSMENT
GSSC (CAP-BRULÉ) WASTEWATER TREATMENT PLANT

Prepared for:

GREATER SHEDIAC SEWERAGE COMMISSION
DES ÉGOUTS SHEDIAC ET BANLIEUES

Greater Shediac Sewerage Commission
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Prepared by:

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FINAL REPORT
Our File No.: 11079-1
February 27, 2014

Crandall File: 11079-1
February 27, 2014

"SENT VIA E-MAIL"

Department of Environment and Local Government
P.O. Box 6000
Fredericton, N.B.
E3B 5H1

ATTENTION: Mr. Scott Lloy, M. Eng., P. Eng., Senior Water & Wastewater Engineer

Dear Sir:

Environmental Risk Assessment (ERA) Final Report
GSSC (Cap-Brulé) Wastewater Treatment Plant
Shediac, New Brunswick

Crandall Engineering Ltd. is pleased to submit on behalf of our client, the Greater Shediac Sewerage Commission (GSSC), the attached Environmental Risk Assessment (ERA) Final Report.

This Final Report provides a detailed summary of the work done, and the results of the characterization of the WWTP effluent and the receiving water at the effluent discharge point. The work was completed in accordance with the requirements of the Canadian Council of Ministers of Environment (CCME) "Strategy of Management of Municipal Wastewater Effluent".

As a result of this work, Environmental Quality Objectives (EQOs) have been identified for substances of concern in the receiving water leading to the Northumberland Strait, and Effluent Discharge Objectives (EDOs) have been determined for the WWTP effluent. It was found that the WWTP is meeting and exceeding the (NBDELG) effluent treatment objectives as stated in the Certificate of Approval to Operate.

This Final Report provides updated EDOs to reflect Crandall's new procedure for determining EQOs and EDOs. It has also been updated in response to your comments in your January 6, 2014 e-mail.

Several recommendations are made with regard to Compliance Monitoring of substances in the effluent including $CBOD_5$, TSS, un-ionized ammonia, TAN, TKN, TP, E. coli, Nitrate + Nitrite, Manganese, and Toxaphene. A recommendation is also made to repeat the Rainbow Trout and Ceriodaphnia dubia toxicity tests in September 2014. A formal *Effluent Monitoring Plan*, as required under Clause 34 of the facility's Certificate of Approval to Operate, will be provided to you by the GSSC at a later date.

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Please do not hesitate to contact us should you require any additional information.

Yours very truly,

CRANDALL ENGINEERING LTD.

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C. Mr. Joey Frenette, P.Tech., General Manager - The Greater Shediac Sewerage Commission

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ENVIRONMENTAL RISK ASSESSMENT REPORT
GSSC (CAP-BRULÉ) WASTEWATER TREATMENT PLANT

EXECUTIVE SUMMARY

1. **Introduction**: This Report presents the work done for and results of a 12-month study to assess the impact of the GSSC (Cap-Brulé) WWTP effluent's discharge into the receiving water leading to the Northumberland Strait. The receiving water for this facility was intended to be the Northumberland Strait when it was initially constructed. However, with time and tidal action on the dunes, the Northumberland Strait has been isolated and a small pond was created at the discharge pipe location as may be observed today (Appendix A). Therefore, the receiving water is no longer considered the Northumberland Strait but this small pond with no significant incoming source of water that is flushed by tidal activities from the Northumberland Strait. The 12-month study resulted in the identification of Environmental Quality Objectives (EQOs) in the receiving water leading to the Northumberland Strait and the Effluent Discharge Objectives (EDOs) required in the WWTP effluent to ensure that the receiving water's EQOs were not exceeded. This work was conducted in accordance with the procedures required by the Canadian Council of Ministers of Environment (CCME) in their "Canada-wide Strategy for Management of Municipal Wastewater Effluent".

2. **Facility Characterization**: In order to apply the correct analyses and frequency of testing of water quality parameters, it was necessary to determine the classification of the GSSC's WWTP under the CCME Guidelines. The GSSC (Cap-Brulé) facility is an aerated lagoon (secondary treatment level) facility which has ultraviolet disinfection of the effluent prior to discharge. Based on its average daily flow volume of 6,340 m^3/day as measured over the monitoring period, the Cap-Brulé facility is classified as a "medium WWTP". Based on this classification, the CCME Guidelines state a list of "Potential Substances of Concern" which are to be assessed. This list is included as Table 1 of this Report.

3. **Characterization of the Municipal Wastewater Effluent**: The CCME list of "potential substances of concern" was applied to the effluent after UV disinfection but prior to reaching the receiving water leading to the Strait. Chemical and physical analyses were carried out on the receiving water. In addition, acute and chronic toxicity studies were conducted in order to assess possible impacts on marine life. The CCME procedures required most analyses, including toxicity studies, to be carried out quarterly, but several general chemistry and nutrient parameters were analyzed bi-weekly. Samples were also analyzed in the receiving water leading to the Northumberland Strait downstream of the effluent discharge point in order to establish background levels as there was no incoming stream to the receiving water.

4. **Establishing Effluent Discharge Objectives (EDOs)**: EDO values of potential substances of concern in the effluent were determined as a function of the Environmental Quality Objectives (EQOs) in the receiving water leading to the Strait, the background levels of substances in the receiving water, and the amount of dilution achieved in the receiving water within the permissible effluent dilution plume. The maximum EDO is calculated as the concentration of a substance in the effluent which

can be added to the level of this substance already in the receiving water, adequately mixed, without exceeding the receiving water's EQO concentration.

In order to determine the amount of dilution of effluent in the receiving water, detailed information on the receiving water's cross-section and flow was required. On-site dye tests indicated that a dilution of 1 to 5 was achieved within 250 m of the discharge point but only when tidal effects were included. This area is designated as the "mixing zone".

The results of the toxicity tests are also considered in setting the EDO values. Of the eight (8) acute toxicity tests conducted, all but one (1) achieved the desired result of 1 TU_a. Of the quarterly chronic toxicity tests conducted, all but one (1) achieved the desired result of 1 TU_c (its value was 6.5 TU_c, greater than the EDO).

Although these two (2) non-ideal results may be the result of non-representative samples or other issues not related to effluent quality, since there was not 100% success in the toxicity studies a recommendation for further testing in September 2014 is being made as part of this Report.

EQOs for the receiving water at the end of the mixing zone were identified from CCME documents, and are summarized in Table 6. The EDO values for all potential substances of concern were then calculated, and are presented in Table 7. Table 8 was then developed showing a side-by-side comparison of the "Proposed EQOs", "Proposed EDOs", and "Effluent Values" from the 12-month initial characterization sampling process. It is acceptable for the EDO value to be greater than the EQO value if the level in the receiving water is lower than the EQO value.

This process as summarized in Table 8 shows that the vast majority of Substances of Potential Concern are not significant with regard to the GSSC (Cap-Brulé) WWTP effluent discharging to the receiving water leading to the Northumberland Strait, based on the downstream values as there was no incoming stream to the receiving water.

5. **Selection of Substances for Compliance Monitoring**: In accordance with CCME Technical Supplement 3: Selection of Substances for Compliance Monitoring, the list of potential substances of concern was reviewed to identify those which fell under the requirements for compliance monitoring. Compliance monitoring is done to ensure that the WWTP meets its treatment objectives, and to monitor the concentrations of substances that are near the threshold EDO values to ensure protection of the receiving water.

   In order to ensure compliance with the WWTP's "Certificate of Approval to Operate", $CBOD_5$, TSS as well as un-ionized ammonia will be analyzed every two-weeks.

EXECUTIVE SUMMARY CONTINUED

Substances near the threshold EDO levels were identified for compliance monitoring. Total ammonia nitrogen will be analyzed bi-weekly. Substances with no guideline EQO were not identified for monitoring due to the lack of "true" background concentration data. All other substances were either tested to be below the lab's reporting limit, or well below the threshold EDO levels; therefore, need not be monitored.

6. **Conclusions and Recommendations**:
    a. This ERA has carried out a comprehensive program of characterizing the GSSC (Cap-Brulé) WWTP effluent and the receiving water leading to the Northumberland Strait at the effluent discharge area.

    b. Substances of Potential Concern were identified from the CCME Strategy. Based on this list, the results of effluent monitoring, and downstream receiving water sampling, Environmental Quality Objectives were established for the receiving water and Effluent Discharge Objectives were established for the WWTP effluent.

    c. It was found that an acceptable mixing zone does not exist in the receiving water. It was found that there is no significant incoming source of water, besides the tidal influence from the Northumberland Strait, to flush the pond that has been created since the initial construction of the effluent discharge pipe.

        i. *It is recommended that* further study be conducted regarding the possibility of relocating the effluent discharge pipe to a more appropriate location where an acceptable mixing zone could be achieved. This study should include a characterization of the receiving water once a potential outfall location is selected, including the identification of dilution patterns and the determination of EQOs and EDOs specific to that location.

    d. It was found that the majority of substances on the CCME's list of Substances of Potential Concern are not significant for the GSSC (Cap-Brulé) WWTP effluent.

    e. It was found that the GSSC (Cap-Brulé) WWTP is meeting the requirements of the NB Department of Environment and Local Government "Certificate of Approval to Operate".

    f. Because two (2) of the toxicity tests did not meet the desired objectives, *it is recommended that* the Rainbow Trout and *Ceriodaphnia dubia* tests be repeated in September 2014. This can be done during the additional Study work recommended above. This will provide the additional information required to determine if operational or treatment modifications are required, or if the previous test results were simply non-representative.

EXECUTIVE SUMMARY CONTINUED

g. *It is recommended that* a program of compliance monitoring be commenced:

   i. Bi-weekly testing of the effluent for $CBOD_5$, TSS, and un-ionized ammonia, in accordance with the facility's "Certificate of Approval to Operate", Dated April 30, 2013;

   ii. Bi-weekly testing of the effluent for TAN.

h. *It is recommended that* this Report be submitted to the NB Department of Environment and Local Government to fulfill the GSSC's (Cap-Brulé) obligation under the CCME "Strategy for Management of Municipal Wastewater Effluent".

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ABBREVIATIONS

CAO: Certificate of Approval to Operate
$CBOD_5$: Carbonaceous 5-day Biochemical Oxygen Demand
CCME: Canadian Council of Ministers of the Environment
COD: Chemical Oxygen Demand

DO: Dissolved Oxygen

EDO: Effluent Discharge Objective
EQO: Environmental Quality Objective
ERA: Environmental Risk Assessment

GSSC: Greater Shediac Sewerage Commission

MDL: Method Detection Limit
mg/L: Milligrams per litre
MWWE: Municipal Wastewater Effluent
MPN: Most Probable Number

N/A: Not Applicable
NBDELG: New Brunswick Department of Environment and Local Government

PAH: Polycyclic Aromatic Hydrocarbons
PCB: Polychlorinated Biphenyls

TAN: Total Ammonia Nitrogen
TBD: To Be Determined
TKN: Total Kjeldahl Nitrogen
TP: Total Phosphorus
TSS: Total Suspended Solids
TU: Toxicity Unit

VOC: Volatile Organic Compounds

WET: Whole Effluent Toxicity

X:Y: Dilution Ratio (Effluent : Receiving Water Flow)

SECTION 1.0: INTRODUCTION

The Canadian Council of Ministers of the Environment (CCME) has developed a Canada-wide Strategy for the Management of Municipal Wastewater Effluent (MWWE). The Strategy was established in order to ensure that wastewater facility owners will have clarity in managing municipal wastewater effluent that will be protective of human health and of the surrounding environment. This Strategy includes the preparation of Environmental Risk Assessments for the effluent discharges into the receiving water.

This Environmental Risk Assessment (ERA) study was conducted on the GSSC (Cap-Brulé) facility. It is located on Cap-Brulé Road, off of Route 133, and is situated in the southeast area of New Brunswick. It is approximately 30 km from the City of Moncton. It is an aerated lagoon that has been upgraded to include an ultraviolet (UV) disinfection system at the end of the facility's treatment process.

The ERA will identify the effluent discharge objectives (EDOs) for this facility based on the strategy for the MWWE (described as environmental quality objectives, EQOs), and will be a function of the site and facility characteristics. Effluent discharge objectives (EDOs) are the effluent quality characteristics as they leave the wastewater treatment facility before the effluent enters the receiving water. These EDOs are selected so that they will result in the effluent meeting the environmental quality objectives (EQOs) at the edge of the designated mixing plume in the receiving water. This Study will also determine if the effluent is impacting the receiving environment at the edge of the specified mixing zone.

This Report includes the results obtained over a one-year period where the effluent quality from the facility was characterized (initial characterization for the year from June through June, 2011-2012) and based on these results will be determined as "protective" (a term defined by CCME), or will require further monitoring or even physical changes to the facility as a result of the analysis provided herein.

SECTION 2.0: FACILITY CHARACTERIZATION

In order to properly conduct the ERA the correct characterization of the facility, a list of substances of potential concern, as well as additional possible effluent substances due to industrial discharges, were established according to the facility size and location to appropriately set the EDOs for all relevant substances present in the MWWE.

2.1 Facility Categorization

The GSSC's (Cap-Brulé) aerated wastewater treatment facility is located on PID 01065655 and 01065663 and includes one (1) bar screen, one (1) grit chamber, one (1) two-celled aerated lagoon utilizing subsurface aerators, three (3) alternating blowers, one (1) polishing pond and one (1) UV disinfection facility.

The effluent flow rate is measured by a SCADA software system. During the initial characterization period the average flow rate of the aerated lagoon was recorded and noted to be approximately 6,340 m^3/day for the year 2011-2012. The facility is classified as a medium WWTP since the average flow rate is between 2,500 m^3/day and 17,500 m^3/day.

There were no industrial inputs observed during the initial characterization period, such as resource exploration and development, manufacturing/fabrications, processing, marine or air transport, landfill leachate, hospitals and laboratories, which exceed 5% of the total dry weather flow in the sewer on an annual average basis. Therefore, the wastewater treatment plant is correctly classified as a medium facility.

As indicated on attached drawing 11079-1D-C01 of Appendix A, the effluent from the GSSC's (Cap-Brulé) lagoon is discharged into an un-named, man-made, open channel that eventually discharges to an un-named pond, which then leads to the Northumberland Strait.

Figure 1: Outfall Pipe and Drainage Ditch to Un-named Pond

2.2 List of Potential Substances of Concern

The potential substances of concern are listed below for the medium WWTP facility of the GSSC (Cap-Brulé):

Table 1: Medium Sized Facility - Potential Substances of Concern

Test Group	Substances
General Chemistry / Nutrients	Fluoride Nitrate Nitrate + Nitrite Total Ammonia Nitrogen Total Kjeldahl Nitrogen (TKN) Total Phosphorus (TP) Total Suspended Solids (TSS) Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) Chemical Oxygen Demand (COD) Cyanide (total) pH Temperature
Metals	Aluminium, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, molybdenum, nickel, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc, arsenic, antimony, selenium and mercury
Pathogens	E. *coli* Faecal coliform
Organochlorine Pesticides	Alpha-BHC, endosulfan (I and II), endrin, heptachlor epoxide, lindane (gamma-BHC), mirex, DDT, methoxychlor, aldrin, dieldrin, heptachlor, a-chlordane and g-chlordane, toxaphene
Polychlorinated Biphenyls (PCBs)	Total PCBs
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, methylnaphthalene, naphthalene, phenanthrene, pyrene
Volatile Organic Compounds (VOCs)	Benzene, bromodichloromethane, bromoform, carbon tetrachloride, chlorobenzene, chlorodibromomethane, chloroform, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, dichloromethane, ethylbenzene, 1,1,1,2-tetrachloroethane, 1,1,2,2-tetrachloroethane, tetrachloroethene, toluene, trichloroethene, vinyl chloride, m/p-xylene, o-xylene
Phenolic Compounds	2,3,4,6-tetrachlorophenol, 2,4,6-trichlorophenol, 2,4-dichlorophenol, pentachlorophenol
Surfactants	Non-ionic and anionic

Samples of these substances have been obtained by grab sampling at the lagoon disinfection building or the outfall structure after the UV disinfection equipment and the "Rectangular notch" weir plate. They have also been sampled approximately 250 m downstream (sampled seasonally) of the facility for the duration of the one-year initial characterization period as there was no incoming stream to the pond as shown in the attached drawing in Appendix A.

The levels of the substances being discharged were then assessed as being protective of the environment or requiring compliance monitoring.

It is to be noted that regardless of the one-year initial characterization results TSS and $CBOD_5$ will be selected for ongoing compliance monitoring as outlined in *Technical Supplement 3* of the CCME strategy as they monitor the efficiency of the facility's treatment.

2.3 Industrial Discharges

The industries located in the GSSC - Cap-Brulé area are primarily service industries and include a health center, motels, pharmacy and restaurants that do also contribute to the municipal waste. There is also some small-scale seasonal seafood processing. However, the industrial input does not exceed 5% of the total dry weather flow of the MWWE as mentioned in CCME section 2.1 – Facility Categorization.

The industrial discharges to the GSSC (Cap-Brulé) facility have not changed during the initial characterization program over the period of 2011-2012.

SECTION 3.0: PREPARE CHARACTERIZATION OF MWWE

The initial characterization program included monitoring of the selected substances, sampling for the toxicity tests, and frequent sampling of the facility over a one-year period to complete the initial characterization program.

3.1 Substances to be Monitored

For the initial characterization of the assessment, the substances of potential concern that are listed in Table 1 of Section 2.2 – List of Substances of Potential Concern were monitored according to the facility size as demonstrated in Table 2 of Section 3.3 – Sampling Frequency.

3.2 Select Toxicity Testing Methods

For a "medium" facility, acute and chronic toxicity testing was required in accordance with the Strategy. Tests were done using the following methods:

1. The acute toxicity tests were carried out utilizing Rainbow Trout as well as *Daphnia magna* in six (6) different concentrations for a period of 96 hours. The acute test allows for screening of concentrations high enough to cause effects over a short exposure time. The samples for these tests required a disinfected effluent sample, prior to coming into contact with the receiving water.

2. The chronic toxicity tests were carried out utilizing *Ceriodaphnia dubia*. Chronic tests conducted over a period of seven (7) or more days to determine whether there were any sub lethal effects such as inhibited growth or reproduction resulting from exposure to the effluent. These tests required a disinfected effluent sample and were tested at different dilutions.

The acute and chronic toxicity tests were done quarterly (January, March, June and September), in accordance with the Strategy for the initial characterization of the facility over a period of one (1) year as shown in Table 2, Section 3.3 – Sampling Frequency. During the on-site toxicity sampling, photographs of the site conditions were taken on the different sampling dates (fall: September 19, 2011, winter: January 23, 2012, spring: March 19, 2012 and summer: June 21, 2012) as shown in the Figures below:

Figure 2a: GSSC Lagoon
(Fall Conditions)

Figure 2b: Small Open Channel to Un-named Pond

Figure 3a: GSSC Lagoon
(Winter Conditions)

Figure 3b: Northumberland Strait
(Ice covered – No Sampling)

Figure 4a: GSSC Lagoon
(Spring Conditions)

Figure 4b: Un-named Pond
(Sampling Point)

Figure 5a: GSSC Lagoon
(Summer Conditions)

Figure 5b: Northumberland Strait
(Sampling Point)

The results of the quarterly toxicity sampling carried out on the GSSC (Cap-Brulé) effluent are presented in Section 4.4 - Finding Toxicological EQOs, and the laboratory analyses are attached in Appendix B for reference. Effluent samples for toxicity testing were collected quarterly by GSSC's General Manager and Crandall's Personnel and sent to Buchanan Environmental Ltd. in Fredericton, N.B. for analysis.

3.3 Sampling Frequency

Based on the size of the facility and the potential substances of concern listed in Table 1, the following Table identifies the sampling frequency required for the initial characterization program over the year 2011-2012.

Table 2: Monitoring for Substances and Test Groups for Initial Characterization
(monitored over one (1) year continuous discharge)

Facility Size	$CBOD_5$, TSS, Pathogens and Nutrients[1]	Substances and Test Groups[2]	Acute Toxicity	Chronic Toxicity
Medium	Biweekly	Quarterly	Quarterly	Quarterly

[1] Nutrients include total ammonia nitrogen, TKN (ammonia + organic N) and total phosphorus. Temperature and pH must also be measured to determine the level of toxicity of ammonia. Dissolved Oxygen (DO) must also be measured to determine if the effluent will create an oxygen deficiency, which will also be verification for the $CBOD_5$. Pathogens include E.*coli*. and Faecal coliform.

[2] Substances and test groups include fluoride, nitrate, nitrate+nitrite, total extractable metals, metal hydrides, COD, organochlorine pesticides, PCBs, PAHs, cyanide (total), pH, VOCs, mercury, phenolic compounds and surfactants.

The GSSC (Cap-Brulé) facility Operators sampled for $CBOD_5$, TSS, pathogens and nutrients (including dissolved oxygen, temperature and pH) every two (2) weeks, and recorded the facility's average daily flow rate. The samples were sent to the Province of New Brunswick certified laboratory in Fredericton, N.B. and the results were passed on to Crandall to be included in this report. Crandall sampled for Substances and Test Groups every three (3) months. The samples were sent to RPC's certified laboratory in Moncton, N.B. The laboratory analyses are attached in Appendix C for reference.

3.4 Other Considerations

Sampling downstream of the effluent discharge location leading to the pond and the Northumberland Strait was also conducted quarterly (to represent the different seasons, as shown in Figures 4b and 5b above) by personnel from Crandall Engineering Ltd. No upstream sample was possible at the Cap-Brulé discharge pipe location as it discharges to a pond with no other incoming stream until it reaches Des Boudreau Lake. Therefore, the downstream concentrations of potential substances of concern were used in the EDO calculations (see Section 4.11 - Development of the EDOs). This was not an ideal situation and will be addressed in the Recommendations.

Furthermore, the downstream sampling during the winter months was not possible as the Northumberland Strait was completely covered with ice and snow. Crandall personnel were concerned about the safety risks and therefore did not attempt to sample during this season.

The downstream sampling location is the water leading to the Northumberland Strait, not the shallow basin following the man made trench from the wastewater treatment facility. When the lagoon was constructed in 1971, the receiving water was intended to be the Northumberland Strait. However, over time the sand dunes began to form and started to slowly limit the flow into the Northumberland Strait, producing a shallow pond.

It is not possible to tell what the receiving water environment will look like in the future; however, a new outfall pipe may be required in the long term in order to continue to discharge within the Northumberland Strait as was intended initially. If the discharge pipe is relocated in the future, additional testing should be done in the new proposed discharged area. The new area is also recommended to have an inflowing stream to further contribute to the mixing of the effluent within the receiving water. Therefore, **additional upstream sampling and field investigations** would be required in that location as part of the recommended studies on the relocation of the outfall.

During the downstream sampling, some aquatic life was observed to be present in the sampling environment. There were also a few different kinds of birds flying and nesting in the sampling area.

The downstream samples were also sent to RPC in Moncton, N.B. and the laboratory analyses area attached in Appendix C for reference.

SECTION 4.0: IMPLEMENTING THE INITIAL CHARACTERIZATION PROGRAM

The single discharge ERA begins with the CCME guidelines, to first establish the EQOs for the receiving environment. EQOs for the receiving water are defined as numerical concentrations or narrative statements developed to protect the most sensitive designated use at a site, in this case the GSSC (Cap-Brulé) WWTP discharge area. The following steps will identify the EQOs for this specific site location, which will then be used to establish the EDOs.

4.1 Water Uses on Northumberland Strait

The MWWE could affect the health of the ecosystem if not carefully regulated. The CCME guidelines will be used based on the protection of aquatic/marine life values, as well as the downstream values in order to determine an appropriate effluent discharge objective for this site specific area.

Figure 6: Northumberland Strait near the GSSC (Cap-Brulé) Facility
(September 19, 2011)

Figure 6 shows the Northumberland Strait, which is approximately 450 m downstream from the lagoon location. The downstream environment as examined at this location downstream has some signs of aquatic life as mentioned in Section 3.4 – Other Considerations. A sub-surface investigation for fish or other aquatic life not otherwise visible was not carried out. However, it is known that fishing is commonly done within the Northumberland Strait.

4.2 Identifying EQOs

The CCME Guidelines based on the protection of aquatic/marine life (as mentioned previously) will be used as the identification of the EQOs. The values for each substance of potential concern are shown in Table 3 below. The Guideline values were found from the CCME website.

Table 3: CCME Water Quality Values

Test Group	Substances	CCME EQOs (mg/L)	
		Freshwater	Marine
General Chemistry / Nutrients	Fluoride	N/A	N/A
	Nitrate	13.00	16.00
	Nitrate+Nitrite	N/A	N/A
	TAN (measured)	1.7[2]	N/A
	Un-ionized NH_3 (calculated)	N/A	*N/A*
	TKN	N/A	N/A
	TP	N/A	N/A
	TSS	N/A	25.00
	$CBOD_5$	N/A	N/A
	COD	N/A	N/A
	Cyanide (total)	0.005	N/A
	pH (units)	6.5-9.0	7.0-8.7
	Temperature (°C)	N/A	±1
Metals	Aluminum	See Note[3]	N/A
	Barium	N/A	N/A
	Beryllium	N/A	N/A
	Boron	1.50	N/A
	Cadmium	See Note[4]	0.00012
	Chromium (total)	N/A	N/A
	Cobalt	N/A	N/A
	Copper	See Note[5]	N/A
	Iron	0.30	N/A
	Lead	See Note[6]	N/A
	Manganese	N/A	N/A
	Molybdenum	0.073	N/A
	Nickel	See Note[7]	N/A
	Silver	0.0001	N/A
	Strontium	N/A	N/A
	Thallium	0.0008	N/A
	Tin	N/A	N/A
	Titanium	N/A	N/A
	Uranium	0.015	N/A
	Vanadium	N/A	N/A
	Zinc	0.03	N/A
	Arsenic	0.005	0.0125
	Antimony	N/A	N/A
	Selenium	0.001	N/A
	Mercury	N/A	N/A
Pathogens	E.*coli* (MPN/100mL)	N/A	N/A
	Faecal coliform (MPN/100mL)	N/A	N/A

Table 3: CCME Water Quality Values (Cont'd)

Test Group	Substances	CCME EQOs (mg/L)	
		Freshwater	Marine
Organochlorine Pesticides	Alpha-BHC	N/A	N/A
	Endosulfan (I and II)	0.0000003	0.000002
	Endrin	N/A	N/A
	Heptachlor epoxide	N/A	N/A
	Lindane (gamma-BHC)	0.00001	N/A
	Mirex	N/A	N/A
	DDT	N/A	N/A
	Methoxychlor	N/A	N/A
	Aldrin	N/A	N/A
	Dieldrin	N/A	N/A
	Heptachlor	N/A	N/A
	a-Chlordane	N/A	N/A
	g-Chlordane	N/A	N/A
	Toxaphene	N/A	N/A
PCBs	Total PCBs	N/A	N/A
PAHs	Acenaphthene	0.0058	N/A
	Acenaphthylene	N/A	N/A
	Anthracene	0.000012	N/A
	Benzo(a)anthracene	0.000018	N/A
	Benzo(a)pyrene	0.000015	N/A
	Benzo(b)fluoranthene	N/A	N/A
	Benzo(g,h,i)pyrelene	N/A	N/A
	Benzo(k)fluoranthene	N/A	N/A
	Chrysene	N/A	N/A
	Dibenz(a,h)anthracene	N/A	N/A
	Fluoranthene	0.00004	N/A
	Fluorene	0.003	N/A
	Indeno(1,2,3-cd)pyrene	N/A	N/A
	Methylnaphthalene	N/A	N/A
	Naphthalene	0.0011	0.0014
	Phenanthrene	0.0004	N/A
	Pyrene	0.000025	N/A

Table 3: CCME Water Quality Values (Cont'd)

Test Group	Substances	CCME EQOs (mg/L)	
		Freshwater	Marine
VOCs	Benzene	0.37	0.11
	Bromodichloromethane	N/A	N/A
	Bromoform	N/A	N/A
	Carbon tetrachloride	0.0133	N/A
	Chlorobenzene	N/A	N/A
	Chlorodibromomethane	N/A	N/A
	Chloroform	0.0018	N/A
	1,2-Dichlorobenzene	0.0007	0.042
	1,4-Dichlorobenzene	0.026	N/A
	1,2-Dichloroethane	0.1	N/A
	1,1-Dichloroethene	N/A	N/A
	Dichloromethane	0.0981	N/A
	Ethylbenzene	0.09	0.025
	1,1,1,2-Tetrachloroethane	N/A	N/A
	1,1,2,2-Tetrachloroethane	N/A	N/A
	Tetrachloroethene	0.002	0.215
	Toluene	N/A	N/A
	Trichloroethene	N/A	N/A
	Vinyl chloride	N/A	N/A
	m/p-Xylene	N/A	N/A
	o-Xylene	N/A	N/A
Phenolic Compounds	2,3,4,6-tetrachlorophenol	N/A	N/A
	2,4,6-trichlorophenol	N/A	N/A
	2,4-Dichlorophenol	N/A	N/A
	Pentachlorophenol	0.0005	N/A
Surfactants	Non-ionic	N/A	N/A
	Anionic	N/A	N/A

[1]Dissolved Oxygen will be calculated by using the Streeter-Phelps DO sag equation in Section 4.10 - Development of EDOs as verification of the $CBOD_5$ values.

[2]Note that the total ammonia nitrogen is dependent on the pH and temperature values for freshwater or marine. The CCME guideline presents the recommended maximum total ammonia nitrogen concentration in mg/L in a Table depending on temperature and pH shown below for easier reference.

Water Quality Guidelines for Total Ammonia for the Protection of Aquatic Life ($mg/L\ NH_3$) as a Function of Temperature and pH

		pH							
		6.0	6.5	7.0	7.5	8.0	8.5	9.0	10.0
Temp (°C)	0	231	73.0	23.1	7.32	2.33	0.749	0.25	0.042
	5	153	48.3	15.3	4.84	1.54	0.502	0.172	0.034
	10	102	32.4	10.3	3.26	1.04	0.343	0.121	0.029
	15	69.7	22.0	6.98	2.22	0.715	0.239	0.089	0.026
	20	48.0	15.2	4.82	1.54	0.499	0.171	0.067	0.024
	25	33.5	10.6	3.37	1.08	0.354	0.125	0.053	0.022
	30	23.7	7.50	2.39	0.767	0.256	0.094	0.043	0.021

Source: CCME - Canadian Environmental Quality Guidelines Summary Table, Web site: http://st-ts.ccme.ca/

Based on the upstream pH of approximately 7.8 units and a temperature of approximately 11.9°C the generic EQO of total ammonia nitrogen for freshwater is approximately 1.7 mg/L.

[3] Note that if pH is less than 6.5, the allowable concentration is 0.005mg/L and for pH values equal to or greater than 6.5, the allowable concentration is 0.1mg/L.

[4] Note the allowable concentration is calculated with the following formula:

Equation 1 – Cd Concentration: $Cadmium\ concentration=10^{0.83[log10(hardness)]-2.46}/1000\ [mg/L]$

[5] Note the minimum allowable concentration is 0.002mg/L and the maximum allowable concentration is 0.04 mg/L, regardless of water hardness. Given the water hardness the allowable concentration may be calculated with the following formula:

Equation 2 – Cu Concentration: $Copper\ concentration=e^{0.8545[ln(hardness)]-1.465}*0.2ug/L*1000\ [mg/L]$

[6] Note that minimum allowable concentration is 0.001mg/L regardless of water hardness. However, given the water hardness the allowable concentration may also be calculated with the following formula:

Equation *3* – Pd Concentration: $Lead\ concentration=e^{1.273[ln(hardness)]-4.705}*1000\ [mg/L]$

[7] Note that minimum allowable concentration is 0.025mg/L regardless of water hardness. However, given the water hardness the allowable concentration may also be calculated with the following formula:

Equation *4* – Ni Concentration: $Nickel\ concentration=e^{1.76[ln(hardness)+1.06}*1000\ [mg/L]$

4.3 Characterizing the Receiving Water

In order to properly characterize the MWWE receiving environment, field studies were conducted during the different seasons (except for the winter season due to ice formation causing safety concerns to the sampling personnel as described in Section 3.4 – Other Considerations) around the GSSC (Cap-Brulé) facility to obtain relevant chemical and physical information.

The downstream water quality levels of the water leading to the Northumberland Strait are shown in the following Table. The September 1, 2011 values from the initial field investigations by NATECH have also been added to provide additional information on the downstream characteristics for this study. Note that although it is not ideal, the downstream concentrations were used in EDO calculations due to the lack of an incoming stream.

Table 4: Downstream Water Quality Levels

Test Group	Substances	Sept. 1, 2011 (mg/L)	Fall 2011 (mg/L)	Winter 2011 (mg/L)	Spring 2012 (mg/L)	Summer 2012 (mg/L)	Average 2011-12 (mg/L)
General Chemistry / Nutrients	Fluoride	1.68	1.65		0.84	1.67	1.46
	Nitrate	<0.05	<0.05		<0.05	<0.05	<0.05
	Nitrate + Nitrite	<0.05	<0.05		<0.05	<0.05	<0.05
	TSS	<5.00	5		6	5	5.25
	$CBOD_5$	<6.00	<6.00		<6.00	<6.00	<6
	Total Ammonia Nitrogen	0.13	0.17		1.96	<0.05	0.58
	Un-ionized NH_3 (calculated)	*0.00456*	*0.0029*	N/A	*0.00448*	*0.000846*	*0.00319*
	TKN	0.5	<0.25		2	<0.25	0.75
	TP	0.035	0.068		0.347	0.026	0.119
	COD	---	870		50	300	407
	Cyanide (total)	<0.002	<0.002		0.004	<0.01	0.0045
	pH	7.9	7.9		7.5	7.8	7.78
	Temperature	22.0	12.0		-1.5	15.0	5-15±10
Metals	Aluminum	<0.05	<0.05		0.08	0.07	0.063
	Barium	<0.05	<0.05		0.05	<0.05	0.05
	Beryllium	<0.005	<0.005		<0.001	<0.05	0.015
	Boron	3.96	3.83		1.18	3.22	3.05
	Cadmium	<0.0005	<0.0005		<0.0001	<0.05	0.013
	Chromium	<0.05	<0.05		<0.01	<0.05	0.04
	Cobalt	<0.005	<0.005		<0.001	<0.05	0.015
	Copper	<0.05	<0.05		<0.01	<0.05	0.04
	Iron	2.1	<1		0.5	<0.05	0.91
	Lead	<0.005	<0.005		<0.001	<0.05	0.015
	Manganese	<0.05	<0.05		0.23	<0.05	0.095
	Molybdenum	0.024	0.012		0.003	<0.05	0.022
	Nickel	<0.05	<0.05	N/A	<0.01	<0.05	0.04
	Silver	<0.005	<0.005		<0.001	<0.05	0.015
	Strontium	6.5	6.7		2	0.704	5.56
	Thallium	<0.005	<0.005		<0.001	<0.05	0.015
	Tin	<0.005	<0.005		<0.001	<0.05	0.015
	Titanium	---	<0.05		0.005	<0.05	0.035
	Uranium	<0.005	<0.005		<0.001	<0.05	0.015
	Vanadium	<0.05	<0.05		<0.01	<0.05	0.04
	Zinc	<0.05	<0.05		<0.01	<0.05	0.04
	Arsenic	<0.05	<0.05		0.01	<0.05	0.04
	Antimony	<0.005	<0.0005		<0.01	<0.05	0.015
	Selenium	<0.05	<0.05		0.01	<0.05	0.04
	Mercury	<0.000025	<0.000025		<0.000025	<0.000025	<0.000025

Table 4: Downstream Water Quality Levels (Cont'd)

Test Group	Substances	Sept. 1, 2011 (mg/L)	Fall 2011 (mg/L)	Winter 2011 (mg/L)	Spring 2012 (mg/L)	Summer 2012 (mg/L)	Average 2011-12 (mg/L)
Pathogens	E. *coli* (CFU/100mL)	22**	10	N/A	160	2	49
	Faecal coliform(CFU/100mL)	22**	40		580	4	162
Organochlorine Pesticides	Alpha-BHC	N/A	<0.00001	N/A	<0.00001	<0.00001	<0.00001
	Endosulfan		<0.00001		<0.00001	<0.00001	<0.00001
	Endrin		<0.00001		<0.00001	<0.00001	<0.00001
	Heptachlor epoxide		<0.00001		<0.00001	<0.00001	<0.00001
	Lindane (gamma-BHC)		<0.00001		<0.00001	<0.00001	<0.00001
	Mirex		<0.00001		<0.00001	<0.00001	<0.00001
	DDT		<0.00001		<0.00001	<0.00001	<0.00001
	Methoxychlor		<0.00001		<0.00001	<0.00001	<0.00001
	Aldrin		<0.00001		<0.00001	<0.00001	<0.00001
	Dieldrin		<0.00001		<0.00001	<0.00001	<0.00001
	Heptachlor		<0.00001		<0.00001	<0.00001	<0.00001
	a-Chlordane		<0.00001		<0.00001	<0.00001	<0.00001
	g-Chlordane		<0.00001		<0.00001	<0.00001	<0.00001
	Toxaphene		<0.0001		<0.0001	<0.00001	<0.00007
PCBs	Total PCBs	N/A	<0.0001	N/A	<0.0001	<0.0001	<0.0001
PAHs	Acenaphthene	N/A	<0.00001	N/A	<0.00001	<0.00001	<0.00001
	Acenaphthylene		<0.00001		<0.00001	<0.00001	<0.00001
	Anthracene		<0.00001		<0.00001	<0.00001	<0.00001
	Benzo(a)anthracene		<0.00001		<0.00001	<0.00001	<0.00001
	Benzo(a)pyrene		<0.00001		<0.00001	<0.00001	<0.00001
	Benzo(b)fluoranthene		<0.00001		<0.00001	<0.00001	<0.00001
	Benzo(g,h,i)perylene		<0.00001		<0.00001	<0.00001	<0.00001
	Benzo(k)fluoranthene		<0.00001		<0.00001	<0.00001	<0.00001
	Chrysene		<0.00001		<0.00001	<0.00001	<0.00001
	Dibenz(a,h)anthracene		<0.00001		<0.00001	<0.00001	<0.00001
	Fluoranthene		<0.00001		<0.00002	<0.00001	<0.000013
	Fluorene		<0.00001		<0.00001	<0.00001	<0.00001
	Indeno(1,2,3-cd)pyrene		<0.00001		<0.00001	<0.00001	<0.00001
	Methylnaphthalene		<0.00005		<0.00005	<0.00005	<0.00005
	Napththalene		<0.00005		<0.00005	<0.00005	<0.00005
	Phenanthrene		<0.00001		<0.00002	<0.00001	<0.000013
	Pyrene		<0.00001		<0.00001	<0.00001	<0.00001

Table 4: Downstream Water Quality Levels (Cont'd)

Test Group	Substances	Sept. 1, 2011 (mg/L)	Fall 2011 (mg/L)	Winter 2011 (mg/L)	Spring 2012 (mg/L)	Summer 2012 (mg/L)	Average 2011-12 (mg/L)
VOCs	Benzene	N/A	<0.0005	N/A	<0.0005	<0.0005	<0.0005
	Bromodichloromethane		<0.0005		<0.0005	<0.0005	<0.0005
	Bromoform		<0.0005		<0.0005	<0.0005	<0.0005
	Carbon tetrachloride		<0.0005		<0.0005	<0.0005	<0.0005
	Chlorobenzene		<0.0005		<0.0005	<0.0005	<0.0005
	Chlorodibromomethane		<0.0005		<0.0005	<0.0005	<0.0005
	Chloroform		<0.0005		<0.0005	<0.0005	<0.0005
	1,2-dichlorobenzene		<0.0005		<0.0005	<0.0005	<0.0005
	1,4-dichlorobenzene		<0.0005		<0.0005	<0.0005	<0.0005
	1,2-dichloroethane		<0.0005		<0.0005	<0.0005	<0.0005
	1,1-dichloroethene		<0.0005		<0.0005	<0.0005	<0.0005
	Dichloromethane		<0.005		<0.005	<0.005	<0.005
	Ethylbenzene		<0.0005		<0.0005	<0.0005	<0.0005
	1,1,1,2-Tetrachloroethane		<0.0005		<0.0005	<0.0005	<0.0005
	1,1,2,2-Tetrachloroethane		<0.0005		<0.0005	<0.0005	<0.0005
	Tetrachloroethene		<0.0005		<0.0005	<0.0005	<0.0005
	Toluene		<0.0005		<0.0005	<0.0005	<0.0005
	Trichloroethene		<0.0005		<0.0005	<0.0005	<0.0005
	Vinyl chloride		<0.0005		<0.0005	<0.0005	<0.0005
	m/p-Xylene		<0.0005		<0.0005	<0.0005	<0.0005
	o-Xylene		<0.0005		<0.0005	<0.0005	<0.0005
Phenolic Compounds	2,3,4,6-Tetrachlorophenol	N/A	<0.0001	N/A	<0.0001	<0.0001	<0.0001
	2,4,6-Trichlorophenol		<0.0001		<0.0001	<0.0001	<0.0001
	2,4-Dichlorophenol		<0.0001		<0.0001	<0.0001	<0.0001
	Pentachlorophenol		<0.0001		<0.0001	<0.0001	<0.0001
Surfactants	Non-ionic	N/A	N/A	N/A	<0.0005	<0.0005	<0.0005
	Anionic				<0.0001	<0.00005	0.000075
Receiving Water Property	Hardness (mg/L $CaCO_3$)	5180	5140	N/A	1570	4950	4210
	Flow (m^3/day)	22,045	N/A	N/A	16,485	20,067	19,532

*The winter values are not applicable as the Northumberland Strait was covered with ice and sampling was not possible due to safety reasons.

**NATECH used the units of MPN/100 mL, however, the E. *coli* for the upstream results were analyzed by RPC in Moncton, N.B. The units used are CFU/100mL. The effluent values (Table 8), analyzed by Department of Environment Laboratory in Fredericton, N.B., used units of MPN/100mL (as did NATECH). The units differ due to the different techniques used by the two different accredited laboratories. However, both laboratories run proficiency testing in order to achieve similar results. Therefore, the units used throughout the report for E. *coli* will be MPN/100mL.

The average downstream total Kjeldahl nitrogen concentration value was measured to be approximately 0.75 mg/L. In this case, the receiving water TKN values are demonstrating hyper-eutrophic levels.

