Sewage Disposal Facility Report
Hamlet of Arviat

Prepared By:

Nuna Burnside Engineering and Environmental Ltd.
PO Box 879 Building 764, Fred Coman Way Iqaluit NU X0A 0H0
and
15 Townline Orangeville ON L9W 3R4

Prepared for:

Hamlet of Arviat

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1.0 Introduction

The Hamlet of Arviat provides sewage treatment and disposal services for the community. The Hamlet of Arviat operates their municipal water, sewage, and solid waste facilities under the Nunavut Water Board (NWB) License 3AM-ARV1015 (Appendix A). The licence was issued on August 23, 2010 and expires on August 31, 2015. This report is a condition of the licence in Part D, Item 5.

The report will provide the following:

- A detailed description of the construction and current conditions of the facility
- An assessment of environmental impacts
- A management plan for the assessment and disposal of sewage sludge
- Recommendations for optimizing the life of the facility.

1.1 Hamlet Description

The Hamlet of Arviat is located within the Kivalliq Region, Nunavut, at general latitude 61°6'N and general longitude 94°3'W. The Hamlet is located approximately 225 km south of Rankin Inlet and 265 km north of Churchill, Manitoba (Figure 1). A layout of the entire community and infrastructure is displayed on Figure 2.

2.0 Physical Setting

2.1 Topography

Arviat is located on the northern shore of a peninsula on the west coast of Hudson Bay. The topography surrounding the Hamlet of Arviat is relatively flat with a sight rise when moving inland away from Hudson Bay. Approximately 20 to 30 percent of the land is shallow ponds with depths of 1 m or less. Topographic highs are found along eskers.

2.2 Geology and Morphology

Local bedrock is Archean in age and generally overlain by glacial fluvial sediments. Bedrock on the peninsula where the Hamlet is located consists of tonalities, diorites and gabbros. Local bedrock is generally overlain by glacial fluvial sediments. Arviat is located in the physiographic region of the Hudson Bay lowlands, characterized by low topographic relief, occasional bedrock outcrops and glacial and glacio-fluvial overburden sediments. Boulder fields and eskers are common.

The Hamlet is located in a zone of continuous permafrost, extending from 30 m to over 100 m. The predominant local vegetation consists of mosses and lichens on rocky outcrops, with hardy grasses and sages in swampy and/or more sheltered areas.

2.3 Climate

The closest climate station to Arviat is the Rankin Inlet Airport Weather Station. The Rankin Inlet area receives an average of 18.1 cm of rainfall and 119.7 cm of snowfall per annum. Mean annual precipitation totals 29.7 cm per annum. July mean high and low temperatures are 14.9^{o}C and 5.9^{o}C, respectively. January mean high and low temperatures are -28.3^{o}C and -35.5^{o}C, respectively. Winds are generally north-west, and average 23 km/h (Rankin Inlet Weather Station, Climate Normals 1991-2000, Environment Canada, 2010). Climate data is included in Appendix B.

3.0 Sewage Disposal Facility

The Sewage Disposal Facility operated by the Hamlet of Arviat is located approximately 2.8 km south-west from the Hamlet (Figure 2).

The Sewage Disposal Facility consists of two components:

- Sewage Lagoon – a facultative lagoon, which provides retention time for the settlement of solids aerobic and anaerobic processes, which decomposes the sewage through microbial activity

- Wetland Treatment Area – receives the discharge of the treated effluent from the lagoon for final treatment via filtering and biological digestion by plants and micro-organisms in a designated wetland.

Sewage is collected daily by truck from all the houses and occupied buildings with holding tanks. The sewage is collected from the holding tanks via external discharge ports on the exterior wall of these buildings. The trucks discharge the sewage into the lagoon located approximately 2.8 km south-west from the Hamlet (Figure 3). The lagoon has a storage capacity of approximately 43,000 m^3. This capacity is estimated from the original design drawings, 2010 site condition observations, and a minimum of 1.0 m of free board below the top of the lagoon berms. Actual “working” capacity may be significantly less, as the exfiltration area of the south berm appears to allow discharge from the lagoon at the same rate as the discharge into the lagoon. Hamlet staff information and field observations indicate that (with the exception of a brief few weeks during spring run-off) the lagoon does not fill up much more than the level observed. Sewage stored in the lagoon eventually discharges through the lagoon’s south berm into the wetland treatment area.

3.1 Sewage Volumes

There are no records for the volume of sewage discharged into the Hamlet of Arviat sewage lagoon. To estimate the volume of sewage in trucked service communities, it is normally assumed that the sewage generated is equivalent to water consumption. Accordingly, the daily and annual sewage generation rates for the Hamlet of Arviat are conservatively assumed to be equal to the water consumption rates.

Sewage volumes were determined using the projected population, associated water requirements and sewage generation rates using information from the Nunavut Bureau of Statistics. The Government of Nunavut has adopted the standards of the

Government of the North West Territories (NWT) Department of Municipal and Community Affairs. The Municipal and Community Affairs (MACA) planning guidelines suggest that the increase in the projected per capita water use in a community of less than 2000 people can be calculated using the following formulae. Although Arviat has a population greater than 2000, they are still on a truck distribution system and therefore this formula has been used.

RWU x (1.0 + (0.00023 x Population)

The RWU is the residential water use rate per capita. In the MACA guidelines it is assumed to be 90 L per capita. To fit the recorded water usage rates for the Hamlet, the RWU residential water use was modified to be 65 L per capita (Lpcd). This is a lower RWU than most communities however it has been confirmed that Arviat has a lower water use rate per capita than other communities. The same RWU was used in the Potable Water Supply Study completed by IEG in 2005. The factor 0.00023 x population represents the commercial and industrial water use.

The community has a population of approximately 2060 (2006 Census), with an approximate 3.2 percent projected growth rate over the 20-year design period. Based on the above criteria, the projected annual volume of sewage generated at the end of 10 years (2019) is 105,331 m^3, while the 20-year (2029) annual volume will be 142,470 m^3. Table C-1, Appendix C provides a summary of the sewage generation rate for the Hamlet of Arviat over the 20-year design period.

3.2 Field Work

Nuna Burnside conducted field visits to the Hamlet of Arviat in September and November 2010. Work completed by Nuna Burnside in September 2010 included sludge sampling from the lagoon and surface water sampling at the lagoon and within the wetland treatment area. A topographic survey was completed around the lagoons and the surrounding wetlands. In November 2010, measurements of the lagoon depth and sludge thickness were collected from the ice surface of the lagoon. A test pit (ARV-4-1) was excavated in the wetland area just south of the lagoon and a water sample (ARV-4) was collected from the pond at the discharge point of the lagoon (Figure 4).

4.0 Sewage Lagoons

There are three sewage lagoons in the Hamlet of Arviat. The newest lagoon located closest to the ocean was commissioned in 2005. The two older lagoons are no longer in use. An Abandonment and Restoration Plan, dated December 2010, for the old lagoons was prepared by Nuna Burnside, and submitted to the NWB and in compliance with the water license.

4.1 Sewage Lagoon Design

The active sewage lagoon was constructed starting in 2003 and commissioned in 2005. The lagoon consists of a man-made pond surrounded by berms with a footprint of approximately 2.9 ha. Sewage is discharged by municipal trucks at a tipping point made of metal, wood and large rocks to prevent erosion (see photo's in Appendix E). The sewage is held in by gravel and sand berms. According to design drawings, an area of higher permeability gravel was used along the southwest berm to allow water to seep through into the adjacent wetland area (FSC, 2003). The lagoon discharges through the exfiltration area in the south berm at a slow continuous rate maintaining a consistent water level in the lagoon.

No original as-built drawings of the lagoon are known to exist. Design concept drawings from FSC Architects and Engineers are included in Appendix D. Based on the design concept drawings and a field survey completed in Sept 2010, as-built drawings have been created by Nuna Burnside and are included in Appendix D. This drawing displays current conditions, as determined from visual inspections and a topographic survey. No intrusive investigations were conducted to determine the sub-surface construction or composition of the berms or the base of the lagoon.

No geotechnical drilling or geophysical methods were used to examine the subsurface structure or conditions. Nuna Burnside cannot comment on the composition or integrity of the subsurface, only report the conditions found during the inspection and information provided. Photographs of the facility are included in Appendix E.

Measurements of the actual depth of the lagoon were collected in November 2010. The measurements are shown on Figure 4. The thickness of sludge was also recorded. The sludge thicknesses ranged from 6 to 8 cm. There were two layers of sludge observed. The top layer was soft, and consisted primarily of organic material. The top layer ranged in depths from 1.2 to 5 cm. The second layer was hard and

gritty likely made up of fine grained sediments that settled to the bottom of the lagoon. The hard layer ranged from 1.2 to 3.8 cm.

4.1.1 Inspection of Lagoon Berms

Part D, Item 5-C and Item 16 of the licence requires that a geotechnical inspection of the sewage lagoon's berms be completed by a geotechnical engineer. This condition of the licence was not in our scope of work and could not be done by a geotechnical engineer however; an inspection of the sewage lagoon's berms was completed in September 2010 by a construction inspector and professional geoscientist. Pictures of the lagoon berm are provided in Appendix E. The berms are intact with no signs of failure or erosion. There were no signs of seepage through the lagoon berms except for the south side of the lagoon where the designed exfiltration discharge area is located.

Figure D-1 in Appendix D illustrates the conditions of the lagoon observed and surveyed in September 2010. Nuna Burnside included information provided by others, but cannot comment on its accuracy. No subsurface intrusive (drilling) or geophysical (ground penetrating radar or seismic) studies were conducted.

4.2 Lagoon Storage Capacity

The lagoon (including berms) has a foot print of approximately 19,000 m^2. Since the lagoon used to be a natural pond the bottom topography of the lagoon varies. The deepest spots were measured at depths up to 5 meters below the top of berm. Based on photographs during construction of the lagoon in 2004, most of the lagoon bottom is fairly shallow, 2 to 3 meters below top of berm (Appendix D). To calculate the volume, an average useable depth of 3 meters was used and the capacity of the lagoon was estimated to be approximately 43,000 m^3. The capacity is based upon maintaining a minimum of 1 m of freeboard below the top of the berm.

The volume of accumulated sludge must also be considered in determining the total storage volume of the lagoon. Sludge has not been removed from the lagoon since it was commissioned in 2005. The average sludge thickness measured in 2010 was 7.5 cm.

To predict how sludge will accumulate in the lagoon over time, the volume of dry solids based on wastewater volumes has been calculated. Typically, the value of dry solids within sewage can range from 3 to 5 percent. A 5 percent dry solids accumulation has been used in calculations provided in Table C-1, Appendix C. The

height of the sludge accumulation in the lagoon should be monitored at intervals to ensure accumulation does not exceed a certain percent volume of the lagoon as this will reduce retention time.

This height is presently set at 0.6 m from the bottom of the lagoon floor, which is 20 percent volume of the lagoon. As shown on the table in Appendix C, the volume of sludge will reach 20 percent of the volume of the lagoon by Planning Year 5 (2014). It is noted, that in September 2010 average sludge thickness was noted to be 7.5 cm. Based on this information, the sludge accumulation rate for the first five years of lagoon's life would be in the order of less than 0.1 m. The calculations in Appendix C appear to be quite conservative. Continuous monitoring of the sludge thickness is the most effective way to track accumulations. Removal of the sludge would be planned when accumulations approach 0.6 m. Water quality results taken at the lagoon discharge may also be used to identify when desludging is necessary.

The level of the lagoon remains fairly consistent throughout the year. High water marks on the lagoon berm indicate a fluctuation of approximately 0.8 m, with water the highest in the spring and lowest in the winter. Projected sewage volumes for the Hamlet of Arviat are included in Appendix C. For calculation purposes we have assumed that the annual discharge from the lagoon is equal to the annual input into the lagoon.

4.2.1 Influx into Lagoon

To establish the influx of water into the lagoon the volume of precipitation and the rate of evaporation must also be considered. It is assumed that water evaporates from a sewage lagoon at the same rate as from a lake. It is also assumed that a sublimation rate, which is the evaporation from a frozen surface, is not a significant factor. The annual evaporation rate for the Hamlet of Arviat is estimated to be approximately 200 mm/year. Climate normal data from the Environment Canada website indicates that the average annual precipitation for the closest weather station to Arviat, Rankin Inlet is 297 mm/year (climate data is included in Appendix B). Therefore the net addition of precipitation to the lagoon is 97 mm/year. The lagoon has raised berms therefore there should be no runoff draining into the lagoon. Therefore the total influx into the lagoon is equal to the annual discharge of sewage from the Hamlet and net addition of precipitation.

4.2.2 Sewage Lagoon Retention Time

In Appendix C, the retention time for the sewage has been calculated for a planning period of 20 years using the volume of the lagoon divided by total flow rate into the lagoon. The calculations take into account the input of sewage, the annual input from precipitation and the volume of cumulative sludge in the lagoon. It should be noted that during the winter, the lagoon and surrounding ground is predominately frozen and therefore, the flow out of the lagoon is severely restricted. At the same time dilution due to the input of precipitation is also greatly decreased.

The calculations illustrate that the lagoon currently holds the raw sewage for approximately 164 days, and that in 20 years the retention time of the lagoon will decrease to 40 days. Sludge removal will increase the capacity of the lagoon and increase the retention time.

There are no engineering reports available to indicate why the lagoon was designed in the way it was or what the predicted retention times were. Nuna Burnside can only comment on observed conditions. The water level in the lagoon never appears to fluctuate much above the observed level in September 2010. Hamlet staff and observations of “water level lines” within the berms suggest that, with the exception for a few weeks during spring run-off, the water level in the berm does not fluctuate very much. Hamlet staff and field observations indicate that with the exception of a few week period during spring run-off, the level in the lagoon is relatively constant, indicating flow out of the lagoon into the wetland is equivalent to the discharge of sewage into the lagoon.

Based on the information provided by Hamlet staff and field observations, the retention time for sewage is directly linked to the fixed volume of the lagoon at its current water level, and the rate of discharge and outflow through the permeable section of the southern berm. The calculations in Appendix C reflect the declining retention times as the rate of inflow increases with population.

There were no engineering or design data regarding the fate of the effluent after it exfiltrated through the south berm.

Continuous monitoring is the most effective method to determine the effectiveness of the lagoon and wetland treatment area to attenuate the discharge.

4.3 Sludge Management Plan

Sludge management involves the handling and disposal of wastewater sludge in an environmentally acceptable manner. A Sludge Management Plan is required by the Hamlet of Arviat's water board water licence.