The average downstream total phosphorus concentration value was measured to be approximately 0.119 mg/L. In this case, the receiving water total phosphorus values are demonstrating hyper-eutrophic levels.

The current velocity in the receiving basin was calculated by NATECH Environmental to be an average of 0.18 m/s near the inlet to the Northumberland Strait on September 1, 2011, during a falling tide. The initial Field Investigation Report is attached in Appendix D of this Report.

The following gauge information from Palmers Creek was used to approximate the 10 year – 7 day dry weather flow rate of the receiving water (the 10 year – 7 day dry weather flow rate in a watercourse is accepted as the critical flow to which discharges such as this be related to):

- Gauge: Palmers Creek Drainage Basin – Year 2010
  (Source: Université de Moncton – Climatic and Hydroscience Lab - http://www.umoncton.ca/hydro/node/14)
- 10 Yr – 7 day dry weather flow (average): 25 L/s
- Drainage Basin: 34.2 km^2
- Map Reference: 01BU004

The drainage area of the receiving water up to the WWTP discharge location into the pond leading to the Northumberland Strait was identified from mapping and contours. The drainage area was then compared to the area of the reference gauge (Palmers Creek) to approximate the 10 year – 7 day dry weather flow of the receiving water. This was summarized as follows:

- Receiving Water: Pond leading to the Northumberland Strait
- Drainage Basin: 15.4 km^2
- Drainage Basin Ratio: 15.4 km^2 / 34.2 km^2 = 45%
- 10 year – 7 day dry weather flow: 25 L/s x 45% = 11.3 L/s

The critical flow rate of the stream was estimated to be 11.3 L/s (976.3 m^3/day).

4.4 Identifying Toxicological EQOs

The toxicological EQOs may be based on either the acute or chronic toxicity tests. The methodologies of these tests were explained in Section 3.2 – Select Toxicity Testing Methods.

Toxicological EQOs are expressed as Toxicity Units (TUs). These values are obtained by dividing 100% by the minimum percentage of effluent that produces an effect on the aquatic life being tested. The lower this threshold concentration level, the higher the value of the TU and more toxic is the effluent. If there is no effect at 100% effluent, the TU is 1.0, which is the ideal value.

In terms of objectives, the acute toxicological EQO is 1 TU_a at the end of the effluent discharge pipe, without dilution, to avoid acute lethality within the mixing zone. For chronic toxicity, the EQO objective is 1 TU_c at the end of the mixing zone, to avoid any long-term effects on aquatic life.

Because the acute toxicological EQO must be met at the end of the discharge pipe, the acute EDO is 1TU_a. The chronic EDO for this facility is 1.8 TU_c, calculated as follows:

Equation 5 - Chronic Toxicity Effluent Discharge Objective (EDO)

$$EDO = 1TU_c \frac{(Q_e + ff * Q_s)}{Q_e}$$

Where,

Q_e = effluent discharge flow rate,
Q_s = average upstream flow rate,
ff = fraction of flow (25%)

For the GSSC's (Cap-Brulé) aerated facility, wastewater samples for the acute and chronic toxicity tests were obtained from the effluent discharge following the UV disinfection treatment equipment and the "Rectangular notch" weir plate. The sample was tested by Buchanan Environmental Ltd. in Fredericton, N.B. (Refer to Appendix B for results of the complete tests.)

Figure 7: MWWE Toxicity Test Sampling Location - "Rectangular notch" Weir
(January 23, 2012)

The results showed that the acute toxicity test was non-lethal for both the Rainbow Trout and *Daphnia magna* Bioassays. There were:

- 10 Rainbow Trout in 25 L of aerated lagoon effluent with no fatalities **except for one (1) test during the month of September with $TU_a > 1$**; and,
- 10 Daphnids in 150 mL of aerated lagoon effluent with no fatalities.

The sub-lethal chronic toxicity test was conducted on *Ceriodaphnia dubia* to test growth and reproduction of the species. The chronic toxicity test result was equal to 1 TU_c for *Ceriodaphnia dubia* for three (3) of the quarterly tests. **However, there was one (1) test during the September sampling that had $TU_c > 1$.**

Table 5: Summary of Toxicity Test Results

Substances		Units	June	September	January	March
Acute	Rainbow Trout	TU_a	1	1.4[1]	1	1
	Daphnia magna	TU_a	1	1	1	1
Chronic	*Ceriodaphnia dubia*	TU_C	1	6.5[2]	1	1

[1] at an effluent concentration of 70.71 %
[2] at an effluent concentration of 15.45 %

It is reasonable to assume that the sample collected in September may not have been a good representation of the facility's treated effluent, as all other results during the year have passed. Additional toxicity tests will be recommended for Rainbow Trout and Ceriodaphnia dubia in September 2014.

4.5 Definition of Mixing Zones

The mixing zone is the defined portion of the receiving water that dilutes the MWWE. The water quality beyond the mixing zone boundary must meet the EQOs in order to be protective of the aquatic life that may be found in this area.

The physical size of the mixing zone is not fixed but varies with time according to the effluent flow rate, design of the outfall, ambient properties of the receiving water (depth, velocity, density, etc.), tidal influences and concentrations of the substances in both the receiving environment and the effluent.

NBDELG has stated that in terms of defining the allowable mixing zone, a near-field (where mixing is controlled largely by the addition of the effluent) dilution of 1:100, and a far-field (where mixing is controlled more by ambient processes such as turbulence and wave action) dilution of 1:1000 shall be the limits. Furthermore, NBDELG dictate that the mixing zone shall not be assumed to use more than 25% (1/4) of the flow in the receiving water and extend no more than 250 m downstream of the discharge pipe before the desired dilution is achieved.

The water body is considered protected even if the environmental values are exceeded within the mixing zone, as long as the effluent does not cause significant mortality inside the zone and respects the environmental values (EQOs) at the end of the zone.

4.6 Criteria for Defining the Mixing Zone

The following criteria were applied for defining the mixing zone for the MWWE for the GSSC's (Cap-Brulé) facility.

- The mixing zone shall be as small as possible;
- The mixing zone shall not impinge on the aquatic life;
- The area outside the mixing zone should be sufficient to support all of the uses designated by the receiving environment;
- A zone of passage for aquatic organisms shall be maintained including passage into tributaries;
- No mixing zones should be allocated for persistent, toxic and bioaccumulative substances; and,
- The mixing zone shall not use more than 25% of the receiving water cross-section.

4.7 Mixing Zone Limits and Acceptable Dilution for Mixing

The dimensions of the mixing zone describe where the dilution factor should be estimated. With this factor it is possible to back-calculate from the EQO, at the end of the mixing zone, to the EDO from the MWWE at the end of the discharge pipe.

The field investigation results by NATECH conclude that the effluent from the GSSC (Cap-Brulé) lagoon does not mix effectively in the small pond leading to the Northumberland Strait. A best-case near field dilution of 1:5 was observed, based on the dye-testing carried out during the field investigation, approximately 450 m from the discharge pipe - roughly where the stream enters the Northumberland Strait.

During the rising tide, the effluent is pooling in the intertidal zone of the Northumberland Strait. During the low tide, the pooled water will be drained into the Des Boudreau Lake estuary until the next high tide at which time it will once again be discharged and mix within the Northumberland Strait. For the complete dilution predictions refer to NATECH's Field Investigation Report, Figure 3-6, in Appendix D.

4.8 Proposed Effluent Discharge Location for Additional Dilution for Mixing

As discussed in Section 4.7 – Mixing Zone Limits and Acceptable Dilution for Mixing, the present location of the effluent discharge is within a small pond with limited mixing. The mixing occurs within the pond due to the flushing affects of the Northumberland Strait during high and low tides with no other incoming sources of water for additional dilution.

Initially the Northumberland Strait was the desired receiving body of water for the effluent discharge as mentioned in Section 3.4 – Other Considerations. Due to the changing of the dunes, the Strait has been isolated and a small pond has been naturally created with time.

Therefore, it will be recommended that further studies be considered regarding a new effluent discharge location for the GSSC's (Cap-Brulé) facility, in a location where there is an incoming source of fresh water. An ideal location would provide some initial mixing and dilution before reaching the Northumberland Strait, which is close to an area of recreational swimming, more specifically the Provincial Parlee Beach. Before proposing a specific outfall location, more testing and analysis should be done to properly assess the proposed location.

4.9 CORMIX Simulation and Assumptions – Discharge Location

CORMIX software predicts plume dispersion of a discharge into a receiving environment. CORMIX modeling identifies the theoretical mixing plume generated by the effluent in the receiving environment beginning at the WWTP discharge point.

However, in this case, the GSSC (Cap-Brulé) facility discharges into a small stream that leads to the Northumberland Strait. Because of the characteristics of the small stream, use of the software is not practical and will provide simulation warnings. It was also found that after the field investigation and dye testing observation of rapid complete mixing of the effluent within the receiving water the CORMIX model analysis would be unnecessary for this particular case.

4.10 Development of the EQOs and Other Effluent Discharge Guidelines

In order to obtain site specific guidelines, the CCME EQOs were determined from their website (http://st-ts.ccme.ca/) as well as from the Certificate of Approval to Operate from NBDELG for other substance specific effluent discharge objectives as shown in Table 6 below.

Table 6: Determining Appropriate Guidelines for GSSC's (Cap-Brulé) Facility

Test Group	Substances	CCME EQOs (mg/L)		NBDELG EDO - CAO (mg/L)
		Freshwater	Marine	
General Chemistry / Nutrients	Fluoride	N/A	N/A	N/A
	Nitrate	13.00	16.00	N/A
	Nitrate+Nitrite	N/A	N/A	N/A
	TSS	N/A	N/A	25.00
	$CBOD_5$	N/A	*N/A*	25.00
	Total Ammonia Nitrogen	1.7	N/A	N/A
	Un-ionized Ammonia	*1.25*[1]	N/A	*1.25*
	TKN	N/A	N/A	N/A
	TP	N/A	N/A	N/A
	COD	N/A	N/A	N/A
	Cyanide (total)	0.005	N/A	N/A
	pH	6.5-9.0	7.0-8.7	N/A
Metals	Aluminum	0.1[2]	N/A	N/A
	Barium	N/A	N/A	N/A
	Beryllium	N/A	N/A	N/A
	Boron	1.50	N/A	N/A
	Cadmium	0.00037[3]	0.00012	N/A
	Chromium	N/A	N/A	N/A
	Cobalt	N/A	N/A	N/A
	Copper	0.04[3]	N/A	N/A
	Iron	0.30	N/A	N/A
	Lead	0.007[3]	N/A	N/A
	Manganese	N/A	N/A	N/A
	Molybdenum	0.073	N/A	N/A
	Nickel	1.64[3]	N/A	N/A
	Silver	0.0001	N/A	N/A
	Strontium	N/A	N/A	N/A
	Thallium	0.0008	N/A	N/A
	Tin	N/A	N/A	N/A
	Titanium	N/A	N/A	N/A
	Uranium	0.015	N/A	N/A
	Vanadium	N/A	N/A	N/A
	Zinc	0.03	N/A	N/A
	Arsenic	0.005	0.0125	N/A
	Antimony	N/A	N/A	N/A
	Selenium	0.001	N/A	N/A
	Mercury	N/A	N/A	N/A
Pathogens	E.*coli*	N/A	N/A	200
	Faecal coliform	N/A	N/A	N/A

Table 6: Determining Appropriate Guidelines for GSSC's (Cap-Brulé) Facility (Cont'd)

Test Group	Substances	CCME EQOs (mg/L)		NBDELG EDO - CAO (mg/L)
		Freshwater	Marine	
Organochlorine Pesticides	Alpha-BHC	N/A	N/A	N/A
	Endosulfan	0.0000003	0.000002	N/A
	Endrin	N/A	N/A	N/A
	Heptachlor epoxide	N/A	N/A	N/A
	Lindane (gamma-BHC)	0.00001	N/A	N/A
	Mirex	N/A	N/A	N/A
	DDT	N/A	N/A	N/A
	Methoxychlor	N/A	N/A	N/A
	Aldrin	N/A	N/A	N/A
	Dieldrin	N/A	N/A	N/A
	Heptachlor	N/A	N/A	N/A
	a-Chlordane	N/A	N/A	N/A
	g-Chlordane	N/A	N/A	N/A
	Toxaphene	N/A	N/A	N/A
PCBs	Total PCBs	N/A	N/A	N/A
PAHs	Acenaphthene	0.0058	N/A	N/A
	Acenaphthylene	N/A	N/A	N/A
	Anthracene	0.000012	N/A	N/A
	Benzo(a)anthracene	0.000018	N/A	N/A
	Benzo(a)pyrene	0.000015	N/A	N/A
	Benzo(b)fluoranthene	N/A	N/A	N/A
	Benzo(g,h,i)perylene	N/A	N/A	N/A
	Benzo(k)fluoranthene	N/A	N/A	N/A
	Chrysene	N/A	N/A	N/A
	Dibenz(a,h)anthracene	N/A	N/A	N/A
	Fluoranthene	0.00004	N/A	N/A
	Fluorene	0.003	N/A	N/A
	Indeno(1,2,3-cd)pyrene	N/A	N/A	N/A
	Methylnaphthalene	N/A	N/A	N/A
	Naphthalene	0.0011	0.0014	N/A
	Phenanthrene	0.0004	N/A	N/A
	Pyrene	0.000025	N/A	N/A

Table 6: Determining Appropriate Guidelines for GSSC's (Cap-Brulé) Facility (Cont'd)

Test Group	Substances	CCME EQOs (mg/L)		NBDELG EDO - CAO (mg/L)
		Freshwater	Marine	
VOCs	Benzene	0.37	0.11	N/A
	Bromodichloromethane	N/A	N/A	N/A
	Bromoform	N/A	N/A	N/A
	Carbon tetrachloride	0.0133	N/A	N/A
	Chlorobenzene	N/A	N/A	N/A
	Chlorodibromomethane	N/A	N/A	N/A
	Chloroform	0.0018	N/A	N/A
	1,2-Dichlorobenzene	0.0007	0.042	N/A
	1,4-Dichlorobenzene	0.026	N/A	N/A
	1,2-Dichloroethane	0.1	N/A	N/A
	1,1-Dichloroethene	N/A	N/A	N/A
	Dichloromethane	0.1	N/A	N/A
	Ethylbenzene	0.09	0.025	N/A
	1,1,1,2-Tetrachloroethane	N/A	N/A	N/A
	1,1,2,2-Tetrachloroethane	N/A	N/A	N/A
	Tetrachloroethene	0.002	0.215	N/A
	Toluene	N/A	N/A	N/A
	Trichloroethene	N/A	N/A	N/A
	Vinyl chloride	N/A	N/A	N/A
	m/p-Xylene	N/A	N/A	N/A
	o-Xylene	N/A	N/A	N/A
Phenolic Compounds	2,3,4,6-Tetrachlorophenol	N/A	N/A	N/A
	2,4,6-Trichlorophenol	N/A	N/A	N/A
	2,4-Dichlorophenol	N/A	N/A	N/A
	Pentachlorophenol	0.0005	N/A	N/A
Surfactants	Non-ionic	N/A	N/A	N/A
	Anionic	N/A	N/A	N/A

[1]Un-ionized Ammonia may be calculated from the total ammonia nitrogen measured in the field by the following equations:

Equation 6 - pK_a:

$$pK_a = 0.0901821 + \frac{2729.92}{T(K = 273.15^\circ C)} \text{ and}$$

Equation 7 - factor of un-ionized to total ammonia:

$$f = \frac{1}{10^{(pK_a - pH)} + 1} = \frac{un-ionized}{total}$$

Therefore, the un-ionized ammonia calculated from the measured total ammonia nitrogen may be found:

Equation 8 - un-ionized ammonia:

$$un-ionized(mg/L) = f * total(mg/L)$$

[2]Based on the upstream pH of greater than 6.5 units, the allowable concentration for aluminum is 0.1mg/L.

[3]Based on the upstream $CaCO_3$ hardness of approximately 4,210 mg/L $CaCO_3$ the following substances could be calculated by using the formula shown in Section 4.2 - Finding Generic EQOs:

- Cadmium was determined to be 0.00037 mg/L;
- Copper was determined to be 0.004 mg/L;
- Lead was determined to be 0.007 mg/L; and,
- Nickel was determined to be 1.64 mg/L.

Based on the Certificate of Approval to Operate (dated April 30, 2013, attached in Appendix G) issued by the NBDELG the wastewater treatment facility final effluent discharge limits (present objectives) are as follow:

- $CBOD_5$: shall not exceed 25 mg/L;
- Suspended Solids (TSS): 25 mg/L;
- Un-ionized ammonia: 1.25 mg/L; and,
- E.coli: shall not exceed 200 MPN/100 mL after disinfection.

However, no other guidelines were provided in this Certificate for the remaining substances of potential concern. Therefore, effluent concentrations for these parameters will compared directly with the upstream concentrations, and conclusions will be drawn from these comparisons.

Furthermore, the CAO and CCME guidelines require that the effluent discharge limit for $CBOD_5$ and TSS be 25 mg/L. Therefore, in order to meet the new regulations, the EDO for $CBOD_5$ and TSS shall be 25 mg/L each.

4.11 Development of the EDOs

For additional reference, the sampling results from the year of 2010 have also been included in Appendix E for historical data on the facility. It is to be noted that these samples were collected from the months of April to December. During the winter months the lagoon and the receiving basin are covered with ice as may be observed in Figure 3 of Section 3.2 – Select Toxicity Testing Methods and it has historically not been required by the Province to monitor effluent quality during those months at this facility.

The initial characterization sampling for the year 2011-2012 was completed from June 2011 to June 2012. During the different seasons the following was observed:

- Winter (December-April): the lagoon is usually covered with snow and ice. There are no activities to comment on during this season.
- Spring (May-June): the lagoon becomes green in color with frequent visitation by ducks. In many occasions there is lots of ducks nesting on the lagoon.
- Summer (July-August): the lagoon becomes a lighter green in color.
- Fall (September-November): the lagoon becomes a green in color once again with a number of ducks preparing to migrate for the winter.

See attached GSSC (Cap-Brulé) WWTP sampling results in Appendix F for further details of the 2011-2012 results.

Based on the effluent discharge flow (6,340 m^3/day), mixing zone (dilution ratio of 1:5 based on the field investigation conducted by NATECH) in the stream leading to the Northumberland Strait (average flow of 19,532 m^3/day and critical flow of 976.3 m^3/day) and downstream concentrations of the various substances of potential

concern (Table 4), the EDOs may be established for the GSSC (Cap-Brulé) facility as summarized in Table 7. Note that certain EDOs have been pre-determined by the NBDELG within the Certificate of Approval to Operate as shown in Appendix G. Also note that the downstream concentrations were used in EDO calculations due to the lack of an incoming stream.

Table 7: EDOs for Substances of Potential Concern

Test Group	Substances	Downstream Conc. (mg/L)	CCME EQOs (mg/L)	Proposed EQOs (mg/L)	Proposed EDOs (mg/L)
General Chemistry /Nutrients	Fluoride	1.46	No Guideline	No Guideline	No Guideline
	Nitrate	<0.05	16.0	16.00	16.6
	Nitrate+Nitrite	<0.05	No Guideline	No Guideline	No Guideline
	TSS	5.25	No Guideline	No Guideline	25.0
	$CBOD_5$	<6	No Guideline	No Guideline	25.0
	TAN	0.58	1.7	1.70	1.74
	Un-ionized Ammonia	*0.00319*	No Guideline	No Guideline	No Guideline
	TKN	0.75	No Guideline	No Guideline	No Guideline
	TP	0.119	No Guideline	No Guideline	No Guideline
	COD	407	No Guideline	No Guideline	No Guideline
	Cyanide (total)	0.002	0.005	0.005	0.0051
	pH (units)	7.78	6.5-9.0	6.5-9.0	6.0-9.0
Metals	Aluminum	0.063	0.10	0.10	0.101
	Barium	0.05	No Guideline	1.00	1.037
	Beryllium	0.015	No Guideline	No Guideline	No Guideline
	Boron	3.05	1.50	1.50	1.440
	Cadmium*	0.025	0.00037	0.025	0.025
	Chromium*	0.04	0.0015	0.04	0.04
	Cobalt	0.015	No Guideline	No Guideline	No Guideline
	Copper*	0.04	0.004	0.04	0.04
	Iron*	0.91	0.30	0.91	0.91
	Lead*	0.015	0.007	0.015	0.015
	Manganese	0.095	No Guideline	No Guideline	No Guideline
	Molybdenum	0.022	0.073	0.073	0.075
	Nickel	0.04	1.640	1.64	1.70
	Silver*	0.015	0.0001	0.0150	0.0150
	Strontium	5.56	No Guideline	No Guideline	No Guideline
	Thallium*	0.015	0.0008	0.0150	0.0150
	Tin	0.015	No Guideline	No Guideline	No Guideline
	Titanium	0.035	No Guideline	No Guideline	No Guideline
	Uranium	0.015	0.015	0.015	0.015
	Vanadium	0.04	No Guideline	No Guideline	No Guideline
	Zinc*	0.04	0.03	0.04	0.04
	Arsenic*	0.04	0.013	0.04	0.04
	Antimony	0.015	No Guideline	No Guideline	No Guideline
	Selenium*	0.04	0.001	0.040	0.040
	Mercury	<0.000025	0.001	0.001	0.001038
Pathogens	E.*coli*	49	No Guideline	No Guideline	200
	Faecal coliform	162	No Guideline	No Guideline	200

Table 7: EDOs for Substances of Potential Concern (Cont'd)

Test Group	Substances	Downstream Conc. (mg/L)	CCME EQOs (mg/L)	Proposed EQOs (mg/L)	Proposed EDOs (mg/L)
Organochlorine Pesticides	Alpha-BHC	<0.00001	No Guideline	No Guideline	No Guideline
	Endosulfan (I and II)*	<0.00001	0.000002	0.00001	0.00001
	Endrin	<0.00001	No Guideline	No Guideline	No Guideline
	Heptachlor epoxide	<0.00001	No Guideline	No Guideline	No Guideline
	Lindane (gamma-BHC)	<0.00001	0.00001	0.00001	0.00001
	Mirex	<0.00001	No Guideline	No Guideline	No Guideline
	DDT	<0.00001	No Guideline	No Guideline	No Guideline
	Methoxychlor	<0.00001	No Guideline	No Guideline	No Guideline
	Aldrin	<0.00001	No Guideline	No Guideline	No Guideline
	Dieldrin	<0.00001	No Guideline	No Guideline	No Guideline
	Heptachlor	<0.00001	No Guideline	No Guideline	No Guideline
	a-Chlordane	<0.00001	No Guideline	No Guideline	No Guideline
	g-Chlordane	<0.00001	No Guideline	No Guideline	No Guideline
	Toxaphene	0.0001*	No Guideline	No Guideline	No Guideline
Polychlorinated Biphenyls (PCBs)	Total PCBs	<0.0001	No Guideline	No Guideline	No Guideline
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	<0.00001	0.0058	0.0058	0.00602
	Acenaphthylene	<0.00001	No Guideline	No Guideline	No Guideline
	Anthracene	<0.00001	0.000012	0.000012	0.00001
	Benzo(a)anthracene	<0.00001	0.000018	0.000018	0.00002
	Benzo(a)pyrene	<0.00001	0.000015	0.000015	0.00002
	Benzo(b)fluoranthene	<0.00001	No Guideline	No Guideline	No Guideline
	Benzo(g,h,i)perylene	<0.00001	No Guideline	No Guideline	No Guideline
	Benzo(k)fluoranthene	<0.00001	No Guideline	No Guideline	No Guideline
	Chrysene	<0.00001	No Guideline	No Guideline	No Guideline
	Dibenz(a,h)anthracene	<0.00001	No Guideline	No Guideline	No Guideline
	Fluoranthene	<0.000013	0.00004	0.00004	0.000041
	Fluorene	<0.00001	0.003	0.003	0.00312
	Indeno(1,2,3-cd)pyrene	<0.00001	No Guideline	No Guideline	No Guideline
	Methylnaphthalene	<0.00005	No Guideline	No Guideline	No Guideline
	Naphthalene	<0.00005	0.0011	0.0011	0.00114
	Phenanthrene	<0.000013	0.0004	0.0004	0.000415
	Pyrene	<0.00001	0.000025	0.000025	0.00003

Table 7: EDOs for Substances of Potential Concern (Cont'd)

Test Group	Substances	Downstream Conc. (mg/L)	CCME EQOs (mg/L)	Proposed EQOs (mg/L)	Proposed EDOs (mg/L)
Volatile Organic Compounds (VOCs)	Benzene	<0.0005	0.11	0.11	0.1142
	Bromodichloromethane	<0.0005	No Guideline	No Guideline	No Guideline
	Bromoform	<0.0005	No Guideline	No Guideline	No Guideline
	Carbon tetrachloride	<0.0005	0.0133	0.0133	0.0138
	Chlorobenzene	<0.0005	0.03	0.03	0.0259
	Chlorodibromomethane	<0.0005	No Guideline	No Guideline	No Guideline
	Chloroform	<0.0005	0.0018	0.0018	0.0019
	1,2-Dichlorobenzene	<0.0005	0.042	0.042	0.0436
	1,4-Dichlorobenzene	<0.0005	0.026	0.026	0.0270
	1,2-Dichloroethane	<0.0005	0.1	0.10	0.1038
	1,1-Dichloroethene	<0.0005	No Guideline	No Guideline	No Guideline
	Dichloromethane	<0.005	0.1	0.10	0.102
	Ethylbenzene	<0.0005	0.025	0.025	0.0259
	1,1,1,2-Tetrachloroethane	<0.0005	No Guideline	No Guideline	No Guideline
	1,1,2,2-Tetrachloroethane	<0.0005	No Guideline	No Guideline	No Guideline
	Tetrachloroethene	<0.0005	0.22	0.22	0.2233
	Toluene	<0.0005	0.215	0.215	0.2233
	Trichloroethene	<0.0005	0.2	0.02	0.0208
	Vinyl chloride	<0.0005	No Guideline	No Guideline	No Guideline
	m/p-Xylene	<0.0005	No Guideline	No Guideline	No Guideline
	o-Xylene	<0.0005	No Guideline	No Guideline	No Guideline
Phenolic Compounds	2,3,4,6-Tetrachlorophenol	<0.0001	0.001	0.001	0.001
	2,4,6-Trichlorophenol	<0.0001	0.018	0.018	0.0187
	2,4-Dichlorophenol	<0.0001	0.0002	0.0002	0.0002
	Pentachlorophenol	<0.0001	0.0005	0.0005	0.0005
Surfactants	Non-ionic	<0.0005	No Guideline	No Guideline	No Guideline
	Anionic	0.000075	No Guideline	No Guideline	No Guideline

* In cases where the concentration in the receiving water exceed the generic CCME EQO, CCME guidelines state that it is permissible to use the background concentration as a site-specific EQO.

The proposed EDOs in Table 7 above were based on the effluent discharge flow rate (Q_e= 6,340 m^3/day), average downstream flow rate (Q_s = 19,532 m^3/day) and critical downstream flow rate (Q_s=976.3 m^3/day), fraction of flow (*ff*=25% of upstream flow rate) and average downstream concentration values (Table 7) for the different substances of potential concern using the formula as shown below:

Equation 9 - Effluent Discharge Objective (EDO)

$$EDO = \frac{EQO * (Q_e + ff * Q_s) - ff * Q_s * C_s}{Q_e}$$

CCME Guideline values are not available for all the EQO substances as shown in Table 7. Therefore, EQOs were not determined for these substances. Instead, Effluent concentrations will be compared to upstream concentrations, and conclusions will be drawn from this comparison.

Hence, the EQOs identified for the various substances of potential concern for the GSSC's (Cap-Brulé) facility require that the MWWE meet EDOs as described in Table 7, above, in order to meet the mixing zone requirements.

Furthermore, the proposed EDOs as calculated and based on the one (1) year initial characterization period for the year of 2011 and 2012 are based on ensuring that the receiving Strait is being protected and that the water quality at the end of the mixing zone is achieved for the different substances of potential concern.

The average effluent values obtained during the initial characterization are to the right of the proposed EDO values as shown in Table 8.

Based on the results of the Initial Characterization testing, the effluent from the GSSC (Cap-Brulé) WWTP is meeting its current Certificate of Approval to Operate limits.

However, as described in Section 2.2 – List of Substances of Potential Concern, TSS and $CBOD_5$ will also be selected for compliance monitoring as they monitor the efficiency of the facility's treatment.

Table 8: 2011-2012 Effluent Values Compared to Proposed EDOs for Each Substances of Potential Concern

Test Group	Substances	Downstream Conc. (mg/L)	Proposed EQOs (mg/L)	Proposed EDOs (mg/L)	Average Effluent Values 2011-2012 (mg/L)
General Chemistry / Nutrients	Fluoride	1.46	No Guideline	No Guideline	0.36
	Nitrate	<0.05	16.00	16.6	0.38
	Nitrate + Nitrite	<0.05	No Guideline	No Guideline	0.43
	TSS	5.25	No Guideline	25.0	15.77
	$CBOD_5$	<6	No Guideline	25.0	8.41
	TAN	0.58	1.70	1.74	11.44
	Un-ionized NH_3	*0.00319*	No Guideline	No Guideline	0.12
	TKN	0.75	No Guideline	No Guideline	14.51
	TP	0.119	No Guideline	No Guideline	1.83
	COD	407	No Guideline	No Guideline	37.5
	Cyanide	0.002	0.005	0.0051	0.003
	pH	7.78	6.5-9.0	6.0-9.0	7.44
Metals	Aluminum	0.063	0.10	0.101	0.0455
	Barium	0.05	1.00	1.037	0.162
	Beryllium	0.015	No Guideline	No Guideline	0.0001
	Boron	3.05	1.50	1.440	0.1353
	Cadmium	0.025	0.025	0.025	0.0000125
	Chromium	0.04	0.04	0.04	0.00125
	Cobalt	0.015	No Guideline	No Guideline	0.00018
	Copper	0.04	0.04	0.04	0.003
	Iron	0.91	0.91	0.91	0.2275
	Lead	0.015	0.015	0.015	0.0003
	Manganese	0.095	No Guideline	No Guideline	0.3515
	Molybdenum	0.022	0.073	0.075	0.00038
	Nickel	0.04	1.64	1.70	0.001
	Silver	0.015	0.0150	0.0150	0.0001
	Strontium	5.56	No Guideline	No Guideline	0.30925
	Thallium	0.015	0.0150	0.0150	0.0001
	Tin	0.015	No Guideline	No Guideline	0.000125
	Titanium	0.035	No Guideline	No Guideline	0.004
	Uranium	0.015	0.015	0.015	0.00018
	Vanadium	0.04	No Guideline	No Guideline	0.001
	Zinc	0.04	0.04	0.04	0.00725
	Arsenic	0.04	0.04	0.04	0.001
	Antimony	0.015	No Guideline	No Guideline	0.000125
	Selenium	0.04	0.040	0.040	0.001
	Mercury	<0.000025	0.001	0.001038	0.000025
Pathogens	E. *coli*	49	No Guideline	200	15
	Fecal coliform	162	No Guideline	200	44

Table 8: 2011-2012 Effluent Values Compared to Proposed EDOs for Each Substances of Potential Concern (Cont'd)

Test Group	Substances	Proposed EQOs (mg/L)	Proposed EDOs (mg/L)	Average Effluent Values 2011-2012 (mg/L)
Organochlorine Pesticides	Alpha-BHC	No Guideline	No Guideline	0.00001
	Endosulfan (I and II)	0.00001	0.00001	0.00001
	Endrin	No Guideline	No Guideline	0.00001
	Heptachlor epoxide	No Guideline	No Guideline	0.00001
	Lindane (gamma-BHC)	0.00001	0.00001	0.00001
	Mirex	No Guideline	No Guideline	0.00001
	DDT	No Guideline	No Guideline	0.00001
	Methoxychlor	No Guideline	No Guideline	0.00001
	Aldrin	No Guideline	No Guideline	0.00001
	Dieldrin	No Guideline	No Guideline	0.00001
	Heptachlor	No Guideline	No Guideline	0.00001
	a-Chlordane	No Guideline	No Guideline	0.00001
	g-Chlordane	No Guideline	No Guideline	0.00001
	Toxaphene	No Guideline	No Guideline	0.00175
Polychlorinated Biphenyls (PCBs)	Total PCBs	No Guideline	No Guideline	0.0001
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	0.0058	0.00602	0.00002
	Acenaphthylene	No Guideline	No Guideline	0.00001
	Anthracene	0.000012	0.00001	0.00001
	Benzo(a)anthracene	0.000018	0.00002	0.00001
	Benzo(a)pyrene	0.000015	0.00002	0.00001
	Benzo(b)fluoranthene	No Guideline	No Guideline	0.00001
	Benzo(g,h,i)perylene	No Guideline	No Guideline	0.00001
	Benzo(k)fluoranthene	No Guideline	No Guideline	0.00001
	Chrysene	No Guideline	No Guideline	0.00001
	Dibenz(a,h)anthracene	No Guideline	No Guideline	0.00001
	Fluoranthene	0.00004	0.000041	0.0000125
	Fluorene	0.003	0.00312	0.00002
	Indeno(1,2,3-cd)pyrene	No Guideline	No Guideline	0.00001
	Methylnaphthalene	No Guideline	No Guideline	0.00005
	Naphthalene	0.0011	0.00114	0.0000575
	Phenanthrene	0.0004	0.000415	0.0001175
	Pyrene	0.000025	0.00003	0.00001

Table 8: 2011-2012 Effluent Values Compared to Proposed EDOs for Each Substances of Potential Concern (Cont'd)

Test Group	Substances	Proposed EQOs (mg/L)	Proposed EDOs (mg/L)	Average Effluent Values 2011-2012 (mg/L)
Volatile Organic Compounds (VOCs)	Benzene	0.11	0.1142	0.0005
	Bromodichloromethane	No Guideline	No Guideline	0.0005
	Bromoform	No Guideline	No Guideline	0.0005
	Carbon tetrachloride	0.0133	0.0138	0.0005
	Chlorobenzene	0.03	0.0259	0.0005
	Chlorodibromomethane	No Guideline	No Guideline	0.0005
	Chloroform	0.0018	0.0019	0.0005
	1,2-Dichlorobenzene	0.042	0.0436	0.0005
	1,4-Dichlorobenzene	0.026	0.0270	0.0005
	1,2-Dichloroethane	0.10	0.1038	0.0005
	1,1-Dichloroethene	No Guideline	No Guideline	0.0005
	Dichloromethane	0.10	0.102	0.005
	Ethylbenzene	0.025	0.0259	0.0005
	1,1,1,2-Tetrachloroethane	No Guideline	No Guideline	0.0005
	1,1,2,2-Tetrachloroethane	No Guideline	No Guideline	0.0005
	Tetrachloroethene	0.22	0.2233	0.0005
	Toluene	0.215	0.2233	0.0005625
	Trichloroethene	0.02	0.0208	0.0005
	Vinyl chloride	No Guideline	No Guideline	0.0005
	m/p-Xylene	No Guideline	No Guideline	0.0005
	o-Xylene	No Guideline	No Guideline	0.0005
Phenolic Compounds	2,3,4,6-Tetrachlorophenol	0.001	0.001	0.0001
	2,4,6-Trichlorophenol	0.018	0.0187	0.0001
	2,4-Dichlorophenol	0.0002	0.0002	0.0001
	Pentachlorophenol	0.0005	0.0005	0.0001
Surfactants	Non-ionic	No Guideline	No Guideline	0.0005
	Anionic	No Guideline	No Guideline	0.0001

According to the CCME guidelines, the recommended minimum concentration of DO in marine waters is 8.0 mg/L. The addition of effluent to the receiving water should not cause its DO level to decrease by more than 10% of the natural concentration in the receiving environment.

Dissolved Oxygen will be calculated by using the Streeter-Phelps DO sag equation as shown below as verification of the $CBOD_5$ values:

Equation 10 - Streeter-Phelps DO sag equation:

$$D = \frac{k_1 L_0}{k_2 - k_1}\left(e^{-k_1 t} - e^{-k_2 t}\right) + D_0 e^{-k_2 t}$$

Where,

$k_1 = k_{20}\theta^{(T-20)}$ and k_{20} = 0.12-0.23 (for well-treated sewage) and θ = 1.047

$k_{2@20^oC} = \frac{3.9v^{\frac{1}{2}}}{H^{\frac{3}{2}}}$ and v = velocity and H = depth; or

$$k_{2,T} = k_{2@20^oC}\theta^{(T-20)} \text{ and } \theta = 1.024$$

$$L_o = \frac{Q_w L_w + Q_r L_r}{Q_w + Q_r} \text{ and,}$$

$$D_o = DO_{sat} - \frac{Q_w DO_w + Q_r DO_r}{Q_w + Q_r}$$

The DO sag equation will be used to determine the minimum concentration of DO expected within the stream. The time at which the minimum DO occurs is expressed as follows:

Equation 11 – critical time:

$$t_{crit} = \frac{1}{k_2 - k_1} \ln\left[\frac{k_2}{k_1}\left(1 - \frac{D_0(k_2 - k_1)}{L_0 k_1}\right)\right]$$

To find the value of the critical oxygen deficit (at the critical time at which the minimum DO occurs) the Streeter-Phelps DO sag equation will be combined with the t_{crit} equation above. Therefore, the minimum dissolved oxygen concentration is:

Equation 12 – minimum dissolved oxygen (at a temperature of 11°C):

$$DO_{crit} = DO_{sat} - D_{crit}$$

Therefore, it was found that the minimum dissolved oxygen concentration for the critical flow had a value of approximately 7.5 mg/L within the receiving water, a 41 % decrease from the downstream value. This is both below the minimum recommended value, and more than the recommended maximum decrease of 10 % of the natural DO level.

It was found that the minimum dissolved oxygen concentration for the average flow had a value of approximately 12.7 mg/L within the receiving water, which meets the CCME guidelines.

SECTION 5.0: SELECTION OF SUBSTANCES FOR COMPLIANCE MONITORING

5.1 Selection of Substances

As noted in Section 7 – Selection of Substances for Compliance Monitoring in the *CCME Technical Supplement 3*, regardless of the results of the initial characterization program, TSS and $CBOD_5$ must be selected for compliance monitoring as these parameters described the functionality and treatment efficiency of the GSSC (Cap-Brulé) WWTP facility.

The following criteria were used in order to determine the remaining potential substances of concern to be selected for compliance monitoring as stated in the *CCME Technical Supplement 3: Section 7.0 – Selection of Substances for Compliance Monitoring:*

- Based on the initial characterization results the substances of potential concern that **do not meet the EQOs;** and,
- Substances of potential concern with mean effluent values greater than or equal to **80% of proposed EDOs.**

The only effluent substance from the initial characterization period that has a concentration exceeding the guideline EQOs is total ammonia nitrogen (TAN).

Substances that have a concentration greater than the EQO may be identified for compliance monitoring, but in cases where the permissible EDO is greater than the EQO, this means that the downstream level is lower than the EQO. Therefore, this permits the discharge of an effluent with a concentration greater than the EQO (based on effluent and stream flows as measured) without the resultant diluted substance at the boundary of the plume area exceeding the EQO. Provided the effluent values do not exceed the EDO, water quality in the receiving water will not be compromised.

Substances that have a concentration equal to or exceeding 80% of the permissible EDOs are important to identify for compliance monitoring because they are presently close to the permissible EDO. Protection of the receiving water and staying within the guideline EQOs will require that their effluent concentrations do not exceed the EDO values, making ongoing monitoring of such substances important.

The effluent substances that have a concentration equal to or exceeding 80% of the permissible EDOs, based on the results of the initial characterization period, are: total ammonia nitrogen (TAN), Endosulfan (I and II), Lindane (gamma-BHC), and anthracene. However, **among these substances, only TAN will be selected for monitoring**. The effluent concentrations of Endosulfan (I and II), Lindane (gamma-BHC), and anthracene were lower than the laboratory's reporting limit in all samples; therefore, there is no need to monitor these substances.

For substances with no guideline EQO's, those with effluent concentrations exceeding the background levels measured in the receiving water would normally be selected for monitoring. However, because of the present discharge location into an isolated pond with no significant inflow except for tidal action, true background levels could not be established. Therefore, no additional substances were identified for monitoring.

Further studies regarding a new effluent discharge location to an acceptable receiving water will be recommended. When a suitable location for the outfall is determined, a complete characterization of the receiving water, including the determination of EQOs and EDOs, should be carried out.

It is a requirement that the receiving environment, prior to receiving the discharge, be returned to the same trophic status within the mixing zone. However, the receiving stream also shows high trophic levels for both nitrogen and phosphorus. Once a suitable location for the WWTP outfall is determined, further testing of the receiving environment should be carried out as mentioned previously.

Lastly, as discussed in Section 4.4 - Identifying Toxicological EQOs, the acute test involving Rainbow Trout and the chronic test involving *Ceriodaphnia dubia* failed only once during the entire initial characterization period. It has therefore been concluded that a non-representative sample may be the cause of the test failure and therefore this result will be regarded as an outlier. However, to confirm this assumption, additional acute and chronic toxicity testing will be recommended in September 2014.

5.2 Selection of Monitoring Frequencies

Compliance monitoring will study more closely the operation of the facilities now that the initial characterization program has been completed. The Table below represents the monitoring frequencies of $CBOD_5$ and TSS in order to document the efficiency of the treatment operation at the facility. Both are required regardless of the results of the initial characterization program as per the *CCME Technical Supplement 3: Section 7.0 - Selection of Substances for Compliance Monitoring*.

Table 9: Compliance Monitoring
(continuous discharge facilities)

Facility Size	$CBOD_5$ and TSS[1]	Acute Toxicity	Chronic Toxicity
Medium	Every two Weeks	Quarterly	Quarterly

[1] Note that any substances of potential concern that did not meet the respective EDO shall fall under this category. This includes un-ionized ammonia (as per CAO, until June 30, 2014) and TAN.

Therefore, based on the above Table, TSS and $CBOD_5$ will be sampled every two (2) weeks (as per the Certificate of Approval to Operate) in order to continue to monitor the treatment efficiency of the wastewater treatment plant. Un-ionized ammonia will also be analyzed every two (2) weeks until June 30, 2014, in accordance with the CAO, as well as TAN.

It is also recommended that Rainbow Trout acute and *Ceriodaphnia dubia* chronic toxicity tests be carried out in September 2014, to provide additional data for the evaluation of possible effluent toxicity.