An estimation of the volume of sludge accumulated in the lagoon over the 20 year design period has been calculated in Table C-1, Appendix C. To determine if the lagoon needs to have sludge removed from the lagoon, annual inspections should be completed to determine the thickness of sludge. This may be conducted using a small boat in the summer or through a hole in the ice in the winter. Sludge thickness measured in November 2010 ranged from 0.06 to 0.09 metres (Figure 4).

Desludging of the lagoon should be conducted, based on the sludge thickness in the lagoon. A trigger sludge depth of 0.6 m (average) will be used to determine the need for desludging.

Before sludge disposal, the sludge will be tested to ensure that the location of disposal is appropriate for the contamination levels in the sludge. The sludge will be tested for metals and inorganics and compared to the Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (CCME, 2007b) standards for industrial land uses.

According to the guidelines in the Nunavut Water Board publication "Discharge of Domestic Wastewater in Nunavut" sewage sludge may be disposed of on the land by incorporating it into the soil. In order to be disposed of to land it must meet specific criteria. If the sludge is unsuitable or undesirable it may disposed of in special cells at a solid waste site or incinerated (NWB, 2000).

The Hamlet of Arviat does not have any suitable locations to dispose of sewage sludge to land therefore the sludge should be disposed of in the landfill. It can be used as cover material once dried sufficiently to place. The sludge should be covered with a thin layer of granular material to limit dust after drying.

The Sludge Management Plan includes:

- Monitoring sludge accumulations using a probe and tying in the elevations to the elevation datum (ARV-8) set at the discharge point
- Prepare for de-sludging when accumulations reach an average of 0.6 m
- Pump the standing discharge from the lagoon to the wetland early in the summer
- Conduct monitoring and treatment of the discharge (if necessary) to ensure continuing to meet the discharge requirements

- Excavate the sludge at the landfill as cover material, providing it meets the regulatory criteria for landfill disproval
- Alternating to landfill disposal can be considered (i.e. a supplement to a contaminated soil landfarm).

5.0 Wetland Treatment Area

The Sewage Disposal Facility wetland treatment area is located on the southwest side of the sewage lagoon beginning at the discharge point of the lagoon and extending west approximately 440 m until all flow has been infiltrated into the tundra or discharged into the ocean. The total area is approximately 7.3 ha and is shown in Figure 3.

There was no information regarding the planning, predicted operation, or design of the wetland treatment area found in Hamlet or GM archives.

The wetland treatment area is a secondary treatment system from the primary treatment system (the facultative lagoon). Wetland systems operate by dispersing sewage lagoon-treated effluent over an area of sufficient size, to allow natural processes such as sedimentation, adsorption by soil particles, uptake, and digestion of nutrient components by plants, microbial decomposition of complex molecules, physical entrainment in changing flow regimes, and dilution by intermixing with the natural water system.

As part of the field investigations, a test pit was excavated in the wetland attenuation zone to determine the active zone and depth to permafrost. In November 2010, the test pit was dug to a depth of 1.2 metres. From 0 to 15 cm was organic material and from 0.15 to 1.2 metres was medium black sand. The groundwater table was encountered at 0.4 cm. A sample of the sand (ARV 4-1) was sent to the lab for grain-size analysis.

5.1 Surface Flow

Surface water flow in the wetland is controlled by the slope of the land, vegetation and ground cover. The wetland consists of tundra mosses and small shrubs. Beach ridges and linear ridges run parallel to the Hudson Bay shore line. Drainage flows from the lagoon discharge point are generally in a southeast direction. The sewage moves through the wetland treatment area travelling up to 440 metres west from the lagoons' discharge point before heading south towards Hudson Bay. Effluent flows through numerous natural flow paths within the wetland. Flow is not continuous through the year and the flow paths may dry up before reaching the ocean. Flow paths are shown in Figure 3.

5.2 Subsurface Flow

A portion of the effluent discharged from the lagoon will infiltrate into the subsurface becoming groundwater. Infiltration and movement of groundwater will only occur during thawed conditions. Water will move by convection only as the underlying permafrost impedes percolation (Martini et al. 2009). Groundwater flow direction is assumed to be similar to surface flow with the end discharge point being the ocean.

Based on test pitting in November 2010, depth to water table is approximately 0.4 metres and depth to permafrost is approximately 1.2 metres. Grain size analysis results for the sample taken from the test pit show that the shallow active zone aquifer is made up of silty sand with moderate hydraulic conductivity. A grain size distribution curve was completed and is provided in Appendix C. Using the Hazen approximation a hydraulic conductivity of 1.2×10^{-5} m/sec was estimated. Groundwater velocity within the saturated zone was calculated to be 0.036 m per day. Considering that the ground is thawed for approximately 150 days a year, the distance that groundwater travels in one year is 5.45 m. Calculations are provided in Appendix C. The volume of water that infiltrates into the shallow active layer aquifer is significantly less than the component that moves via surface runoff.

5.3 Wetland Modelling

An assessment of available models for wetland treatment areas was completed. This included the Alberta Environment Wetland Treatment Predictive Model (ADE, 2000) and SubWet 2.O Subsurface Wetland Modelling Software (UNEP, 2010).

The models have many limitations. The accuracy of the output is dependent on the quality of data input and the applicability of your assumptions when actual data is not available. The simple predictive model from ADE, 2000 has been used to calculate the required wetland area to meet effluent quality guidelines. This model was chosen because it required parameters that were available from the sampling data set. SubWet 2.0 required more parameters and sampling points than available. Model calculations are provided in Appendix C. The Alberta Environmental Wetland Treatment Predictive Model indicates that the current NWB effluent quality guidelines for Total Suspended Solids, BOD and Fecal Coliforms can be met with the current wetland treatment area.

Wetland modelling in northern climates is in its infancy as there are very few studies in the area. Many of the available models were made for warmer climates and therefore have little applicability to the north. To fill the data gap, Environment Canada and several academic institutions are working on initiatives related to research in this area. New models may available in the future.

6.0 Impact Assessment on Environment

6.1 Wastewater Discharge Criteria

The lagoon is designed to receive municipal sewage only. The discharge of other liquid wastes is prohibited, unless it can be demonstrated that the waste will have not have deleterious impact on the Sewage Treatment Facility.

Prior to the discharge of any wastewater, the quality of the water must be assessed to ensure it does not cause a deleterious impact to the Sewage Lagoon (impact microbial processes or contaminates the water and soil), or the Wetland Treatment Area (contaminates the water, soil, and impact the vegetation and aquatic life). The source and nature of the wastewater must be assessed, and if there is any question of the chemical content, the water must be sampled and the results assess prior to discharge.

The Environmental Guidelines for Industrial Waste Discharge in Nunavut provides a decision flow chart for managing an industrial waste discharge (GN, 2002). It also includes schedules of comparative criteria for evaluating liquid waste. Liquid wastes meeting the criteria are acceptable for discharge into the Sewage Disposal Facility. Liquid wastes that do not meet the criteria must be pre-treated until they do, or be stored in barrels as hazardous waste for future disposal at a licensed facility located outside of the community. Liquid wastes not suitable for disposal at the Sewage Treatment Facility must be stored in a secure storage area at the Hamlet's Hazardous Waste Storage Area.

6.2 Water Quality Sampling

Water quality sampling was completed by Nuna Burnside in September and November 2010. Samples were taken from the lagoon (SL-1), at the discharge point of the lagoon (ARV-4) and within the wetland treatment area (SL-WET-1, 2, 3, and 4) to evaluate the effectiveness of the treatment system. Sample locations are shown in Figure 4.