SECTION 6.0: CONCLUSION & RECOMMENDATIONS

This Report summarizes the information gathered and documented as a result of conducting an Environmental Risk Assessment (ERA) of the GSSC (Cap-Brulé), New Brunswick, municipal wastewater treatment plant (WWTP) effluent.

The purpose of conducting this ERA was to identify the characteristics of the effluent from the WWTP and the characteristics of the receiving water, a small pond leading to the Northumberland Strait, and determine if the WWTP effluent is negatively impacting the receiving water. This process was carried out in accordance with the "Canada-wide Strategy for Management of Municipal Wastewater Effluent" as developed by the Canadian Council of Ministers of the Environment (CCME). This information was compared to guidelines for water quality in receiving waters to provide the answers to several water quality protection questions, including:

a. What are the background concentration levels of various substances of interest in the receiving water? What are other relevant receiving water characteristics such as flow?
b. What are the concentrations of various substances of interest in the WWTP effluent discharged to the receiving water? What are other relevant effluent characteristics such as flow?
c. Does the effluent from the WWTP cause any of the Environmental Quality Objectives (EQOs) in the receiving water to be exceeded, that is, is it detrimental to water quality in the receiving water? (This analysis permits consideration of mixing of the effluent with a portion of the flows in the receiving stream – "the plume" – before the impact of quality values on the receiving stream are assessed.)
d. What are the required Effluent Discharge Objectives (EDOs), that is, limits, for the substances of interest in the WWTP effluent that will prevent the WWTP effluent from having a detrimental impact on the quality of the receiving water? (EDOs are measured in the effluent before it enters the receiving water.)
e. What substances in the effluent require EDOs to be established for them?
f. What are the monitoring requirements for substances in the WWTP effluent?

The work done, conclusions, and recommendations from this ERA are summarized below:

1. The GSSC (Cap-Brulé) WWTP is a two-cell aerated lagoon system which incorporates ultraviolet disinfection of the effluent. It is required to be operated in accordance with a "Certificate of Approval to Operate" issued by the NB Department of Environment and Local Government.

2. In order to obtain the information required for the ERA study, information was obtained on the WWTP effluent and receiving water quality characteristics for a one (1) year period, from June 2011 to May 2012. This involved collecting and analyzing effluent and receiving water samples, conducting toxicity tests and obtaining other information needed to characterize the facility and water characteristics. This study was carried out over a 12-month period, with major tests and analyses done quarterly to characterize all seasons. As a result of flow characteristics and volume (6,340 m^3/day), the GSSC (Cap-Brulé) WWTP is classified as a "medium" wastewater treatment facility under the CCME guidelines.

3. On a quarterly basis, comprehensive sampling and testing was conducted for:

    i. General chemistry and nutrients (also tested bi-weekly)
    ii. Metals
    iii. Pathogens (also tested bi-weekly)
    iv. Organochlorine pesticides
    v. Polychlorinated biphenols (PCBs)
    vi. Polycyclic aromatic hydrocarbons (PAHs)
    vii. Volatile organic compounds (VOCs)
    viii. Phenolic compounds
    ix. Surfactants

    Some of these analytical tests were also carried out bi-weekly, as indicated.

4. Acute and chronic toxicity tests were carried out using wastewater effluent at various concentrations; this was done to determine any short- and long-term effects on aquatic life. These tests were used to establish toxicological EQOs for the receiving water. In eight (8) acute toxicity tests, all except one (1) were non-lethal. In the quarterly chronic toxicity tests all except one (1) were sub-lethal. The isolated occurrence of two (2) failed tests suggests that the sample may not have been representative of the effluent; this will be included in a recommendation for follow-up tests in September 2014.

5. A study of the receiving water in the area of the effluent discharge was also conducted to provide detailed physical data. This included the receiving water width and depth, velocity and pattern of flow, and water quality characteristics. Dye tests were done to assess dilutions achieved at different distances downstream of the release point.

6. Environmental Quality Objectives were identified for the substances of interest for this ERA. These were obtained from the CCME Guidelines and other sources.

7. The receiving water was evaluated and due to poor mixing conditions within the pond (created over several years due to tidal influence and changes in the sand dunes, isolating the original receiving water of the Northumberland Strait from the effluent discharge location) further studies regarding a new effluent discharge pipe location are recommended.

    A new effluent pipe location would improve the overall mixing of the effluent within the receiving stream and provide continuous of water for better dilution. However, before proposing a new location, additional testing and analysis would be recommended to establish upstream water quality and dilution patterns in the receiving water.

8. Based upon the mixing achieved within the plume defined within the pond leading to the Northumberland Strait, and incorporating the background (downstream) concentrations of substances of interest in the receiving water, the Effluent Discharge Objectives (EDOs) were calculated. Table 10, below, summarizes the EDOs and the EQOs proposed for the GSSC (Cap-Brulé) WWTP facility.

Table 10: EDOs for Each Substances of Potential Concern

Test Group	Substances	Proposed EQOs (mg/L)	Proposed EDOs (mg/L)
General Chemistry / Nutrients	Fluoride	No Guideline	No Guideline
	Nitrate	16.00	16.6
	Nitrate + Nitrite	No Guideline	No Guideline
	TSS	No Guideline	25.0
	$CBOD_5$	No Guideline	25.0
	TAN	1.70	1.74
	Un-ionized NH_3	No Guideline	No Guideline
	TKN	No Guideline	No Guideline
	TP	No Guideline	No Guideline
	COD	No Guideline	No Guideline
	Cyanide	0.005	0.0051
	pH	6.5-9.0	6.0-9.0
Metals	Aluminum	0.10	0.101
	Barium	1.00	1.037
	Beryllium	No Guideline	No Guideline
	Boron	1.50	1.440
	Cadmium	0.025	0.025
	Chromium	0.04	0.04
	Cobalt	No Guideline	No Guideline
	Copper	0.04	0.04
	Iron	0.91	0.91
	Lead	0.015	0.015
	Manganese	No Guideline	No Guideline
	Molybdenum	0.073	0.075
	Nickel	1.64	1.70
	Silver	0.0150	0.0150
	Strontium	No Guideline	No Guideline
	Thallium	0.0150	0.0150
	Tin	No Guideline	No Guideline
	Titanium	No Guideline	No Guideline
	Uranium	0.015	0.015
	Vanadium	No Guideline	No Guideline
	Zinc	0.04	0.04
	Arsenic	0.04	0.04
	Antimony	No Guideline	No Guideline
	Selenium	0.040	0.040
	Mercury	0.001	0.001038
Pathogens	*E.coli*	No Guideline	200
	Fecal coliform	No Guideline	200

Table 10: EDOs for Each Substances of Potential Concern (Cont'd)

Test Group	Substances	Proposed EQOs (mg/L)	Proposed EDOs (mg/L)
Organochlorine Pesticides	Alpha-BHC	No Guideline	No Guideline
	Endosulfan (I and II)	0.00001	0.00001
	Endrin	No Guideline	No Guideline
	Heptachlor epoxide	No Guideline	No Guideline
	Lindane (gamma-BHC)	0.00001	0.00001
	Mirex	No Guideline	No Guideline
	DDT	No Guideline	No Guideline
	Methoxychlor	No Guideline	No Guideline
	Aldrin	No Guideline	No Guideline
	Dieldrin	No Guideline	No Guideline
	Heptachlor	No Guideline	No Guideline
	a-Chlordane	No Guideline	No Guideline
	g-Chlordane	No Guideline	No Guideline
	Toxaphene	No Guideline	No Guideline
Polychlorinated Biphenyls (PCBs)	Total PCBs	No Guideline	No Guideline
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	0.0058	0.00602
	Acenaphthylene	No Guideline	No Guideline
	Anthracene	0.000012	0.00001
	Benzo(a)anthracene	0.000018	0.00002
	Benzo(a)pyrene	0.000015	0.00002
	Benzo(b)fluoranthene	No Guideline	No Guideline
	Benzo(g,h,i)perylene	No Guideline	No Guideline
	Benzo(k)fluoranthene	No Guideline	No Guideline
	Chrysene	No Guideline	No Guideline
	Dibenz(a,h)anthracene	No Guideline	No Guideline
	Fluoranthene	0.00004	0.000041
	Fluorene	0.003	0.00312
	Indeno(1,2,3-cd)pyrene	No Guideline	No Guideline
	Methylnaphthalene	No Guideline	No Guideline
	Naphthalene	0.0011	0.00114
	Phenanthrene	0.0004	0.000415
	Pyrene	0.000025	0.00003

Table 10: EDOs for Each Substances of Potential Concern (Cont'd)

Test Group	Substances	Proposed EQOs (mg/L)	Proposed EDOs (mg/L)
Volatile Organic Compounds (VOCs)	Benzene	0.11	0.1142
	Bromodichloromethane	No Guideline	No Guideline
	Bromoform	No Guideline	No Guideline
	Carbon tetrachloride	0.0133	0.0138
	Chlorobenzene	0.03	0.0259
	Chlorodibromomethane	No Guideline	No Guideline
	Chloroform	0.0018	0.0019
	1,2-Dichlorobenzene	0.042	0.0436
	1,4-Dichlorobenzene	0.026	0.0270
	1,2-Dichloroethane	0.10	0.1038
	1,1-Dichloroethene	No Guideline	No Guideline
	Dichloromethane	0.10	0.102
	Ethylbenzene	0.025	0.0259
	1,1,1,2-Tetrachloroethane	No Guideline	No Guideline
	1,1,2,2-Tetrachloroethane	No Guideline	No Guideline
	Tetrachloroethene	0.22	0.2233
	Toluene	0.215	0.2233
	Trichloroethene	0.02	0.0208
	Vinyl chloride	No Guideline	No Guideline
	m/p-Xylene	No Guideline	No Guideline
	o-Xylene	No Guideline	No Guideline
Phenolic Compounds	2,3,4,6-Tetrachlorophenol	0.001	0.001
	2,4,6-Trichlorophenol	0.018	0.0187
	2,4-Dichlorophenol	0.0002	0.0002
	Pentachlorophenol	0.0005	0.0005
Surfactants	Non-ionic	No Guideline	No Guideline
	Anionic	No Guideline	No Guideline

9. The results of the information received from this ERA show that the effluent discharged from the GSSC (Cap-Brulé) WWTP is meeting the requirements for TSS and $CBOD_5$ as set out by the NB Department of Environment and Local Government in their "Certificate of Approval to Operate".

10. In order to monitor the performance of the GSSC (Cap-Brulé) WWTP and ensure it continues to be protective of the receiving environment, it is recommended that Compliance Monitoring be carried out on effluent samples on a:

    - bi-weekly basis for TSS, $CBOD_5$, and un-ionized ammonia (in accordance with the CAO, until June 30, 2014 for un-ionized ammonia);
    - bi-weekly basis for total ammonia nitrogen (TAN).

    This is summarized in the table below. Note that substances required for the Certificate of Approval to Operate have also been added to the Table. Other substances may be added to this list by the regulatory agencies; this list represents the minimum monitoring required.

Table 11: Compliance Monitoring - Substances of Potential Concern

Test Group	EDO	Frequency
$CBOD_5$	25.0 mg/L	Bi-Weekly
TSS	25.0 mg/L	Bi-Weekly
Un-ionized Ammonia	1.25 mg/L	Bi-Weekly*
TAN	1.74	Bi-weekly
E. coli	200	Monthly

* Test for un-ionized ammonia until June 30, 2014

11. Because two (2) of the toxicity tests did not meet the required EDO, it is recommended that toxicity testing be conducted on Rainbow Trout and *Ceriodaphnia dubia* using the WWTP effluent in September 2014. The need for further action will then be assessed from these results.

Table 12: Compliance Monitoring - Toxicity Test

Toxicity Test	Frequency
Rainbow Trout	Once - September, 2014
Ceriodaphnia dubia	Once - September, 2014

12. Further isolation of the basin receiving effluent may require future extension of the outfall to the Northumberland Strait.

13. Although the EQOs are being met because of the efficiency of the GSSC (Cap-Brulé) wastewater treatment facility, the isolated tidal basin which formed after the initial WWTP construction does not provide acceptable dilution and is at risk of becoming blocked by additional sand deposits at its discharge to the Northumberland Strait. In addition, during critical flow periods the DO levels do not meet CCME's guidelines. **Therefore, it is recommended that additional studies be conducted on a new discharge location. Once a potential discharge location is selected, a complete characterization of the receiving water, including the determination of site-specific EQOs and EDOs, should be carried out.**

14. It is recommended that the GSSC accept this report and submit it to the New Brunswick Department of Environment and Local Government in order to fulfill the requirements of the CCME "Strategy for Management of Municipal Wastewater Effluent".

APPENDIX A: Crandall Engineering Ltd. Drawing 11079-1D-C01

NOTES

NO.	DATE	REVISIONS	BY
00	AUG 25/11	ISSUED FOR CLIENT REVIEW	IC

GREATER SHEDIAC SEWERAGE COMMISSION
DES ÉGOUTS SHEDIAC ET BANLIEUES

crandall

PROJECT TITLE

GREATER SHEDIAC
SEWERAGE
ENVIROMENTAL RISK
ASSESSEMENT

SHEDIAC N.B.

DRAWING TITLE

SHEDIAC WWTP
SITE PLAN

Scale: 50m 0 100m (1:5000 FULL SCALE)	Drawn By: IC
	Checked By: — / Cadd Check: —
Date: AUGUST 25, 2011	Sheet 1 of 1
File Name: 11079-1 SITE PLAN.DWG	
Drawing No.: 11079-1D-C01	Rev.: 0

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APPENDIX B: Buchanan Environmental Ltd. Toxicity Test Results

Buchanan Environmental Ltd.

138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: ***R6461***

Rainbow Trout Bioassay Report

Facility Submitting Sample **Greater Shediac Sewerage Commission**

Address: 290 Main St., Shediac, NB E4P 2E3

Sample Material: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : Jessica de Vries
Sampling Point Description : Outlet Chamber (after UV)

Time & Date Collected: 3:30 am, June 21, 2011
Time & Date Received: 9:25 am, June 22, 2011

Sample Characterization *(unadjusted, undiluted)*

Volume received : 5 x 20 L
Temperature : 19.6 ° C (on arrival)
pH : 7.43
Dissolved oxygen : 7.3 mg/L
Conductivity : 1144 µmhos/cm
Colour/Appearance : Dark Green
Odour : Mild
Storage : 30 hours at 4 ± 2° C
Temperature adjustment overnight in lab: Yes

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 7.33
Conductivity : 378 µmhos/cm
Hardness : 96 mg/L as $CaCO_3$

Test Conditions

Type of test : Multi Concentration
Volume/Vessel : 25 L
Test Temperature : 15±1° C
Aeration rate : 6.5 ± 1 mL/min/L
Pre-aeration period : 30 minutes
Test Duration : 96 hours

Test Organism

Species: *Oncorhynchus mykiss*
Source: Aquamerik, Quebec
Average length: 42.1 ± 5.2 mm
Average weight: 0.7 ± 0.3 g
Number/Vessel (25L): 10 each
Stocking Density: 0.29 g/L
% Culture Mortality (< 7 days/ testing): 0.0%

Test Started (time, date) : 11:15 am, 24 June, 2011
Test Ended (time, date) : 11:15 am, 28 June, 2011

Buchanan Environmental Ltd.
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: R6461

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	9.5	7.53	279	15.0	9.1	8.01	15.2	1	10
6.25	9.2	7.63	335	15.0	9.2	8.08	15.2	2	20
12.5	9.1	8.02	337	15.0	9.2	8.08	15.2	0	0
25	9.0	8.00	444	15.0	9.2	8.08	15.2	0	0
50	9.1	7.94	623	15.0	9.0	8.04	15.2	0	0
100	8.7	7.72	1064	15.0	9.1	8.07	15.2	1	10

* Values measured upon test initiation

 # Control showing atypical/stressed behaviour : 1/10

96 hour LC50 value (static, acute) : **Non-lethal** sample material

95 percent Confidence Limits (95% CI) : N/A

Comments:

Reference Toxicity Test Data

Most Recent Reference Toxicity Test No. : LS216
Test time, Date : 4:15 pm. June 13, 2011
Toxicant tested : Phenol
96 hr LC50 : 7.58 mg Phenol/L (*Spearman-Karber*)
95% Confidence Limits : (5.8, 9.89) mg Phenol/L
Historic Mean ± Warning Limits (2SD) : 9.21 ± 2.01 mg Phenol/L

* All bioassays were conducted following Environment Canada protocol (EPS 1/RM/13, May 2007).

Testing performed by A. Kaye, B. Wark and J. Comeau of *Buchanan Environmental Ltd.*

Authorization RB as per
R.D. Buchanan
Head, Aquatic Toxicology

Buchanan Environmental Ltd
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: J922

Daphnia magna Bioassay Report

Facility Submitting Sample: **Greater Shediac Sewerage Commission**

Address: 290 Main St., Shediac, NB E4P 2E3

Sample Material: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : J. de Vries
Sampling Point Description : Outlet chamber after UV

Time & Date Collected: 3:30 pm, June 21, 2011
Time & Date Received: 9:25 am, June 22, 2011

Sample Characterization *(unadjusted, undiluted)*

Volume received	: 5 x 20 L
Temperature	: 19.6°C (on arrival)
pH	: 7.64
Dissolved oxygen	: 8.4 mg/L
Conductivity	: 1235 µmhos/cm
Hardness	: 180 mg/L as $CaCO_3$
Colour	: Yellow/Green
Odour	: None
Storage	: None

Temperature adjustment overnight in lab: No

Dilution Water Characterization

Source	: Lower St. Mary's well
pH	: 8.17
Conductivity	: 273 µmhos/cm
Hardness	: 97 mg/L as $CaCO_3$

Test Conditions:

Type of test	: Multi-Concentration	Volume/test vessel	: 150 mL
No. daphnids/vessel	: 10	No. of vessel/conc.	: 1
Stocking Density	: 15 mL/neonate	Culture Mortality (<7 days/testing):	1.28%
Pre-Aeration	: 0 minutes	Aeration rate	: 37.5±12.5 mL/min/L
Test Temperature	: 20± 2° C	Test Duration	: 48 hours

Test Started (time, date) : 3:30 pm, June 22, 2011
Test Ended (time, date) : 3:30 pm, June 24, 2011

Buchanan Environmental Ltd.
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: J922

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O.** mg/L	**pH**	**Cond.** µmhos/cm	**Temp.** °C	**D.O.** mg/L	**pH**	**Temp.** °C	**Mortality** x/10	%
Control	8.8	8.15	283	22.0	8.4	7.93	20.8	0	0
6.25	8.8	8.12	350	21.5	8.5	7.92	20.6	0	0
12.5	8.8	8.09	419	21.3	8.5	7.94	20.6	0	0
25	8.7	8.01	545	20.6	8.5	7.91	20.4	0	0
50	8.7	7.88	809	21.5	8.5	7.95	20.4	0	0
100	8.5	7.69	1292	20.8	8.5	7.95	20.6	0	0

* Values measured upon test initiation

 # Control showing atypical/stressed behaviour : 0/10

48 hour LC50 Value (static, acute) : **Non-lethal** sample material

95 percent confidence limits (95 % CL) : n/a

Comments:

Reference Toxicant Test Data

Test organism: *Daphnia magna* (≤24 hr old neonates)
Culture Providing Neonates : May 24, 2011
Time to First Brood : 8 days
Average number of neonates per brood (2-4th brood): 21.2
Most Recent Reference Toxicant Test (#649) : 11:40 am, June 8, 2011
Toxicant tested : Sodium Chloride (NaCl)
Statistical Analysis : Spearman-Karber
48 hr LC50 : 5.58 g NaCl/L
95% Confidence Limits : (4.64, 6.64) g NaCl/L
Historic Mean 48 hr LC50 ± Warning limits (2SD) : 5.65 ± 0.89 g NaCl/L

* All bioassays were conducted following Environment Canada protocol (EPS 1/RM/14, Dec 2000).

Testing performed by L. Boone, A. Kaye, and K. Gilmore of *Buchanan Environmental Ltd.*

Authorization _____
R.D. Buchanan
Head, Aquatic Toxicology

AquaTox Testing & Consulting Inc.
11B Nicholas Beaver Rd.
RR 3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

Work Order : 219381
Sample Number : 31017

SAMPLE IDENTIFICATION

Company :	Buchanan Environmental Ltd.		
Location :	Fredericton NB	Date Collected :	2011-06-21
Substance :	Whole Effluent proj. # 11079-1	Time Collected :	15:30
Sampling Method :	Grab	Date Received :	2011-06-23
Sampled By :	J. De Vries	Time Received :	10:00
Temp. on arrival :	17.0°C	Date Tested :	2011-06-24
Sample Description :	Clear, yellow, mild odour		

Test Method : Test of Reproduction and Survival using the Cladoceran *Ceriodaphnia dubia*. Environment Canada, Conservation and Protection. Ottawa, Ontario. Report EPS 1/RM/21, 2nd ed. (February 2007).

TEST RESULTS

Effect	Value	95% Confidence Limits	Statistical Method
LC50	>100%	-	-
IC25 (Reproduction)	<1.56*%	-	Linear Interpolation (CETIS) a

The results reported relate only to the sample tested.

SODIUM CHLORIDE REFERENCE TOXICANT DATA

Date Tested :	2011-06-09	Analyst(s) :	NK/CL
Organism Batch :	Cd11-06	Test Duration :	6 days
IC25 Reproduction :	0.60 g/L**	LC50 :	2.14 g/L
95% Confidence Limits :	0.41 - 0.75 g/L	95% Confidence Limits :	1.89 - 2.43 g/L
Statistical Method :	Non-Linear Regression (CETIS)[a]	Statistical Method :	Spearman-Kärber (CETIS)[a]
Historical Mean IC25 :	1.11 g/L	Historical Mean LC50 :	1.98 g/L
Warning Limits (± 2SD) :	0.64 - 1.94 g/L	Warning Limits (± 2SD) :	0.84 - 4.65 g/L

The reference toxicity test was performed under the same experimental conditions as those used with the test sample.

TEST CONDITIONS

Sample Filtration :	None	Test Volume per Replicate :	15 mL
Test Aeration :	None	Test Vessel :	22 mL polystyrene vial
pH Adjustment :	None	Depth of Test Solution :	4.0 cm
Hardness Adjustment :	None	Organisms per Replicate :	1
Daily Renewal Method :	Transferred to fresh solutions	Number of Replicates :	10
Control/Dilution Water :	Well water (no chemicals added)	Test Method Deviation(s) :	None

COMMENTS

*Note: The IC25 was less than the lowest concetration tested (1.56%).

**Note : The reference toxicant test result fell outside the 95% warning limits for historical data. It is expected that 1 out of 20 results will fall outside the warning limits. All test validity criteria were satisfied, and therefore the test result is considered acceptable.

•All test validity criteria as specified in the test method cited above were satisfied.

•Statistical analysis could not be performed using non linear regression, since a suitable model could not be found. Therefore, test results were calculated using Linear Interpolation (CETIS)[a].

Work Order : 219381
Sample Number : 31017

TEST ORGANISMS

Test Organism :	*Ceriodaphnia dubia*	Range of Age (at start of test) :	09:15 h - 20:20 h
Organism Batch :	Cd11-06	Mean Brood Organism Mortality :	3.3%
Organism Origin :	Single in-house mass culture	Ephippia in Culture :	No
Test Organism Origin :	Individual in-house cultures		

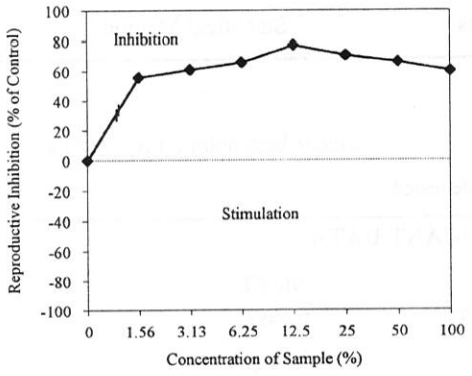
Brood Organism Neonate Production

Replicate :	1	2	3	4	5	6	7	8	9	10	Mean
Total (third or subsequent brood):	10	12	17	17	15	15	13	12	17	22	15.0
Total (first three broods):	25	27	25	25	24	26	22	20	28	27	24.9

No organisms exhibiting unusual appearance, behaviour, or undergoing unusual treatment were used in the test.

TEST DATA

***Ceriodaphnia dubia* Reproductive Inhibition**



Cumulative Daily Test Organism Mortality (%)

		Concentration of Sample (%)							
Date	**Test Day**	Control	1.56	3.13	6.25	12.5	25	50	100
2011-06-25	1	0	0	0	0	0	0	0	0
2011-06-26	2	0	0	0	0	0	0	0	0
2011-06-27	3	0	0	0	0	0	0	0	0
2011-06-28	4	0	0	0	0	0	0	0	0
2011-06-29	5	0	10	0	0	0	0	0	0
2011-06-30	6	0	10	0	0	0	0	0	0
Total Mortality (%)		0	10	0	0	0	0	0	0

REFERENCES

[a] CETIS, © 2001-2007. Comprehensive Environmental Toxicity Information System. Tidepool Scientific Software, McKinleyville, Calif. 95519[Program on disk and printed User's Guide].

Date : 2011-07-14
yyyy-mm-dd

Approved By : Shan Wu
Project Manager

Work Order : 219381
Sample Number : 31017

Ceriodaphnia dubia Survival and Reproduction

Test Initiation Date : 2011-06-24
Initiation Time : 13:50
Test Completion Date : 2011-06-30

Concentration (%) Control	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Mean Young (±SD)	Analyst(s)
2011-06-25	1	0	0	0	0	0	0	0	0	0	0	0	KG
2011-06-26	2	0	0	0	0	0	0	0	0	0	0	0	JGG
2011-06-27	3	0	2	0	0	5	4	5	0	0	0	1.6	EJ
2011-06-28	4	0	0	3	4	9	0	6	5	4	3	3.4	EJ
2011-06-29	5	8	13	12	0	10	0	8	0	7	9	6.7	NK
2011-06-30	6	13	16	15	8	–	9	–	1	15	17	9.4	EJ
Total		**21**	**31**	**30**	**12**	**24**	**13**	**19**	**6[1]**	**26**	**29**	**21.1 (±8.5)**	

Concentration (%) 12.5	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Mean Young (±SD)
2011-06-25	1	0	0	0	0	0	0	0	0	0	0	0
2011-06-26	2	0	0	0	0	0	0	0	0	0	0	0
2011-06-27	3	0	0	0	0	0	0	2	0	0	0	0.2
2011-06-28	4	0	0	0	0	5	2	0	0	1	0	0.8
2011-06-29	5	2	0	6	0	2	2	0	5	7	0	2.4
2011-06-30	6	6	4	0	1	3	0	0	0	0	0	1.4
Total		**8**	**4**	**6**	**1**	**10**	**4**	**2**	**5**	**8**	**0**	**4.8 (±3.3)**

Concentration (%) 1.56	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Mean Young (±SD)
2011-06-25	1	0	0	0	0	0	0	0	0	0	0	0
2011-06-26	2	0	0	0	0	0	0	0	0	0	0	0
2011-06-27	3	0	2	5	0	0	5	2	0	0	0	1.4
2011-06-28	4	0	0	9	5	6	0	0	0	2	0	2.2
2011-06-29	5	0	0 x	0	0	0	0	0	3	4	3	1.0
2011-06-30	6	2	0	2	7	5	2	2	12	2	13	4.7
Total		**2**	**2**	**16**	**12**	**11**	**7**	**4**	**15**	**8**	**16**	**9.3 (±5.5)**

Concentration (%) 25	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Mean Young (±SD)
2011-06-25	1	0	0	0	0	0	0	0	0	0	0	0
2011-06-26	2	0	0	0	0	0	0	0	0	0	0	0
2011-06-27	3	0	0	0	0	0	0	4	0	0	0	0.4
2011-06-28	4	0	0	0	6	4	0	0	0	4	0	1.4
2011-06-29	5	0	6	0	3	0	0	0	2	6	3	2.0
2011-06-30	6	0	4	6	1	6	1	6	0	0	0	2.4
Total		**0**	**10**	**6**	**10**	**10**	**1**	**10**	**2**	**10**	**3**	**6.2 (±4.3)**

Concentration (%) 3.13	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Mean Young (±SD)
2011-06-25	1	0	0	0	0	0	0	0	0	0	0	0
2011-06-26	2	0	0	0	0	0	0	0	0	0	0	0
2011-06-27	3	0	0	0	0	4	3	0	0	0	1	0.8
2011-06-28	4	0	0	0	2	0	0	0	0	4	3	0.9
2011-06-29	5	8	0	0	3	0	3	0	3	2	4	2.3
2011-06-30	6	13	9	1	2	0	4	1	7	2	3	4.2
Total		**21**	**9**	**1**	**7**	**4**	**10**	**1**	**10**	**8**	**11**	**8.2 (±5.8)**

Concentration (%) 50	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Mean Young (±SD)
2011-06-25	1	0	0	0	0	0	0	0	0	0	0	0
2011-06-26	2	0	0	0	0	0	0	0	0	0	0	0
2011-06-27	3	0	0	5	0	4	2	0	0	0	0	1.1
2011-06-28	4	2	0	0	3	0	0	0	1	1	1	0.8
2011-06-29	5	10	11	0	5	0	4	0	0	0	8	3.8
2011-06-30	6	0	1	0	4	0	2	5	2	0	0	1.4
Total		**12**	**12**	**5**	**12**	**4**	**8**	**5**	**3**	**1**	**9**	**7.1 (±4.1)**

Concentration (%) 6.25	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Mean Young (±SD)
2011-06-25	1	0	0	0	0	0	0	0	0	0	0	0
2011-06-26	2	0	0	0	0	0	0	0	0	0	0	0
2011-06-27	3	0	0	0	0	0	0	1	0	0	0	0.1
2011-06-28	4	2	0	0	0	5	0	5	2	0	2	1.6
2011-06-29	5	0	0	0	10	0	0	0	6	0	3	1.9
2011-06-30	6	0	0	6	1	6	7	4	2	2	8	3.6
Total		**2**	**0**	**6**	**11**	**11**	**7**	**10**	**10**	**2**	**13**	**7.2 (±4.5)**

Concentration (%) 100	Day	Replicate 1	2	3	4	5	6	7	8	9	10	Mean Young (±SD)
2011-06-25	1	0	0	0	0	0	0	0	0	0	0	0
2011-06-26	2	0	0	0	0	0	0	0	0	0	0	0
2011-06-27	3	0	0	2	0	0	0	5	0	0	0	0.7
2011-06-28	4	2	3	0	1	3	4	0	6	0	0	1.9
2011-06-29	5	0	0	0	2	0	3	0	8	5	4	2.2
2011-06-30	6	0	11	5	5	6	0	8	0	1	0	3.6
Total		**2**	**14**	**7**	**8**	**9**	**7**	**13**	**14**	**6**	**4**	**8.4 (±4.1)**

NOTES : •All young produced by a test organism during its fourth and subsequent broods were discarded and not included in the above counts. The presence of two or more neonates in any test chamber, during any given day of the test, constitutes a brood.

•[1] Outlier according to Grubbs Test (CETIS)[a]. Outlying data points were not excluded from statistical analysis, since they could not be attributed to error.

"x"= test organism mortality

"*"= accidental test organism mortality

"–"=4th brood (see 'NOTES')

Data Reviewed By : SM

Date : 2011-07-08

Work Order : 219381
Sample Number: 31017

Ceriodaphnia dubia Water Chemistry Data

	Initial Chemistry:	Temp. (°C)	DO (mg/L)	pH	Conductivity (µmhos/cm)	Hardness (mg/L as $CaCO_3$)
		25.0	7.7	7.8	1324	230

		Day 0 - 1	Day 1 - 2	Day 2 - 3	Day 3 - 4	Day 4 - 5	Day 5 - 6
Date :		2011-06-24	2011-06-25	2011-06-26	2011-06-27	2011-06-28	2011-06-29
Sub-sample Used		1	1	1	2	2	3
Temperature (°C)		25.0	25.0	25.0	25.0	25.0	25.0
Dissolved Oxygen (mg/L)		7.7	7.8	8.2	7.8	7.6	7.5
Dissolved Oxygen % Sat.[3]		100	99	104	98	97	96
pH		7.8	7.7	7.7	7.6	7.6	7.6
Pre-aeration Time (min)[4]		0	0	20	0	0	0
Analyst(s)	Initial	PP(SM)	KD	AW	SM	PP(SM)	HP(SM)
	Final	KD	AW	SM	CL	VC	PP(SM)
Control (0%)							
Temp. (°C)	Initial	25.0	25.0	25.0	24.5	25.0	25.0
	Final	25.0	25.0	25.0	25.0	25.0	25.0
DO % Sat.[3]	Initial	98	99	100	98	98	99
DO (mg/L)	Initial	7.7	7.8	8.0	7.7	7.7	7.9
	Final	7.1	7.3	7.0	7.2	7.4	7.3
pH	Initial	8.3	8.2	8.3	8.3	8.2	8.3
	Final	8.1	8.2	8.1	8.1	8.2	8.0
Cond. (µmhos)	Initial	467	452	467	448	478	476
1.56 %							
Temp. (°C)	Initial	25.0	25.0	25.0	24.5	25.0	25.0
	Final	25.0	25.0	25.0	25.0	25.0	25.0
DO (mg/L)	Initial	7.8	7.9	7.9	7.8	7.8	7.9
	Final	7.0	7.4	7.1	7.2	7.3	7.3
pH	Initial	8.3	8.3	8.4	8.4	8.2	8.3
	Final	8.1	8.2	8.2	8.1	8.2	8.1
Cond. (µmhos)	Initial	484	485	481	468	495	493
25 %							
Temp. (°C)	Initial	25.0	25.0	25.0	24.5	25.0	25.0
	Final	25.0	25.0	25.0	25.0	25.0	25.0
DO (mg/L)	Initial	7.7	7.9	7.8	7.8	7.7	7.9
	Final	6.9	7.0	6.9	7.1	7.2	7.1
pH	Initial	8.2	8.2	8.2	8.2	8.1	8.2
	Final	8.1	8.1	8.1	8.1	8.1	8.0
Cond. (µmhos)	Initial	688	660	688	678	699	697
100 %							
Temp. (°C)	Initial	25.0	25.0	25.0	24.5	25.0	25.0
	Final	25.0	25.0	25.0	25.0	25.0	25.0
DO (mg/L)	Initial	7.6	7.7	7.6	7.6	7.5	7.4
	Final	6.7	6.8	6.5	6.7	6.6	6.4
pH	Initial	7.9	7.9	8.0	7.8	7.8	7.8
	Final	8.0	8.0	8.0	7.9	7.9	7.9
Cond. (µmhos)	Initial	1326	1334	1332	1336	1325	1330

"–" = not measured

[3] % saturation (adjusted for actual temperature and barometric pressure)

[4] ≤100 bubbles/minute

Buchanan Environmental Ltd.

138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: R6550

Rainbow Trout Bioassay Report

Facility Submitting Sample **Greater Shediac Sewerage Commission**

Address: 290 Main St., Shediac, NB E4P 2E3

Sample Material: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : J. de Vries
Sampling Point Description : Outlet Chamber

Time & Date Collected: 2:30 pm, Sept 19, 2011
Time & Date Received: 9:20 am, Sept 20, 2011

Sample Characterization *(unadjusted, undiluted)*

Volume received : 4 x 20 L
Temperature : 18.3 ° C (on arrival)
pH : 7.94
Dissolved oxygen : 10.0 mg/L
Conductivity : 1438 µmhos/cm
Colour/Appearance : Yellow w/ particles
Odour : Mild
Storage : 29 hours at 4 ± 2° C
Temperature adjustment overnight in lab: Yes

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 8.31
Conductivity : 224 µmhos/cm
Hardness : 90 mg/L as $CaCO_3$

Test Conditions

Type of test : Multi Concentration
Volume/Vessel : 2x20 L
Test Temperature : 15±1° C

Aeration rate : 6.5 ± 1 mL/min/L
Pre-aeration period : 30 minutes
Test Duration : 96 hours

Test Organism

Species: *Oncorhynchus mykiss*
Average length: 47.1 ± 4.8 mm
Number/Vessel (2x20L): 10 each
% Culture Mortality (< 7 days/ testing): 0.0%

Source: New Dundee, Ontario
Average weight: 1.3 ± 0.6 g
Stocking Density: 0.33 g/L

Test Started (time, date) : 9:30 am, 22 Sept, 2011
Test Ended (time, date) : 9:30 am, 26 Sept, 2011

Buchanan Environmental Ltd.
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: R6550

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	10.1	8.20	231	14.6	9.7	7.39	15.0	0	0
6.25	10.1	8.15	288	14.6	9.6	7.46	15.0	0	0
12.5	10.0	8.12	314	14.6	9.6	8.08	15.0	0	0
25	10.1	8.04	618	14.6	9.4	8.16	15.0	0	0
50	10.1	7.99	814	14.6	9.4	8.17	15.0	0	0
100	10.2	7.91	1433	14.6	9.3	8.28	15.0	10	100

* Values measured upon test initiation

 # Control showing atypical/stressed behaviour : 0/10

96 hour LC50 value (static, acute) : **70.71 Lethal** sample material

95 percent Confidence Limits (95% Cl) : 50, 100

Comments:

Reference Toxicity Test Data

Most Recent Reference Toxicity Test No. : LS221
Test time, Date : 2:30pm, Aug 29, 2011
Toxicant tested : Phenol
96 hr LC50 : 11.49 mg Phenol/L (*Spearman-Karber*)
95% Confidence Limits : (9.4, 14.04) mg Phenol/L
Historic Mean ± Warning Limits (2SD) : 9.49 ± 2.92 mg Phenol/L

* All bioassays were conducted following Environment Canada protocol (EPS 1/RM/13, May 2007).

Testing performed by A. Kaye, E. Dowling, and J. Blanchard of *Buchanan Environmental Ltd.*

Authorization _____
R.D. Buchanan
Head, Aquatic Toxicology

Buchanan Environmental Ltd
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: K017

Daphnia magna Bioassay Report

Facility Submitting Sample: **Greater Shediac Sewerage Commission**

Address: 290 Main St., Shediac, NB E4P 2E3

Sample Material: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : J. de Vries
Sampling Point Description : Outlet chamber

Time & Date Collected: 2:30 pm, Sept 19, 2011
Time & Date Received: 9:20 am, Sept 20, 2011

Sample Characterization *(unadjusted, undiluted)*

Volume received : 4 x 20 L
Temperature : 18.3°C (on arrival)
pH : 7.54
Dissolved oxygen : 8.1 mg/L
Conductivity : 1732 µmhos/cm
Hardness : 200 mg/L as $CaCO_3$
Colour : light yellow/clear
Odour : Mild
Storage : None
Temperature adjustment overnight in lab: Yes

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 8.00
Conductivity : 270µmhos/cm
Hardness : 96 mg/L as $CaCO_3$

Test Conditions:

Type of test : Multi-Concentration
No. daphnids/vessel : 10
Stocking Density : 15 mL/neonate
Pre-Aeration : 0 minutes
Test Temperature : 20± 2° C

Volume/test vessel : 150 mL
No. of vessel/conc. : 1
Culture Mortality (<7 days/testing): 0%
Aeration rate : 37.5±12.5 mL/min/L
Test Duration : 48 hours

Test Started (time, date) : 11:45 am, Sept 21, 2011
Test Ended (time, date) : 11:45 am, Sept 23, 2011

Buchanan Environmental Ltd.
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: K017

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	8.9	7.84	270	21.1	8.5	7.70	20.5	0	0
6.25	8.8	7.81	365	21.3	8.5	7.71	20.7	0	0
12.5	8.7	7.77	456	21.3	8.5	7.70	20.9	0	0
25	8.6	7.73	649	21.3	8.4	7.67	21.3	0	0
50	8.3	7.64	1024	21.3	8.5	7.71	20.5	0	0
100	8.1	7.55	1736	21.3	8.5	7.71	20.5	1	10

* Values measured upon test initiation

 # Control showing atypical/stressed behaviour : 0/10

48 hour LC50 Value (static, acute) : **Non-lethal** sample material

95 percent confidence limits (95 % CL) : n/a

Comments:

Reference Toxicant Test Data

Test organism: *Daphnia magna* (≤24 hr old neonates)

Culture Providing Neonates	: Aug 29, 2011
Time to First Brood	: 8 days
Average number of neonates per brood (2-4th brood)	: 23.9
Most Recent Reference Toxicant Test (#665)	: 2:45pm Sept 12, 2011
Toxicant tested	: Sodium Chloride (NaCl)
Statistical Analysis	: Spearman-Karber
48 hr LC50	: 5.29 g NaCl/L
95% Confidence Limits	: (4.46, 6.27) g NaCl/L
Historic Mean 48 hr LC50 ± Warning limits (2SD)	: 5.78 ± 1.16 g NaCl/L

* All bioassays were conducted following Environment Canada protocol (EPS 1/RM/14, Dec 2000).

Testing performed by K. Gilmore, L. Boone, and J. Comeau of *Buchanan Environmental Ltd.*

Authorization _____
R.D. Buchanan
Head, Aquatic Toxicology

Buchanan Environmental Ltd
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: C28

Ceriodaphnia dubia Bioassay Report

Facility Submitting Sample: **Greater Shediac Sewerage Commission**

Address: 290 Main St. Unit 301, Shediac, NB E4P 2E3

Sample Material Description: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : Jessica de Vries
Sampling Point Description : Outlet Chamber

Time & Date Collected: 2:30 pm, Sept 19, 2011
Time & Date Received: 9:20 am, Sept 20, 2011

Sample Characterization *(unadjusted, undiluted)*

Volume received : 4 X 20L
Temperature : 18.3°C (on arrival)
pH : 7.51
Dissolved oxygen : 8.2 mg/L
Conductivity : 1881 µmhos/cm
Hardness : 214 mg/L as $CaCO_3$
Colour : Light Yellow
Odour : None
Storage : 29.25 hrs. @ 4+/- 2°C
Temperature adjustment overnight in lab: Yes

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 8.00
Conductivity : 270 µmhos/cm
Hardness : 96 mg/L as $CaCO_3$

Test Conditions:

Type of test : Multi Concentration
No. daphnids/vessel : 1
Stocking Density : 22 mL/neonate
Pre-Aeration : 0 min
Test Temperature : 25 ± 1° C
pH adjustment : none

Volume/test vessel : 22 mL
No. of vessel/conc. : 10
Culture Mortality (<7 days/testing): 0.0%
Aeration rate : 37.5±12.5 mL/min/L
Test Duration : 7 days
Hardness Adjustment: None

Daily renewal method: transferred to new solutions Sample filtration: None

Test Started (time, date) : 11:00 am, 22 Sept, 2011
Test Ended (time, date) : 11:00 am, 29 Sept, 2011

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	8.2	8.07	259	24.0	8.2	7.79	24.0	0	0
1.56	8.1	8.06	278	24.4	8.2	7.79	25.0	1	10
3.12	8.2	8.02	296	24.0	8.0	7.81	24.8	0	0
6.25	8.1	8.01	341	24.0	8.1	7.81	24.8	0	0
12.5	8.1	7.97	424	24.4	8.1	7.81	24.6	0	0
25	8.2	7.92	612	24.6	8.1	7.82	24.8	1	10
50	8.1	7.83	967	24.6	8.1	7.83	24.8	2	20
100	8.0	7.72	1634	24.4	8.2	7.80	24.4	1	10

* Values measured upon test initiation

Effect	Value	95% confidence Limits	Statistical Method
LC50	>100%	N/A	linear interpolation
IC25 (reproduction)	15.45	10.21, 22.04	linear interpolation

Reference Toxicant Test Data

Test organism: *Ceriodaphnia dubia* (≤24 hr old neonates)
Culture board providing neonates: Board # 58
Time to First Brood: 4 days

Most Recent Reference Toxicant Test (Lab Ref. # 35): 10:00 am, Sept. 22, 2011
Toxicant tested: Sodium Chloride (NaCl)

IC25 Reproduction: 1.04 g/L
95% Confidence Limits: 0.915, 1.14 g/L
Statistical method: Linear interpolation(CETIS)
Historical mean IC25: 0.745 g/L
Warning Limits (± 2SD): 0, 1.51 g/L

LC50: 2.12 g/L
95% confidence Limits: 1.70, 2.64 g/L
Statistical method: Linear interpolation (CETIS)
Historical mean LC50: 1.99 g/L
Warning Limits (± 2SD): 1.59, 2.40 g/L

*The reference toxicity test was performed under the same experimental conditions as those used with the test sample.

Test Organisms

Test Organism: *Ceriodaphnia dubia*
Organism batch (board #): # 58
Organism Origin: In-house mass culture
Ephippia in Culture: None

Days to first Brood: 4 days
Mean Brood organism mortality: 0%
Range of Age at Start of Test: 0hrs-24hrs.

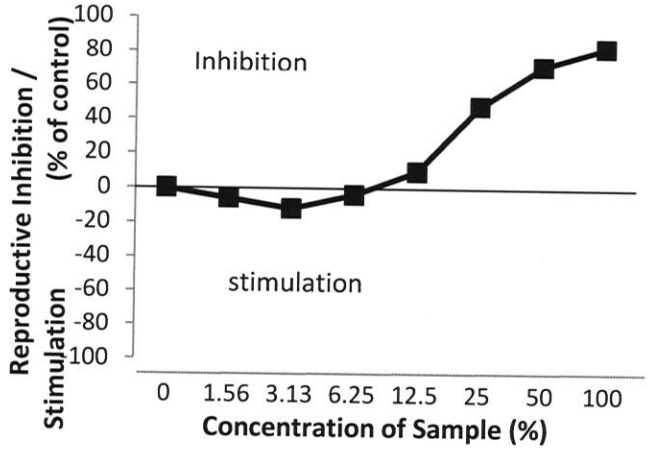
Brood Organism Neonate Production

Replicate	1	2	3	4	5	6	7	8	9	10	Mean
Total (first three broods)	15	20	29	20	37	26	22	24	31	29	23.3

Organisms showing abnormal appearance, behaviour, or undergoing unusual treatment will not be used in the test

Test Data

***Ceriodaphnia dubia* Reproductive Inhibition**



Cumulative Daily Test Organism Mortality (%)

		Concentration of Sample (%)							
Date	**Test day**	Control	1.56	3.13	6.25	12.5	25	50	100
12-Aug11	1	0	0	0	0	0	0	0	0
13-Aug11	2	0	0	0	0	0	0	0	0
14-Aug11	3	0	0	0	0	0	10	10	0
15-Aug11	4	0	0	0	0	0	10	10	0
16-Aug11	5	0	0	0	0	0	10	10	10
17-Aug11	6	0	0	0	0	0	10	10	10
18-Aug11	7	0	10	0	0	0	10	20	10
Total Mortality (%)		0	10	0	0	0	10	20	10

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138 Gibson Street, Fredericton, N.B. E3A 4E2

Lab Sample Reference # C28

Ceriodaphnia dubia Survival and Reproduction

Concentration (%)		Replicate										Mean	Analysts
Control	Day	1	2	3	4	5	6	7	8	9	10	Young	
12-Aug-11	1	0	0	0	0	0	0	0	0	0	0	0.0	LB
13-Aug-11	2	0	0	0	0	0	0	0	0	0	0	0.0	JB
14-Aug-11	3	0	0	0	0	0	0	0	0	0	0	0.0	ED
15-Aug-11	4	7	6	8	7	5	0	5	2	6	8	5.4	JC
16-Aug-11	5	9	12	4	5	9	7	8	10	9	13	8.6	ED
17-Aug-11	6	0	0	1	2	2	14	0	15	0	0	3.4	JC
18-Aug-11	7	17	15	16	18	19	2	20	0	15	16	13.8	KG
Total		**33**	**33**	**29**	**32**	**35**	**23**	**33**	**27**	**30**	**37**	**31.2**	
												(± 2SD) = 8.2	

Concentration (%)		Replicate										Mean
12.5	Day	1	2	3	4	5	6	7	8	9	10	Young
12-Aug-11	1	0	0	0	0	0	0	0	0	0	0	0.0
13-Aug-11	2	0	0	0	0	0	0	0	0	0	0	0.0
14-Aug-11	3	0	0	0	0	0	0	0	0	0	0	0.0
15-Aug-11	4	5	1	0	5	6	0	0	4	0	6	2.7
16-Aug-11	5	10	6	4	9	10	5	8	12	9	5	7.8
17-Aug-11	6	0	0	10	13	1	11	8	0	15	0	5.8
18-Aug-11	7	16	14	2	0	18	0	0	15	0	20	8.5
Total		**31**	**21**	**16**	**27**	**35**	**16**	**16**	**31**	**24**	**31**	**24.8**
												(± 2SD) = 14.5

Concentration (%)		Replicate										Mean
1.56	Day	1	2	3	4	5	6	7	8	9	10	Young
12-Aug-11	1	0	0	0	0	0	0	0	0	0	0	0.0
13-Aug-11	2	0	0	0	0	0	0	0	0	0	0	0.0
14-Aug-11	3	0	0	0	0	0	0	0	0	0	0	0.0
15-Aug-11	4	8	6	6	0	5	5	6	5	0	5	4.6
16-Aug-11	5	6	8	7	6	8	9	10	7	7	9	7.7
17-Aug-11	6	0	0	0	18	1	10	16	0	13	0	5.8
18-Aug-11	7	20	15	21	0	18	0	0	18	X	18	12.2
		34	**29**	**34**	**24**	**32**	**24**	**32**	**30**	**20**	**32**	**29.1**
												(± 2SD) = 9.6

Concentration (%)		Replicate										Mean
25	Day	1	2	3	4	5	6	7	8	9	10	Young
12-Aug-11	1	0	0	0	0	0	0	0	0	0	0	0.0
13-Aug-11	2	0	0	0	0	0	0	0	0	0	0	0.0
14-Aug-11	3	0	0	0	0	0	0	X	0	0	0	0.0
15-Aug-11	4	2	0	0	6	0	6	X	7	2	5	3.1
16-Aug-11	5	2	5	0	0	0	8	X	6	6	1	3.1
17-Aug-11	6	9	2	8	0	0	2	X	1	0	0	2.4
18-Aug-11	7	0	0	14	14	12	15	X	14	11	0	8.9
		13	**7**	**22**	**20**	**12**	**31**	**0**	**28**	**19**	**6**	**15.8**
												(± 2SD) = 19.9

Concentration (%)		Replicate										Mean
3.13	Day	1	2	3	4	5	6	7	8	9	10	Young
12-Aug-11	1	0	0	0	0	0	0	0	0	0	0	0.0
13-Aug-11	2	0	0	0	0	0	0	0	0	0	0	0.0
14-Aug-11	3	0	0	0	0	0	0	0	0	0	0	0.0
15-Aug-11	4	7	0	6	6	7	0	9	8	8	9	6.0
16-Aug-11	5	11	6	8	5	12	8	10	9	6	13	8.8
17-Aug-11	6	14	0	1	0	0	15	0	0	0	0	3.0
18-Aug-11	7	0	2	21	18	16	1	15	20	19	17	12.9
		32	**8**	**36**	**29**	**35**	**24**	**34**	**37**	**33**	**39**	**30.7**
												(± 2SD) = 18.1

Concentration (%)		Replicate										Mean
50	Day	1	2	3	4	5	6	7	8	9	10	Young
12-Aug-11	1	0	0	0	0	0	0	0	0	0	0	0.0
13-Aug-11	2	0	0	0	0	0	0	0	0	0	0	0.0
14-Aug-11	3	0	0	0	0	0	0	X	0	0	0	0.0
15-Aug-11	4	0	0	4	9	6	3	X	4	5	4	3.9
16-Aug-11	5	3	0	0	2	3	5	X	0	2	0	1.7
17-Aug-11	6	0	0	0	0	0	0	X	0	0	0	0.0
18-Aug-11	7	9	0	0	0	11	8	X	0	0	0	3.1
		12	**0**	**4**	**11**	**20**	**16**	**0**	**4**	**7**	**4**	**7.8**
												(± 2SD) = 13.5

Concentration (%)		Replicate										Mean
6.25	Day	1	2	3	4	5	6	7	8	9	10	Young
12-Aug-11	1	0	0	0	0	0	0	0	0	0	0	0.0
13-Aug-11	2	0	0	0	0	0	0	0	0	0	0	0.0
14-Aug-11	3	0	0	0	0	0	0	0	0	0	0	0.0
15-Aug-11	4	0	0	5	8	6	7	6	7	7	7	5.3
16-Aug-11	5	10	5	3	9	10	12	4	8	9	6	7.6
17-Aug-11	6	18	18	18	0	0	1	13	0	2	0	7.0
18-Aug-11	7	0	0	15	20	17	18	0	17	21	14	12.2
		28	**23**	**41**	**37**	**33**	**38**	**23**	**32**	**39**	**27**	**32.1**
												(± 2SD) = 13.2

Concentration (%)		Replicate										Mean
100	Day	1	2	3	4	5	6	7	8	9	10	Young
12-Aug-11	1	0	0	0	0	0	0	0	0	0	0	0.0
13-Aug-11	2	0	0	0	0	0	0	0	0	0	0	0.0
14-Aug-11	3	0	0	0	0	0	0	0	0	0	0	0.0
15-Aug-11	4	0	0	0	0	2	1	0	5	2	4	1.4
16-Aug-11	5	0	1	0	4	0	X	0	0	3	0	0.9
17-Aug-11	6	3	0	0	0	0	X	0	0	0	8	1.2
18-Aug-11	7	7	0	0	0	0	X	0	0	4	3	1.6
		10	**1**	**0**	**4**	**2**	**1**	**0**	**5**	**9**	**15**	**4.7**
												(± 2SD) = 10.2

"X" - test organism mortality

"*" - accidental organism mortality

"-" - 4th brood (see NOTES)

NOTE: All young produced by any test organism during its fourth and subsequent broods were discarded and not included in the above counts.
The presence of two or more neonates in any test chamber, during any given day of the test, constitutes a brood.

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***Lab sample Reference* # C28**

Ceriodaphnia dubia Water Chemistry Data During Testing

		24 Hrs 12/08/2011	48 Hrs 13/08/2011	72 Hrs 14/08/2011	96 Hrs 15/08/2011	120 Hrs 16/08/2011	144 Hrs 17/08/2011
Control (0%)							
Temp. (°C):	**Initial:**	24.6	24.2	25.0	24.6	25.0	24.4
	Final:	24.2	24.8	24.0	25.0	24.8	24.0
DO (mg/L)	**Initial:**	8.6	8.5	8.4	8.3	8.2	8.9
	Final:	8.3	8.4	8.4	8.5	8.3	8.3
pH	**Initial:**	7.92	8.20	7.98	7.89	7.93	8.19
	Final:	8.05	8.40	7.97	8.01	7.95	8.00
Cond. (µmhos)	**Initial:**	284	281	284	280	285	258
1.56%							
Temp. (°C):	**Initial:**	24.6	24.4	25.4	25.0	25.0	25.0
	Final:	24.8	24.6	24.6	24.6	25.2	24.2
DO (mg/L)	**Initial:**	8.6	8.1	8.2	7.9	8.1	8.9
	Final:	8.2	8.3	8.3	8.5	8.2	8.3
pH	**Initial:**	7.81	8.29	7.96	8.20	7.93	8.22
	Final:	8.04	8.21	7.95	8.00	7.94	8.00
Cond. (µmhos)	**Initial:**	310	306	309	275	307	282
25%							
Temp. (°C):	**Initial:**	25.0	24.8	24.6	24.6	24.8	24.4
	Final:	24.4	24.8	25.8	24.8	25.0	24.2
DO (mg/L)	**Initial:**	8.6	8.1	8.2	8.0	8.1	8.8
	Final:	8.2	8.2	8.4	8.2	8.1	8.1
pH	**Initial:**	7.56	8.08	7.72	8.02	7.78	8.08
	Final:	7.91	7.97	7.80	7.80	7.87	7.84
Cond. (µmhos)	**Initial:**	694	683	685	630	692	628
100%							
Temp. (°C):	**Initial:**	25.4	25.0	24.8	25.4	24.6	24.2
	Final:	24.6	25.0	24.2	24.4	25.0	24.0
DO (mg/L)	**Initial:**	8.7	8.0	8.8	8.4	8.5	8.6
	Final:	8.0	8.1	8.0	8.0	8.4	8.1
pH	**Initial:**	7.29	7.74	7.34	7.69	7.59	7.84
	Final:	7.71	7.74	7.31	7.30	7.60	7.59
Cond. (µmhos)	**Initial:**	1838	1791	1813	1655	1785	1646

Comments:

** All bioassays were conducted following Environment Canada protocol (EPS 1/RM/1421, Feb 2007).*
Testing performed by K. Gilmore, E. Dowling, J. Comeau, L. Boone, and J. Blanchard of Buchanan Environmental Ltd.

Authorization: _____
R.D. Buchanan
Head of Aquatic Toxicology

Buchanan Environmental Ltd.

138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: R6669

Rainbow Trout Bioassay Report

Facility Submitting Sample: Greater Shediac Sewerage Commission (11079-1c)

Address: 290 Main St., Shediac, NB E4P 2E3

Sample Material: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : J. de Vries
Sampling Point Description : After UV Treatment- Outlet Chamber

Time & Date Collected: 10:30 am, 23 Jan, 2012
Time & Date Received: 9:05 am, 24 Jan, 2012

Sample Characterization *(unadjusted, undiluted)*

Volume received : 4 x 20L
Temperature : 2.6° C (on arrival)
pH : 7.18
Dissolved oxygen : 8.9 mg/L
Conductivity : 1241 µmhos/cm
Colour/Appearance : Light Green
Odour : None
Storage : 53 hours at 4 ± 2° C
Temperature adjustment overnight in lab: Yes

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 7.67
Conductivity : 206 µmhos/cm
Hardness : 88 mg/L as $CaCO_3$

Test Conditions

Type of test : Multi Concentration
Volume/Vessel : 25L
Test Temperature : 15±1° C
Aeration rate : 6.5 ± 1 mL/min/L
Pre-aeration period : 30 minutes
Test Duration : 96 hours

Test Organism

Species: *Oncorhynchus mykiss*
Source: Rainbow Springs, Ontario
Average length: 42.0 ± 4.7 mm
Average weight: 0.7 ± 0.2 g
Number/Vessel (25L): 10 each
Stocking Density: 0.29 g/L
% Culture Mortality (< 7 days/ testing): 0.0%

Test Started (time, date) : 9:10 am, 27 Jan, 2012
Test Ended (time, date) : 9:10 am, 31 Jan, 2012

Buchanan Environmental Ltd.
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: R6669

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	9.6	7.62	205	14.0	9.0	7.67	15.2	0	0
6.25	9.7	7.59	278	14.0	8.7	7.64	15.2	0	0
12.5	9.7	7.56	350	14.0	8.7	7.61	15.0	0	0
25	9.7	7.47	481	14.0	9.0	7.65	15.0	0	0
50	9.7	7.35	673	14.0	8.9	7.70	15.0	0	0
100	10.6	7.16	1232	14.0	9.0	7.77	14.8	0	0

* Values measured upon test initiation

 # Control showing atypical/stressed behaviour : 0/10

96 hour LC50 value (static, acute) : **Non-Lethal** sample material

95 percent Confidence Limits (95% Cl) : N/A

Comments:

Reference Toxicity Test Data

Most Recent Reference Toxicity Test No. : LS228
Test time, Date : 11:00 am, January 19, 2012
Toxicant tested : Phenol
96 hr LC50 : 9.33 mg Phenol/L (*Spearman-Karber*)
95% Confidence Limits : (7.53, 11.57) mg Phenol/L
Historic Mean ± Warning Limits (2SD) : 9.52 ± 3.23 mg Phenol/L

* All bioassays were conducted following Environment Canada protocol (EPS 1/RM/13, May 2007).

Testing performed by J. Comeau, E. Dowling, and J. Blanchard of *Buchanan Environmental Ltd.*

Authorization _____
R.D. Buchanan
Head, Aquatic Toxicology

Buchanan Environmental Ltd
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: K180

Daphnia magna Bioassay Report

Facility Submitting Sample: **Greater Shediac Sewerage Commission (11079-1C)**

Address: 290 Main St., Shediac, NB E4P 2E3

Sample Material: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : J. de Vries
Sampling Point Description : After UV Treatment- Outlet Chamber

Time & Date Collected: 10:30 am, 23 Jan, 2012
Time & Date Received: 9:05 am, 24 Jan, 2012

Sample Characterization *(unadjusted, undiluted)*

Volume received : 4 x 20 L
Temperature : 2.6°C (on arrival)
pH : 7.35
Dissolved oxygen : 11.5 mg/L
Conductivity : 1362 µmhos/cm
Hardness : 210 mg/L as $CaCO_3$
Colour : Yellow/Green w/ Sediment
Odour : None
Storage : None
Temperature adjustment overnight in lab: No

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 8.00
Conductivity : 252µmhos/cm
Hardness : 96 mg/L as $CaCO_3$

Test Conditions:

Type of test : Multi-Concentration
No. daphnids/vessel : 10
Stocking Density : 15 mL/neonate
Pre-Aeration : 30 minutes
Test Temperature : 20± 2° C

Volume/test vessel : 150 mL
No. of vessel/conc. : 1
Culture Mortality (<7 days/testing): 1.28%
Aeration rate : 37.5±12.5 mL/min/L
Test Duration : 48 hours

Test Started (time, date) : 3:45 pm, 24 Jan, 2012
Test Ended (time, date) : 3:45 pm, 26 Jan, 2012

Buchanan Environmental Ltd.
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: K180

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	8.8	7.92	251	20.2	8.6	7.96	20.0	0	0
6.25	8.9	7.87	332	20.4	8.2	7.93	19.8	0	0
12.5	9.1	7.81	409	20.2	8.2	7.93	20.6	0	0
25	9.3	7.72	555	20.2	8.3	7.93	19.8	0	0
50	10.1	7.59	903	20.2	7.7	7.91	20.8	0	0
100	10.8	7.44	1452	19.8	7.7	7.92	20.0	0	0

* Values measured upon test initiation

 # Control showing atypical/stressed behaviour : 0/10

48 hour LC50 Value (static, acute) : **Non-lethal** sample material

95 percent confidence limits (95 % CL) : N/A

Comments:

Reference Toxicant Test Data

Test organism: *Daphnia magna* (≤24 hr old neonates)

Culture Providing Neonates	: January 2, 2012
Time to First Brood	: 7 days
Average number of neonates per brood (2-4th brood)	: 27.8
Most Recent Reference Toxicant Test (#683)	: 11:50 am, January 16, 2012
Toxicant tested	: Sodium Chloride (NaCl)
Statistical Analysis	: Spearman-Karber
48 hr LC50	: 6.23 g NaCl/L
95% Confidence Limits	: (5.31, 7.31) g NaCl/L
Historic Mean 48 hr LC50 ± Warning limits (2SD)	: 5.61 ± 0.96 g NaCl/L

* All bioassays were conducted following Environment Canada protocol (EPS 1/RM/14, Dec 2000).

Testing performed by L. Boone and J. Comeau of *Buchanan Environmental Ltd.*

Authorization _____

R.D. Buchanan
Head, Aquatic Toxicology

Buchanan Environmental Ltd
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: ***C55***

Ceriodaphnia dubia Bioassay Report

Facility Submitting Sample: **Greater Shediac Sewerage Commision - 11079-1c**

Address: 290 Main Street, Unit 301, Shediac, NB, E4P 2E3

Sample Material Description: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : J. de Vries
Sampling Point Description : After UV Treatment- Outlet Chamber

Time & Date Collected: 10:30 am, 23 Jan, 2012
Time & Date Received: 9:05 am, 24 Jan, 2012

Sample Characterization *(unadjusted, undiluted)*

Volume received : 2 X4L
Temperature : 5.2°C (on arrival)
pH : 7.30
Dissolved oxygen : 7.1 mg/L
Conductivity : 1641 µmhos/cm
Hardness : 200 mg/L as $CaCO_3$
Colour : Light Green
Odour : Mild
Storage : 28 hours at 4±2°C
Temperature adjustment overnight in lab: Yes

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 8.00
Conductivity : 258 µmhos/cm
Hardness : 100 mg/L as $CaCO_3$

Test Conditions:

Type of test : Multi Concentration
No. daphnids/vessel : 1
Stocking Density : 22 mL/neonate
Pre-Aeration : None
Test Temperature : 25 ± 1° C
pH adjustment : None
Volume/test vessel : 22 mL
No. of vessel/conc. : 10
Culture Mortality (<7 days/testing): 0.0%
Aeration rate : 37.5±12.5 mL/min/L
Test Duration : 7 days
Hardness Adjustment: None
Daily renewal method: Transferred to new solutions Sample filtration: None

Test Started (time, date) : 12:00 pm, 26 Jan, 2012
Test Ended (time, date) : 12:00 pm, 02 Feb, 2012

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	8.0	8.05	270	24.2	8.0	7.98	24.4	0	0
1.56	8.0	8.07	285	24.0	7.9	7.99	24.8	0	0
3.12	8.0	8.07	305	24.0	7.9	7.99	25.0	0	0
6.25	8.1	8.04	348	24.6	7.9	8.01	24.6	0	0
12.5	7.9	7.97	430	24.6	7.9	8.01	24.6	0	0
25	7.8	7.86	610	25.0	7.8	8.02	24.8	2	20
50	7.5	7.67	941	25.0	7.6	8.03	24.4	1	10
100	7.1	7.44	1576	24.4	7.2	7.99	24.8	0	0

* Values measured upon test initiation

Effect	Value	95% confidence Limits	Statistical Method
LC50	>100%	N/A	-
IC25 (reproduction)	>100%	N/A	-

Reference Toxicant Test Data

Test organism: *Ceriodaphnia dubia* (≤24 hr old neonates)
Culture board providing neonates: Board # 69
Time to First Brood: 4 days

Most Recent Reference Toxicant Test (Lab Ref. # 45): 10:00 am, January 26, 2012
Toxicant tested: Sodium Chloride (NaCl)

IC25 Reproduction: 1.22 g/L
95% Confidence Limits: 0.86, 1.63 g/L
Statistical method: Linear Interpolation(CETIS)
Historical mean IC25: 0.81 g/L
Warning Limits (± 2SD): 0.09, 1.53 g/L

LC50: 2.16 g/L
95% confidence Limits: 2.16, 2.16 g/L
Statistical method: Linear Interpolation (CETIS)
Historical mean LC50: 2.04 g/L
Warning Limits (± 2SD): 1.80, 2.29 g/L

*The reference toxicity test was performed under the same experimental conditions as those used with the test sample.

Test Organisms

Test Organism: *Ceriodaphnia dubia*
Organism batch (board #): # 69
Organism Origin: In-house mass culture
Ephippia in Culture: No

Days to first Brood: 4 days
Mean Brood organism mortality: 0%
Range of Age at Start of Test: >0hrs-24hrs.

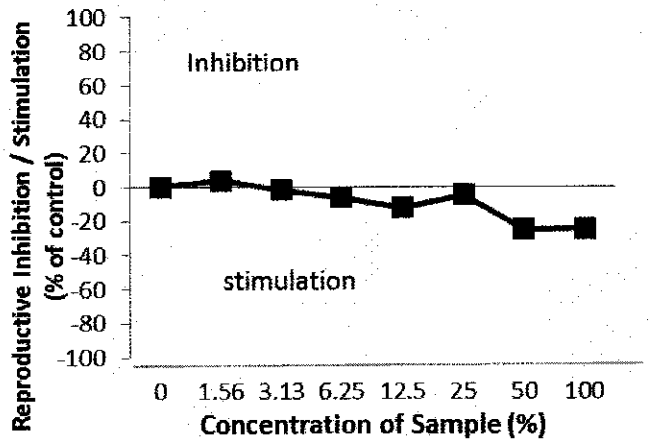
Brood Organism Neonate Production

Replicate	1	2	3	4	5	6	7	8	9	10	Mean
Total (first three broods)	51	33	7	37	30	44	17	31	30	56	33.6

Organisms showing abnormal appearance, behaviour, or undergoing unusual treatment will not be used in the test

Test Data

***Ceriodaphnia dubia* Reproductive Inhibition**



Cumulative Daily Test Organism Mortality (%)

		Concentration of Sample (%)							
Date	**Test day**	Control	1.56	3.13	6.25	12.5	25	50	100
27-Jan-12	1	0	0	0	0	0	0	0	0
28-Jan-12	2	0	0	0	0	0	0	0	0
29-Jan-12	3	0	0	0	0	0	0	0	0
30-Jan-12	4	0	0	0	0	0	0	0	0
31-Jan-12	5	0	0	0	0	0	0	0	0
01-Feb-12	6	0	0	0	0	0	20	0	0
02-Feb-12	7	0	0	0	0	0	20	10	0
Total Mortality (%)		0	0	0	0	0	20	10	0

Buchanan Environmental Ltd.
138 Gibson Street. Fredericton, N.B. E3A 4E2

Lab Sample Reference #: **C55**

Ceriodaphnia dubia Survival and Reproduction

Concentration (%)		Replicate										Mean	Analysts
Control	Day	1	2	3	4	5	6	7	8	9	10	Young	
27-Jan-12	1	0	0	0	0	0	0	0	0	0	0	0.0	LB
28-Jan-12	2	0	0	0	0	0	0	0	0	0	0	0.0	ED
29-Jan-12	3	0	0	0	0	0	0	0	0	0	0	0.0	ED
30-Jan-12	4	5	5	4	5	4	6	7	7	0	6	4.9	LB
31-Jan-12	5	0	0	0	0	0	0	0	0	5	0	0.5	KG
01-Feb-12	6	9	12	12	14	11	13	9	8	10	11	10.9	JC
02-Feb-12	7	16	17	19	17	15	19	14	18	18	16	16.9	KG
Total		**30**	**34**	**35**	**36**	**30**	**38**	**30**	**33**	**33**	**33**	**33.2**	
												(± 2SD) = 5.4	

Concentration (%)		Replicate										Mean
12.5	Day	1	2	3	4	5	6	7	8	9	10	Young
27-Jan-12	1	0	0	0	0	0	0	0	0	0	0	0.0
28-Jan-12	2	0	0	0	0	0	0	0	0	0	0	0.0
29-Jan-12	3	0	0	0	0	0	0	0	0	0	0	0.0
30-Jan-12	4	6	5	4	7	6	6	6	6	8	6	6.0
31-Jan-12	5	14	0	0	0	0	12	10	14	13	14	7.7
01-Feb-12	6	0	12	11	12	15	0	0	0	0	0	5.0
02-Feb-12	7	15	18	13	23	18	23	18	20	19	19	18.6
Total		**35**	**35**	**28**	**42**	**39**	**41**	**34**	**40**	**40**	**39**	**37.3**
												(± 2SD) = 8.5

Concentration (%)		Replicate										Mean
1.56	Day	1	2	3	4	5	6	7	8	9	10	Young
27-Jan-12	1	0	0	0	0	0	0	0	0	0	0	0.0
28-Jan-12	2	0	0	0	0	0	0	0	0	0	0	0.0
29-Jan-12	3	0	0	0	0	0	0	0	0	0	0	0.0
30-Jan-12	4	6	7	0	7	6	6	6	6	6	5	5.5
31-Jan-12	5	0	0	5	12	15	10	8	12	16	0	7.8
01-Feb-12	6	12	10	13	0	0	0	10	0	0	7	5.2
02-Feb-12	7	0	20	17	17	20	14	-	14	15	17	14.9
		18	**37**	**35**	**36**	**41**	**30**	**24**	**32**	**37**	**29**	**31.9**
												(± 2SD) = 13.8

Concentration (%)		Replicate										Mean
25	Day	1	2	3	4	5	6	7	8	9	10	Young
27-Jan-12	1	0	0	0	0	0	0	0	0	0	0	0.0
28-Jan-12	2	0	0	0	0	0	0	0	0	0	0	0.0
29-Jan-12	3	0	0	0	0	0	0	0	0	0	0	0.0
30-Jan-12	4	6	6	6	7	9	7	6	7	5	6	6.5
31-Jan-12	5	11	0	0	0	14	16	14	0	0	15	7.0
01-Feb-12	6	0	X-12	12	13	0	0	0	13	X-14	0	4.8
02-Feb-12	7	21	X	19	21	17	18	19	16	X	17	18.5
		38	**18**	**37**	**41**	**40**	**41**	**39**	**36**	**19**	**38**	**34.7**
												(± 2SD) = 17.4

Concentration (%)		Replicate										Mean
3.13	Day	1	2	3	4	5	6	7	8	9	10	Young
27-Jan-12	1	0	0	0	0	0	0	0	0	0	0	0.0
28-Jan-12	2	0	0	0	0	0	0	0	0	0	0	0.0
29-Jan-12	3	0	0	0	0	0	0	0	0	0	0	0.0
30-Jan-12	4	5	6	5	6	6	6	5	7	6	6	5.8
31-Jan-12	5	0	0	0	0	0	0	0	13	0	0	1.3
01-Feb-12	6	10	6	12	13	12	11	12	0	9	13	9.8
02-Feb-12	7	17	18	19	16	15	12	18	17	18	19	16.9
		32	**30**	**36**	**35**	**33**	**29**	**35**	**37**	**33**	**38**	**33.8**
												(± 2SD) = 5.9

Concentration (%)		Replicate										Mean
50	Day	1	2	3	4	5	6	7	8	9	10	Young
27-Jan-12	1	0	0	0	0	0	0	0	0	0	0	0.0
28-Jan-12	2	0	0	0	0	0	0	0	0	0	0	0.0
29-Jan-12	3	0	0	0	0	0	0	0	0	0	0	0.0
30-Jan-12	4	7	6	6	7	6	7	7	7	8	7	6.8
31-Jan-12	5	15	14	16	15	0	16	17	15	0	16	12.4
01-Feb-12	6	0	0	0	0	19	0	0	0	16	0	3.5
02-Feb-12	7	20	15	22	22	23	12	20	X-18	20	16	18.9
		42	**35**	**44**	**44**	**48**	**35**	**44**	**40**	**44**	**39**	**41.5**
												(± 2SD) = 8.4

Concentration (%)		Replicate										Mean
6.25	Day	1	2	3	4	5	6	7	8	9	10	Young
27-Jan-12	1	0	0	0	0	0	0	0	0	0	0	0.0
28-Jan-12	2	0	0	0	0	0	0	0	0	0	0	0.0
29-Jan-12	3	0	0	0	0	0	0	0	0	0	0	0.0
30-Jan-12	4	6	6	7	5	5	5	7	7	5	7	6.0
31-Jan-12	5	0	12	0	14	13	13	12	15	12	13	10.4
01-Feb-12	6	11	0	12	0	0	0	0	0	0	0	2.3
02-Feb-12	7	17	17	13	18	16	16	18	17	19	15	16.6
		34	**35**	**32**	**37**	**34**	**34**	**37**	**39**	**36**	**35**	**35.3**
												(± 2SD) = 4.0

Concentration (%)		Replicate										Mean
100	Day	1	2	3	4	5	6	7	8	9	10	Young
27-Jan-12	1	0	0	0	0	0	0	0	0	0	0	0.0
28-Jan-12	2	0	0	0	0	0	0	0	0	0	0	0.0
29-Jan-12	3	0	0	0	0	0	0	0	0	0	0	0.0
30-Jan-12	4	6	8	7	8	6	7	5	8	7	10	7.2
31-Jan-12	5	0	16	0	0	0	0	13	0	15	0	4.4
01-Feb-12	6	17	0	12	13	15	15	0	15	1	14	10.2
02-Feb-12	7	24	20	26	18	20	18	17	17	20	16	19.6
		47	**44**	**45**	**39**	**41**	**40**	**35**	**40**	**43**	**40**	**41.4**
												(± 2SD) = 6.9

"X" - test organism mortality

"*" - accidental organism mortality

"-" - 4th brood (see NOTES)

NOTE: All young produced by any test organism during its fourth and subsequent broods were discarded and not included in the above counts.

The presence of two or more neonates in any test chamber, during any given day of the test, constitutes a brood.

Buchcanan Environmental Ltd.
138 Gibson Street. Fredericton, N.B. E3A 4E2

Lab sample Reference #: C55

Ceriodaphnia dubia Water Chemistry Data During Testing

		24 Hrs 27/01/2012	48 Hrs 28/01/2012	72 Hrs 29/01/2012	96 Hrs 30/01/2012	120 Hrs 31/01/2012	144 Hrs 01/02/2012
Control (0%)							
Temp. (°C):	**Initial:**	24.0	24.6	24.0	25.0	24.0	24.0
	Final:	24.0	24.2	24.8	24.0	24.4	24.0
DO (mg/L)	**Initial:**	8.7	8.2	8.6	8.2	8.2	8.1
	Final:	7.9	8.3	8.5	8.5	8.1	8.3
pH	**Initial:**	7.96	8.27	8.24	8.16	8.16	8.19
	Final:	8.07	8.27	8.21	8.25	8.14	8.21
Cond. (µmhos)	**Initial:**	262	256	252	266	275	265
1.56%							
Temp. (°C):	**Initial:**	24.0	25.0	24.0	24.2	24.0	24.0
	Final:	24.2	24.6	25.0	24.2	25.0	24.2
DO (mg/L)	**Initial:**	8.6	8.3	8.4	8.1	8.2	8.1
	Final:	7.9	8.4	8.4	8.3	8.0	8.2
pH	**Initial:**	8.03	8.28	8.25	8.15	8.16	8.17
	Final:	8.10	8.29	8.23	8.26	8.12	8.18
Cond. (µmhos)	**Initial:**	289	287	270	278	284	281
25%							
Temp. (°C):	**Initial:**	25.0	24.6	24.2	24.0	24.0	24.0
	Final:	25.2	24.2	24.2	24.4	24.8	24.0
DO (mg/L)	**Initial:**	8.3	8.1	8.1	8.0	7.9	8.0
	Final:	8.1	8.1	8.3	8.1	7.9	8.0
pH	**Initial:**	7.86	8.07	8.08	7.95	7.89	7.83
	Final:	7.90	8.09	8.06	8.07	7.91	7.99
Cond. (µmhos)	**Initial:**	572	571	523	562	582	572
100%							
Temp. (°C):	**Initial:**	24.2	24.8	24.2	24.4	24.0	24.0
	Final:	25.2	24.4	24.0	24.4	25.2	24.6
DO (mg/L)	**Initial:**	7.1	7.2	7.0	6.6	6.9	6.9
	Final:	7.0	7.1	7.1	7.0	6.9	7.1
pH	**Initial:**	7.39	7.60	7.63	7.54	7.40	7.32
	Final:	7.56	7.63	7.64	7.65	7.46	7.53
Cond. (µmhos)	**Initial:**	1575	1576	1548	1551	1631	1580

Comments:

** All bioassays were conducted following Environment Canada protocol (EPS 1/RM/1421, Feb 2007).*
Testing performed by E. Dowling, J. Comeau, K. Gilmore and L. Boone of Buchanan Environmental Ltd.

Authorization: _____
R.D. Buchanan
Head of Aquatic Toxicology

Buchanan Environmental Ltd.

138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: R6710

Rainbow Trout Bioassay Report

Facility Submitting Sample Greater Shediac Sewerage Commission

Address: 290 Main St., Shediac, NB E4P 2E3

Sample Material: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : J. de Vries
Sampling Point Description : Outlet Chamber

Time & Date Collected: 12:00 pm, 19 Mar, 2012
Time & Date Received: 8:35 am, 20 Mar, 2012

Sample Characterization *(unadjusted, undiluted)*

Volume received : 4 x 20 L
Temperature : 6.4 ° C (on arrival)
pH : 6.74
Dissolved oxygen : 9.0 mg/L
Conductivity : 1043 µmhos/cm
Colour/Appearance : Yellow/Brown
Odour : None
Storage : 28 hours at 4 ± 2° C
Temperature adjustment overnight in lab: Yes

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 7.64
Conductivity : 222 µmhos/cm
Hardness : 98 mg/L as $CaCO_3$

Test Conditions

Type of test : Multi Concentration
Volume/Vessel : 25 L
Test Temperature : 15±1° C
Aeration rate : 6.5 ± 1 mL/min/L
Pre-aeration period : 30 minutes
Test Duration : 96 hours

Test Organism

Species: *Oncorhynchus mykiss*
Source: Rainbow Springs, Ontario
Average length: 50.9 ± 2.8 mm
Average weight: 1.2 ± 0.1 g
Number/Vessel (25L): 10 each
Stocking Density: 0.49 g/L
% Culture Mortality (< 7 days/ testing): 0.0%

Test Started (time, date) : 10:20 am, 22 Mar, 2012
Test Ended (time, date) : 10:20 am, 26 Mar, 2012

Buchanan Environmental Ltd.
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: R6710

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	10.2	7.61	211	14.8	10.0	7.55	14.2	0	0
6.25	10.2	7.59	281	14.8	10.0	7.59	14.0	0	0
12.5	10.0	7.54	337	14.8	9.5	7.47	14.0	0	0
25	9.9	7.43	442	14.6	9.8	7.59	14.2	0	0
50	9.9	7.13	655	14.8	9.9	7.55	14.4	0	0
100	9.3	6.86	1065	14.6	9.8	7.54	14.0	0	0

* Values measured upon test initiation

 # Control showing atypical/stressed behaviour : 0/10

96 hour LC50 value (static, acute) : **Non-lethal** sample material

95 percent Confidence Limits (95% Cl) : N/A

Comments:

Reference Toxicity Test Data

Most Recent Reference Toxicity Test No. : LS231
Test time, Date : 3:00 pm, March 05, 2012
Toxicant tested : Phenol
96 hr LC50 : 8.71 mg Phenol/L (*Spearman-Karber*)
95% Confidence Limits : (7.12, 10.64) mg Phenol/L
Historic Mean ± Warning Limits (2SD) : 9.35 ± 3.22 mg Phenol/L

* All bioassays were conducted following Environment Canada protocol (EPS 1/RM/13, May 2007).

Testing performed by J. Comeau, J. Blanchard, E. Dowling of *Buchanan Environmental Ltd.*

Authorization _____
R.D. Buchanan
Head, Aquatic Toxicology

Buchanan Environmental Ltd
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: K228

Daphnia magna Bioassay Report

Facility Submitting Sample: **Greater Shediac Sewerage Commission**

Address: 290 Main St., Shediac, NB E4P 2E3

Sample Material: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : J. de Vries
Sampling Point Description : Outlet Chamber

Time & Date Collected: 12:00 pm, 19 Mar, 2012
Time & Date Received: 8:35 am, 20 Mar, 2012

Sample Characterization *(unadjusted, undiluted)*

Volume received : 4 x 20 L
Temperature : 6.4°C (on arrival)
pH : 6.85
Dissolved oxygen : 5.4 mg/L
Conductivity : 1353 µmhos/cm
Hardness : 188 mg/L as $CaCO_3$
Colour : Light Yellow/Beige
Odour : None
Storage : None
Temperature adjustment overnight in lab: Yes

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 7.90
Conductivity : 279 µmhos/cm
Hardness : 92 mg/L as $CaCO_3$

Test Conditions:

Type of test : Multi-Concentration
No. daphnids/vessel : 10
Stocking Density : 15 mL/neonate
Pre-Aeration : 0 minutes
Test Temperature : 20± 2° C

Volume/test vessel : 150 mL
No. of vessel/conc. : 1
Culture Mortality (<7 days/testing): 0%
Aeration rate : 37.5±12.5 mL/min/L
Test Duration : 48 hours

Test Started (time, date) : 10:35 am, 21 Mar, 2012
Test Ended (time, date) : 10:35 am, 23 Mar, 2012

Buchanan Environmental Ltd.
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: K228

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	7.9	7.98	232	22.0	8.6	7.97	20.2	0	0
6.25	7.8	7.91	332	21.4	8.4	7.96	20.4	0	0
12.5	7.7	7.78	393	21.6	8.1	7.94	20.2	0	0
25	7.4	7.59	540	21.6	7.9	7.91	20.2	0	0
50	6.9	7.30	831	21.8	7.3	7.86	20.2	0	0
100	5.9	6.99	1227	21.8	6.4	7.79	20.2	0	0

* Values measured upon test initiation

 # Control showing atypical/stressed behaviour : 0/10

48 hour LC50 Value (static, acute) : **Non-lethal** sample material

95 percent confidence limits (95 % CL) : N/A

Comments:

Reference Toxicant Test Data

Test organism: *Daphnia magna* (≤24 hr old neonates)

Culture Providing Neonates	: February 20, 2012
Time to First Brood	: 7 days
Average number of neonates per brood (2-4th brood)	: 25.7
Most Recent Reference Toxicant Test (#690)	: 10:30 am, March 06, 2012
Toxicant tested	: Sodium Chloride (NaCl)
Statistical Analysis	: Spearman-Karber
48 hr LC50	: 5.90 g NaCl/L
95% Confidence Limits	: (4.98, 6.99) g NaCl/L
Historic Mean 48 hr LC50 ± Warning limits (2SD)	: 5.57 ± 0.97 g NaCl/L

* All bioassays were conducted following Environment Canada protocol (EPS 1/RM/14, Dec 2000).