Samples were compared to the Nunavut Water Board effluent guidelines and the Canadian Water Quality Guidelines for Aquatic Life (CCME, 2007a). Exceedences of the CCME guidelines were noted for iron and arsenic. These metals are not typical contaminants of sewage effluent and are likely naturally occurring in the water as a result of the chemistry of the local sediments.

A summary of some of the key parameters is provided in Table 1.

Table 1 Sewage Lagoon and Wetland Area Sampling Results, Sept 2010

Parameter	NWB Licence Guidelines	Sewage Lagoon (SL-1)	Discharge of Sewage Lagoon (ARV-4)	Most downstream point of Wetland Area (SL-WET-3)
Total Suspended Solids (mg/L)	100	156	169	<10
Ammonia as N (mg/L)	-	49.7	28.2	18.3
BOD_5 (mg/L)	80	420	65.0	5.6
Fecal Coliforms (MPN/100mL)	-	15000	2100	9
Total Phosphorus (mg/L)	-	7.23	5.81	1.45

Table 1 illustrates that the wetland treatment area is effective at reducing the levels of nutrients and bacteria contamination in the effluent discharged from the sewage lagoon. Sampling taken from the most downstream location within the wetland (SL-WET-3) met all of the requirements listed in the NWB licence.

Baseline and intensive data on the wetland was collected as part of a study for the International Polar Year headed by Fleming College in 2007 and 2008. Data collected as part of the study is included in Appendix F. The conclusions from the study have not yet been published.

6.2.1 Biotoxicity Monitoring

Toxicity testing provides an evaluation of effluent quality that integrates all measured parameter's and provides an indication of overall effluent characterization with respect to deleteriousness.

A toxicity sample was taken from ARV-4 in September 2010. ARV-4 is located just outside of the discharge point of the lagoon before the wetland treatment area. The acute lethality test showed a 100% mortality in Rainbow Trout and 0 % mortality for Daphnia magna. Sampling documentation is included in Appendix F.

Since the sample location is located before the wetland treatment area, it does not evaluate the toxicity of the water after treatment within the wetland. It is recommended that testing of surface water for toxicity be completed at the final discharge point of the wetland as stated in the new NWB licence.

6.3 Impacts on Vegetation and Wildlife

The final discharge point of the Sewage Disposal Facility is Hudson Bay. Water quality sampling from the discharge point meets the Canadian Water Quality Guidelines for the Protection of Aquatic Life and should not impact marine wildlife.

6.4 Land Use Planning

A 450 metre setback surrounding the lagoons is designated in the Community Land Use Plan as restrictive development. The lagoon is fenced and warning signs are posted. The Wetland Treatment Area is designed as a part of the Sewage Treatment Facility and the land area is formally set aside for this land use, and all other land use that could be a conflict.

The landuse plan should designate the entire Sewage Disposal Facility area, including the lagoon and wetland treatment area, as off limits to all other activities. Travel through the area should be restricted especially in the summer.

6.5 Emergency Response

The Environmental Emergency Contingency Plan, Hamlet of Arviat (prepared as a separate document) provides procedures and direction in the case of a spill or environmental emergency.

7.0 Recommendations

7.1 Environmental Monitoring Program

As outlined in the NWB water license, regular monitoring of the effluent from the Sewage Disposal Facility is required to monitor impacts on the environment. Currently only one monitoring location (ARV-4) is required by the NWB licence. Sampling at ARV-4 has historically taken from the pond immediately outside of the lagoon discharge point before effluent enters the wetland treatment area. In order to fully assess the attenuation capacity of the wetland, it is recommended that more sampling stations be established including stations at the discharge of the lagoon, within the wetland treatment area and at the final discharge point of the wetland area.

It is our opinion that monitoring the wetlands is a better method of predicting their effectiveness than the use of hydraulic models as modelling of northern wetland treatment systems is still in its development stages. Research on northern wetlands treatment systems is ongoing and new models may be available in the near future.

7.2 Optimization of Sewage Disposal Facility

The environmental monitoring program should be used to evaluate the efficacy of the facility and identify when the maintenance of the lagoon is required. Optimization measures should be used to prolong the life of the sewage lagoon and ensure that the environment is not impacted. Best practices outlined in the document published by the Federation of Canadian Municipalities and National Research Canada, “National Guide to Sustainable Municipal Infrastructure: Optimization of Lagoon Operations” (NRC, 2004) should be used.

8.0 Abandonment and Restoration

Part G of the Water License (Appendix A), requires the submission of an Abandonment and Restoration Plan at least six months prior to abandoning any facilities and construction of new facilities to replace existing ones.

The Sewage Treatment Facility consisting of the lagoon and Wetland Treatment Area, has been designed to meet the required 20 design period. It is expected that it could continue to operate for a significant period of time beyond 20 years. Desludging on a regular basis would extend its life as it approaches year 20. Once sewage volume exceeds the capacity of the lagoon, the lagoon can be expanded or an additional lagoon constructed. A new location for a Sewage Disposal Facility would be chosen in consultation with the Hamlet.

In the future, should the sewage lagoon no longer be required, abandonment would be straight forward as follows:

- Drain the lagoon during the discharge period
- Desludge the lagoon (if necessary based on sludge chemistry)
- Open the berms to allow natural drainage
- Contour the area to match the surrounding tundra
- Berms could be regraded or left standing
- The Wetland Treatment Area would return to natural conditions.

The Sewage Treatment Facility O&M Plan provides details for site staff (Nuna Burnside, 2010). The O&M Plan includes a short term and long term planning process, which would prompt the Hamlet to prepare for expansion and closure as the facility reaches the later years of its design life.

There are two abandoned lagoons located beside the active sewage lagoon. An Abandonment and Restoration Plan was completed by Nuna Burnside in December 2010 as a separate report.

9.0 Summary

The Hamlet of Arviat provides sewage treatment and disposal services for the community. The Hamlet of Arviat operates their Sewage Treatment Facility under the Nunavut Water Board (NWB) License 3AM-ARV1015. The licence was issued on August 23, 2010 and expires on August 31, 2015. This report is a listed as a condition of the licence in Part D, Item 5.

Sewage is collected daily by truck from all the houses and occupied buildings with holding tanks. The trucks discharge the sewage into a lagoon located approximately 2.8 km south-west from the Hamlet. Sewage stored in the lagoon eventually discharges through the lagoon's berm into a wetland treatment area.

The lagoon has a capacity to receive sewage from the community for the next 20 years. Desludging of the lagoon may be required to maintain retention time of sewage within the lagoon. A sludge management plan has been created to assist the Hamlet with disposal of sewage sludge. Sludge should be tested and disposed of in the landfill, provided it meets the regulatory conditions. Water quality of the effluent from lagoon and within wetland treatment area should be monitored to indicate when desludging is required.

Drawings of the conditions of the lagoon and berms, based on an inspection in 2010, reflect surficial conditions and visible observations. No intrusive investigations of the subsurface were conducted. Nuna Burnside cannot comment on the accuracy of information provided by others regarding the construction and condition of the facility.

Respectfully Submitted:

Stephanie Charity, P.Geo.

December 24, 2010
Date

Jim Walls, P.Geo.