Testing performed by L. Boone, K. Gilmore and J. Comeau of *Buchanan Environmental Ltd.*

Authorization _____
R.D. Buchanan
Head, Aquatic Toxicology

Buchanan Environmental Ltd
138 Gibson St., Fredericton, N.B., E3A 4E2

Lab sample Reference #: C60

Ceriodaphnia dubia Bioassay Report

Facility Submitting Sample: **Greater Shediac Sewerage Commission**

Address: 290 Main St. Unit 301, Shediac, NB E4P 2E3

Sample Material Description: Whole Effluent

Sample Collection:
Sampling method : Grab
Sample Collected by : J. de Vries
Sampling Point Description : Outlet Chamber

Time & Date Collected: 12:00 pm, 19 Mar, 2012
Time & Date Received: 8:35 am, 20 Mar, 2012

Sample Characterization *(unadjusted, undiluted)*

Volume received : 2 X 4L
Temperature : 6.4°C (on arrival)
pH : 6.87
Dissolved oxygen : 5.1 mg/L
Conductivity : 1419 µmhos/cm
Hardness : 164 mg/L as $CaCO_3$
Colour : Cloudy
Odour : None
Storage : 27 hrs. @ 4+/- 2°C
Temperature adjustment overnight in lab: Yes

Dilution Water Characterization

Source : Lower St. Mary's well
pH : 7.90
Conductivity : 279 µmhos/cm
Hardness : 92 mg/L as $CaCO_3$

Test Conditions:

Type of test : Multi Concentration
No. daphnids/vessel : 1
Stocking Density : 22 mL/neonate
Pre-Aeration : 0 min
Test Temperature : 25 ± 1° C
pH adjustment : None
Daily renewal method: Transferred to new solutions

Volume/test vessel : 22 mL
No. of vessel/conc. : 10
Culture Mortality (<7 days/testing): 0.0%
Aeration rate : 37.5±12.5 mL/min/L
Test Duration : 7 days
Hardness Adjustment: None
Sample filtration: None

Test Started (time, date) : 10:30 am, 22 Mar, 2012
Test Ended (time, date) : 10:30 am, 29 Mar, 2012

TEST RESULTS

	Initial Measurements *				Final Measurements				
Conc. (% Sample)	**D.O. mg/L**	**pH**	**Cond. µmhos/cm**	**Temp. °C**	**D.O. mg/L**	**pH**	**Temp. °C**	**Mortality x/10**	**%**
Control	8.7	8.13	281	24.0	8.1	8.00	24.0	0	0
1.56	8.4	8.01	316	24.0	7.9	8.00	24.4	0	0
3.12	8.2	8.03	321	24.0	7.7	7.99	24.8	0	0
6.25	8.1	7.98	333	24.0	7.6	7.88	24.6	0	0
12.5	8.1	7.92	398	24.0	7.4	7.79	25.0	0	0
25	7.7	7.73	521	24.0	7.3	7.64	24.4	0	0
50	7.2	7.45	808	24.2	7.0	7.56	24.6	0	0
100	6.0	7.08	1333	24.2	6.8	7.40	24.2	0	0

* Values measured upon test initiation

Effect	**Value**	**95% confidence Limits**	**Statistical Method**
LC50	>100%	N/A	linear interpolation
IC25 (reproduction)	>100%	N/A	linear interpolation

Reference Toxicant Test Data

Test organism: *Ceriodaphnia dubia* (≤24 hr old neonates)
Culture board providing neonates: Board # 73
Time to First Brood: 4 days

Most Recent Reference Toxicant Test (Lab Ref. # 49): 10:00 am, March 22, 2012
Toxicant tested: Sodium Chloride (NaCl)

IC25 Reproduction: 1.06 g/L
95% Confidence Limits: 0.267, 1.25 g/L
Statistical method: Linear interpolation(CETIS)
Historical mean IC25: 0.865 g/L
Warning Limits (± 2SD): 0.196, 1.53 g/L

LC50: 2.14 g/L
95% confidence Limits: 2.10, 2.16 g/L
Statistical method: Linear interpolation (CETIS)
Historical mean LC50: 2.07 g/L
Warning Limits (± 2SD): 1.87, 2.26 g/L

*The reference toxicity test was performed under the same experimental conditions as those used with the test sample.

Test Organisms

Test Organism: *Ceriodaphnia dubia*
Organism batch (board #): # 73
Organism Origin: In-house mass culture
Ephippia in Culture: None

Days to first Brood: 4 days
Mean Brood organism mortality: 0%
Range of Age at Start of Test: 0hrs-24hrs.

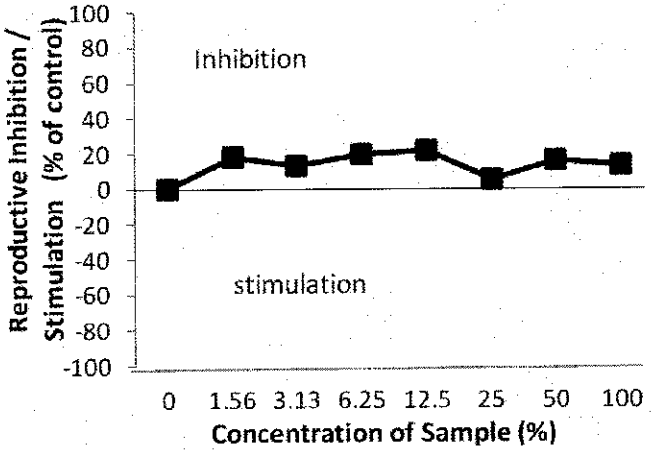
Brood Organism Neonate Production

Replicate	1	2	3	4	5	6	7	8	9	10	Mean
Total (first three broods)	36	25	60	38	47	33	43	32	41	16	37.1

Organisms showing abnormal appearance, behaviour, or undergoing unusual treatment will not be used in the test

Test Data

***Ceriodaphnia dubia* Reproductive Inhibition**



Cumulative Daily Test Organism Mortality (%)

		Concentration of Sample (%)							
Date	**Test day**	Control	1.56	3.13	6.25	12.5	25	50	100
23-Mar-12	1	0	0	0	0	0	0	0	0
24-Mar-12	2	0	0	0	0	0	0	0	0
25-Mar-12	3	0	0	0	0	0	0	0	0
26-Mar-12	4	0	0	0	0	0	0	0	0
27-Mar-12	5	0	0	0	0	0	0	0	0
28-Mar-12	6	0	0	0	0	0	0	0	0
29-Mar-12	7	0	0	0	0	0	0	0	0
Total Mortality (%)		0	0	0	0	0	0	0	0

Buchanan Environmental Ltd.
138 Gibson Street. Fredericton, N.B. E3A 4E2

Lab Sample Reference #: **C60**

Ceriodaphnia dubia Survival and Reproduction

Concentration (%)		Replicate										Mean	Analysts
Control	**Day**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Young**	
23-Mar-12	1	0	0	0	0	0	0	0	0	0	0	0.0	JC
24-Mar-12	2	0	0	0	0	0	0	0	0	0	0	0.0	JB
25-Mar-12	3	0	0	0	0	0	0	0	0	0	0	0.0	ED
26-Mar-12	4	8	10	10	9	7	8	5	8	8	11	8.4	KG
27-Mar-12	5	14	0	0	16	15	16	15	13	0	0	8.9	KG
28-Mar-12	6	0	11	17	0	0	0	0	0	16	18	6.2	JC
29-Mar-12	7	23	20	23	21	19	21	17	22	20	16	20.2	KG
Total		**45**	**41**	**50**	**46**	**41**	**45**	**37**	**43**	**44**	**45**	**43.7**	
												(± 2SD) = 7.0	

Concentration (%)		Replicate										Mean
12.5	**Day**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Young**
23-Mar-12	1	0	0	0	0	0	0	0	0	0	0	0.0
24-Mar-12	2	0	0	0	0	0	0	0	0	0	0	0.0
25-Mar-12	3	0	0	0	0	0	0	0	0	0	0	0.0
26-Mar-12	4	5	6	9	6	0	7	7	8	7	5	6.0
27-Mar-12	5	14	15	0	13	12	15	11	14	14	0	10.8
28-Mar-12	6	0	14	10	20	0	15	12	0	0	17	8.8
29-Mar-12	7	25	0	22	-	0	-	0	1	20	18	10.8
Total		**44**	**35**	**41**	**39**	**12**	**37**	**30**	**23**	**41**	**40**	**34.2**
												(± 2SD) = 19.9

Concentration (%)		Replicate										Mean
1.56	**Day**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Young**
23-Mar-12	1	0	0	0	0	0	0	0	0	0	0	0.0
24-Mar-12	2	0	0	0	0	0	0	0	0	0	0	0.0
25-Mar-12	3	0	0	0	0	0	0	0	0	0	0	0.0
26-Mar-12	4	9	7	5	8	5	7	6	0	6	7	6.0
27-Mar-12	5	14	0	14	13	15	13	14	0	0	11	9.4
28-Mar-12	6	0	12	0	0	17	15	0	6	16	3	6.9
29-Mar-12	7	18	23	23	26	0	-	19	4	21	-	16.8
		41	**42**	**42**	**47**	**37**	**35**	**39**	**10**	**43**	**21**	**35.7**
												(± 2SD) = 22.9

Concentration (%)		Replicate										Mean
25	**Day**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Young**
23-Mar-12	1	0	0	0	0	0	0	0	0	0	0	0.0
24-Mar-12	2	0	0	0	0	*	0	0	0	0	0	0.0
25-Mar-12	3	0	0	0	0	*	0	0	0	0	0	0.0
26-Mar-12	4	7	3	8	8	*	6	6	7	7	6	6.4
27-Mar-12	5	0	0	13	16	*	12	16	12	12	0	9.0
28-Mar-12	6	14	16	0	0	*	17	16	0	0	15	8.7
29-Mar-12	7	22	20	24	23	*	0	0	21	23	22	17.2
		43	**39**	**45**	**47**	*	**35**	**38**	**40**	**42**	**43**	**41.3**
												(± 2SD) = 7.4

Concentration (%)		Replicate										Mean
3.13	**Day**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Young**
23-Mar-12	1	0	0	0	0	0	0	0	0	0	0	0.0
24-Mar-12	2	0	0	0	0	0	0	0	0	0	0	0.0
25-Mar-12	3	0	0	0	0	0	0	0	0	0	0	0.0
26-Mar-12	4	5	6	8	6	6	7	9	7	8	9	7.1
27-Mar-12	5	11	0	14	15	12	10	15	12	14	12	11.5
28-Mar-12	6	0	10	0	0	0	0	0	0	0	2	1.2
29-Mar-12	7	20	23	24	16	20	19	19	20	20	-	20.1
		36	**39**	**46**	**37**	**38**	**36**	**43**	**39**	**42**	**23**	**37.9**
												(± 2SD) = 12.3

Concentration (%)		Replicate										Mean
50	**Day**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Young**
23-Mar-12	1	0	0	0	0	0	0	0	0	0	0	0.0
24-Mar-12	2	0	0	0	0	0	0	0	0	0	0	0.0
25-Mar-12	3	0	0	0	0	0	0	0	0	0	0	0.0
26-Mar-12	4	7	5	6	8	7	6	6	7	7	5	6.4
27-Mar-12	5	0	7	11	13	8	17	8	15	0	13	9.2
28-Mar-12	6	13	0	9	0	0	0	12	15	11	0	6.0
29-Mar-12	7	23	20	1	23	23	15	0	0	22	23	15.0
		43	**32**	**27**	**44**	**38**	**38**	**26**	**37**	**40**	**41**	**36.6**
												(± 2SD) = 12.6

Concentration (%)		Replicate										Mean
6.25	**Day**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Young**
23-Mar-12	1	0	0	0	0	0	0	0	0	0	0	0.0
24-Mar-12	2	0	0	0	0	0	0	0	0	0	0	0.0
25-Mar-12	3	0	0	0	0	0	0	0	0	0	0	0.0
26-Mar-12	4	7	8	5	8	3	8	7	6	7	7	6.6
27-Mar-12	5	12	13	19	14	0	13	15	11	0	14	11.1
28-Mar-12	6	0	14	0	0	11	0	0	16	0	16	5.7
29-Mar-12	7	24	-	20	22	13	19	0	-	19	-	16.7
		43	**35**	**44**	**44**	**27**	**40**	**22**	**33**	**26**	**37**	**35.1**
												(± 2SD) = 16.0

Concentration (%)		Replicate										Mean
100	**Day**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Young**
23-Mar-12	1	0	0	0	0	0	0	0	0	0	0	0.0
24-Mar-12	2	0	0	0	0	0	0	0	0	0	0	0.0
25-Mar-12	3	0	0	0	0	0	0	0	0	0	0	0.0
26-Mar-12	4	8	9	6	6	7	5	7	7	9	6	7.0
27-Mar-12	5	0	11	12	8	10	13	0	0	0	12	6.6
28-Mar-12	6	12	3	0	0	0	0	18	13	13	0	5.9
29-Mar-12	7	22	-	23	19	22	22	21	18	18	19	20.4
		42	**23**	**41**	**33**	**39**	**40**	**46**	**38**	**40**	**37**	**37.9**
												(± 2SD) = 12.5

"X" - test organism mortality

"*" - accidental organism mortality

"-" - 4th brood (see NOTES)

NOTE: All young produced by any test organism during its fourth and subsequent broods were discarded and not included in the above counts.

The presence of two or more neonates in any test chamber, during any given day of the test, constitutes a brood.

Buchcanan Environmental Ltd.
138 Gibson Street. Fredericton, N.B. E3A 4E2

Lab sample Reference ‡# C28

Ceriodaphnia dubia Water Chemistry Data During Testing

		24 Hrs 23/03/2012	48 Hrs 24/03/2012	72 Hrs 25/03/2012	96 Hrs 26/03/2012	120 Hrs 27/03/2012	144 Hrs 28/03/2012
Control (0%)							
Temp. (°C):	**Initial:**	24.0	24.0	24.0	24.2	24.2	24.0
	Final:	24.0	24.2	24.0	25.0	24.6	24.4
DO (mg/L)	**Initial:**	8.6	8.7	8.6	8.7	8.3	8.5
	Final:	8.6	8.4	8.5	8.3	8.4	8.2
pH	**Initial:**	8.16	7.89	8.20	8.22	8.19	8.21
	Final:	8.10	8.17	8.19	8.19	8.24	8.21
Cond. (µmhos)	**Initial:**	291	283	249	276	279	285
1.56%							
Temp. (°C):	**Initial:**	24.0	24.2	24.0	24.4	24.0	24.0
	Final:	24.2	24.4	24.2	24.8	24.6	24.2
DO (mg/L)	**Initial:**	8.4	8.5	8.5	8.6	8.5	8.3
	Final:	8.5	8.4	8.6	8.3	8.3	8.1
pH	**Initial:**	8.15	7.97	8.19	8.19	8.18	8.14
	Final:	8.08	8.14	8.18	8.14	8.20	8.16
Cond. (µmhos)	**Initial:**	289	277	268	290	289	290
25%							
Temp. (°C):	**Initial:**	24.8	24.2	24.0	24.0	24.2	24.0
	Final:	24.2	24.0	24.4	24.6	24.4	24.2
DO (mg/L)	**Initial:**	8.3	8.2	8.3	8.3	8.3	7.8
	Final:	7.6	8.0	8.3	7.9	7.9	7.6
pH	**Initial:**	7.85	7.93	7.95	7.93	7.86	7.74
	Final:	7.76	7.81	8.00	7.90	7.77	7.84
Cond. (µmhos)	**Initial:**	516	456	496	522	528	530
100%							
Temp. (°C):	**Initial:**	24.0	24.2	24.0	24.0	24.0	24.4
	Final:	24.2	24.4	24.0	25.0	24.4	24.2
DO (mg/L)	**Initial:**	6.8	6.9	6.7	6.8	7.2	6.7
	Final:	6.3	6.6	6.9	6.2	6.6	6.9
pH	**Initial:**	7.21	7.29	7.41	7.30	7.15	7.05
	Final:	7.13	7.29	7.44	7.36	7.26	7.10
Cond. (µmhos)	**Initial:**	1333	1229	1267	1335	1359	1366

Comments:

** All bioassays were conducted following Environment Canada protocol (EPS 1/RM/1421, Feb 2007).*
Testing performed by K. Gilmore, E. Dowling, J. Comeau, L. Boone, and J. Blanchard of Buchanan Environmental Ltd.

Authorization: _____
R.D. Buchanan
Head of Aquatic Toxicology

APPENDIX C: Environmental Risk Assessment Lagoon Effluent & Upstream Sampling Results – 2011-2012

Report ID: 120856-IAS
Report Date: 06-Jul-11
Date Received: 21-Jun-11

CERTIFICATE OF ANALYSIS

for
Crandall Engineering Ltd
1077 Boul. St. George Blvd, Suite 400
Moncton, NB E1E 4C9

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

Analysis of Water

RPC Sample ID:			120856-1	120856-2
Client Sample ID:			Influent	Effluent
Date Sampled:			21-Jun-11	21-Jun-11
Analytes	**Units**	**RL**		
Ammonia (as N)	mg/L	0.05	14.9	8.4
Kjeldahl Nitrogen	mg/L	0.25	17	8.4
pH	units	-	-	7.8
Fluoride	mg/L	0.05	-	0.35
Nitrate + Nitrite (as N)	mg/L	0.05	-	0.34
Nitrate (as N)	mg/L	0.05	-	0.26
Nitrite (as N)	mg/L	0.05	-	0.08
Cyanide - Total	mg/L	0.002	-	0.003
Phosphorus - Total	mg/L	0.002	2.45	1.75
BOD_5	mg/L	6	62	< 6
$CBOD_5$	mg/L	6	60	< 6
COD	mg/L	10	-	40
Solids - Total Suspended	mg/L	5	87	15

This report relates only to the sample(s) and information provided to the laboratory.

RL = Repor ing Limit

Ross Kean

A. Ross Kean, M.Sc.
Department Head
Inorganic Analytical Chemistry

Peter Crowhurst, B.Sc., C.Chem
Analytical Chemist
Inorganic Analytical Chemistry

Report ID: 120856-IAS
Report Date: 06-Jul-11
Date Received: 21-Jun-11

CERTIFICATE OF ANALYSIS

for
Crandall Engineering Ltd
1077 Boul. St. George Blvd, Suite 400
Moncton, NB E1E 4C9

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

Analysis of Metals in Water

RPC Sample ID:			120856-2
Client Sample ID:			Effluent
Date Sampled:			21-Jun-11
Analytes	**Units**	**RL**	
Aluminum	µg/L	1	18
Antimony	µg/L	0.1	0.1
Arsenic	µg/L	1	1
Barium	µg/L	1	154
Beryllium	µg/L	0.1	< 0.1
Bismuth	µg/L	1	< 1
Boron	µg/L	1	121
Cadmium	µg/L	0.01	< 0.01
Calcium	µg/L	50	42800
Chromium	µg/L	1	2
Cobalt	µg/L	0.1	0.1
Copper	µg/L	1	2
Iron	µg/L	20	80
Lead	µg/L	0.1	< 0.1
Lithium	µg/L	0.1	4.8
Magnesium	µg/L	10	19500
Manganese	µg/L	1	299
Mercury	µg/L	0.025	< 0.025
Molybdenum	µg/L	0.1	0.3
Nickel	µg/L	1	< 1
Potassium	µg/L	20	9600
Rubidium	µg/L	0.1	5.4
Selenium	µg/L	1	1
Silver	µg/L	0.1	< 0.1
Sodium	µg/L	50	159000
Strontium	µg/L	1	261
Tellurium	µg/L	0.1	< 0.1
Thallium	µg/L	0.1	< 0.1
Tin	µg/L	0.1	< 0.1
Titanium	µg/L	1	< 1
Uranium	µg/L	0.1	0.1
Vanadium	µg/L	1	< 1
Zinc	µg/L	1	3

Report ID: 120856-IAS
Report Date: 06-Jul-11
Date Received: 21-Jun-11

CERTIFICATE OF ANALYSIS
for
Crandall Engineering Ltd
1077 Boul. St. George Blvd, Suite 400
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Methods

Analyte	RPC SOP #	Method Reference	Method Principle
Ammonia	4.M47	APHA 4500-NH_3 G	"Phenate" Colourimetry
Kjeldahl Nitrogen	4.M16	APHA 4500-NORG	Digestion, phenate colorimetry
pH	4.M03	APHA 4500-H^+ B	pH Electrode - Electrometric
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO_3 H	Hydrazine Red., Derivitization, Colourimetry
Nitrite (as N)	4.M49	APHA 4500-NO2- B	Ferrous ammonium sulfate Colourimetry
Phosphorus - Total	4.M17	APHA 4500-P E	Digestion, Manual Colourimetry
BOD_5	4.M07	APHA 5210 B	Seeding, incubation, DO measurement (meter)
COD	4.M40	APHA 5220 D	Closed reflux, Colourimetry
Solids - Total Suspended	4.M05	APHA 2540 D	Filtration, Gravimetry
Trace Metals	4.M01 & 4.M29	EPA 200.8 or EPA 200.7	ICP-MS or ICP-ES
Mercury	4.M21	EPA 245.1	Cold Vapor AAS

Report ID: 120856-MB-WATER
Report Date: 23-Jun-11
Date Received: 21-Jun-11

CERTIFICATE OF ANALYSIS

for

Crandall Engineering Ltd
1077 Boul. St. George Blvd,Suite 400
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rpc
150 Lutz St
Moncton NB
Canada E1C 5E9
Tel: 506.855.6472
Fax: 506.855.8294
www.rpc.ca

Attention: Jessica de Vries

Project/Job #: 11079-1
Client Location: Shediac
Examination of Water

RPC Sample ID:			120856-2
Client Sample ID:			Effluent
Date Sampled:			21-Jun-11
Time Sampled:			3:30:00 PM
Analyses	Date Analyzed	Units	
E. coli (MB 02)	22-Jun-11	cfu/100mL	< 2
Faecal Coliforms (MB 05)	22-Jun-11	cfu/100mL	< 2

This report relates only to sample(s) and information provided to the laboratory.

Michael Lawlor
Lab Supervisor
Moncton Laboratory

Paul Mazerolle
Microbiology Technician
Moncton Laboratory

Report ID: 120856-MB-WATER
Report Date: 23-Jun-11
Date Received: 21-Jun-11

CERTIFICATE OF ANALYSIS

for

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150 Lutz St
Moncton NB
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Tel: 506.855.6472
Fax: 506.855.8294
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General Report Comments

Elevated detection limits due to dilution

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

CERTIFICATE OF ANALYSIS

for
Crandall Engineering Ltd
1077 Boul. St. George Blvd, Suite 400
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921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

PAH in Water

RPC Sample ID:			120856-2
Client Sample ID:			Effluent
Date Sampled:			21-Jun-11
Matrix:			water
Analytes	Units	RL	
Naphthalene	µg/L	0.05	< 0.05
2-Methylnaphthalene	µg/L	0.05	< 0.05
1-Methylnaphthalene	µg/L	0.05	< 0.05
Acenaphthylene	µg/L	0.01	< 0.01
Acenaphthene	µg/L	0.01	< 0.01
Fluorene	µg/L	0.01	< 0.01
Phenanthrene	µg/L	0.01	< 0.01
Anthracene	µg/L	0.01	< 0.01
Fluoranthene	µg/L	0.01	< 0.01
Pyrene	µg/L	0.01	< 0.01
Benz(a)anthracene	µg/L	0.01	< 0.01
Chrysene/Triphenylene	µg/L	0.01	< 0.01
Benzo(b)fluoranthene	µg/L	0.01	< 0.01
Benzo(k)fluoranthene	µg/L	0.01	< 0.01
Benzo(e)pyrene	µg/L	0.01	< 0.01
Benzo(a)pyrene	µg/L	0.01	< 0.01
Indenopyrene	µg/L	0.01	< 0.01
Benzo(g,h,i)perylene	µg/L	0.01	< 0.01
Dibenz(a,h)anthracene	µg/L	0.01	< 0.01
2-fluorobiphenyl (surrogate)	%		78

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Bruce Phillips
Department Head
Organic Analytical Services

Troy Smith
Lab Supervisor
Organic Analytical Services

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

CERTIFICATE OF ANALYSIS

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www.rpc.ca

Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

PAH in Water

RPC Sample ID:			120856-2
Client Sample ID:			Effluent
Date Sampled:			21-Jun-11
Matrix:			water
Analytes	Units	RL	
p-terphenyl-d14 (surrogate)	%		97

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

PCB's in Water

RPC Sample ID:			120856-2
Client Sample ID:			Effluent
Date Sampled:			21-Jun-11
Matrix:			water
Analytes	Units	RL	
Total PCB	µg/L	0.1	< 0.1
PCB Surrogate (DCB)	%		119
Resemblance			ND

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Bruce Phillips
Department Head
Organic Analytical Services

Troy Smith
Lab Supervisor
Organic Analytical Services

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

Volatile Organic Compounds in Water

RPC Sample ID:			120856-2
Client Sample ID:			Effluent
Date Sampled:			21-Jun-11
Matrix:			water
Analytes	Units	RL	
Chloromethane	µg/L	5.0	< 5.0
Vinyl Chloride	µg/L	0.5	< 0.5
Bromomethane	µg/L	5.0	< 5.0
Chloroethane	µg/L	5.0	< 5.0
Trichlorofluoromethane	µg/L	5.0	< 5.0
1,1-Dichloroethylene	µg/L	0.5	< 0.5
Methylene Chloride	µg/L	5.0	< 5.0
1,2-Dichloroethylene (trans)	µg/L	0.5	< 0.5
1,1-Dichloroethane	µg/L	0.5	< 0.5
1,2-Dichloroethylene (cis)	µg/L	0.5	< 0.5
Bromochloromethane	µg/L	0.5	< 0.5
Chloroform	µg/L	0.5	< 0.5
1,1,1-Trichloroethane	µg/L	0.5	< 0.5
Carbon Tetrachloride	µg/L	0.5	< 0.5
Benzene	µg/L	0.5	< 0.5
1,2-Dichloroethane	µg/L	0.5	< 0.5
Trichloroethylene	µg/L	0.5	< 0.5
1,2-Dichloropropane	µg/L	0.5	< 0.5
Bromodichloromethane	µg/L	0.5	< 0.5
1,3-Dichloropropylene (trans)	µg/L	0.5	< 0.5

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Bruce Phillips
Department Head
Organic Analytical Services

Angela Colford
Lab Supervisor
Organic Analytical Services

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

CERTIFICATE OF ANALYSIS

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Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

Volatile Organic Compounds in Water

RPC Sample ID:			120856-2
Client Sample ID:			Effluent
Date Sampled:			21-Jun-11
Matrix:			water
Analytes	Units	RL	
Toluene	µg/L	0.5	< 0.5
1,3-Dichloropropylene (cis)	µg/L	0.5	< 0.5
1,1,2-Trichloroethane	µg/L	0.5	< 0.5
Tetrachloroethylene	µg/L	0.5	< 0.5
Dibromochloromethane	µg/L	0.5	< 0.5
1,2-Dibromoethane	µg/L	0.5	< 0.5
Chlorobenzene	µg/L	0.5	< 0.5
Ethylbenzene	µg/L	0.5	< 0.5
m,p-Xylenes	µg/L	0.5	< 0.5
o-Xylene	µg/L	0.5	< 0.5
Styrene	µg/L	0.5	< 0.5
Bromoform	µg/L	0.5	< 0.5
1,1,1,2-Tetrachloroethane	µg/L	0.5	< 0.5
1,1,2,2-Tetrachloroethane	µg/L	0.5	< 0.5
1,3-Dichlorobenzene	µg/L	0.5	< 0.5
1,4-Dichlorobenzene	µg/L	0.5	< 0.5
1,2-Dichlorobenzene	µg/L	0.5	< 0.5
1,2-Dichloroethane-d4	%		101
Toluene-d8	%		96
4-Bromofluorobenzene	%		101

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Method Summary

Polynuclear Aromatic Hydrocarbons (PAH) in Water (OAS-SV02): Solvent extraction followed by GC/MS analysis; based on USEPA 3510C/8270C.
Total Polychlorinated biphenyls (PCB) in Water (OAS-SV04): Solvent extraction, GC-ECD analysis; based on EPA Methods 3540C/8082.
Volatile Organic Compounds in Water: Purge and trap extraction followed by GC/MS analysis; based on USEPA 624.

Resemblance Legend

Resemblance Code	Resemblance
ARO1242/54	Mix of Aroclors 1242,1254.
ARO1242/60	Mix of Aroclors 1242,1260.
ARO1254/60	Mix of Aroclors 1254, 1260.
ARO.1016	Aroclor 1016
ARO.1242	Aroclor 1242

Resemblance Code	Resemblance
ARO.1254	Aroclor 1254
ARO.1260	Aroclor 1260
MIXTURE	Mix of Aroclors 1242, 1254 and 1260.
ND	Not Detected

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

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Project #: 11079-1
Location: Shediac
QA/QC Report

RPC Sample ID:			BLANKA7407	SPIKEA7341
Matrix:			water	water
Analytes	Units	RL		% Recovery
Naphthalene	µg/L	0.05	< 0.05	103%
Acenaphthylene	µg/L	0.01	< 0.01	104%
Acenaphthene	µg/L	0.01	< 0.01	99%
Fluorene	µg/L	0.01	< 0.01	114%
Phenanthrene	µg/L	0.01	< 0.01	88%
Anthracene	µg/L	0.01	< 0.01	93%
Fluoranthene	µg/L	0.01	< 0.01	101%
Pyrene	µg/L	0.01	< 0.01	108%
Benz(a)anthracene	µg/L	0.01	< 0.01	77%
Chrysene/Triphenylene	µg/L	0.01	< 0.01	74%
Benzo(b)fluoranthene	µg/L	0.01	< 0.01	90%
Benzo(k)fluoranthene	µg/L	0.01	< 0.01	90%
Benzo(e)pyrene	µg/L	0.01	< 0.01	87%
Benzo(a)pyrene	µg/L	0.01	< 0.01	89%
Indenopyrene	µg/L	0.01	< 0.01	97%
Benzo(g,h,i)perylene	µg/L	0.01	< 0.01	88%
Dibenz(a,h)anthracene	µg/L	0.01	< 0.01	80%

RL = Reporting Limit

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

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Project #: 11079-1
Location: Shediac
QA/QC Report

RPC Sample ID:			BLANKA7393	SPIKEA7327
Matrix:			water	water
Analytes	Units	RL		% Recovery
Total PCB	µg/L	0.1	< 0.1	92%

RL = Reporting Limit

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

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Project #: 11079-1
Location: Shediac
QA/QC Report

RPC Sample ID:			BLANKA7376	SPIKEA7310
Matrix:			water	water
Analytes	Units	RL		% Recovery
Chloromethane	µg/L	5.0	< 5.0	111%
Vinyl Chloride	µg/L	0.5	< 0.5	111%
Bromomethane	µg/L	5.0	< 5.0	117%
Chloroethane	µg/L	5.0	< 5.0	105%
Trichlorofluoromethane	µg/L	5.0	< 5.0	119%
1,1-Dichloroethylene	µg/L	0.5	< 0.5	122%
Methylene Chloride	µg/L	5.0	< 5.0	113%
1,2-Dichloroethylene (trans)	µg/L	0.5	< 0.5	109%
1,1-Dichloroethane	µg/L	0.5	< 0.5	106%
1,2-Dichloroethylene (cis)	µg/L	0.5	< 0.5	110%
Bromochloromethane	µg/L	0.5	< 0.5	109%
Chloroform	µg/L	0.5	< 0.5	111%
1,1,1-Trichloroethane	µg/L	0.5	< 0.5	108%
Carbon Tetrachloride	µg/L	0.5	< 0.5	103%
Benzene	µg/L	0.5	< 0.5	118%
1,2-Dichloroethane	µg/L	0.5	< 0.5	114%
Trichloroethylene	µg/L	0.5	< 0.5	112%
1,2-Dichloropropane	µg/L	0.5	< 0.5	113%
Bromodichloromethane	µg/L	0.5	< 0.5	104%
1,3-Dichloropropylene (trans)	µg/L	0.5	< 0.5	100%

RL = Reporting Limit

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

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Project #: 11079-1
Location: Shediac
QA/QC Report

RPC Sample ID:			BLANKA7376	SPIKEA7310
Matrix:			water	water
Analytes	Units	RL		% Recovery
Toluene	µg/L	0.5	< 0.5	114%
1,3-Dichloropropylene (cis)	µg/L	0.5	< 0.5	106%
1,1,2-Trichloroethane	µg/L	0.5	< 0.5	107%
Tetrachloroethylene	µg/L	0.5	< 0.5	111%
Dibromochloromethane	µg/L	0.5	< 0.5	97%
1,2-Dibromoethane	µg/L	0.5	< 0.5	108%
Chlorobenzene	µg/L	0.5	< 0.5	114%
Ethylbenzene	µg/L	0.5	< 0.5	111%
m,p-Xylenes	µg/L	0.5	< 0.5	116%
o-Xylene	µg/L	0.5	< 0.5	112%
Styrene	µg/L	0.5	< 0.5	112%
Bromoform	µg/L	0.5	< 0.5	87%
1,1,1,2-Tetrachloroethane	µg/L	0.5	< 0.5	102%
1,1,2,2-Tetrachloroethane	µg/L	0.5	< 0.5	106%
1,3-Dichlorobenzene	µg/L	0.5	< 0.5	110%
1,4-Dichlorobenzene	µg/L	0.5	< 0.5	109%
1,2-Dichlorobenzene	µg/L	0.5	< 0.5	109%

RL = Reporting Limit

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

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Project #: 11079-1

Summary of Date Analyzed

	PAH		PCB		VOC	
RPC Sample ID	**Extracted**	**Analyzed**	**Extracted**	**Analyzed**	**Extracted**	**Analyzed**
120856-2	24-Jun-11	29-Jun-11	27-Jun-11	28-Jun-11	23-Jun-11	23-Jun-11

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

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Attention: Jessica de Vries
Fax #:
jed@crandallengineering.ca

Project #: 11079-1
Location: Shediac
Organochlorine Pesticides in Water

RPC Sample ID:			120856-2	Method Blank	Spike Rec. (%)
Client Sample ID:			Effluent		
Date Sampled:			21-Jun-11		
Matrix:			water	water	water
Analytes	Units	RL			
α-BHC	ng/mL	0.01	< 0.01	< 0.01	71
β-BHC	ng/mL	0.01	< 0.01	< 0.01	81
γ-BHC (Lindane)	ng/mL	0.01	< 0.01	< 0.01	72
δ-BHC	ng/mL	0.01	< 0.01	< 0.01	50
Heptachlor	ng/mL	0.01	< 0.01	< 0.01	40
Aldrin	ng/mL	0.01	< 0.01	< 0.01	29
Heptachlor epoxide	ng/mL	0.01	< 0.01	< 0.01	77
2,4'-DDE	ng/mL	0.01	< 0.01	< 0.01	64
Endosulfan I	ng/mL	0.01	< 0.01	< 0.01	78
4,4'-DDE	ng/mL	0.01	< 0.01	< 0.01	70
Dieldrin	ng/mL	0.01	< 0.01	< 0.01	79
2,4'-DDD	ng/mL	0.01	< 0.01	< 0.01	85
Endrin	ng/mL	0.01	< 0.01	< 0.01	83
Endosulfan II	ng/mL	0.01	< 0.01	< 0.01	92
4,4'-DDD	ng/mL	0.01	< 0.01	< 0.01	88
2,4'-DDT	ng/mL	0.01	< 0.01	< 0.01	88
Endrin aldehyde	ng/mL	0.01	< 0.01	< 0.01	109
Endosulfan sulfate	ng/mL	0.01	< 0.01	< 0.01	104
4,4'-DDT	ng/mL	0.01	< 0.01	< 0.01	89
Endrin ketone	ng/mL	0.01	< 0.01	< 0.01	101
Methoxychlor	ng/mL	0.01	< 0.01	< 0.01	106
α-Chlordane	ng/mL	0.01	< 0.01	< 0.01	66
γ-Chlordane	ng/mL	0.01	< 0.01	< 0.01	63
Mirex	ng/mL	0.01	< 0.01	< 0.01	78
Toxaphene	ng/mL	0.1	< 0.1	< 0.1	73

This report relates only to the sample(s) and information provided to the laboratory.
Method: Solvent extraction with analysis by Gas Chromatography/Electron Capture Detection (GC/ECD).
RL = Reporting Limit
Spike recoveries for heptachlor and aldrin are below acceptance limit.

Bruce Phillips
Dept. Head
Organic Analytical Services

Karen Broad
Chemist
Organic Analytical Services

Report ID: 120856-OAS
Report Date: 04-Jul-11
Date Received: 21-Jun-11

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Attention: Jessica de Vries
Fax #:
jed@crandallengineering.ca

Project #: 11079-1
Location: Shediac
Chlorophenols in Water

RPC Sample ID:			120856-2	Method Blank	Spike Rec. (%)
Client Sample ID:			Effluent		
Date Sampled:			21-Jun-11		
Matrix:			water	water	water
Analytes	Units	RL			
2,3,4,5-Tetrachlorophenol	µg/L	0.1	< 0.1	< 0.1	81
2,3,4,6-Tetrachlorophenol[1]	µg/L	0.1	< 0.1	< 0.1	83
2,3,5,6-Tetrachlorophenol[1]	µg/L	0.1	< 0.1	< 0.1	83
2,3,4-Trichlorophenol	µg/L	0.1	< 0.1	< 0.1	72
2,3,5-Trichlorophenol	µg/L	0.1	< 0.1	< 0.1	83
2,4,5-Trichlorophenol	µg/L	0.1	< 0.1	< 0.1	75
2,4,6-Trichlorophenol	µg/L	0.1	< 0.1	< 0.1	83
2,4-Dimethylphenol	µg/L	0.5	< 0.1	< 0.1	56
2,4-Dinitrophenol	µg/L	0.5	< 0.1	< 0.1	66
2,4-Dichlorophenol	µg/L	0.1	< 0.1	< 0.1	76
2,6-Dichlorophenol	µg/L	0.1	< 0.1	< 0.1	36
4,6-Dinitro-o-cresol	µg/L	0.5	< 0.1	< 0.1	75
2-Chlorophenol	µg/L	0.5	< 0.1	< 0.1	11
4-Chloro-3-methylphenol	µg/L	0.1	< 0.1	< 0.1	88
4-Nitrophenol	µg/L	0.5	< 0.1	< 0.1	22
m-Cresol[1]	µg/L	0.1	< 0.1	< 0.1	42
o-Cresol	µg/L	0.1	< 0.1	< 0.1	46
p-Cresol[1]	µg/L	0.1	< 0.1	< 0.1	42
Pentachlorophenol	µg/L	0.1	< 0.1	< 0.1	82
Phenol	µg/L	0.1	< 0.1	< 0.1	14
Surrogate Recoveries					
d6-Phenol	%	-	4	-	-
Tribromophenol	%	-	69	-	-

This report relates only to the sample(s) and information provided to the laboratory.
Method: Solvent extraction with analysis by gas chromatography / mass selective detection (GC/MSD).
RL = Reporting Limit
[1] Combination of unresolved peaks used for both calculations.
Spike recoveries for 2-chlorophenol and 4-nitrophenol are below acceptance limit.

Bruce Phillips
Dept. Head
Organic Analytical Services

Karen Broad
Chemist
Organic Analytical Services

Report ID: 120856-OAS
Report Date: 15-Jul-11
Date Received: 21-Jun-11

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Attention: Jessica de Vries
Fax #:
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Project #: 11079-1
Location: Shediac
Non-Ionic (CTAS) and Anionic (MBAS) Surfactants

RPC Sample ID:			120856-2	Mehod Blank	Method Spike (%)
Client Sample ID:			Effluent		
Date Sampled:			21-Jun-11		
Matrix:			water	water	water
Analytes	Units	RL			
CTAS Surfactants	mg/L	0.5	< 0.5	< 0.5	-
MBAS Surfactants	mg/L	0.1	< 0.1	< 0.1	79

This report relates only to the sample(s) and information provided to the laboratory.
Method: AWWA 5540C mod.
RL = Reporting Limit
Samples were subcontracted.

Bruce Phillips
Dept. Head
Organic Analytical Services

Troy Smith
Section Supervisor
Organic Analytical Services

Report ID: 125654-IAS
Report Date: 06-Oct-11
Date Received: 19-Sep-11

CERTIFICATE OF ANALYSIS

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac WWTP

Analysis of Water

RPC Sample ID:			125654-1	125654-2
Client Sample ID:			Upstream	Effluent
Date Sampled:			19-Sep-11	19-Sep-11
Analytes	**Units**	**RL**		
Ammonia (as N)	mg/L	0.05	0.17	21
Kjeldahl Nitrogen	mg/L	0.25	< 0.25	26
pH	units	-	7.9	7.8
Fluoride	mg/L	0.05	1.65	0.50
Nitrate + Nitrite (as N)	mg/L	0.05	< 0.05	-
Nitrate (as N)	mg/L	0.05	< 0.05	-
Nitrite (as N)	mg/L	0.05	< 0.05	-
Cyanide - Total	mg/L	0.002	< 0.002	0.003
Phosphorus - Total	mg/L	0.002	0.068	2.46
BOD_5	mg/L	6	< 6	< 6
$CBOD_5$	mg/L	6	< 6	< 6
COD	mg/L	10	870	30
Solids - Total Suspended	mg/L	5	5	< 5
Hardness (as $CaCO_3$)	mg/L	0.2	5140	-

This report relates only to the sample(s) and information provided to the laboratory.