REGISTERED PROFESSIONAL GEOLOGIST
J.R. WALLS
LICENSEE
NWT/NU

December 24, 2010
Date

10.0 References

ADE, 2000. Guidelines for the Approval and Design of Natural and Constructed Treatment Wetlands for Water Quality Improvement, Alberta Department of the Environment, Program Development Branch, Environmental Services Division, March 2000.

CCME, 2007a. Canadian Water Quality Guidelines for the Protection of Aquatic Life: Summary Table, Updated September, 2007. In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

CCME, 2007b. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health: Summary Table, Updated September, 2007. In: Canadian Environmental Quality Guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

CCME, 2005. Guidelines for Compost Quality, Canadian Council of Ministers of the Environment, 2005.

Environment Canada, 2010. Canadian Climate Normals 1971-2000, Rankin Inlet A Weather Station, Environment Canada. <http://climate.weatheroffice.ec.gc.ca/climate_normals/results_e.html?StnID=1721&autofwd=1>. Accessed Sept 21, 2010.

FSC, 2003. Design Concept for Arviat Sewage Lagoon Design, prepared for the Government of Nunavut, FSC Architects & Engineers, May 2003.

FSC, 2005. Abandonment and Restoration of Sewage Lagoons in Nunavut, Draft Review Report. Prepared for Department of Indian Affairs and Northern Development, FSC Architects and Engineers, January 2005.

GN, 2002. Guideline for Industrial Waste Discharges in Nunavut. Department of Sustainable Development, Environmental Protection Service, Government of Nunavut, January 2002.

IEG, 2005. Potable Water Supply Study, Arviat NU, Prepared for Government of Nunavut, Department of Community Government Services, IEG Environmental, December 2005.

MACA, 1988. Guidelines for the Planning, Design, Operation and Maintenance of Wastewater Lagoon Systems in NWT. Prepared for Department of Municipal and Community Affairs, Government of the North West Territories, 1988.

Martini et. al. 2009. Polar Coastal Wetlands: Development, Structure, and Land Use. P. Martini, R. Jefferies, R.I. Morrison and K. Abraham. From: Coastal Wetlands: An Integrated Ecosystem Approach, Elsevier, 2009.

NRC, 2004. National Guide to Sustainable Municipal Infrastructure: Optimization of Lagoon Operations. National Research Council, Ottawa, Ontario. August 2004.

Nunavut Bureau of Statistics, 2010. Kivalliq Community Population Projections, 2009 to 2036, Nunavut Bureau of Statistics, April 2010. <http://www.eia.gov.nu.ca/stats/population.html> Accessed November 9, 2010.

NWB, 2000. Guidelines for the Discharge of Domestic Wastewater in Nunavut, Nunavut Water Board, Yellowknife, 2000.

NWB, 2010. Hamlet of Arviat Water License 3AM-ARV1015. Gjoa Haven, Nunavut. Nunavut Water Board. 23 Aug 2010.

Nuna Burnside, 2010. Sewage Treatment Facility Operations and Maintenance Plan, Hamlet of Arviat. Nuna Burnside Engineering & Environmental Ltd., (May 2009, revised May 2010)

Nuna Burnside, 2010. Environmental Emergency Contingency Plan, Hamlet of Arviat. Nuna Burnside Engineering & Environmental Ltd., (May 2009, revised May 2010)

UNEP, 2010. SubWet 2.0 Subsurface Wetland Modelling Software, United Nations Environment Program, Division of Technology, Industry and Economics website http://www.unep.or.jp/letc/Publications/Water_Sanitation/SubWet2/index.asp. Accessed Nov 2, 2010.

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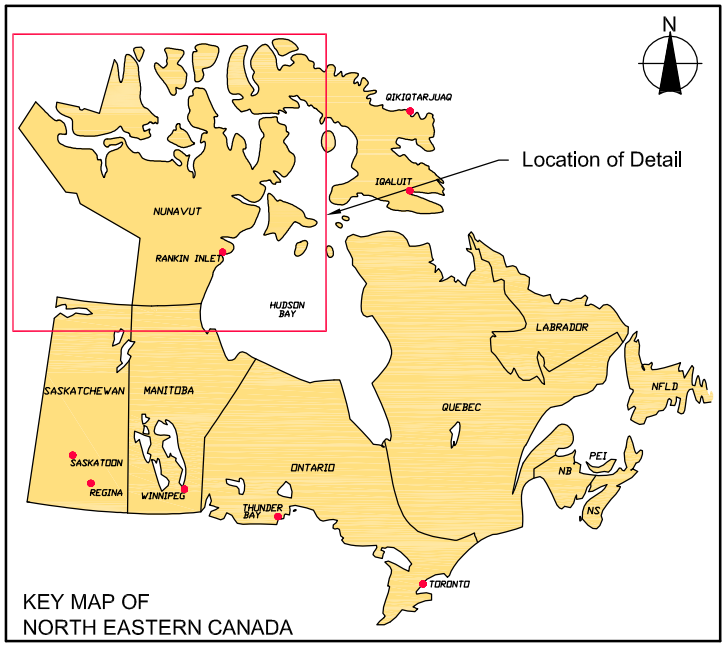
Figures

Map Reference:
Map Art Publishing



KEY MAP OF
NORTH EASTERN CANADA

FIGURE 1 - SITE LOCATION MAP

HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT

SEWAGE DISPOSAL FACILITY REPORT

November, 2010
Project Number: N-O15746

Prepared by: C. Dickie

Verified by: S. Charity

BURNSIDE

N-O15746 SDFR 2010 SL.dwg

Plot Time: Dec 13, 2010 - 3:49pm

FIGURE 2

HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
SEWAGE DISPOSAL FACILITY REPORT

COMMUNITY PLAN

Satellite Image Source:
Background colour satellite image obtained from Google Earth Pro.

Map Source:
Background physical features obtained from the National Topographic Database Website.

N

0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
Kilometres

1:50,000
December, 2010
Project Number: N-O15746

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Dickie

Verified by: S. Charity

BURNSIDE

N-O15746 SDFR 2010 CP.dwg

Plot Time: Dec 13, 2010 - 3:54pm

FIGURE 3

HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
SEWAGE DISPOSAL FACILITY REPORT

SEWAGE DISPOSAL FACILITY

LEGEND

- WETLAND TREATMENT AREA
- FLOW DIRECTION
- 10m GROUND SURFACE CONTOUR *(Survey by Burnside, September 2010)*

Satellite Image Source:
Quickbird Satellite Image ©Digital Globe Inc., Date 2008

Map Source:
Background physical features obtained from the National Topographic Database Website.

N

0 25 50 75 100 125 150 175 200
Metres

1:2,500
December 2010
Project Number: N-O15746

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Dickie

Verified by: S. Charity

BURNSIDE

N-O15746 SDFR 2010 SEWAGE DISPOSAL FACILITY.dwg

Plot Time: Dec 13, 2010 - 4:20pm

FIGURE 4

HAMLET OF ARVIAT
HAMLET OF ARVIAT, NUNAVUT
SEWAGE DISPOSAL FACILITY REPORT

SAMPLING LOCATIONS

LEGEND

◉	WATER SAMPLE LOCATION
■	TEST PIT LOCATION
△	SEWAGE LAGOON MEASUREMENT LOCATION
(9.93masl)	BOTTOM OF SEWAGE LAGOON MEASUREMENT (masl)
[8.9cm]	SLUDGE THICKNESS AT SEWAGE LAGOON MEASUREMENT (cm)
— — —	WETLAND TREATMENT AREA
→	FLOW DIRECTION

Satellite Image Source:
Quickbird Satellite Image ©Digital Globe Inc., Date 2008

Map Source:
Background physical features obtained from the National Topographic Database Website.

N

0 25 50 75 100 125 150 175 200

Metres

1:2,500
November 2010
Project Number: N-O157460

Projection: UTM Zone 15
Datum: NAD83

Prepared by: C. Dickie

Verified by: S. Charity

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N-O15746 SDFR 2010 SAMPLING LOCATIONS.dwg

Plot Time: Jan 18, 2011 - 11:19am

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Appendix A
Nunavut Water Board Licence

NUNAVUT WATER BOARD

WATER LICENCE NO: 3AM-ARV1015

Hamlet of Arviat, Nunavut

NUNAVUT WATER BOARD

LICENCE NO: 3AM-ARV1015

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NUNAVUT WATER BOARD

WATER LICENCE No. 3AM-ARV1015

Pursuant to the *Nunavut Waters and Nunavut Surface Rights Tribunal Act* and the *Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada*, the Nunavut Water Board, hereinafter referred to as the Board, hereby grants to

HAMLET OF ARVIAT
(Licensee or Applicant)

ARVIAT, NUNAVUT X0C 0E0
(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water or dispose of waste for a period subject to restrictions and conditions contained within this Licence:

Licence Number/Type:	3AM-ARV1015 TYPE "A"
Water Management Area:	NUNAVUT 06
Location:	ARVIAT, KIVALLIQ REGION, NUNAVUT LATITUDE: 61° 06' 30" N, LONGITUDE: 94° 03' 31" W
Classification:	MUNICIPAL UNDERTAKING
Purpose:	DIRECT USE OF WATER AND DEPOSIT OF WASTE
Quantity of Water use not to Exceed:	EIGHTY-SIX THOUSAND (86,000) CUBIC METRES PER ANNUM
Date of Licence Issuance:	AUGUST 23, 2010
Expiry of Licence:	AUGUST 31, 2015

This Licence, issued and recorded at Gjoa Haven, Nunavut, includes and is subject to the annexed conditions.

Thomas Kabloona,
Nunavut Water Board
Chair

APPROVED BY:

Minister of Indian and Northern Affairs Canada

DATE LICENCE APPROVED: _____

PART A: SCOPE, DEFINITIONS AND ENFORCEMENT

1. SCOPE

a. This Licence allows for the use of Water and disposal of Waste including operation of a Water Supply Facility, Solid Waste Disposal Facility, Hazardous Waste Storage Area, Bulky Metals Area, and Sewage Disposal Facility; as well as construction and operation of a New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility, upon approval by the Board, by the Hamlet of Arviat, Nunavut for a municipal undertaking (Latitude 61° 06' 30" N and Longitude 94° 03' 31" W);

b. This Licence is issued subject to conditions contained herein with respect to the taking of Water and the depositing of Waste of any type in any Waters or in any place under any conditions where such Waste or any other Waste that results from the deposits of such Waste may enter any Waters. Whenever new regulations are made or existing regulations are amended by the Governor in Council under the Act, or other statutes imposing more stringent conditions relating to the quantity, type or manner under which any such Waste may be so deposited, this Licence shall be deemed to be subject to such requirements; and

c. Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with all applicable legislation, guidelines and directives.

2. DEFINITIONS

In this Licence, these definitions apply and changes may be made at the discretion of the Board.

"Act" means the *Nunavut Waters and Nunavut Surface Rights Tribunal Act;*

"Amendment" means a change to original terms and conditions of this Licence requiring correction, addition or deletion of specific terms and conditions of the Licence and/or modifications inconsistent with the terms of the set terms and conditions of the Licence;

"Analyst" means an Analyst designated by the Minister under Section 85 (1) of the Act;

"Applicant" means the Licensee;

"Appurtenant undertaking" means an undertaking in relation to which a use of Waters or a deposit of Waste is permitted by a licence issued by the Board;

"Board" means the Nunavut Water Board established under the *Nunavut Land Claims Agreement*;

"Bulky Metals Area" comprises the area and associated structures designed to contain bulky metal waste as described in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

"Effluent" means treated or untreated liquid waste material that is discharged into the environment from a structure such as a settling pond or a treatment plant;

"Engineer" means a professional engineer registered to practice in Nunavut in accordance with the *Consolidation of Engineers and Geoscientists Act S. Nu 2008, c.2* and the *Engineering and Geoscience Professions Act S.N.W.T. 2006, c.16 Amended by S.N.W.T. 2009, c.12*;

"Final Discharge Point" in respect of an Effluent, means an identifiable discharge point of a facility beyond which the operator of the facility no longer exercises control over the quality of the Effluent;

"Freeboard" means the vertical distance between water line and the designed maximum operating height on the crest of a dam or dyke's upstream slope;

"Geotechnical Engineer" means a professional engineer registered with the Northwest Territories and Nunavut Association of Professional Engineers and Geoscientists and whose principal field of specialization is with the engineering properties of earth materials in dealing with man-made structures and earthworks that will be built on a site. These can include shallow and deep foundations, retaining walls, dams, and embankments;

"Grab Sample" means a single Water or wastewater sample taken at a time and place representative of the total discharge;

"Greywater" means all liquid wastes from showers, baths, sinks, kitchens and domestic washing facilities, but does not include toilet wastes;

"Hazardous Waste" means waste classified as "hazardous" by Nunavut Territorial or Federal legislation, or as "dangerous goods" under the *Transportation of Dangerous Goods Act*;

"Hazardous Waste Storage Area" comprises the area and associated structures designed to contain Hazardous Waste as described in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

"Hydrocarbon Impacted Soil Storage and Treatment Facility" means an area designed to treat Petroleum Hydrocarbon-Impacted Soil, as referred to in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

"Inspector" means an Inspector designated by the Minister under Section 85 (1) of the Act;

"Licensee" means the holder of this Licence;

"Modification" means an alteration to a physical work that introduces a new structure or eliminates an existing structure and does not alter the purpose or function of the work, but does not include an expansion, and changes to the operating system that are consistent with the terms of this Licence and do not require amendment;

"Monitoring Program" means a monitoring program established to collect data on surface Water and groundwater quality, Waste and Waste deposition, to assess impacts to the freshwater aquatic environment of an appurtenant undertaking;

"New Solid Waste Disposal Facility" comprises the area and associated structures designed to contain solid waste as referred to in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

"Nunavut Land Claims Agreement" (NLCA) means the *"Agreement Between the Inuit of the Nunavut Settlement Area and Her Majesty the Queen in right of Canada*", including its preamble and schedules, and any amendments to that agreement made pursuant to it;

"Petroleum Hydrocarbon Impacted Soil" means soil in which the primary petroleum product present, as determined by laboratory analysis consistent with that described in the *Canada-Wide Standards for Petroleum Hydrocarbons in Soil*, generally consists of fuel oil, diesel fuel, gasoline and/or jet fuel;

"Sewage" means all Toilet Wastes and Greywater;

"Sewage Disposal Facilities" comprises the area, including wetland and engineered lagoon designed to contain Sewage as described in the Application for Water Licence filed by the Applicant on September 2, 2003, and illustrated in Arviat Sewage Lagoon drawings prepared by FSC Architects and Engineers for Government of Nunavut, Job No. 507-340, FSC Project No. 2003-0440-003, Submission for Tender July 11th, 2003;