RL = Repor ing Limit

Ross Kean

A. Ross Kean, M.Sc.
Department Head
Inorganic Analytical Chemistry

Peter Crowhurst, B.Sc., C.Chem
Analytical Chemist
Inorganic Analytical Chemistry

Report ID: 125654-IAS
Report Date: 06-Oct-11
Date Received: 19-Sep-11

CERTIFICATE OF ANALYSIS

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac WWTP

Analysis of Metals in Water

RPC Sample ID:			125654-1	125654-2
Client Sample ID:			Upstream	Effluent
Date Sampled:			19-Sep-11	19-Sep-11
Analytes	**Units**	**RL**		
Aluminum	µg/L	1	< 50	25
Antimony	µg/L	0.1	< 5	< 0.1
Arsenic	µg/L	1	< 50	< 1
Barium	µg/L	1	< 50	202
Beryllium	µg/L	0.1	< 5	< 0.1
Bismuth	µg/L	1	< 50	< 1
Boron	µg/L	1	3830	178
Cadmium	µg/L	0.01	< 0.5	< 0.01
Calcium	µg/L	50	342000	50400
Chromium	µg/L	1	< 50	< 1
Cobalt	µg/L	0.1	< 5	0.2
Copper	µg/L	1	< 50	1
Iron	µg/L	20	< 1000	270
Lead	µg/L	0.1	< 5	0.3
Lithium	µg/L	0.1	145	6.7
Magnesium	µg/L	10	1040000	27200
Manganese	µg/L	1	< 50	399
Mercury	µg/L	0.025	< 0.025	< 0.025
Molybdenum	µg/L	0.1	12	0.3
Nickel	µg/L	1	< 50	1
Potassium	µg/L	20	328000	15000
Rubidium	µg/L	0.1	92	8.6
Selenium	µg/L	1	< 50	< 1
Silver	µg/L	0.1	< 5	< 0.1
Sodium	µg/L	50	8010000	264000
Strontium	µg/L	1	6700	381
Tellurium	µg/L	0.1	< 5	< 0.1
Thallium	µg/L	0.1	< 5	< 0.1
Tin	µg/L	0.1	< 5	0.1
Titanium	µg/L	1	< 50	1
Uranium	µg/L	0.1	< 5	0.2
Vanadium	µg/L	1	< 50	< 1
Zinc	µg/L	1	< 50	3

Report ID: 125654-IAS
Report Date: 06-Oct-11
Date Received: 19-Sep-11

CERTIFICATE OF ANALYSIS
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Methods

Analyte	RPC SOP #	Method Reference	Method Principle
Ammonia	4.M47	APHA 4500-NH_3 G	"Phenate" Colourimetry
Kjeldahl Nitrogen	4.M16	APHA 4500-NORG	Digestion, phenate colorimetry
pH	4.M03	APHA 4500-H^+ B	pH Electrode - Electrometric
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO_3 H	Hydrazine Red., Derivitization, Colourimetry
Nitrite (as N)	4.M49	APHA 4500-NO2- B	Ferrous ammonium sulfate Colourimetry
Phosphorus - Total	4.M17	APHA 4500-P E	Digestion, Manual Colourimetry
BOD_5	4.M07	APHA 5210 B	Seeding, incubation, DO measurement (meter)
COD	4.M40	APHA 5220 D	Closed reflux, Colourimetry
Solids - Total Suspended	4.M05	APHA 2540 D	Filtration, Gravimetry
Trace Metals	4.M01 & 4.M29	EPA 200.8 or EPA 200.7	ICP-MS or ICP-ES
Mercury	4.M21	EPA 245.1	Cold Vapor AAS

Report ID: 125654-MB-WATER
Report Date: 21-Sep-11
Date Received: 19-Sep-11

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Attention: Jessica de Vries

Project/Job #: 11079-1
Client Location: Shediac WWTP
Examination of Water

RPC Sample ID:			125654-1	125654-2
Client Sample ID:			Upstream	Effluent
Date Sampled:			19-Sep-11	19-Sep-11
Time Sampled:				
Analyses	Date Analyzed	Units		
E. coli (MB 02)	19-Sep-11	cfu/100mL	10	< 10
Faecal Coliforms (MB 05)	19-Sep-11	cfu/100mL	40	< 10

This report relates only to sample(s) and information provided to the laboratory.

Michael Lawlor
Lab Supervisor
Moncton Laboratory

Paul Mazerolle
Microbiology Technician
Moncton Laboratory

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac WWTP

PAH in Water

RPC Sample ID:			125654-1	125654-2
Client Sample ID:			Upstream	Effluent
Date Sampled:			19-Sep-11	19-Sep-11
Matrix:			water	water
Analytes	Units	RL		
Naphthalene	µg/L	0.05	< 0.05	< 0.05
2-Methylnaphthalene	µg/L	0.05	< 0.05	< 0.05
1-Methylnaphthalene	µg/L	0.05	< 0.05	< 0.05
Acenaphthylene	µg/L	0.01	< 0.01	< 0.01
Acenaphthene	µg/L	0.01	< 0.01	< 0.01
Fluorene	µg/L	0.01	< 0.01	< 0.01
Phenanthrene	µg/L	0.01	< 0.01	< 0.01
Anthracene	µg/L	0.01	< 0.01	< 0.01
Fluoranthene	µg/L	0.01	< 0.01	< 0.01
Pyrene	µg/L	0.01	< 0.01	< 0.01
Benz(a)anthracene	µg/L	0.01	< 0.01	< 0.01
Chrysene/Triphenylene	µg/L	0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/L	0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/L	0.01	< 0.01	< 0.01
Benzo(e)pyrene	µg/L	0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/L	0.01	< 0.01	< 0.01
Indenopyrene	µg/L	0.01	< 0.01	< 0.01
Benzo(g,h,i)perylene	µg/L	0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/L	0.01	< 0.01	< 0.01
2-fluorobiphenyl (surrogate)	%		82	44

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Bruce Phillips
Department Head
Organic Analytical Services

Troy Smith
Lab Supervisor
Organic Analytical Services

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac WWTP

PAH in Water

RPC Sample ID:			125654-1	125654-2
Client Sample ID:			Upstream	Effluent
Date Sampled:			19-Sep-11	19-Sep-11
Matrix:			water	water
Analytes	Units	RL		
p-terphenyl-d14 (surrogate)	%		90	87

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac WWTP

PCB's in Water

RPC Sample ID:			125654-1	125654-2
Client Sample ID:			Upstream	Effluent
Date Sampled:			19-Sep-11	19-Sep-11
Matrix:			water	water
Analytes	Units	RL		
Total PCB	µg/L	0.1	< 0.1	< 0.1
PCB Surrogate (DCB)	%		98	95
Resemblance			ND	ND

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Bruce Phillips
Department Head
Organic Analytical Services

Karen Broad
Chemist
Organic Analytical Services

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac WWTP

Volatile Organic Compounds in Water

RPC Sample ID:			125654-1	125654-2
Client Sample ID:			Upstream	Effluent
Date Sampled:			19-Sep-11	19-Sep-11
Matrix:			water	water
Analytes	Units	RL		
Chloromethane	µg/L	5.0	< 5.0	< 5.0
Vinyl Chloride	µg/L	0.5	< 0.5	< 0.5
Bromomethane	µg/L	5.0	< 5.0	< 5.0
Chloroethane	µg/L	5.0	< 5.0	< 5.0
Trichlorofluoromethane	µg/L	5.0	< 5.0	< 5.0
1,1-Dichloroethylene	µg/L	0.5	< 0.5	< 0.5
Methylene Chloride	µg/L	5.0	< 5.0	< 5.0
1,2-Dichloroethylene (trans)	µg/L	0.5	< 0.5	< 0.5
1,1-Dichloroethane	µg/L	0.5	< 0.5	< 0.5
1,2-Dichloroethylene (cis)	µg/L	0.5	< 0.5	< 0.5
Bromochloromethane	µg/L	0.5	< 0.5	< 0.5
Chloroform	µg/L	0.5	< 0.5	< 0.5
1,1,1-Trichloroethane	µg/L	0.5	< 0.5	< 0.5
Carbon Tetrachloride	µg/L	0.5	< 0.5	< 0.5
Benzene	µg/L	0.5	< 0.5	< 0.5
1,2-Dichloroethane	µg/L	0.5	< 0.5	< 0.5
Trichloroethylene	µg/L	0.5	< 0.5	< 0.5
1,2-Dichloropropane	µg/L	0.5	< 0.5	< 0.5
Bromodichloromethane	µg/L	0.5	< 0.5	< 0.5
1,3-Dichloropropylene (trans)	µg/L	0.5	< 0.5	< 0.5

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Bruce Phillips
Department Head
Organic Analytical Services

Angela Colford
Lab Supervisor
Organic Analytical Services

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac WWTP

Volatile Organic Compounds in Water

RPC Sample ID:			125654-1	125654-2
Client Sample ID:			Upstream	Effluent
Date Sampled:			19-Sep-11	19-Sep-11
Matrix:			water	water
Analytes	Units	RL		
Toluene	µg/L	0.5	< 0.5	< 0.5
1,3-Dichloropropylene (cis)	µg/L	0.5	< 0.5	< 0.5
1,1,2-Trichloroethane	µg/L	0.5	< 0.5	< 0.5
Tetrachloroethylene	µg/L	0.5	< 0.5	< 0.5
Dibromochloromethane	µg/L	0.5	< 0.5	< 0.5
1,2-Dibromoethane	µg/L	0.5	< 0.5	< 0.5
Chlorobenzene	µg/L	0.5	< 0.5	< 0.5
Ethylbenzene	µg/L	0.5	< 0.5	< 0.5
m,p-Xylenes	µg/L	0.5	< 0.5	< 0.5
o-Xylene	µg/L	0.5	< 0.5	< 0.5
Styrene	µg/L	0.5	< 0.5	< 0.5
Bromoform	µg/L	0.5	< 0.5	< 0.5
1,1,1,2-Tetrachloroethane	µg/L	0.5	< 0.5	< 0.5
1,1,2,2-Tetrachloroethane	µg/L	0.5	< 0.5	< 0.5
1,3-Dichlorobenzene	µg/L	0.5	< 0.5	< 0.5
1,4-Dichlorobenzene	µg/L	0.5	< 0.5	< 0.5
1,2-Dichlorobenzene	µg/L	0.5	< 0.5	< 0.5
1,2-Dichloroethane-d4	%		103	103
Toluene-d8	%		99	100
4-Bromofluorobenzene	%		101	100

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Method Summary

Polynuclear Aromatic Hydrocarbons (PAH) in Water (OAS-SV02): Solvent extraction followed by GC/MS analysis; based on USEPA 3510C/8270C.
Total Polychlorinated biphenyls (PCB) in Water (OAS-SV04): Solvent extraction, GC-ECD analysis; based on EPA Methods 3540C/8082.
Volatile Organic Compounds in Water: Purge and trap extraction followed by GC/MS analysis; based on USEPA 624.

Resemblance Legend

Resemblance Code	Resemblance
ARO1242/54	Mix of Aroclors 1242,1254.
ARO1242/60	Mix of Aroclors 1242,1260.
ARO1254/60	Mix of Aroclors 1254, 1260.
ARO.1016	Aroclor 1016
ARO.1242	Aroclor 1242

Resemblance Code	Resemblance
ARO.1254	Aroclor 1254
ARO.1260	Aroclor 1260
MIXTURE	Mix of Aroclors 1242, 1254 and 1260.
ND	Not Detected

General Report Comments

125654-2: 2-fluorobiphenyl surrogate recovery below acceptance limit.

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Project #: 11079-1
Location: Shediac WWTP
QA/QC Report

RPC Sample ID:			BLANKA8091	SPIKEA8021
Matrix:			water	water
Analytes	Units	RL		% Recovery
Naphthalene	µg/L	0.05	< 0.05	78%
Acenaphthylene	µg/L	0.01	< 0.01	82%
Acenaphthene	µg/L	0.01	< 0.01	81%
Fluorene	µg/L	0.01	< 0.01	89%
Phenanthrene	µg/L	0.01	< 0.01	96%
Anthracene	µg/L	0.01	< 0.01	81%
Fluoranthene	µg/L	0.01	< 0.01	94%
Pyrene	µg/L	0.01	< 0.01	92%
Benz(a)anthracene	µg/L	0.01	< 0.01	88%
Chrysene/Triphenylene	µg/L	0.01	< 0.01	88%
Benzo(b)fluoranthene	µg/L	0.01	< 0.01	94%
Benzo(k)fluoranthene	µg/L	0.01	< 0.01	94%
Benzo(e)pyrene	µg/L	0.01	< 0.01	75%
Benzo(a)pyrene	µg/L	0.01	< 0.01	76%
Indenopyrene	µg/L	0.01	< 0.01	84%
Benzo(g,h,i)perylene	µg/L	0.01	< 0.01	89%
Dibenz(a,h)anthracene	µg/L	0.01	< 0.01	88%

RL = Reporting Limit

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Project #: 11079-1
Location: Shediac WWTP
QA/QC Report

RPC Sample ID:			BLANKA8082	SPIKEA8013
Matrix:			water	water
Analytes	Units	RL		% Recovery
Total PCB	µg/L	0.1	< 0.1	102%

RL = Reporting Limit

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Project #: 11079-1
Location: Shediac WWTP
QA/QC Report

RPC Sample ID:			BLANKA8034	SPIKEA7966
Matrix:			water	water
Analytes	Units	RL		% Recovery
Chloromethane	µg/L	5.0	< 5.0	102%
Vinyl Chloride	µg/L	0.5	< 0.5	98%
Bromomethane	µg/L	5.0	< 5.0	91%
Chloroethane	µg/L	5.0	< 5.0	89%
Trichlorofluoromethane	µg/L	5.0	< 5.0	96%
1,1-Dichloroethylene	µg/L	0.5	< 0.5	94%
Methylene Chloride	µg/L	5.0	< 5.0	99%
1,2-Dichloroethylene (trans)	µg/L	0.5	< 0.5	96%
1,1-Dichloroethane	µg/L	0.5	< 0.5	95%
1,2-Dichloroethylene (cis)	µg/L	0.5	< 0.5	97%
Bromochloromethane	µg/L	0.5	< 0.5	96%
Chloroform	µg/L	0.5	< 0.5	95%
1,1,1-Trichloroethane	µg/L	0.5	< 0.5	95%
Carbon Tetrachloride	µg/L	0.5	< 0.5	95%
Benzene	µg/L	0.5	< 0.5	101%
1,2-Dichloroethane	µg/L	0.5	< 0.5	98%
Trichloroethylene	µg/L	0.5	< 0.5	95%
1,2-Dichloropropane	µg/L	0.5	< 0.5	96%
Bromodichloromethane	µg/L	0.5	< 0.5	93%
1,3-Dichloropropylene (trans)	µg/L	0.5	< 0.5	91%

RL = Reporting Limit

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Project #: 11079-1
Location: Shediac WWTP
QA/QC Report

RPC Sample ID:			BLANKA8034	SPIKEA7966
Matrix:			water	water
Analytes	Units	RL		% Recovery
Toluene	µg/L	0.5	< 0.5	100%
1,3-Dichloropropylene (cis)	µg/L	0.5	< 0.5	93%
1,1,2-Trichloroethane	µg/L	0.5	< 0.5	92%
Tetrachloroethylene	µg/L	0.5	< 0.5	100%
Dibromochloromethane	µg/L	0.5	< 0.5	87%
1,2-Dibromoethane	µg/L	0.5	< 0.5	92%
Chlorobenzene	µg/L	0.5	< 0.5	98%
Ethylbenzene	µg/L	0.5	< 0.5	102%
m,p-Xylenes	µg/L	0.5	< 0.5	107%
o-Xylene	µg/L	0.5	< 0.5	103%
Styrene	µg/L	0.5	< 0.5	101%
Bromoform	µg/L	0.5	< 0.5	83%
1,1,1,2-Tetrachloroethane	µg/L	0.5	< 0.5	99%
1,1,2,2-Tetrachloroethane	µg/L	0.5	< 0.5	89%
1,3-Dichlorobenzene	µg/L	0.5	< 0.5	100%
1,4-Dichlorobenzene	µg/L	0.5	< 0.5	96%
1,2-Dichlorobenzene	µg/L	0.5	< 0.5	95%

RL = Reporting Limit

Report ID: 125654-OAS
Report Date: 03-Oct-11
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Project #: 11079-1

Summary of Date Analyzed

	PAH		PCB		VOC	
RPC Sample ID	**Extracted**	**Analyzed**	**Extracted**	**Analyzed**	**Extracted**	**Analyzed**
125654-1	26-Sep-11	28-Sep-11	27-Sep-11	28-Sep-11	21-Sep-11	21-Sep-11
125654-2	26-Sep-11	28-Sep-11	27-Sep-11	28-Sep-11	21-Sep-11	21-Sep-11

Report ID: 125654-OAS
Report Date: 03-Oct-11
Date Received: 19-Sep-11

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Attention: Jessica de Vries
Fax #:
jed@crandallengineering.ca

Project #: 11079-1
Location: Shediac WWTP

Chlorophenols in Water

RPC Sample ID:			125654-1	125654-2	Method Blank	Spike Rec. (%)
Client Sample ID:			Upstream	Effluent		
Date Sampled:			19-Sep-11	19-Sep-11		
Matrix:			water	water	water	water
Analytes	Units	RL				
2,3,4,5-Tetrachlorophenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	87
2,3,4,6-Tetrachlorophenol[1]	µg/L	0.1	< 0.1	< 0.1	< 0.1	98
2,3,5,6-Tetrachlorophenol[1]	µg/L	0.1	< 0.1	< 0.1	< 0.1	98
2,3,4-Trichlorophenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	57
2,3,5-Trichlorophenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	90
2,4,5-Trichlorophenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	68
2,4,6-Trichlorophenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	89
2,4-Dimethylphenol	µg/L	0.5	< 0.5	< 0.5	< 0.5	49
2,4-Dinitrophenol	µg/L	0.5	< 0.5	< 0.5	< 0.5	72
2,4-Dichlorophenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	73
2,6-Dichlorophenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	11
4,6-Dinitro-o-cresol	µg/L	0.5	< 0.5	< 0.5	< 0.5	65
2-Chlorophenol	µg/L	0.5	< 0.5	< 0.5	< 0.5	4
4-Chloro-3-methylphenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	129
4-Nitrophenol	µg/L	0.5	< 0.5	< 0.5	< 0.5	25
m-Cresol[1]	µg/L	0.1	< 0.1	< 0.1	< 0.1	71
o-Cresol	µg/L	0.1	< 0.1	< 0.1	< 0.1	78
p-Cresol[1]	µg/L	0.1	< 0.1	< 0.1	< 0.1	71
Pentachlorophenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	86
Phenol	µg/L	0.1	< 0.1	< 0.1	< 0.1	70
Surrogate Recoveries						
d6-Phenol	%	-	30	62	61	50
Tr bromophenol	%	-	77	98	77	98

This report relates only to the sample(s) and information provided to the laboratory.
Method: Solvent extraction with analysis by gas chromatography / mass selective detection (GC/MSD).
RL = Reporting Limit
[1] Combination of unresolved peaks used for both calculations.
2-chlorophenol, 2,6-dichlorophenol and 4-nitrophenol recoveries below acceptance limit.

Bruce Phillips
Dept. Head
Organic Analytical Services

Troy Smith
Lab Supervisor
Organic Analytical Services

Report ID: 125654-OAS
Report Date: 04-Oct-11
Date Received: 19-Sep-11

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Attention: Jessica de Vries
Fax #:
jed@crandallengineering.ca

Project #: 11079-1
Location: Shediac WWTP

Organochlorine Pesticides in Water

RPC Sample ID:			125654-1	125654-2	Method Blank	Spike Rec. (%)
Client Sample ID:			Upstream	Effluent		
Date Sampled:			19-Sep-11	19-Sep-11		
Matrix:			water	water	water	water
Analytes	Units	RL				
α-BHC	ng/mL	0.01	< 0.01	< 0.01	< 0.01	82
β-BHC	ng/mL	0.01	< 0.01	< 0.01	< 0.01	93
γ-BHC (Lindane)	ng/mL	0.01	< 0.01	< 0.01	< 0.01	82
δ-BHC	ng/mL	0.01	< 0.01	< 0.01	< 0.01	86
Heptachlor	ng/mL	0.01	< 0.01	< 0.01	< 0.01	36
Aldrin	ng/mL	0.01	< 0.01	< 0.01	< 0.01	22
Heptachlor epoxide	ng/mL	0.01	< 0.01	< 0.01	< 0.01	90
2,4'-DDE	ng/mL	0.01	< 0.01	< 0.01	< 0.01	73
Endosulfan I	ng/mL	0.01	< 0.01	< 0.01	< 0.01	89
4,4'-DDE	ng/mL	0.01	< 0.01	< 0.01	< 0.01	73
Dieldrin	ng/mL	0.01	< 0.01	< 0.01	< 0.01	93
2,4'-DDD	ng/mL	0.01	< 0.01	< 0.01	< 0.01	89
Endrin	ng/mL	0.01	< 0.01	< 0.01	< 0.01	88
Endosulfan II	ng/mL	0.01	< 0.01	< 0.01	< 0.01	99
4,4'-DDD	ng/mL	0.01	< 0.01	< 0.01	< 0.01	93
2,4'-DDT	ng/mL	0.01	< 0.01	< 0.01	< 0.01	86
Endrin aldehyde	ng/mL	0.01	< 0.01	< 0.01	< 0.01	83
Endosulfan sulfate	ng/mL	0.01	< 0.01	< 0.01	< 0.01	99
4,4'-DDT	ng/mL	0.01	< 0.01	< 0.01	< 0.01	97
Endrin ketone	ng/mL	0.01	< 0.01	< 0.01	< 0.01	106
Methoxychlor	ng/mL	0.01	< 0.01	< 0.01	< 0.01	115
α-Chlordane	ng/mL	0.01	< 0.01	< 0.01	< 0.01	74
γ-Chlordane	ng/mL	0.01	< 0.01	< 0.01	< 0.01	67
Mirex	ng/mL	0.01	< 0.01	< 0.01	< 0.01	80
Toxaphene	ng/mL	0.1	< 0.1	0.3	< 0.1	74

This report relates only to the sample(s) and information provided to the laboratory.
Method: Solvent extraction with analysis by Gas Chromatography/Electron Capture Detection (GC/ECD).
RL = Reporting Limit
Spike recoveries for heptachlor, aldrin and γ-chlordane were below acceptance limits.

Bruce Phillips
Dept. Head
Organic Analytical Services

Karen Broad
Chemist
Organic Analytical Services

Report ID: 125654-OAS
Report Date: 20-Oct-11
Date Received: 19-Sep-11

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Project #: 11079-1
Location: Shediac WWTP

Non-Ionic (CTAS) and Anionic (MBAS) Surfactants

RPC Sample ID:			125654-2	Mehod Blank	Method Spike (%)
Client Sample ID:			Effluent		
Date Sampled:			19-Sep-11		
Matrix:			water	water	water
Analytes	Units	RL			
CTAS Surfactants	mg/L	0.5	< 0.5	< 0.5	82
MBAS Surfactants	mg/L	0.1	< 0.1	< 0.1	-

This report relates only to the sample(s) and information provided to the laboratory.
Method: AWWA 5540C mod.
RL = Reporting Limit
Samples were subcontracted.

Bruce Phillips
Dept. Head
Organic Analytical Services

Troy Smith
Lab Supervisor
Organic Analytical Services

Report ID: 131371-IAS
Report Date: 02-Feb-12
Date Received: 23-Jan-12

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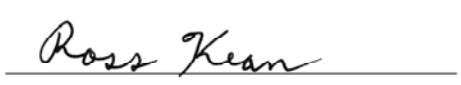
Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

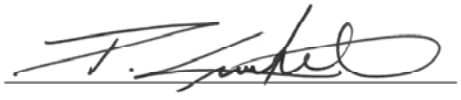
Analysis of Water

RPC Sample ID:			131371-1
Client Sample ID:			11079-1 Effluent (medium)
Date Sampled:			23-Jan-12
Analytes	**Units**	**RL**	
pH	units	-	7.6
Fluoride	mg/L	0.05	0.35
Nitrate + Nitrite (as N)	mg/L	0.05	0.54
Nitrate (as N)	mg/L	0.05	0.54
Nitrite (as N)	mg/L	0.05	< 0.05
Cyanide - Total	mg/L	0.002	0.003
COD	mg/L	10	40

This report relates only to the sample(s) and information provided to the laboratory.

RL = Reporting Limit





A. Ross Kean, M.Sc.
Department Head
Inorganic Analytical Chemistry

Peter Crowhurst, B.Sc., C.Chem
Analytical Chemist
Inorganic Analytical Chemistry

Report ID: 131371-IAS
Report Date: 02-Feb-12
Date Received: 23-Jan-12

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

Analysis of Metals in Water

RPC Sample ID:			131371-1
Client Sample ID:			11079-1 Effluent (medium)
Date Sampled:			23-Jan-12
Analytes	**Units**	**RL**	
Aluminum	µg/L	1	20
Antimony	µg/L	0.1	0.1
Arsenic	µg/L	1	< 1
Barium	µg/L	1	157
Beryllium	µg/L	0.1	< 0.1
Bismuth	µg/L	1	< 1
Boron	µg/L	1	139
Cadmium	µg/L	0.01	< 0.01
Calcium	µg/L	50	48100
Chromium	µg/L	1	< 1
Cobalt	µg/L	0.1	0.2
Copper	µg/L	1	4
Iron	µg/L	20	200
Lead	µg/L	0.1	0.2
Lithium	µg/L	0.1	5.6
Magnesium	µg/L	10	27100
Manganese	µg/L	1	396
Mercury	µg/L	0.025	< 0.025
Molybdenum	µg/L	0.1	0.5
Nickel	µg/L	1	< 1
Potassium	µg/L	20	12200
Rubidium	µg/L	0.1	6.1
Selenium	µg/L	1	< 1
Silver	µg/L	0.1	< 0.1
Sodium	µg/L	50	228000
Strontium	µg/L	1	331
Tellurium	µg/L	0.1	< 0.1
Thallium	µg/L	0.1	< 0.1
Tin	µg/L	0.1	< 0.1
Titanium	µg/L	1	< 1
Uranium	µg/L	0.1	0.2
Vanadium	µg/L	1	< 1
Zinc	µg/L	1	9

Report ID: 131371-IAS
Report Date: 02-Feb-12
Date Received: 23-Jan-12

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Methods

Analyte	RPC SOP #	Method Reference	Method Principle
pH	4.M03	APHA 4500-H^+ B	pH Electrode - Electrometric
Fluoride	4.M30	APHA 4500-F- D	SPADNS Colourimetry
Nitrate + Nitrite (as N)	4.M48	APHA 4500-NO_3 H	Hydrazine Red., Derivitization, Colourimetry
Nitrite (as N)	4.M49	APHA 4500-NO2- B	Ferrous ammonium sulfate Colourimetry
COD	4.M40	APHA 5220 D	Closed reflux, Colourimetry
Trace Metals	4.M01 & 4.M29	EPA 200.8 or EPA 200.7	ICP-MS or ICP-ES
Mercury	4.M21	EPA 245.1	Cold Vapor AAS

Report ID: 131371-OAS
Report Date: 07-Feb-12
Date Received: 23-Jan-12

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

PAH in Water

RPC Sample ID:			131371-1
Client Sample ID:			11079-1 Effluent (medium)
Date Sampled:			23-Jan-12
Matrix:			water
Analytes	Units	RL	
Naphthalene	µg/L	0.05	0.08
2-Methylnaphthalene	µg/L	0.05	< 0.05
1-Methylnaphthalene	µg/L	0.05	< 0.05
Acenaphthylene	µg/L	0.01	< 0.01
Acenaphthene	µg/L	0.01	< 0.05
Fluorene	µg/L	0.01	< 0.05
Phenanthrene	µg/L	0.01	0.28
Anthracene	µg/L	0.01	< 0.01
Fluoranthene	µg/L	0.01	< 0.01
Pyrene	µg/L	0.01	< 0.01
Benz(a)anthracene	µg/L	0.01	< 0.01
Chrysene/Triphenylene	µg/L	0.01	< 0.01
Benzo(b)fluoranthene	µg/L	0.01	< 0.01
Benzo(k)fluoranthene	µg/L	0.01	< 0.01
Benzo(e)pyrene	µg/L	0.01	< 0.01
Benzo(a)pyrene	µg/L	0.01	< 0.01
Indenopyrene	µg/L	0.01	< 0.01
Benzo(g,h,i)perylene	µg/L	0.01	< 0.01
Dibenz(a,h)anthracene	µg/L	0.01	< 0.01
2-fluorobiphenyl (surrogate)	%		54

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Bruce Phillips
Department Head
Organic Analytical Services

Troy Smith
Lab Supervisor
Organic Analytical Services

Report ID: 131371-OAS
Report Date: 07-Feb-12
Date Received: 23-Jan-12

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

PAH in Water

RPC Sample ID:			131371-1
Client Sample ID:			11079-1 Effluent (medium)
Date Sampled:			23-Jan-12
Matrix:			water
Analytes	Units	RL	
p-terphenyl-d14 (surrogate)	%		76

Report ID: 131371-OAS
Report Date: 07-Feb-12
Date Received: 23-Jan-12

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

PCB's in Water

RPC Sample ID:			131371-1
Client Sample ID:			11079-1 Effluent (medium)
Date Sampled:			23-Jan-12
Matrix:			water
Analytes	Units	RL	
Total PCB	µg/L	0.1	< 0.1
PCB Surrogate (DCB)	%		84
Resemblance			ND

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Bruce Phillips
Department Head
Organic Analytical Services

Karen Broad
Chemist
Organic Analytical Services

Report ID: 131371-OAS
Report Date: 07-Feb-12
Date Received: 23-Jan-12

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

Volatile Organic Compounds in Water

RPC Sample ID:			131371-1
Client Sample ID:			11079-1 Effluent (medium)
Date Sampled:			23-Jan-12
Matrix:			water
Analytes	Units	RL	
Chloromethane	µg/L	5.0	< 5.0
Vinyl Chloride	µg/L	0.5	< 0.5
Bromomethane	µg/L	5.0	< 5.0
Chloroethane	µg/L	5.0	< 5.0
Trichlorofluoromethane	µg/L	5.0	< 5.0
1,1-Dichloroethylene	µg/L	0.5	< 0.5
Methylene Chloride	µg/L	5.0	< 5.0
1,2-Dichloroethylene (trans)	µg/L	0.5	< 0.5
1,1-Dichloroethane	µg/L	0.5	< 0.5
1,2-Dichloroethylene (cis)	µg/L	0.5	< 0.5
Bromochloromethane	µg/L	0.5	< 0.5
Chloroform	µg/L	0.5	< 0.5
1,1,1-Trichloroethane	µg/L	0.5	< 0.5
Carbon Tetrachloride	µg/L	0.5	< 0.5
Benzene	µg/L	0.5	< 0.5
1,2-Dichloroethane	µg/L	0.5	< 0.5
Trichloroethylene	µg/L	0.5	< 0.5
1,2-Dichloropropane	µg/L	0.5	< 0.5
Bromodichloromethane	µg/L	0.5	< 0.5
1,3-Dichloropropylene (trans)	µg/L	0.5	< 0.5

This report relates only to the sample(s) and information provided to the laboratory.
RL = Reporting Limit

Bruce Phillips
Department Head
Organic Analytical Services

Angela Colford
Lab Supervisor
Organic Analytical Services

Report ID: 131371-OAS
Report Date: 07-Feb-12
Date Received: 23-Jan-12

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Attention: Jessica de Vries
Project #: 11079-1
Location: Shediac

Volatile Organic Compounds in Water

RPC Sample ID:			131371-1
Client Sample ID:			11079-1 Effluent (medium)
Date Sampled:			23-Jan-12
Matrix:			water
Analytes	Units	RL	
Toluene	µg/L	0.5	< 0.5
1,3-Dichloropropylene (cis)	µg/L	0.5	< 0.5
1,1,2-Trichloroethane	µg/L	0.5	< 0.5
Tetrachloroethylene	µg/L	0.5	< 0.5
Dibromochloromethane	µg/L	0.5	< 0.5
1,2-Dibromoethane	µg/L	0.5	< 0.5
Chlorobenzene	µg/L	0.5	< 0.5
Ethylbenzene	µg/L	0.5	< 0.5
m,p-Xylenes	µg/L	0.5	< 0.5
o-Xylene	µg/L	0.5	< 0.5
Styrene	µg/L	0.5	< 0.5
Bromoform	µg/L	0.5	< 0.5
1,1,1,2-Tetrachloroethane	µg/L	0.5	< 0.5
1,1,2,2-Tetrachloroethane	µg/L	0.5	< 0.5
1,3-Dichlorobenzene	µg/L	0.5	< 0.5
1,4-Dichlorobenzene	µg/L	0.5	< 0.5
1,2-Dichlorobenzene	µg/L	0.5	< 0.5
1,2-Dichloroethane-d4	%		107
Toluene-d8	%		101
4-Bromofluorobenzene	%		102

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Method Summary

Polynuclear Aromatic Hydrocarbons (PAH) in Water (OAS-SV02): Solvent extraction followed by GC/MS analysis; based on USEPA 3510C/8270C.
Total Polychlorinated biphenyls (PCB) in Water (OAS-SV04): Solvent extraction, GC-ECD analysis; based on EPA Methods 3540C/8082.
Volatile Organic Compounds in Water: Purge and trap extraction followed by GC/MS analysis; based on USEPA 624.

Resemblance Legend

Resemblance Code	Resemblance
ARO1242/54	Mix of Aroclors 1242,1254.
ARO1242/60	Mix of Aroclors 1242,1260.
ARO1254/60	Mix of Aroclors 1254, 1260.
ARO.1016	Aroclor 1016
ARO.1242	Aroclor 1242

Resemblance Code	Resemblance
ARO.1254	Aroclor 1254
ARO.1260	Aroclor 1260
MIXTURE	Mix of Aroclors 1242, 1254 and 1260.
ND	Not Detected

General Report Comments

Raised RL for acenaphthene and flourene due to failed qualifier ion ratios.
2-Fluorobiphenyl surrogate recovery below acceptance limit.
Acenaphthelyne, acenaphthene and anthracene spike recoveries below acceptance limit.

Report ID: 131371-OAS
Report Date: 07-Feb-12
Date Received: 23-Jan-12

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Project #: 11079-1
Location: Shediac
QA/QC Report

RPC Sample ID:			BLANKA8912	SPIKEA8829
Matrix:			water	water
Analytes	Units	RL		% Recovery
Naphthalene	µg/L	0.05	< 0.05	72%
Acenaphthylene	µg/L	0.01	< 0.01	67%
Acenaphthene	µg/L	0.01	< 0.01	69%
Fluorene	µg/L	0.01	< 0.01	73%
Phenanthrene	µg/L	0.01	0.01	82%
Anthracene	µg/L	0.01	< 0.01	64%
Fluoranthene	µg/L	0.01	< 0.01	85%
Pyrene	µg/L	0.01	< 0.01	89%
Benz(a)anthracene	µg/L	0.01	< 0.01	86%
Chrysene/Triphenylene	µg/L	0.01	< 0.01	88%
Benzo(b)fluoranthene	µg/L	0.01	< 0.01	88%
Benzo(k)fluoranthene	µg/L	0.01	< 0.01	88%
Benzo(e)pyrene	µg/L	0.01	< 0.01	73%
Benzo(a)pyrene	µg/L	0.01	< 0.01	73%
Indenopyrene	µg/L	0.01	< 0.01	84%
Benzo(g,h,i)perylene	µg/L	0.01	< 0.01	96%
Dibenz(a,h)anthracene	µg/L	0.01	< 0.01	103%

RL = Reporting Limit

Report ID: 131371-OAS
Report Date: 07-Feb-12
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Project #: 11079-1
Location: Shediac
QA/QC Report

RPC Sample ID:			BLANKA8891	SPIKEA8808
Matrix:			water	water
Analytes	Units	RL		% Recovery
Total PCB	µg/L	0.1	< 0.1	94%

RL = Reporting Limit

Report ID: 131371-OAS
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Project #: 11079-1
Location: Shediac
QA/QC Report

RPC Sample ID:			BLANKA8858	SPIKEA8775
Matrix:			water	water
Analytes	Units	RL		% Recovery
Chloromethane	µg/L	5.0	< 5.0	92%
Vinyl Chloride	µg/L	0.5	< 0.5	104%
Bromomethane	µg/L	5.0	< 5.0	73%
Chloroethane	µg/L	5.0	< 5.0	106%
Trichlorofluoromethane	µg/L	5.0	< 5.0	99%
1,1-Dichloroethylene	µg/L	0.5	< 0.5	100%
Methylene Chloride	µg/L	5.0	< 5.0	105%
1,2-Dichloroethylene (trans)	µg/L	0.5	< 0.5	103%
1,1-Dichloroethane	µg/L	0.5	< 0.5	101%
1,2-Dichloroethylene (cis)	µg/L	0.5	< 0.5	100%
Bromochloromethane	µg/L	0.5	< 0.5	107%
Chloroform	µg/L	0.5	< 0.5	101%
1,1,1-Trichloroethane	µg/L	0.5	< 0.5	93%
Carbon Tetrachloride	µg/L	0.5	< 0.5	97%
Benzene	µg/L	0.5	< 0.5	109%
1,2-Dichloroethane	µg/L	0.5	< 0.5	103%
Trichloroethylene	µg/L	0.5	< 0.5	100%
1,2-Dichloropropane	µg/L	0.5	< 0.5	97%
Bromodichloromethane	µg/L	0.5	< 0.5	92%
1,3-Dichloropropylene (trans)	µg/L	0.5	< 0.5	91%

RL = Reporting Limit

Report ID: 131371-OAS
Report Date: 07-Feb-12
Date Received: 23-Jan-12

CERTIFICATE OF ANALYSIS

for
Crandall Engineering Ltd
1077 Boul. St. George Blvd, Suite 400
Moncton, NB E1E 4C9

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Project #: 11079-1
Location: Shediac
QA/QC Report

RPC Sample ID:			BLANKA8858	SPIKEA8775
Matrix:			water	water
Analytes	Units	RL		% Recovery
Toluene	µg/L	0.5	< 0.5	104%
1,3-Dichloropropylene (cis)	µg/L	0.5	< 0.5	97%
1,1,2-Trichloroethane	µg/L	0.5	< 0.5	96%
Tetrachloroethylene	µg/L	0.5	< 0.5	90%
Dibromochloromethane	µg/L	0.5	< 0.5	85%
1,2-Dibromoethane	µg/L	0.5	< 0.5	94%
Chlorobenzene	µg/L	0.5	< 0.5	104%
Ethylbenzene	µg/L	0.5	< 0.5	100%
m,p-Xylenes	µg/L	0.5	< 0.5	101%
o-Xylene	µg/L	0.5	< 0.5	99%
Styrene	µg/L	0.5	< 0.5	94%
Bromoform	µg/L	0.5	< 0.5	80%
1,1,1,2-Tetrachloroethane	µg/L	0.5	< 0.5	99%
1,1,2,2-Tetrachloroethane	µg/L	0.5	< 0.5	99%
1,3-Dichlorobenzene	µg/L	0.5	< 0.5	102%
1,4-Dichlorobenzene	µg/L	0.5	< 0.5	97%
1,2-Dichlorobenzene	µg/L	0.5	< 0.5	97%

RL = Reporting Limit

Report ID: 131371-OAS
Report Date: 07-Feb-12
Date Received: 23-Jan-12

CERTIFICATE OF ANALYSIS

for

Crandall Engineering Ltd
1077 Boul. St. George Blvd, Suite 400
Moncton, NB E1E 4C9

rpc
921 College Hill Rd
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Canada E3B 6Z9
Tel: 506.452.1212
Fax: 506.452.0594
www.rpc.ca

Project #: 11079-1

Summary of Date Analyzed

	PAH		PCB		VOC	
RPC Sample ID	**Extracted**	**Analyzed**	**Extracted**	**Analyzed**	**Extracted**	**Analyzed**
131371-1	26-Jan-12	3-Feb-12	27-Jan-12	30-Jan-12	24-Jan-12	24-Jan-12

Report ID: 131371-OAS
Report Date: 07-Feb-12
Date Received: 23-Jan-12

Crandall Engineering Ltd.
1077 Boul. St. George Blvd., Suite 400
Moncton, NB E1E 4C9

rpc
921 College Hill Rd
Fredericton NB
Canada E3B 6Z9
Tel: 506-452-1212
Fax: 506-452-0594
www.rpc.ca

Attention: Jessica de Vries
Fax #:
jed@crandallengineering.ca

Project #: 11079-1
Location: Shediac
Chlorophenols in Water

RPC Sample ID:			131371-1	Method Blank	Spike Rec. (%)
Client Sample ID:			11079-1 Effluent (medium)		
Date Sampled:			23-Jan-12		
Matrix:			water	water	water
Analytes	Units	RL			
2,3,4,6-Tetrachlorophenol[1]	µg/L	0.1	< 0.1	< 0.1	105
2,4,6-Trichlorophenol	µg/L	0.1	< 0.1	< 0.1	82
2,4-Dichlorophenol	µg/L	0.1	< 0.1	< 0.1	84
Phenol	µg/L	0.1	< 0.1	< 0.1	104
Surrogate Recoveries					
Tribromophenol	%	-	92	-	-

This report relates only to the sample(s) and information provided to the laboratory.
Method: Solvent extraction with analysis by gas chromatography / mass selective detection (GC/MSD).
RL = Reporting Limit
[1] Combination of unresolved peaks used for both calculations.

Bruce Phillips
Dept. Head
Organic Analytical Services

Troy Smith
Lab Supervisor
Organic Analytical Services

Report ID: 131371-OAS
Report Date: 01-Feb-12
Date Received: 23-Jan-12

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Tel: 506-452-1212
Fax: 506-452-0594
www.rpc.ca

Attention: Jessica de Vries
Fax #:
jed@crandallengineering.ca

Project #: 11079-1
Location: Shediac
Organochlorine Pesticides in Water

RPC Sample ID:			131371-1	Method Blank	Spike Rec. (%)
Client Sample ID:			11079-1 Effluent (medium)		
Date Sampled:			23-Jan-12		
Date Extracted:			27-Jan-12	27-Jan-12	27-Jan-12
Matrix:			water	water	water
Analytes	Units	RL			
α-BHC	ng/mL	0.01	< 0.01	< 0.01	77
β-BHC	ng/mL	0.01	< 0.01	< 0.01	88
γ-BHC (Lindane)	ng/mL	0.01	< 0.01	< 0.01	80
δ-BHC	ng/mL	0.01	< 0.01	< 0.01	53
Heptachlor	ng/mL	0.01	< 0.01	< 0.01	23
Aldrin	ng/mL	0.01	< 0.01	< 0.01	14
Heptachlor epoxide	ng/mL	0.01	< 0.01	< 0.01	84
2,4'-DDE	ng/mL	0.01	< 0.01	< 0.01	49
Endosulfan I	ng/mL	0.01	< 0.01	< 0.01	86
4,4'-DDE	ng/mL	0.01	< 0.01	< 0.01	56
Dieldrin	ng/mL	0.01	< 0.01	< 0.01	85
2,4'-DDD	ng/mL	0.01	< 0.01	< 0.01	84
Endrin	ng/mL	0.01	< 0.01	< 0.01	89
Endosulfan II	ng/mL	0.01	< 0.01	< 0.01	95
4,4'-DDD	ng/mL	0.01	< 0.01	< 0.01	89
2,4'-DDT	ng/mL	0.01	< 0.01	< 0.01	73
Endrin aldehyde	ng/mL	0.01	< 0.01	< 0.01	80
Endosulfan sulfate	ng/mL	0.01	< 0.01	< 0.01	98
4,4'-DDT	ng/mL	0.01	< 0.01	< 0.01	81
Endrin ketone	ng/mL	0.01	< 0.01	< 0.01	93
Methoxychlor	ng/mL	0.01	< 0.01	< 0.01	92
α-Chlordane	ng/mL	0.01	< 0.01	< 0.01	81
γ-Chlordane	ng/mL	0.01	< 0.01	< 0.01	74
Mirex	ng/mL	0.01	< 0.01	< 0.01	63
Toxaphene	ng/mL	0.1	< 0.2	< 0.1	79

This report relates only to the sample(s) and information provided to the laboratory.

Organochlorine pesticides in water (OAS-SV05): Solvent extraction followed by GC-ECD analysis; based on USEPA 3510C/3620/8081A.

RL = Reporting Limit

Increased RL for toxaphene due to matrix interference.

Bruce Phillips
Dept. Head
Organic Analytical Services

Karen Broad
Chemist
Organic Analytical Services

Report ID: 131371-OAS
Report Date: 16-Feb-12
Date Received: 23-Jan-12

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Tel: 506-452-1212
Fax: 506-452-0594
www.rpc.ca

Attention: Jessica de Vries
Fax #:
jed@crandallengineering.ca

Project #: 11079-1

Location: Shediac

Non-Ionic (CTAS) and Anionic (MBAS) Surfactants

RPC Sample ID:			131371-1	Mehod Blank	Method Spike (%)
Client Sample ID:			11079-1 Effluent (medium)		
Date Sampled:			23-Jan-12		
Matrix:				water	water
Analytes	Units	RL			
CTAS Surfactants	mg/L	0.5	< 0.5	< 0.5	98
MBAS Surfactants	mg/L	0.1	< 0.1	< 0.1	88

This report relates only to the sample(s) and information provided to the laboratory.

Method: AWWA 5540C mod.

RL = Reporting Limit

Sample was subcontracted.

Bruce Phillips
Dept. Head
Organic Analytical Services

Troy Smith
Lab Supervisor
Organic Analytical Services

Report ID: 133566-MB
Report Date: 20-Mar-12
Date Received: 19-Mar-12

CERTIFICATE OF ANALYSIS

for

Crandall Engineering Ltd
1077 Boul. St. George Blvd, Suite 400
Moncton, NB E1E 4C9

rpc
150 Lutz St
Moncton NB
Canada E1C 5E9
Tel: 506.855.6472
Fax: 506.855.8294
www.rpc.ca

Attention: Jessica de Vries
P/O #: 555
Project/Job #: 11079-1
Location: Shediac

Examination of Water

RPC Sample ID:				133566-1	133566-2
Client Sample ID:				Upstream	Effluent
Date Sampled:				19-Mar-12	19-Mar-12
Analytes	**Method ID**	**Date Analyzed**	**Units**		
E. coli	MB02	19-Mar-12	cfu/100mL	160	7600
Faecal Coliforms	MB05	19-Mar-12	cfu/100mL	580	13700

This report relates only to the sample(s) and information provided to he laboratory.

RL = Reporting Limit

Michael Lawlor
Lab Supervisor
Moncton Laboratory

Nadine Godin
Microbiology Technician
Moncton Laboratory

APPENDIX D: NATECH Environmental Services Inc. Field Investigation Report Dated October 4, 2011

Mixing Zone Field Investigation for the Greater Shediac Wastewater Treatment Plant

Submitted to: **Crandall Engineering Ltd.**
1077 St George Blvd., Suite 400
Moncton, New Brunswick
Canada E1E 4C9

Prepared by: **NATECH Environmental Services Inc.**
109 Patterson Cross Rd.
Harvey Station, N.B.
E6K 1L9

Date: **October 4, 2011**

NATECH

TABLE OF CONTENTS

1. INTRODUCTION

Crandall Engineering Ltd. requested that NATECH Environmental Services Inc. conduct a physical Mixing Zone Assessment at the Shediac Wastewater Treatment Plant (WWTP) in accordance with the Environmental Risk Assessment (ERA) requirements of the CCME guidelines and focused on the discharge environment within the Northumberland Strait. The objective of the investigation was to assess the mixing regime of the treated wastewater effluent from the Shediac WWTP into the receiving marine environment.

The treated effluent is discharged into a long narrow trench that empties into a wide shallow embayment. This basin is connected to the Northumberland Strait by a shallow channel.

2. METHODOLOGY

The field investigation was carried out on September 1st, 2011 from 10:00 to 18:00. The weather conditions during the investigation were sunny and warm (20°C), with light onshore wind.

2.1 Water Level

The water level in the trench was surveyed periodically relative to the top of outlet manhole during the study and converted to geodetic levels using available facility drawings. Also, a water level sensor was installed along the northern bank of the basin to monitor the tidal effects of the Northumberland Strait. Predictive tidal data from the Department of Fisheries and Oceans (DFO) were used to approximate the water level within the Northumberland Strait and interpret the effects of a tidal cycle on the receiving environment.

2.2 Bathymetry

The bathymetry within the trench, basin, and ocean were surveyed using a boat equipped with GPS and echo sounder technology. The depths were originally recorded relative to the water's surface and then converted to geodetic elevations, taking into account changes in the ocean water level.

2.3 Current Direction and Speed

The measurements were taken using drogues equipped with GPS tracking devices that drifted with the current.

2.4 Water Quality

The water quality was measured in the field on September 1, 2011 using a YSI multi-parameter water quality probe. In addition, water samples were taken, stored on ice for 24 hours, and delivered on September 2, 2011 for analysis by RPC in Fredericton. The samples were analyzed for general chemistry, trace metals and microbiology.

2.5 Effluent Flow

The effluent flow rate is monitored (MG/day) by the facility and was read off the real time digital display within the UV building. The effluent flow rate was recorded periodically during the course of the study to ensure accurate dilution rate calculations.

2.6 Mixing

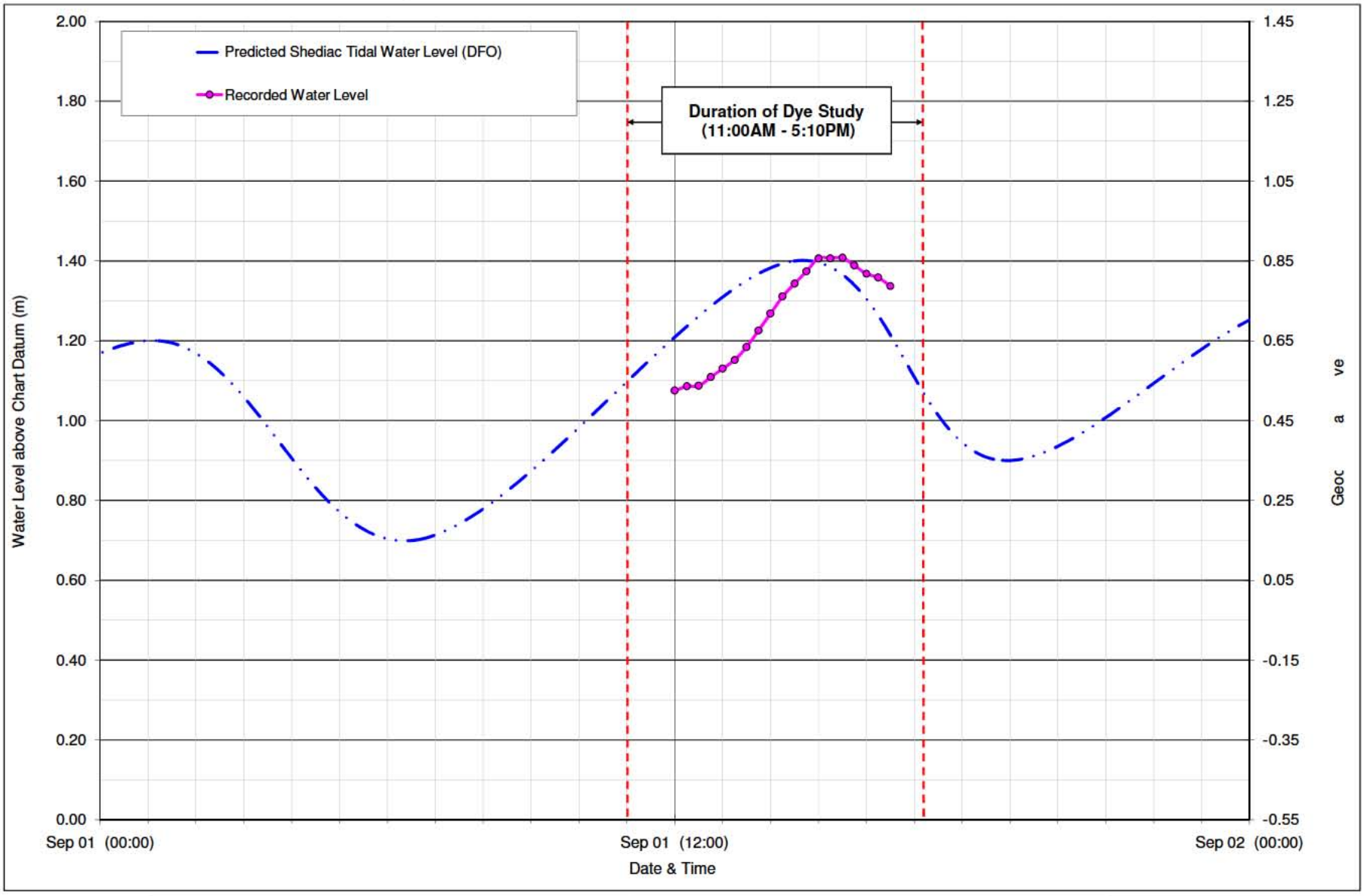
The mixing regime of the effluent in the receiving environment was measured by injecting Rhodamine WT into the effluent stream and measuring dye dilution rates in the trench and basin. Dye sensor readings along with corresponding GPS position and time were documented. Visual observations were sketched and the plume boundary shape was traced in the field using GPS tracking.

3. RESULTS

At the Shediac WWTP, after the UV disinfection, the effluent is discharged through the bank into an approximately 280m long narrow trench located just North of the UV building. The effluent then travels down the trench without mixing until it exits into a large shallow basin (approximately 3.7ha) that is connected to the ocean via a shallow sandy channel.

3.1 Measured Water Level

The study took place during the course of a small amplitude tidal cycle. The water level sensor data reveal that the basin only drains during a portion of the tidal cycle. When the water level within the basin falls below the height of the sand bar, the discharge is cut off from the ocean and becomes stagnant until the next rising tide when ocean water begins to pour into the basin. Water level measurements within the basin indicate that the minimum water level within the basin is 0.52m geodetic. Measured water levels in the basin overlaid on Department of Fisheries and Oceans (DFO) predicted tides in Shediac are shown on Figure 3-1.



MIXING ZONE FIELD INVESTIGATION - GREATER SHEDIAC WWTP

MEASURED WATER LEVEL (SEPT. 1, 2011)

NATECH Environmental Services Inc.
109 Patterson Cross Road,
Harvey Station, NB, CANADA,
E6K 1L9

SCALE: Not to scale

DATE: 2011/10/03

FILE: CRA-11-01

FIGURE: 3-1

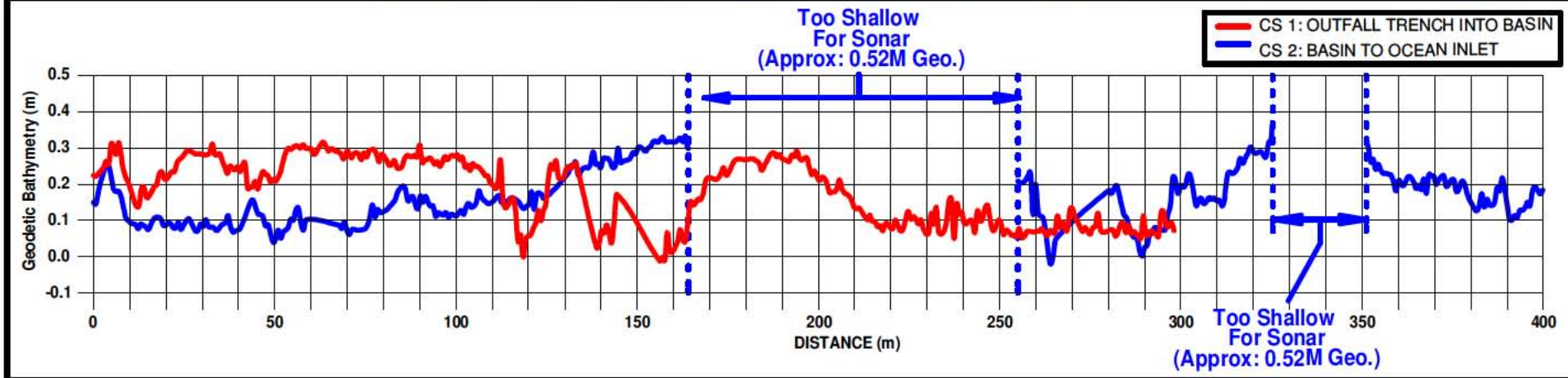
3.2 Bathymetry

Four cross sections were surveyed in order to characterize the bathymetry of the receiving environment. The cross sections were located from the trench to as far as the middle of the basin, from the basin into the ocean inlet, and two more within the ocean (see Figure 3-2 and Figure 3-3). During the survey across the shallow sandy channel from the basin into the ocean, the water level was so shallow that sonar data could not be collected. The field observations and water level sensor data indicate that the approximate average geodetic elevation of the shallow sandy channel was 0.52m. The collection of the survey data was used to produce a bathymetric geodetic elevation map found in Figure 3-4.

3.3 Current Direction and Speed

Figure 3-5 illustrates the current velocity and direction measurements during the study period. The current velocity was measured while the basin was filling in the early afternoon and then later while it was draining in the late afternoon.

While the basin was filling, the current velocity was 0.18m/s near the ocean inlet and accelerated to 0.42m/s across the shallow sandy channel. While the basin was emptying, the current velocity was 0.24m/s in the shallow sandy channel. It slowed to 0.2m/s near the ocean inlet.



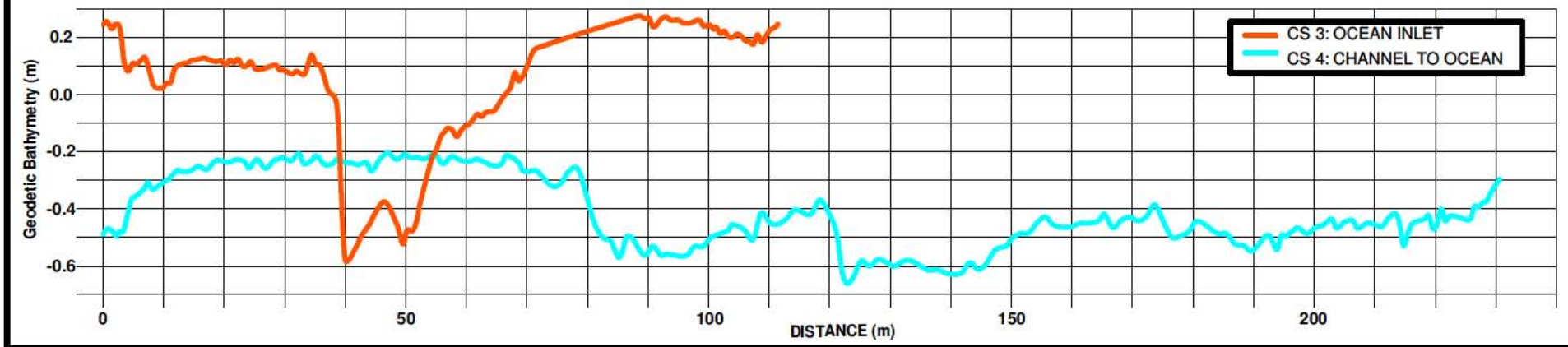
MIXING ZONE FIELD INVESTIGATION - GREATER SHEDIAC WWTP

BATHYMETRY CROSS SECTIONS 1 & 2

NATECH

Environmental Services Inc.
109 Patterson Cross Rd., Harvey Station, N.B.
Ph: (506) 366 1080 Fax: (506) 366 1090

Date: / Date:	Project No.: / Nº du projet
11/10/03	CRA-11-01
Scale: / Echelle:	Sheet No.: / Nº de la feuille:
AS SHOWN	FIGURE 3-2



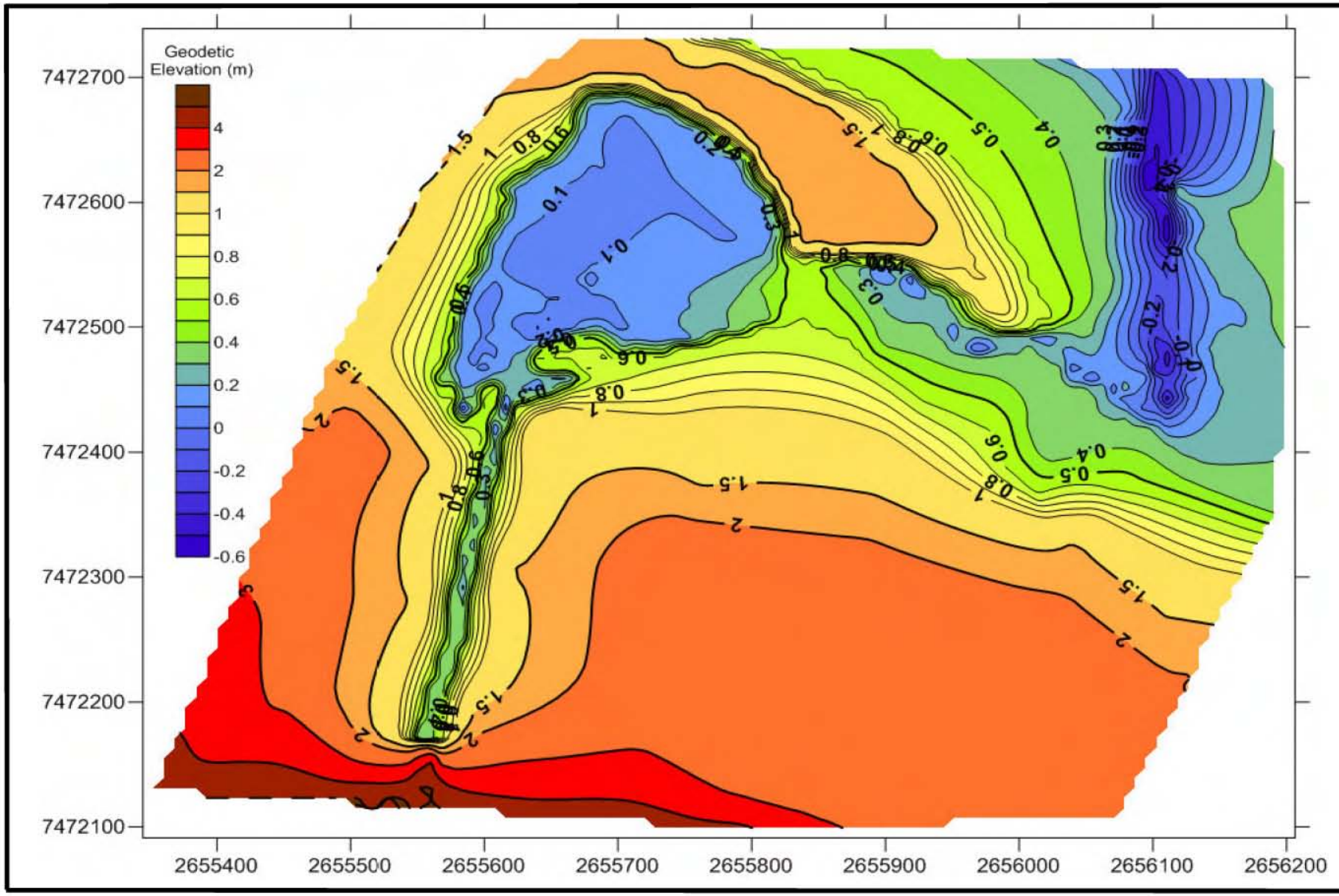
MIXING ZONE FIELD INVESTIGATION - GREATER SHEDIAC WWTP

BATHYMETRY CROSS SECTIONS 3 & 4

NATECH

Environmental Services Inc.
109 Patterson Cross Rd., Harvey Station, N.B.
Ph: (506) 366 1080 Fax: (506) 366 1090

Date: / Date:	Project No.: / Nºdu projet
11/09/29	CRA-11-01
Scale: / Echelle:	**Sheet No.: / Nºde la feuille:**
AS SHOWN	FIGURE 3-3



MXIING ZONE FIELD INVESTIGATION - GREATER SHEDIAC WWTP

BATHYMETRIC CONTOUR MAP

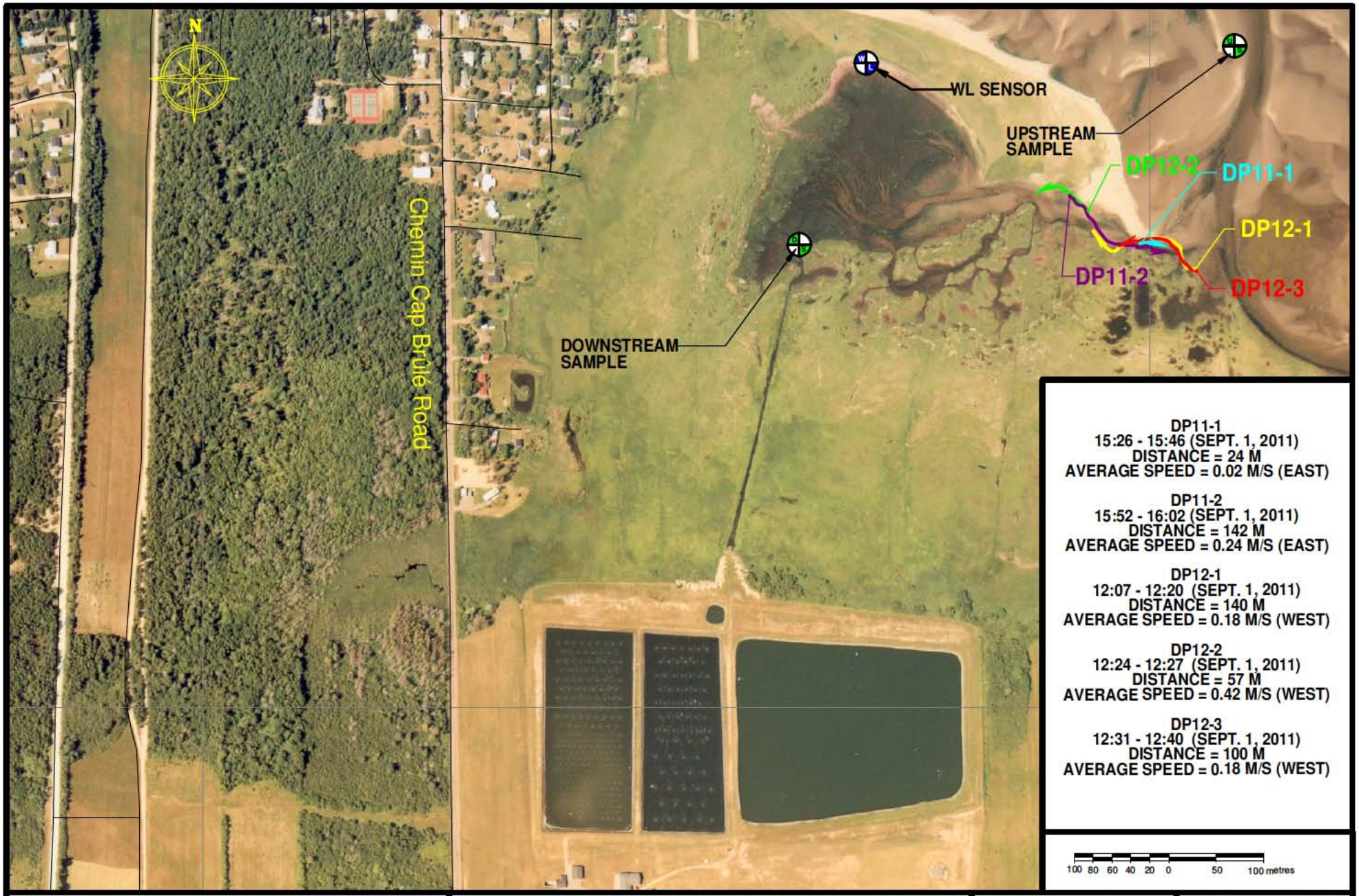
NATECH Environmental Services Inc.
109 Patterson Cross Road,
Harvey Station, NB, CANADA,
E6K 1L9

SCALE: Not to scale

DATE: 2011/09/27

FILE: CRA-11-01

FIGURE: 3-4



MIXING ZONE FIELD INVESTIGATION - GREATER SHEDIAC WWTP

MEASURED CURRENT VELOCITIES

NATECH Environmental Services Inc.
109 Patterson Cross Rd., Harvey Station, N.B.
Ph: (506) 366 1080 Fax: (506) 366 1090

Date: / Date:	Project No.: / Nº du projet
11/09/29	CRA-11-01
Scale: / Echelle:	Sheet No.: / Nº de la feuille:
AS SHOWN	FIGURE: 3-5

3.4 Water Quality

Table 3.1 lists the measured water quality observed in the field, and Table 3.2 contains the laboratory analysis for a wider range of parameters. Sampling locations are shown on Figure 3-5. The treated effluent was sampled downstream of the UV treatment. The high DO reading in the downstream sample is likely due to the presence of algae in the lagoon.

Table 3.1. Measured Water Quality - Shediac - September 1, 2011

Item	Upstream	Effluent	Downstream
Temperature (°C)	22.0	25.0	25.0
Conductivity (uS/cm·deg)	41.00	2.00	17.00
Dissolved Solids (calculated) (mg/L)	26.80	1.23	11.00
Salinity (mg/L)	26.40	0.99	10.00
DO (%)	116.0	109.4	170.0
DO (mg/L)	8.7	9.0	12.7
pH	8.3	8.5	8.3

Table 3.2. Shediac - Laboratory analysis for water samples (Sept. 1, 2011)

Parameter	Unit	Upstream	Effluent	Downstream
General chemistry - Measurements				
Sodium	mg/L	7930	239	2420
Potassium	mg/L	333	17.0	103.
Calcium	mg/L	345	51.2	125
Magnesium	mg/L	1050	27.0	305.
Iron	mg/L	2	0.52	0.7
Manganese	mg/L	< 0.05	0.432	0.29
Copper	mg/L	< 0.05	0.016	< 0.02
Zinc	mg/L	< 0.05	0.097	< 0.02
Ammonia (as N)	mg/L	0.13	10.2	8.9
Total Kjeldahl Nitrogen (TKN)	mg/L	0.5	27	16
pH	units	7.9	7.5	7.8
Alkalinity (as CaCO3)	mg/L	150	170	170
Chloride	mg/L	14900	440	4170
Fluoride	mg/L	1.68	0.64	0.87
Sulfate	mg/L	2600	62	620
Nitrate + Nitrite (as N)	mg/L	< 0.05	0.30	0.32
Nitrate (as N)	mg/L	< 0.05	0.19	0.21
Nitrite (as N)	mg/L	< 0.05	0.11	0.10
Cyanide - Total	mg/L	< 0.002	0.004	0.005
o-Phosphate (as P)	mg/L	0.01	3.2	1.96
Total Phosphorus (TP)	mg/L	0.035	3.39	2.34
r-Silica (as SiO2)	mg/L	< 0.1	11.4	8.6
Total Organic Carbon	mg/L	< 0.5	7.4	1.8
CBOD5	mg/L	< 6	8	< 6
Turbidity	NTU	0.8	7.9	6.9
Total Suspended Solids	mg/L	< 5	26	< 5
Conductivity	µS/cm	51800	1740	13000
General chemistry - Calculated parameters				
Bicarbonate as $CaCO_3$	mg/L	149	169	169
Carbonate as $CaCO_3$	mg/L	1.11	0.504	1.00
Hydroxide as $CaCO_3$	mg/L	0.040	0.016	0.032
Cation sum	meq/L	457	16.4	140
Anion sum	meq/L	477	17.3	134
% difference	%	-2.17	-2.80	2.13
Theoretical Conductivity	µS/cm	32900	1590	10100
Hardness (as $CaCO_3$)	mg/L	5180	239	1570
Ion Sum	mg/L	27200	969	7870
Saturation pH (5°C)	units	7.0	7.8	7.6
Langelier Index (5°C)		0.92	-0.30	0.20
Trace metals				
Aluminum	µg/L	< 50	73	40
Antimony	µg/L	< 5	0.3	< 2
Arsenic	µg/L	< 50	< 1	< 20
Barium	µg/L	< 50	226	120
Beryllium	µg/L	< 5	< 0.1	< 2
Bismuth	µg/L	< 50	< 1	< 20
Boron	µg/L	3960	178	1330
Cadmium	µg/L	< 0.5	0.43	< 0.2
Calcium	µg/L	345000	51200	125000
Chromium	µg/L	< 50	1	< 20
Cobalt	µg/L	< 5	0.3	< 2
Copper	µg/L	< 50	16	< 20
Iron	µg/L	2100	520	700
Lead	µg/L	< 5	2.2	2
Lithium	µg/L	142	6.6	44
Magnesium	µg/L	1050000	27000	305000
Manganese	µg/L	< 50	432	290
Mercury	µg/L	< 0.025	< 0.025	< 0.025
Molybdenum	µg/L	24	0.3	5
Nickel	µg/L	< 50	3	< 20
Potassium	µg/L	333000	17000	103000
Rubidium	µg/L	92	10.5	32
Selenium	µg/L	< 50	< 1	< 20
Silver	µg/L	< 5	< 0.1	< 2
Sodium	µg/L	7930000	239000	2420000
Strontium	µg/L	6500	372	2020
Tellurium	µg/L	< 5	< 0.1	< 2
Thallium	µg/L	< 5	< 0.1	< 2
Tin	µg/L	< 5	0.3	< 2
Uranium	µg/L	< 5	0.1	< 2
Vanadium	µg/L	< 50	< 1	< 20
Zinc	µg/L	< 50	97	< 20
Microbiological				
Coliforms	MPN/100mL	45	257500	74
E.Coli	MPN/100mL	22	100	49
Faecal Coliforms	MPN/100mL	22	500	74

3.5 Effluent Flow

The average effluent discharge was 73.2L/s (1.67MG/day) on September 1, 2011. The discharge was calculated from recorded data taken from the flow monitor's real time measurement display which was located within the UV Building. Effluent flow rates throughout the study were reasonably stable with a measured variation of 2L/s.

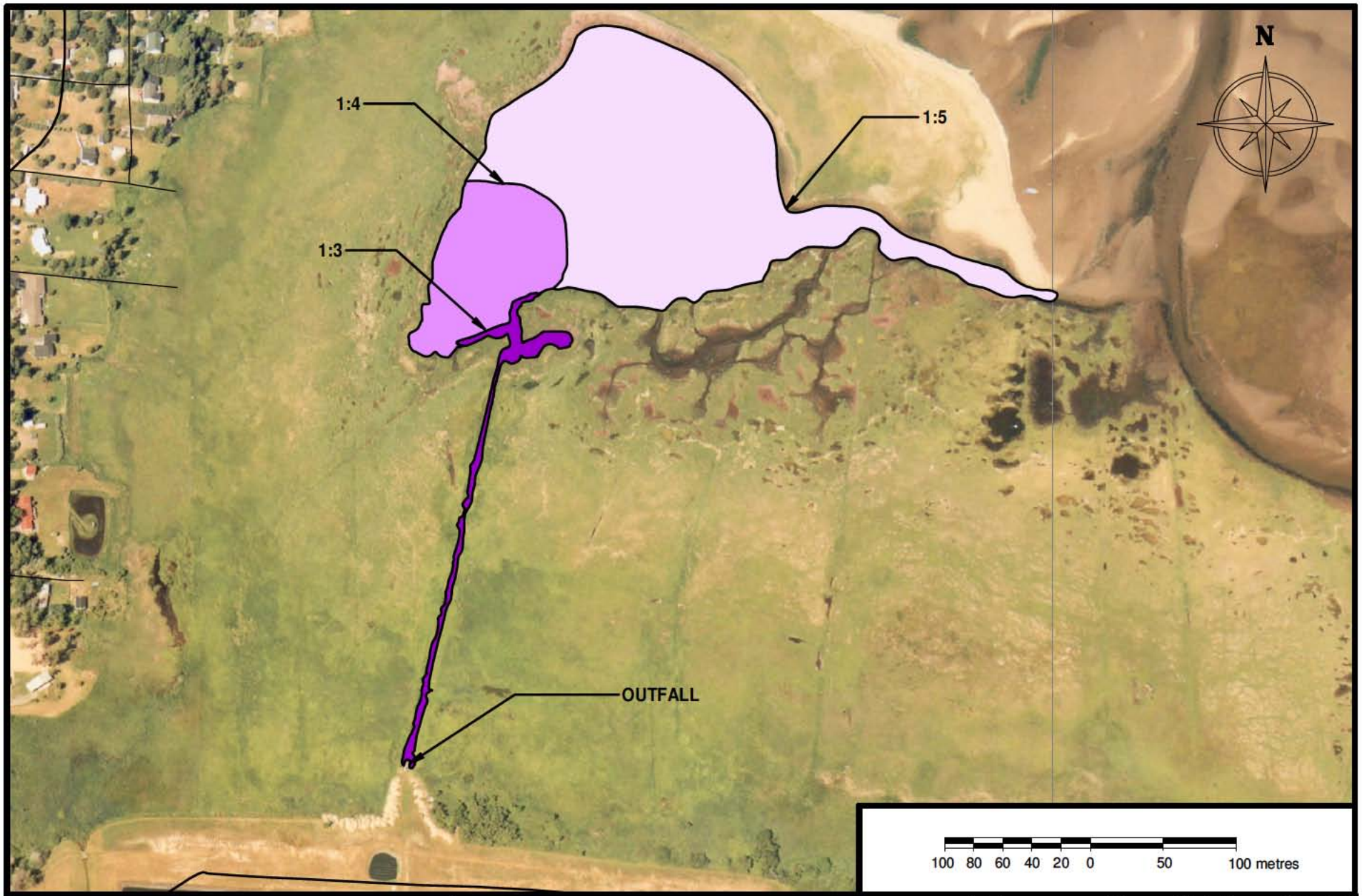
3.6 Mixing

The effluent plume, originating from the outfall located on the bank of the narrow trench, remained undiluted until entering the shallow basin. Values below one in three (1:3) dilution extended approximately 40m from the entrance of the trench into the basin. Measured plume dilutions are shown in Table 3.3 and illustrated in Figure 3-6.

Table 3.3. Observed Effluent Plume Dilutions - Shediac - September 1, 2011

Dilution Rate (Dye : Total Volume)	Max Observed Distance from Outfall (m)
1:3	40
1:4	120
1:5	450

The effluent was found to float at the surface on top of the underlaying saline layer. The volume of clean sea water that flowed into the basin during the tidal cycle studied on September 1st was calculated to be 11,400m^3. The average effluent flow rate was measured to be 73.2L/s, which corresponds to a total volume of 3,300m^3 for a 12.4 hour tidal cycle. The total volume flushing out of the basin during the tidal cycle was 14,700m^3. The volume balance for the tidal cycle on September 1st is illustrated on in Figure 3-7.