"Sewage Sludge" means the semi-solid Sewage material which settles at the bottom of the Sewage lagoon;

"Solid Waste Disposal Facilities" comprises the area and associated structures designed to contain solid waste as described in the Application for Water Licence filed by the Applicant on September 2, 2003;

"Toilet Wastes" means all human excreta and associated products, but does not include Greywater;

"Waste" means, as defined in section 4 of the Act, any substance that, by itself or in combination with other substances found in Water, would have the effect of altering the quality of any Water to which the substance is added to an extent that is detrimental to its use by people or by any animal, fish or plant, or any Water that would have that effect because of the quantity or concentration of the substances contained in it or because it has been treated or changed, by heat or other means;

"**Waste Disposal Facilities**" means all facilities designated for the disposal of Waste including the Sewage Disposal Facilities, Solid Waste Disposal Facilities, Hazardous Waste Storage Area, Bulky Metals Area, and upon approval by the Board, New Solid Waste Disposal Facility, and/or Hydrocarbon Impacted Soil Storage and Treatment Facility, as described in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009;

"Water" means water as defined in section 4 of the Act;

"Water Supply Facilities" comprises the area and associated intake infrastructure at the Wolf River Water Supply, as described in the Application for Water Licence Renewal filed by the Applicant on January 5, 2009 and illustrated in Arviat Water Supply Filtration Upgrade drawings prepared by Dillon Consulting for Government of Nunavut Public Works and Services, Issued for Tender, April 2008, Project No. 078254; Figure 4 – Hamlet of Arviat Water Licence Submission Wolf River Water Intake drawing prepared by Nuna Burnside, December 2008, Project Number N-O15746;

"Work Plan" refers to the electronic document (letter) from Jim Walls, P.Geo., Nuna Burnside Engineering and Environmental Ltd., to Bryan Purdy, Government of Nunavut Community Government Services, Re: Work Plan to Address INAC, DFO, and NWB Licence Compliance Issues GN File 08-3025 Hamlet of Arviat, Nunavut File No. N-0 15746.1, dated June 23, 2010.

3. ENFORCEMENT

a. Failure to comply with this Licence will be a violation of the Act, subjecting the Licensee to the enforcement measures and the penalties provided for in the Act.

b. All inspection and enforcement services regarding this Licence will be provided by Inspectors appointed under the Act.

c. For the purpose of enforcing this Licence and with respect to the use of Water and deposit or discharge of Waste by the Licensee, Inspectors appointed under the Act, hold all powers, privileges and protections that are conferred upon them by the Act or by other applicable law.

PART B: GENERAL CONDITIONS

1. This Licence incorporates a previously issued Type B licence, NWB3ARV0308, to the Hamlet of Arviat, which allowed for the use of water and disposal of waste.

2. In the event of a conflict between the previously issued Type B licences and this Type A Licence, the condition of this Type A Licence prevails.

3. The Licensee shall file an annual report with the Board for review, no later than March 31st

of the year following the calendar year being reported, which shall contain the following information collected during that period:

a. Tabular summaries of all data generated under the Monitoring Program;
b. The monthly and annual quantities of freshwater obtained from all sources;
c. The monthly and annual quantities of Wastes removed for disposal from Water Supply Facilities and Waste Disposal Facilities;
d. A summary of modifications and/or major maintenance work carried out on Water Supply Facilities and Waste Disposal Facilities including all associated structures and facilities;
e. A list of unauthorized discharges and summary of follow-up actions taken;
f. Any revisions to approved plans and manuals as required by Part B, Item 12, submitted in the form of an addendum;
g. A summary of the status of implementation of the Work Plan, including an indication of the status of the funding required to carry out the Work Plan and an estimated timeframe for receipt of the necessary funding;
h. A fiscal update of the Licensee's funding commitments associated with all facilities governed by this Licence including all associated structures and facilities for the upcoming year and identifying shortfalls in such funding commitments for the previous year;
i. A summary of abandonment and restoration work completed during the year and an outline of any work anticipated for the next year;
j. A summary of any studies, reports and plans requested by the Board that relate to Waste disposal, Water use or reclamation, and a brief description of any future studies planned; and
k. Any other details on water use or waste disposal requested by the Board by November 1st of the year being reported.

4. The Licensee shall comply with the Monitoring Program described in this Licence and any Amendments to the Monitoring Program as may be made from time to time, pursuant to the conditions of this Licence.

5. The Monitoring Program and compliance dates specified in the Licence may be modified at the discretion of the Board.

6. Metres, devices or other such methods used for measuring the volumes of Water used and Waste discharged, shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.

7. The Licensee shall, within ninety (90) days after the first visit by the Inspector following approval of this Licence, post the necessary signs, to identify the stations of the Monitoring Program. All signage postings shall be in Inuktitut and English.

8. The Licensee shall, for all plans submitted under this Licence, include a proposed timetable for implementation. Plans submitted, cannot be undertaken without subsequent written Board approval and direction. The Board may alter or modify a plan if necessary to

achieve the legislative objectives and will notify the Licensee in writing of acceptance, rejection or alteration of the plan.

9. In the event that a plan is not found acceptable to the Board, the Licensee shall, within thirty (30) days of notification by the Board, provide a revised version to the Board, for approval in writing.

10. The Licensee shall, for all plans submitted under this Licence, implement the plan as approved by the Board in writing.

11. Every plan to be carried out pursuant to the terms and conditions of this Licence shall become a part of this Licence, and any additional terms and conditions imposed upon approval of a plan by the Board become part of this Licence. All terms and conditions of the Licence should be contemplated in the development of a plan where appropriate.

12. The Licensee shall review the plans and manuals referred to in this Licence as required by changes in operation and/or technology and revise accordingly. Revisions to the plans or manuals are to be submitted in the form of an addendum to be included with the annual report required by Part B, Item 3, complete with a revisions list detailing where significant content changes are made.

13. The Licensee shall ensure a copy of this Licence is maintained at the municipal office and at the site of operation at all times.

14. Any communication with respect to this Licence shall be made in writing to the attention of:

Manager of Licensing
Nunavut Water Board
P. O. Box 119
Gjoa Haven, NU X0B 1J0
Telephone: (867) 360-6338
Fax: (867) 360-6369
Email: licensing@nunavutwaterboard.org

15. Any notice made to an Inspector shall be made in writing to the attention of:

Water Resources Officer
Nunavut District, Nunavut Region
P.O. Box 100
Iqaluit, NU X0A 0H0
Telephone: (867) 975-4295
Fax: (867) 979-6445

16. The Licensee shall submit one (1) paper copy and one (1) electronic copy of all reports, studies, and plans to the Board or as otherwise requested by the Board. Reports or studies submitted to the Board by the Licensee shall include an executive summary in English and

Inuktitut.

17. The Licensee shall ensure that any document(s) or correspondence submitted by the Licensee to the Board, is received by the Board and maintain on file a copy of the acknowledgment of receipt issued by the Manager of Licensing.

18. This Licence is assignable as provided for in Section 44 of the Act.

19. The expiry or cancellation of this Licence does not relieve the Licensee from any obligation imposed by the Licence, or any other regulatory requirement.