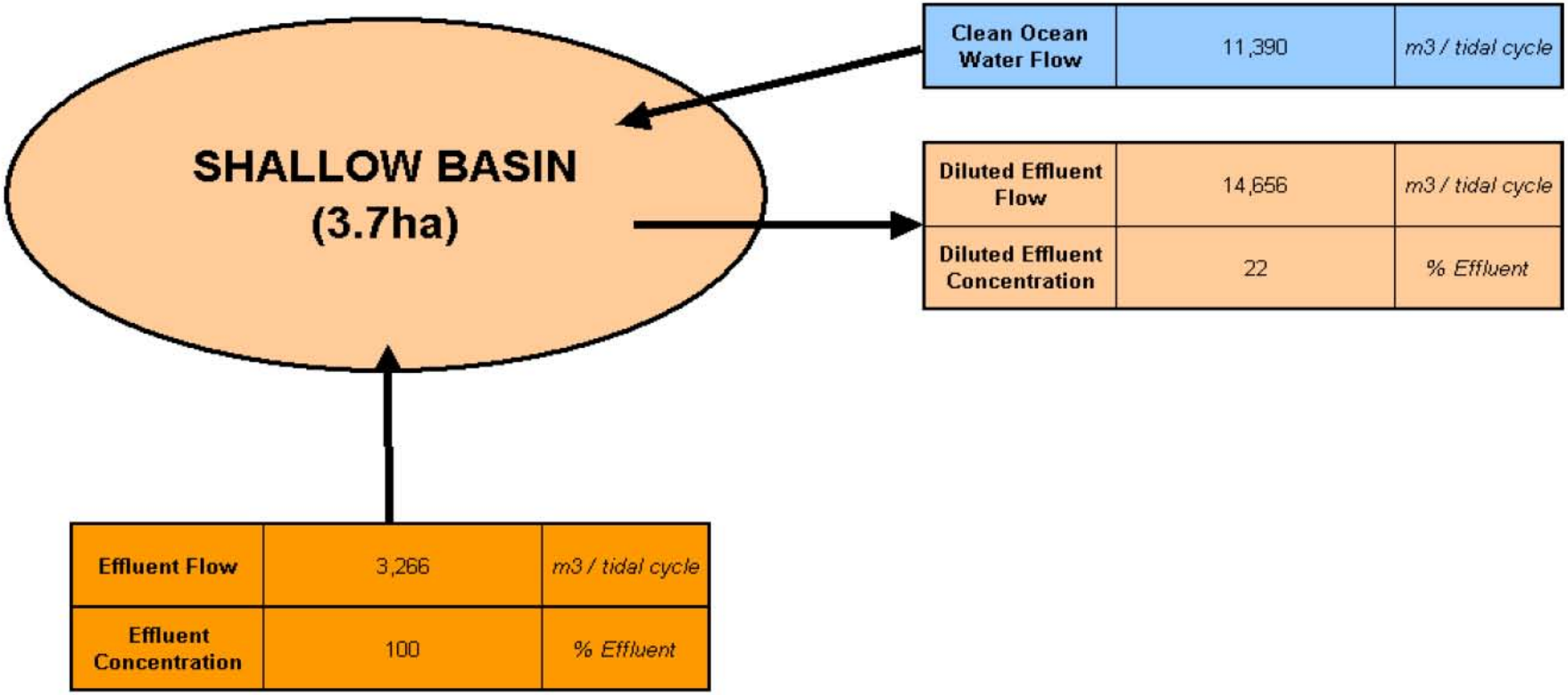


MIXING ZONE FIELD INVESTIGATION -
GREATER SHEDIAC WWTP

OBSERVED EFFLUENT PLUME
SEPT. 1, 2011 (11:00 - 17:10)

NATECH
Environmental Services Inc.
109 Patterson Cross Rd., Harvey Station, N.B.
Ph: (506) 366-1080 Fax: (506) 366-1090

Date: / Date:	Project No.: / Nº du projet
11/09/29	CRA-11-01
Scale: / Echelle:	Sheet No.: / Nº de la feuille:
AS SHOWN	FIGURE: 3-6



Note: Measured flows on September 1, 2011

MIXING ZONE FIELD INVESTIGATION - GREATER SHEDIAC WWTP **EMBAYMENT FLUSHING VOLUMES ON SEPTEMBER 1, 2011**	NATECH	**NATECH Environmental Services Inc.** 109 Patterson Cross Road, Harvey Station, NB, CANADA, E6K 1L9	**SCALE:** Not to scale	**DATE:** 2011/09/27
			FILE: CRA-11-01	**FIGURE:** 3-7

APPENDIX A - SITE PHOTOS

Ditch receiving effluent

Shallow embayment at mouth of ditch

Edge of shallow embayment at low tide

Vegetation in shallow embayment

Channel at exit of shallow basin at low tide

Channel at exit of shallow embayment

Shediac Bay

End of channel draining shallow basin

APPENDIX E: GSSC (Shediac) WWTP Sampling Results
Year 2010

Effluent & Influent Sampling Results - GSSC WWTP

Medium Facility - 2010

EFFLUENT VALUES

Test Group	Substances	Units	2010											
			January	February	March	April	May	June	July	August	September	October	November	December
General Chemistry / Nutrients	Nitrate	mg/L			0.5	1.1	0.3	0.2	0.3	0.2	0.3	7.4	0.9	0.8
	Nitrite	mg/L			0.1	0.1	0.1	0.1	1.9	0.1	1.2	1.5	0.1	0.1
	Nitrate + Nitrite	mg/L			0.6	1.2	0.4	0.3	2.2	0.3	1.5	8.9	1	0.9
	Total Suspended Solids (TSS)	mg/L			3	29.5	14.5	15	21.5	24.5	40	32.67	11	13
	Biological Oxygen Demand (BOD_5)	mg/L			6	15	11	7.5	12.5	7.5	6	11.67	3.5	4.5
	Total Ammonia Nitrogen	mg/L			8.26	1.18	5.44	11.8	12.4	13.9	17.4	1.35	7.17	6.92
	Total Kjeldahl (TKN)	mg/L			10.2	5.07	7.53	14.6	13.9	16.7	22.7	5.33	8.74	8.15
	Total Phosphorus (TP)	mg/L			1.36	0.81	1.5	2.38	1.62	3.31	2.95	1.22	1.17	1.38
	Dissolved Oxygen (DO)	mg/L	11.6	9.7	10.6	14.4	11.5	6.7	8.5	9	8.5	10.1	10	9.7
	pH	units	7.7	7.6	7.8	8.2	8.2	8.2	8.6	8.5	8.3	8.4	8	7.8
	Temperature	°C	1	0.8	2.7	8.5	13.7	17.9	23.5	23	19	13.8	6.9	4.9
Pathogens	E. *coli*	CFU/100 mL					<13.00	8	13	7	41			
	Faecal coliforms	CFU/100 mL					<20.00	<10.00	<20.00	<2.00	14			
Parameter	Effluent Flow	m^3/day						6519.92	6409.96	5371.98	5641.01	6907.59	9215.74	9053.44

INFLUENT VALUES

Test Group	Substances	Units	2010											
			January	February	March	April	May	June	July	August	September	October	November	December
General Chemistry / Nutrients	Biological Oxygen Demand (BOD5)	mg/L			18	13	27	23.5	53	57	43	23.33	34	29.5
	Total Suspended Solids (TSS)	mg/L			25.5	23	42.5	27.5	84	78	72	40.67	53	54
	Dissolved Oxygen (DO)	mg/L	10.1	10.4	11.3	10.8	9.8	8.2	6.7	7.7	6.6	7.4	8.8	9.1
	pH	units	7.6	7.5	7.8	8.1	8.3	8.3	8.7	8.5	8.2	7.6	7.5	7.5
	Temperature	°C	7.7	7.3	6.3	7.4	9.2	11.4	17.9	18.6	18.5	15.8	13.1	11.2
Parameter	Influent Flow	m^3/day	15614.69	11782.25	17063.52	15196.01	7515.29	7165.37	4872.86	4217.73	5136.81	6419.83	13525.68	13994.95

Notes:

Weather Conditions:

Sampler:

APPENDIX F: GSSC (Shediac) WWTP Initial Characterization Program Year 2011-2012

Effluent & Upstream Sampling Results - GSSC WWTP

Medium Facility - 2011-2012

EFFLUENT VALUES														
Test Group	**Substances**	**Units**	**2012**					**2011**						
			January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
General Chemistry / Nutrients	Fluoride	mg/L			0 22			0 35			0 5			0 35
	Nitrate	mg/L			0 54			0 375			0 09			0 53
	Nitrate + Nitrite	mg/L			0 54			0 49			0 16			0 535
	Total Suspended Solids (TSS)	mg/L	13 5	7	9 5	28	28	26 25	17	18	21	5	5	11
	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	12 5	9	6	15 5	11	7 25	8	7 67	<6 00	<6 00	<6 00	<6 00
	Biological Oxygen Demand (BOD_5)	mg/L	11 5	9 5	8 5	15	13	9 25	9	9	<6 00	<6 00	<6 00	8 5
	Total Ammonia Nitrogen	mg/L	11 15	12 35	8 3	4 35	5 25	7 3	15 55	16 27	20 67	17 15	10 35	8 6
	Total Kjeldahl (TKN)	mg/L	12 1	15	10 5	7 6	9 5	10 075	20 05	23 33	24	19 5	11 5	11
	Total Phosphorus (TP)	mg/L	1 64	1 85	1 25	0 94	1 95	1 8	2 99	3	2 83	1 3	0 8	1 6
	Chemical Oxygen Demand (COD)	mg/L			40			40			30			40
	Cyanide (total)	mg/L			0 003			0 003			0 003			0 003
	pH	units	7 8	7 3	7 35	8 55	5 25	8 05	7 3	7 4	7 5	7 7	7 5	7 555
	Temperature	°C	1 1	0 8	2 2	8 48	9 5	17 5	21 7	21 2	18 3	11	5 4	3 43
Metals	Aluminum	µg/L			119			18			25			20
	Barium	µg/L			135			154			202			157
	Beryllium	µg/L			<0 1			<0 1			<0 10			<0 1
	Boron	µg/L			103			121			178			139
	Cadmium	µg/L			0 02			<0 01			<0 01			<0 01
	Chromium	µg/L			<1			2			<1			<1
	Cobalt	µg/L			0 2			0 1			0 2			0 2
	Copper	µg/L			5			2			1			4
	Iron	µg/L			360			80			270			200
	Lead	µg/L			0 6			<0 1			0 3			0 2
	Manganese	µg/L			311			299			399			396
	Molybdenum	µg/L			0 4			0 3			0 3			0 5
	Nickel	µg/L			<1			<1 00			1			<1
	Silver	µg/L			<0 1			<0 1			<0 10			<0 1
	Strontium	µg/L			264			261			381			331
	Thallium	µg/L			<0 1			<0 1			<0 10			<0 1
	Tin	µg/L			0 2			<0 1			0 1			<0 1
	Titanium	µg/L			13			<1 00			1			<1
	Uranium	µg/L			0 2			0 1			0 2			0 2
	Vanadium	µg/L			1			<1 00			<1 00			<1
	Zinc	µg/L			14			3			3			9
	Arsenic	µg/L			<1			1			<1 00			<1
	Antimony	µg/L			0 2			0 1			<0 10			0 1
	Selenium	µg/L			1			1			<1 00			<1
	Mercury	µg/L			<0 025			<0 025			<0 025			<0 025
Pathogens	E *coli* (or other as directed by the jurisdiction)	MPN/100 mL	1985	600	5400	11400	2 7	47	14 5	8	6	340	112	1900
	Faecal coliforms	CFU/100 mL	4595	1900	9050	34000	5	96 5	82 5	26	12	406	390	4300
Organochlorine Pesticides	Alpha-BHC	ng/L			<0 01			<0 01			<0 01			<0 01
	Endosulfan (I)	ng/L			<0 01			<0 01			<0 01			<0 01
	Endosulfan (II)	ng/L			<0 01			<0 01			<0 01			<0 01
	Endrin	ng/L			<0 01			<0 01			<0 01			<0 01
	Heptachlor Epoxide	ng/L			<0 01			<0 01			<0 01			<0 01
	Lindane (gamma-BHC)	ng/L			<0 01			<0 01			<0 01			<0 01
	Mirex	ng/L			<0 01			<0 01			<0 01			<0 01
	DDT	ng/L			<0 01			<0 01			<0 01			<0 01
	Methoxychlor	ng/L			<0 01			<0 01			<0 01			<0 01
	Aldrin	ng/L			<0 01			<0 01			<0 01			<0 01
	Dieldrin	ng/L			<0 01			<0 01			<0 01			<0 01
	Heptachlor	ng/L			<0 01			<0 01			<0 01			<0 01
	a-chlordane	ng/L			<0 01			<0 01			<0 01			<0 01
	g-chlordane	ng/L			<0 01			<0 01			<0 01			<0 01
	toxaphene	ng/L			<0 2			<0 1			0 3			<0 1
PCBs	Total PCBs	µg/L			<0 1			<0 1			<0 1			<0 1

EFFLUENT VALUES															
Test Group	**Substances**	**Units**	**2012**					**2011**							
			January	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	µg/L			<0.01			<0.01			<0.01			<0.05
	Acenphthylene	µg/L			<0.01			<0.01			<0.01			<0.01
	Anthracene	µg/L			<0.01			<0.01			<0.01			<0.01
	Benzo(a)anthracene	µg/L			<0.01			<0.01			<0.01			<0.01
	Benzo(a)pyrene	µg/L			<0.01			<0.01			<0.01			<0.01
	Benzo(b)fluoranthene	µg/L			<0.01			<0.01			<0.01			<0.01
	benzo(g,h,i)perylene	µg/L			<0.01			<0.01			<0.01			<0.01
	benzo(k)fluoranthene	µg/L			<0.01			<0.01			<0.01			<0.01
	chrysene	µg/L			<0.01			<0.01			<0.01			<0.01
	dibenz(a,h)anthracene	µg/L			<0.01			<0.01			<0.01			<0.01
	fluoranthene	µg/L			<0.02			<0.01			<0.01			<0.01
	fluorene	µg/L			<0.01			<0.01			<0.01			<0.05
	indeno(1,2,3-cd)pyrene	µg/L			<0.01			<0.01			<0.01			<0.01
	methylnaphthalene	µg/L			<0.05			<0.05			<0.05			<0.05
	naphthalene	µg/L			<0.05			<0.05			<0.05			0.08
	phenanthrene	µg/L			0.17			<0.01			<0.01			0.28
	pyrene	µg/L			<0.01			<0.01			<0.01			<0.01
Vo atile Organic Compounds (VOCs)	Benzene	µg/L			<0.5			<0.5			<0.5			<0.5
	bromodichloromethane	µg/L			<0.5			<0.5			<0.5			<0.5
	bromoform (tribromomethane)	µg/L			<0.5			<0.5			<0.5			<0.5
	carbon tetrachloride (tetrachloromethane)	µg/L			<0.5			<0.5			<0.5			<0.5
	chlorobenzene	µg/L			<0.5			<0.5			<0.5			<0.5
	chlorodibromomethane	µg/L			<0.5			<0.5			<0.5			<0.5
	chloroform (trichloromethane)	µg/L			<0.5			<0.5			<0.5			<0.5
	1,2-dichlorobenzene	µg/L			<0.5			<0.5			<0.5			<0.5
	1,4-dichlorobenzene	µg/L			<0.5			<0.5			<0.5			<0.5
	1,2-dichloroethane	µg/L			<0.5			<0.5			<0.5			<0.5
	1,1-dichloroethene (dichloroethylene)	µg/L			<0.5			<0.5			<0.5			<0.5
	dichloromethane (methylene chloride)	µg/L			<5.0			<5.0			<5.0			<5.0
	ethylbenzene	µg/L			<0.5			<0.5			<0.5			<0.5
	1,1,1,2-tetrachloroethane	µg/L			<0.5			<0.5			<0.5			<0.5
	1,1,2,2-tetrachloroethane	µg/L			<0.5			<0.5			<0.5			<0.5
	tetrachloroethene	µg/L			<0.5			<0.5			<0.5			<0.5
	toluene	µg/L			0.75			<0.5			<0.5			<0.5
	trichloroethene	µg/L			<0.5			<0.5			<0.5			<0.5
	vinyl chloride (monochloroethene)	µg/L			<0.5			<0.5			<0.5			<0.5
	m/p-xylene	mg/L			<0.5			<0.5			<0.5			<0.5
	o-xylene	mg/L			<0.5			<0.5			<0.5			<0.5
Phenolic Compounds	2,3,4,6-tetrachlorophenol	µg/L			<0.1			<0.1			<0.1			<0.1
	2,4,6-trichlorophenol	µg/L			<0.1			<0.1			<0.1			<0.1
	2,4-dichlorophenol	µg/L			<0.1			<0.1			<0.1			<0.1
	pentachlorophenol	µg/L			<0.1			<0.1			<0.1			<0.1
Surfactants	Non-ionic	mg/L			<0.5			<0.5			<0.5			<0.5
	Anionic	mg/L			0.1			<0.1			<0.1			<0.1
Toxicity Tests	Acute: Rainbow Trout	TUa		<1			<1.00			70.71			<1.00	
	Daphnia magna	TUa		<1			<1.00			<1.00			<1.00	
	Chronic: *Ceriodaphnia dubia*	TU c		>100			>100			>100			>100	
Parameter	Effluent Flow	m^3/day	4501.61	5668.13	6480.15	4954.59	6165.71	6337.19	5948.76	7973.19	5001.09	6514.85	8938.91	7551.98

UPSTREAM VALUES						
Test Group	Substances	Units	2012		2011	
			January - March	April - June	July - September	October - December
General Chemistry / Nutrients	Fluoride	mg/L	0.84	1.67	1.65	N/A
	Nitrate	mg/L	<0.05	<0.05	<0.05	N/A
	Nitrate + Nitrite	mg/L	<0.05	<0.05	<0.05	**N/A**
	Total Suspended Solids (TSS)	mg/L	6	5	5	**N/A**
	Carbonaceous Biochemical Oxygen Demand ($CBOD_5$)	mg/L	<6.00	<6	<6.00	N/A
	Total Ammonia Nitrogen	mg/L	1.96	<0.05	0.17	N/A
	Total Kjeldahl (TKN)	mg/L	2	<0.25	<0.25	N/A
	Total Phosphorus (TP)	mg/L	0.347	0.026	0.068	N/A
	Chemical Oxygen Demand (COD)	mg/L	50	300	870	N/A
	Cyanide (total)	mg/L	0.004	<0.01	<0.002	N/A
	pH	units	7.5	7.8	7.9	N/A
	Temperature	°C	-1.5	15	12	**N/A**
Metals	Aluminum	µg/L	80	70	<50	N/A
	Barium	µg/L	50	<50	<50	N/A
	Beryllium	µg/L	<1	<50	<5	N/A
	Boron	µg/L	1180	3220	3830	N/A
	Cadmium	µg/L	<0.1	<50	<0.5	N/A
	Chromium	µg/L	<10	<50	<50	N/A
	Cobalt	µg/L	<1	<50	<5	N/A
	Copper	µg/L	<10	<50	<50	N/A
	Iron	µg/L	500	<50	<1000	N/A
	Lead	µg/L	<1	<50	<5	N/A
	Manganese	µg/L	230	<50	<50	N/A
	Molybdenum	µg/L	3	<50	12	N/A
	Nickel	µg/L	<10	<50	<50	N/A
	Silver	µg/L	<1	<50	<5	N/A
	Strontium	µg/L	2000	7040	6700	N/A
	Thallium	µg/L	<1	<50	<5	N/A
	Tin	µg/L	<1	<50	<5	N/A
	Titanium	µg/L	5	<50	<50	N/A
	Uranium	µg/L	<1	<50	<5	N/A
	Vanadium	µg/L	<10	<50	<50	N/A
	Zinc	µg/L	<10	<50	<50	N/A
	Arsenic	µg/L	10	<50	<50	N/A
	Antimony	µg/L	<1	<50	<5	N/A
	Selenium	µg/L	10	<50	<50	N/A
	Mercury	µg/L	<0.025	<0.025	<0.025	N/A
Pathogens	E. *coli* (or other as directed by the jurisdiction)	MPN/100 mL	160	2	10	22
	Faecal coliforms	CFU/100 mL	580	4	40	N/A
Organochlorine Pesticides	Alpha-BHC	ng/L	<0.01	<0.01	<0.01	N/A
	Endosulfan (I)	ng/L	<0.01	<0.01	<0.01	N/A
	Endosulfan (II)	ng/L	<0.01	<0.01	<0.01	N/A
	Endrin	ng/L	<0.01	<0.01	<0.01	N/A
	Heptachlor Epoxide	ng/L	<0.01	<0.01	<0.01	N/A
	Lindane (gamma-BHC)	ng/L	<0.01	<0.01	<0.01	N/A
	Mirex	ng/L	<0.01	<0.01	<0.01	N/A
	DDT	ng/L	<0.01	<0.01	<0.01	N/A
	Methoxychlor	ng/L	<0.01	<0.01	<0.01	N/A
	Aldrin	ng/L	<0.01	<0.01	<0.01	N/A
	Dieldrin	ng/L	<0.01	<0.01	<0.01	N/A
	Heptachlor	ng/L	<0.01	<0.01	<0.01	N/A
	a-chlordane	ng/L	<0.01	<0.01	<0.01	N/A
	g-chlordane	ng/L	<0.01	<0.01	<0.01	N/A
	toxaphene	ng/L	<0.1	<0.01	<0.1	N/A
PCBs	Total PCBs	µg/L	<0.1	<0.1	<0.1	N/A

UPSTREAM VALUES						
Test Group	Substances	Units	2012		2011	
			January - March	April - June	July - September	October - December
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	µg/L	<0.01	<0.01	<0.01	N/A
	Acenphthylene	µg/L	<0.01	<0.01	<0.01	N/A
	Anthracene	µg/L	<0.01	<0.01	<0.01	N/A
	Benzo(a)anthracene	µg/L	<0.01	<0.01	<0.01	N/A
	Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	N/A
	Benzo(b)fluoranthene	µg/L	<0.01	<0.01	<0.01	N/A
	benzo(g,h,i)perylene	µg/L	<0.01	<0.01	<0.01	N/A
	benzo(k)fluoranthene	µg/L	<0.01	<0.01	<0.01	N/A
	chrysene	µg/L	<0.01	<0.01	<0.01	N/A
	dibenz(a,h)anthracene	µg/L	<0.01	<0.01	<0.01	N/A
	fluoranthene	µg/L	<0.02	<0.01	<0.01	N/A
	fluorene	µg/L	<0.01	<0.01	<0.01	N/A
	indeno(1,2,3-cd)pyrene	µg/L	<0.01	<0.01	<0.01	N/A
	methylnaphthalene	µg/L	<0.05	<0.05	<0.05	N/A
	naphthalene	µg/L	<0.05	<0.05	<0.05	N/A
	phenanthrene	µg/L	<0.02	<0.01	<0.01	N/A
	pyrene	µg/L	<0.01	<0.01	<0.01	N/A
Volatile Organic Compounds (VOCs)	Benzene	µg/L	<0.5	<0.5	<0.5	N/A
	bromodichloromethane	µg/L	<0.5	<0.5	<0.5	N/A
	bromoform (tribromomethane)	µg/L	<0.5	<0.5	<0.5	N/A
	carbon tetrachloride (tetrachloromethane)	µg/L	<0.5	<0.5	<0.5	N/A
	chlorobenzene	µg/L	<0.5	<0.5	<0.5	N/A
	chlorodibromomethane	µg/L	<0.5	<0.5	<0.5	N/A
	chloroform (trichloromethane)	µg/L	<0.5	<0.5	<0.5	N/A
	1,2-dichlorobenzene	µg/L	<0.5	<0.5	<0.5	N/A
	1,4-dichlorobenzene	µg/L	<0.5	<0.5	<0.5	N/A
	1,2-dichloroethane	µg/L	<0.5	<0.5	<0.5	N/A
	1,1-dichloroethene (dichloroethylene)	µg/L	<0.5	<0.5	<0.5	N/A
	dichloromethane (methylene chloride)	µg/L	<5.0	<5.0	<5.0	N/A
	ethy benzene	µg/L	<0.5	<0.5	<0.5	N/A
	1,1,1,2-tetrachloroethane	µg/L	<0.5	<0.5	<0.5	N/A
	1,1,2,2-tetrachloroethane	µg/L	<0.5	<0.5	<0.5	N/A
	tetrachloroethene	µg/L	<0.5	<0.5	<0.5	N/A
	toluene	µg/L	<0.5	<0.5	<0.5	N/A
	trichloroethene	µg/L	<0.5	<0.5	<0.5	N/A
	vinyl chloride (monochloroethene)	µg/L	<0.5	<0.5	<0.5	N/A
	m/p-xylene	mg/L	<0.5	<0.5	<0.5	N/A
	o-xylene	mg/L	<0.5	<0.5	<0.5	N/A
Phenolic Compounds	2,3,4,6-tetrachlorophenol	µg/L	<0.1	<0.1	<0.1	N/A
	2,4,6-trichlorophenol	µg/L	<0.1	<0.1	<0.1	N/A
	2,4-dichlorophenol	µg/L	<0.1	<0.1	<0.1	N/A
	pentachlorophenol	µg/L	<0.1	<0.1	<0.1	N/A
Surfactants	Non-ionic	mg/L	<0.5	<0.5	N/A	N/A
	Anionic	mg/L	<0.1	<0.05	N/A	N/A
Parameter	Upstream Flow	m^3/day	N/A	16485	20067	N/A

APPENDIX G: Certificate of Approval to Operate – Dated April 30, 2013

APPROVAL TO OPERATE

S-2380

Pursuant to paragraph 8(1) of the *Water Quality Regulation - Clean Environment Act*, this Approval to Operate is hereby issued to:

The Greater Shediac Sewerage Commission
for the operation of the
Wastewater Works - Cap-Brulé

Description of Source:	**This Approval covers the discharge of effluent from the locations contained in the Federal Effluent Regulatory Reporting Information System for the following system.** **Two-Celled Lagoon with Submerged Aerators, a Polishing Pond and a UV Disinfection System** **WWC: Class II** **WWT: Class II**
Mailing Address:	**25 Cap-Brulé Road** **Boudreau-Ouest, NB** **E4P 6H8**
Conditions of Approval:	**See attached Schedules "A" and "B" of this Approval.**
Supersedes Approval:	**S-2321**
Valid From:	**May 01, 2013**
Valid To:	**November 30, 2014**

Recommended by: _____
Community Planning & Environmental Protection Division

Issued by: _____ April 30, 2013
Minister of Environment and Local Government — Date

SCHEDULE "A"

A. DEFINITIONS

1. **"Accredited"** means accreditation to ISO/IEC 17025 by the Standards Council of Canada (SCC), the Canadian Association for Laboratory Accreditation Inc. (CALA), or accreditation to ISO/IEC 17025:2005 from another body that is recognized to grant such accreditation per ISO/IEC 17011 criteria.

2. **"After-hours"** means the hours when the *Department*'s offices are closed. These include statutory holidays, weekends, and the hours before 8:15 a.m. and after 4:30 p.m. from Monday to Friday, or any other time in which direct contact cannot be made with the *Department*.

3. **"Approval Holder"** means the name listed on the Certificate page of this Approval.

4. **"Average Daily Volume"** means a calculation of the sum of the daily volumes of influent or effluent and dividing that sum by the number of days in that calendar year.

5. **"CBOD"** or **"Carbonaceous Biochemical Oxygen Demanding Matter"** means the carbonaceous matter that consumes, by biochemical oxidation, oxygen dissolved in water.

6. **"Certified"** means a valid certificate of qualification that states the class of the *Operator* issued by the Atlantic Canada Water and Wastewater Voluntary Certification Program.

7. **"Department"** means the New Brunswick Department of Environment and Local Government.

8. **"Director"** means the Director of the Impact Management Branch of the *Department*, and includes any person designated to act on the Director's behalf.

9. **"Environmental Emergency"** means a situation where there has been or will be a release, discharge, or deposit of a contaminant or contaminants to the atmosphere, soil, surface water, and/or groundwater environments of such a magnitude or duration that it could cause significant harm to the environment or put the health of the public at risk. This does not include wastewater overflows that are the result of excessive rainfall or snowmelt.

10. **"Final Discharge Point"** means the point, other than an *Overflow Point*, of a wastewater works beyond which its owner or operator no longer exercises control over the quality of the wastewater before it is deposited as effluent to the environment.

11. **"Lagoon"** means a wastewater treatment system where the average period during which wastewater is retained for treatment within the wastewater system is five days or more.

12. **"Normal Business Hours"** means the hours when the *Department*'s offices are open. These include the period between 8:15 a.m. and 4:30 p.m. from Monday to Friday excluding statutory holidays.

13. **"Operator"** means a person who directs, adjusts, inspects, tests or evaluates an operation or process that controls the effectiveness or efficiency of the wastewater works.

14. **"Overflow Point"** means a point of a wastewater work via which excess wastewater may be deposited in water or a place and beyond which its owner or operator no longer exercises control over the quality of wastewater before it is deposited as effluent.

15. **"Point of Entry"** means any point where effluent is deposited in water frequented by fish via the *Final Discharge Point* or an *Overflow Point*.

16. **"Quarter"** in respect of a year, means any of the four periods of three months that begin on the first day of January, April, July and October.

17. **"Suspended Solids"** means any solid matter contained in effluent that is retained on a filter of 2.0 micrometre (μm) or smaller pore size.

18. **"Total Residual Chlorine"** means the sum of free chlorine and combined chlorine, including inorganic chloramines.

B. TERMS AND CONDITIONS - EMERGENCY REPORTING

Pursuant to Sections 8(2) of the *Water Quality Regulation*, this Approval is subject to the following conditions:

19. Immediately following the discovery of an *Environmental Emergency*, a designate representing the *Approval Holder* shall notify the *Department* in the following manner:

    During *Normal Business Hours*, telephone the *Department*'s Central Office **until personal contact is made** (i.e. no voice mail messages will be accepted) and provide all information known about the *Environmental Emergency*.

    The telephone number for the **Central Office is (506) 453-7945.**

After-hours, telephone the Canadian Coast Guard **until personal contact is made** and provide all information known about the *Environmental Emergency*.

The telephone number for the **Canadian Coast Guard** is **1-800-565-1633.**

20. Within 24-hours of the time of initial notification, a copy of a Preliminary Emergency Report shall be e-mailed or faxed to the Wastewater Approvals Coordinator or Engineer responsible for the regulation of the A*pproval Holder*'s wastewater works. The Preliminary Emergency Report shall clearly communicate all information available at the time about the *Environmental Emergency*.

    Within five (5) days of the time of initial notification, a copy of a **Detailed Emergency Report** shall be e-mailed or faxed to the Wastewater Approvals Coordinator or Engineer responsible for the regulation of the *Approval Holder*'s wastewater works. The Detailed Emergency Report shall include, as a minimum, the following: i) a description of the problem that occurred; ii) a description of the impact that occurred; iii) a description of what was done to minimize the impact; and iv) a description of what was done to prevent recurrence of the problem.

C. TERMS AND CONDITIONS - EFFLUENT PERFORMANCE STANDARDS

21. The *Approval Holder* shall ensure that the average concentration of contaminants in the effluent deposited via the *Final Discharge Point* of the wastewater works does not exceed the following limiting criteria. The average must be calculated by using the applicable calculating period listed in Condition 28:

    i. *$CBOD_5$*: 25 mg of $CBOD_5$/L (average); and
    ii. *Suspended Solids*: 25 mg/L (average).

22. For a *Lagoon*, the *Approval Holder*, in the determination of the average referred to in Condition 21 is not to take into account the result of any determination of the concentration of *Suspended Solids* in a sample of effluent referred to in Condition 28 that was taken during the month of July, August, September or October, if that result is greater than 25 mg/L.

23. From **January 1, 2013 to June 30, 2014**, the *Approval Holder* shall ensure that the maximum concentration of contaminants in the effluent deposited via the F*inal Discharge Point* of the wastewater works does not exceed a maximum of 1.25 mg/L of un-ionized ammonia, expressed as nitrogen (N) at 15°C ± 1°C.

24. The *Approval Holder*, on or before **June 30, 2014**, shall apply to the *Director*, in the form and format specified by the *Department*, if the effluent deposited via the F*inal Discharge Point* of the wastewater works contains a concentration of *Suspended Solids* and/or *CBOD* that exceeds 25 mg/L, for the applicable calculating period listed in Condition 28.

25. The *Approval Holder* shall **immediately** apply to the *Director*, in the form and format specified by the *Department***,** if any samples of the effluent deposited via the F*inal Discharge Point* contain a calculated concentration of un-ionized ammonia that is greater than or equal to 1.25 mg/L, expressed as nitrogen (N) at 15°C ± 1°C.

D. TERMS AND CONDITIONS - MONITORING AND SAMPLING

Pursuant to Section 17 of the *Water Quality Regulation*, this Approval is subject to the following conditions:

26. The *Approval Holder* shall, for each calendar year, calculate and record the *Average Daily Volume* of effluent deposited via the system's *Final Discharge Point*. The volume of effluent during each day must be determined by using monitoring equipment that provides:
    i. A continuous measure of the volume of influent or effluent or a measure of the rate of flow of the influent or effluent upon which that daily volume of effluent may be estimated; or
    ii. A continuous measure of the volume of influent or effluent if the *Average Daily Volume* measured during the previous calendar year is greater than 2,500 m^3.

27. The *Approval Holder* shall collect monitoring samples for the following parameters in accordance with the requirements of Condition 28.
    i. The concentration of *CBOD*;
    ii. The concentration of *Suspended Solids*; and
    iii. Until **June 30, 2014**, the concentration of un-ionized ammonia.

28. The *Approval Holder* shall collect monitoring samples at the *Final Discharge Point* of the type and at the frequency indicated below based on the *Average Daily Volume* of effluent calculated in Condition 26:

Average Daily Volume **(m^3)**	**Treatment Type**	**Type of Sample to be Taken**	**Monitoring Frequency**	**Calculating Period[1]**	**Reporting Frequency**
less than 2,500	*Lagoon*	Grab or composite	Quarterly, but at least 60 days after any other sample	Annual	Annual
	Mechanical	Grab or composite	Monthly, but at least 10 days after any other sample	Quarterly	Quarterly
greater than 2,500 but less than or equal to 17,500	*Lagoon*	Grab or Composite	Every two weeks, but at least seven days after any other sample	Quarterly	Quarterly
	Mechanical	Composite			
greater than 17,500 but less than or equal to 50,000	*Lagoon*	Grab or Composite	Weekly, but at least five days after any other sample	Monthly	Quarterly
	Mechanical	Composite			
Greater than 50,000	*Lagoon*	Grab or Composite	Three days per week, but at least one day after any other sample	Monthly	Quarterly
	Mechanical	Composite			

1.The average must be determined for *CBOD* and *Suspended Solids*. The maximum must be determined for Un-ionized Ammonia

29. The *Approval Holder* must calibrate the flow monitoring equipment at least once in every calendar year and at least five months after a previous calibration.

30. The *Approval Holder* shall ensure that the monitoring equipment is capable to determine the volume or rate of flow with a margin of error of ±15%.

31. The *Approval Holder* shall ensure that all samples are collected using the methods described in the latest edition of the ISO 5667-10, Water quality - Sampling - Part 10: Guidance on sampling of waste waters.

32. The *Approval Holder* shall ensure that all parameters that are required to be analysed by this Approval, are analysed by *Accredited* laboratories whose accreditation includes the analytical method used to make the determination.

33. The *Approval Holder* shall ensure that all equipment used for monitoring parameters required by this Approval is calibrated in accordance with manufacturer's recommendations.

34. **Within six months** of completing the Environmental Risk Assessment, the *Approval Holder* shall submit to the *Director* for approval, an Effluent Monitoring Plan based on the wastewater works' Environmental Risk Assessment. This Plan must include the parameters that are Effluent Discharge Objectives and a monitoring frequency for each.

35. The *Approval Holder* shall follow the monitoring requirements outlined in the approved Effluent Monitoring Plan.

E. TERMS AND CONDITIONS – OVERFLOW MANAGEMENT

36. **By January 1, 2016,** the *Approval Holder* shall submit to the *Director* for Approval a long term plan to reduce combined sewer overflows and reduce overflows from infiltration. The plan must follow, as a minimum, the *Department's* CSO/SSO Long-Term Control Plan Guidelines.

37. **By January 1, 2016,** the *Approval Holder* shall ensure that all new lift stations are designed to prevent the release of floatable materials and that existing lift stations are retrofitted for the removal of floatable materials.

F. TERMS AND CONDITIONS - OPERATOR CERTIFICATION

38. Pursuant to Section 19 of the *Water Quality Regulation*, the Minister gives notice that the *Approval Holder* shall employ and have available the following *Certified Operators* based on the Class of the wastewater works listed on the Certificate page of this Approval:

Treatment Class	**Wastewater Treatment (WWT) *Certified Operator***	**Collection Class**	**Wastewater Collection (WWC) *Certified Operator***
I	Minimum one Class I	I	None
II	Minimum one Class II and one Class I	II	One Class I by December 31, 2016
III	Minimum one Class III and one Class II	III	One Class I by December 31, 2016
IV	Minimum one Class IV and one Class III	IV	One Class I by December 31, 2016

G. TERMS AND CONDITIONS – RECORD KEEPING

Pursuant to Section 17 of the *Water Quality Regulation*, this Approval is subject to the following conditions:

39. The *Approval Holder* shall record and retain for a period of five years the following information and make it available to the *Department* upon request:
    a. The date of each day when wastewater effluent was not discharged via the *Final Discharge Point* (if applicable);
    b. For those days when effluent was deposited via the *Final Discharge Point:*
        i. the daily volume deposited, in m^3, if that volume is yielded by a continuous measure, or
        ii. the estimated daily volume deposited, in m^3, in any other case, and the results of the calculation and measurement used in the estimation, as outlined in Condition 26(i);
    c. For all discharges from each *Overflow Point,* including those that were directly caused by excessive rain or snow melt:
        i. the date of each day on which effluent was deposited via the *Overflow Point*,
        ii. for each of those days, the duration or estimated duration, expressed in hours, of the deposit, along with an indication of whether it is the duration or an estimated duration,
        iii. the daily volume deposited in m^3 if that volume is yielded by a continuous measure, or an estimate of the daily volume, in m^3 in any other case;
    d. For all monitoring equipment used to determine the volume or rate of flow:
        i. A description, including the type,
        ii. The manufacturer's specifications, the year of manufacture and the model number,
        iii. the date on which the equipment was calibrated and its degree of accuracy after each calibration,
        iv. The date the equipment was installed and if applicable, the date on which it ceased to be used for monitoring and on which it was replaced;
    e. For each monitoring sample determination required by Condition 28, as well as any additional sample determinations made by an *Accredited* laboratory:
        i. the results of such determinations for each of the parameters listed in Condition 27,
        ii. a statement as to whether the sample is a grab sample or a composite sample and the date on which the sample was taken;
    f. All monitoring sample results for each parameter taken as part of the Effluent Monitoring Plan;
    g. All monitoring sample results required by Schedule B, if applicable;
    h. A list identifying the *Operator(s)* and indicating the training and certification level of each *Operator(s).*

H. TERMS AND CONDITIONS – REPORTING

Pursuant to Section 17 of the *Water Quality Regulation*, this Approval is subject to the following conditions:

40. **Before May 15th, 2013**, the *Approval Holder* shall submit electronically to the *Director*, in the form and format specified by the *Department*, the following information:
    a. The owner's and the operator's name, civic and postal addresses, telephone number and, if any, email address and fax number;
    b. The name, title, civic and postal addresses, telephone number and, if any, email address and fax number, of a contact person;
    c. If any, the wastewater works' name and civic address;
    d. A statement indicating whether it is an intermittent or continuous wastewater works;
    e. For a continuous wastewater works, a statement indicating whether the average period during which wastewater is retained for treatment within the wastewater works (hydraulic retention time) is five days or more;
    f. A statement indicating whether the system is owned or operated, or both, by one or several of the following:
        i. Her Majesty in right of Canada or another federal body,
        ii. Her Majesty in right of a province or another provincial body,
        iii. a municipality or another local authority,
        iv. an entity other than one referred to in clauses (i) to (iii); and
    g. The type of wastewater treatment, if any, including whether chlorine, or one of its compounds, is used, and a description of the type;
    h. The latitude and longitude of the *Final Discharge Point* and the *Point of Entry*, if different;
    i. A description of the water frequented by fish into which effluent is deposited, including:
        i. a description of its use, if any, and
        ii. its name, if any, and the name, if any, of the body of water that includes that water, and
        iii. a statement as to whether the effluent is deposited in water frequented by fish via the *Final Discharge Point* or from a place where it was deposited via the *Final Discharge Point*;
    j. The latitude and longitude for each *Overflow Point* for each of the combined sewers and sanitary sewers of the wastewater works;
    k. For each *Point of Entry* in relation to an *Overflow Point*, a description of the water frequented by fish into which effluent is deposited, including:
        i. a description of its use, if any, and
        ii. its name, if any, and the name, if any, of the body of water that includes that water;
    l. The *Average Daily Volume*, expressed in m^3, of effluent deposited via the wastewater works' *Final Discharge Point* for the previous calendar year;

m. If the information provided in accordance with this Condition changes, the owner or operator must send a notice to the *Director* providing the updated information within 45 days following the change.

41. The *Approval Holder* shall submit electronically to the *Director,* in the form and format specified by the *Department,* a report for the previous reporting period:
    i. **within 45 days of the end of each year**, with the period starting on the first day of January each year, for a *Lagoon* with an *Average Daily Volume* of effluent less than 2,500 m^3/d;
    ii. **within 45 days of the end of each *quarter***, with the first *quarter* starting on the first day of January each year, for all other wastewater works.

    The report must summarize the following:
    a. The number of days during which effluent was deposited;
    b. The volume of effluent that was deposited, expressed in m^3;
    c. The average *CBOD* due to the quantity of *CBOD* matter in the effluent;
    d. The average concentration of *Suspended Solids* in the effluent;
    e. The maximum concentration of un-ionized ammonia in the effluent, if the period ends **on or before June 30, 2014**; and
    f. All test results completed as part of the approved Effluent Monitoring Plan required in Condition 35.

42. The *Approval Holder* shall submit to the *Director* **within 45 days of the end of each year**:
    a. A summary of the date, location, duration including whether it is an estimated or measured duration, and estimated or calculated volume of all discharges from *Overflow Points*, including those that were directly caused by excessive rain or snow melt;
    b. A summary report of any other environmental emergencies that were reported through the Emergency Reporting procedure described in this Approval; and
    c. All monitoring sample results required by Schedule B, if applicable.

SCHEDULE "B"

A. TERMS AND CONDITIONS - DISINFECTION REQUIREMENTS

Pursuant to Sections 8(2) of the *Water Quality Regulation*, this Approval is subject to the following conditions:

1. The *Approval Holder* shall collect monitoring samples from the *Final Discharge Point* and have them analysed for *E. Coli* bacteria monthly for every month that the disinfection system is in operation.

2. The *Approval Holder* shall ensure that the disinfection system is operational from **May 1st to October 31st of each year**.

3. The *Approval Holder* shall ensure that the concentration of contaminants in the effluent deposited via the *Final Discharge Point* of the wastewater works do not exceed 200 MPN/100ml of *E. Coli*.

B. TERMS AND CONDITIONS - ENVIRONMENTAL DISCHARGE OBJECTIVES

Pursuant to Sections 6 of the *Water Quality Regulation*, this Approval is subject to the following conditions:

4. The *Approval Holder* shall complete the Environmental Risk Assessment as outlined in the *Canada-wide Strategy for the Management of Municipal Wastewater Effluent, February 2009* and submit it to the *Department* by **December 31, 2013**.

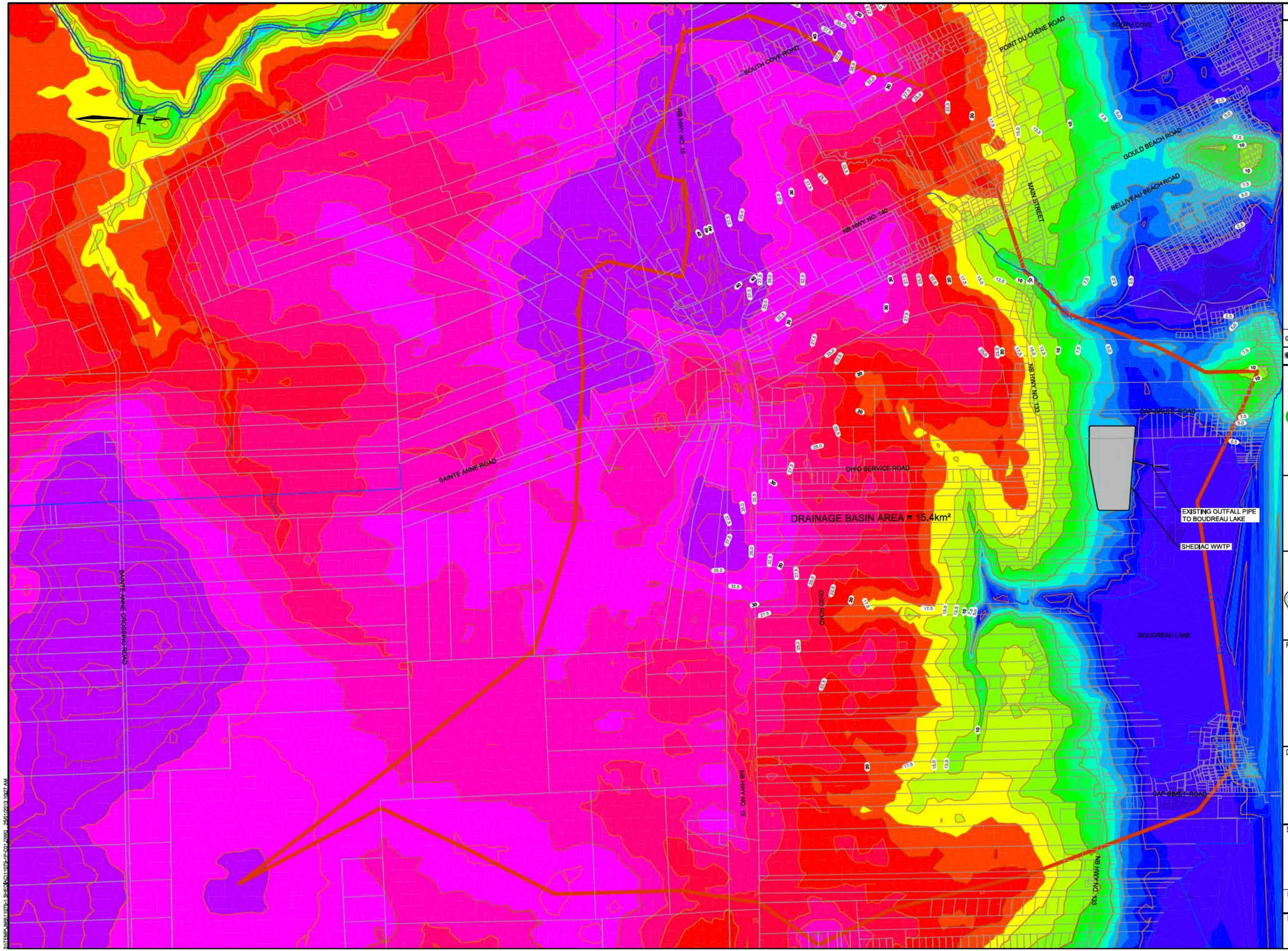
Prepared by:

Denis Chenard, EIT
Water & Wastewater Approvals Coordinator
Impact Management Branch

Reviewed by:

Scott Lloy, M. Eng., P. Eng.
Senior Water and Wastewater Engineer
Impact Management Branch

APPENDIX H: Lagoon Discharge Drainage Basin



NOTES

NO.	DATE	REVISIONS	BY
01	FEB 08/13	ISSUED FOR REPORT	JMB

GREATER SHEDIAC SEWERAGE COMMISSION
DES ÉGOUTS SHEDIAC ET BANLIEUES

crandall

PRELIMINARY ONLY
NOT TO BE USED FOR CONSTRUCTION

PROJECT TITLE

SHEDIAC WWTP
ENVIRONMENTAL RISK ASSESSMENT

SHEDIAC N.B.

DRAWING TITLE

LAGOON OUTFALL DRAINAGE BASIN

Scale	Drawn By	
1:10000	JMB	
	Checked By: JED	Cadd Check: GMG
	Sheet 1 of 1	

File Name: 11079-1P-C01.DWG

Drawing No.: 11079-1P-C01