20. The Licensee shall file a Water Licence Renewal Application with the Board no later than September 1, 2014.

PART C: CONDITIONS APPLYING TO WATER USE AND MANAGEMENT

1. The Licensee shall obtain all freshwater from Wolf River at Monitoring Program Station ARV-1 as otherwise approved by the Board in writing.

2. The annual quantity of water used for all purposes shall not exceed eighty-six thousand (86, 000) cubic metres per annum, or as otherwise approved by the Board in writing.

3. The Licensee shall equip all water intake hoses with a screen of an appropriate mesh size to ensure that fish are not entrained and shall withdraw Water at a rate such that fish do not become impinged on the screen.

4. The Licensee shall submit to the Board for approval in writing by December 31, 2010, as-built drawings stamped and signed by an Engineer confirming compliance with the DFO guideline "Freshwater Intake End of Pipe Fish Screen Guideline". The drawings shall include information regarding the operating capacity of the pump used and the intake screen size.

5. The Licensee shall not remove any material from below the ordinary high water mark of any Water body.

6. The Licensee shall not cause erosion to the banks of any body of Water and shall provide necessary controls to prevent such erosion.

7. Sediment and erosion control measures shall be implemented prior to and maintained during construction and operation to prevent entry of sediment into Water.

8. The Licensee shall submit to the Board for review by December 31, 2010, the Water balance assessment for Wolf River and an assessment of the potential effects of drawdown of Wolf River on the aquatic environment. The assessment shall include recommended mitigation measures and an implementation schedule.

9. The Licensee shall maintain the Water Supply Facilities to the satisfaction of the Inspector.

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL AND MANAGEMENT

1. The Licensee shall direct all Sewage to the Sewage Disposal Facility.

2. All Effluent discharged from the Sewage Disposal Facilities at Monitoring Program Station ARV-4 shall not exceed the following Effluent quality limits, or as otherwise approved by the Board in writing:

Parameter	Maximum Concentration of any Grab Sample
Fecal Coliform	1×10^4 CFU/dl
BOD_5	80 mg/l
Total Suspended Solids	100 mg/l
Oil and Grease	No visible sheen
pH	Between 6 and 9

3. A Freeboard limit of 1.0 metre, or as recommended by a qualified Geotechnical Engineer and as approved by the Board in writing, shall be maintained at all dams, dyke or structures intended to contain, withhold, divert or retain Water or Wastes.

4. The Licensee shall provide at least ten (10) days notification to an Inspector, prior to initiating any planned discharges from any Waste Disposal Facility.

5. The Licensee shall submit to the Board for approval in writing by December 31, 2010, a Sewage Disposal Facility Report. The Report shall include:

   a. As-built drawings and design plans of the Sewage Disposal Facility (including the lagoon and wetland) signed and stamped by an Engineer;
   b. A preliminary discharge and wetland hydrology assessment;
   c. The results of an inspection by a Geotechnical Engineer of the Sewage Disposal Facility lagoon including its berms and an evaluation of the impact of sewage seepage through the lagoon berms on the environment;
   d. An evaluation of the long term impacts of the Sewage Disposal Facility on the environment;
   e. A Sludge Management Plan that addresses sludge assessment and disposal methods. The Plan shall be incorporated in to the Sewage Disposal Facility Operations and Maintenance Manual referred to in Part F Item 1b;
   f. Recommended measures to optimize the Sewage Disposal Facility; and
   g. A schedule for implementing recommended measures.

6. The Licensee shall, prior to commissioning of the New Solid Waste Disposal Facility, or as otherwise approved by the Board in writing:

a. Dispose of and contain all non-Hazardous, non-bulky metal, solid Waste at the Solid Waste Disposal Facility;
b. Dispose of and contain all bulky metal Waste at the Bulky Metals Area; and
c. Segregate and securely store all hazardous materials and Hazardous Waste within the Hazardous Waste Storage Area in a manner as to prevent the deposit of deleterious substances into any Water, until such a time that the materials have been removed for proper disposal at a licensed facility.

7. The Licensee shall not open burn plastics, wood treated with preservatives, electric wire, styrofoam, asbestos or painted wood to prevent the deposition of Waste materials of incomplete combustion and/or leachate from contaminated ash residual, from impacting any surrounding Waters, or as otherwise approved by the Board in writing.

8. The Licensee shall maintain records of all Waste removed from site and records of confirmation of proper disposal of removed Waste. These records shall be made available to an Inspector upon request.

9. The Licensee shall store and contain all Petroleum Hydrocarbon Impacted Soil in a manner as to prevent the deposit of deleterious substances into any Water.

10. The Licensee shall submit to the Board for approval in writing, at least sixty (60) days prior to the commissioning of a Hydrocarbon Impacted Soil Storage and Treatment Facility, a Hydrocarbon Impacted Soil Storage and Treatment Facility Management Plan including proposed Effluent quality limits for Monitoring Program Station ARV-10.

11. The Licensee shall dispose of all Effluent from contaminated soil areas and the Hydrocarbon Impacted Soil Storage and Treatment Facility, that exceed Effluent quality limits approved by the Board in Part D Item 14 (c) and Part D Item 10 respectively, off site at a licensed hazardous waste facility, or as otherwise approved by the Board in writing.

12. The discharge locations for all treated Effluents from the Hydrocarbon Impacted Soil Storage and Treatment Facility and contaminated soil areas shall be located at a minimum of thirty one (31) metres from the ordinary high water mark of any Water body and where direct or indirect flow into a Water body is not possible and no additional impacts are created.

13. The Licensee shall, prior to the removal of any treated soil from the Hydrocarbon Impacted Soil Storage and Treatment Facility, obtain written documentation from the Government of Nunavut Environmental Protection Service, confirming that the soils have been treated in accordance with the Government of Nunavut's "*Environmental Guideline for Contaminated Site Remediation, 2009"* for its intended use.

14. The Licensee shall submit to the Board for approval in writing by December 31, 2010, a Solid Waste Management Report. The Report shall include:

a. As-built drawings of the Solid Waste Disposal Facility, Hazardous Waste Storage Area, and Bulky Metals Area, signed and stamped by an Engineer;
b. Capacity assessment of the Solid Waste Disposal Facility;
c. An inventory and assessment of contaminated soil and water at the Solid Waste Disposal Facility, Bulky Metals Area, and Hazardous Waste Storage Area, and a plan for the treatment and disposal of contaminated soil and water including proposed Effluent quality limits for Monitoring Program Station ARV-11;
d. Recommendations for Water and wastewater containment, treatment, and drainage control. This Plan shall be incorporated into the Solid Waste Disposal Facility Operations and Maintenance Plan referred to in Part F Item 2d.
e. Recommended measures to optimize solid waste management; and
f. A schedule for implementing recommended measures.

15. Licensee shall implement measures to ensure hazardous materials and/or leachate from the Waste Disposal Facilities does not enter Water.

16. Licensee shall, annually between the months of June and September, undertake a geotechnical inspection to be carried out by a Geotechnical Engineer that takes into account all facilities intended to contain, withhold, divert or retain Water or Wastes. The inspection shall be conducted in accordance with the Canadian Dam Safety Guidelines, where applicable.

17. The Licensee shall, within sixty (60) days of completion of the geotechnical inspection referred to in Part D, Item 16, submit to the Board for review, the Geotechnical Engineer's inspection Report. The Licensee shall include a cover letter outlining an implementation plan to address the recommendations of the Geotechnical Engineer.

18. The Licensee shall maintain and operate all Water Supply Facilities and Waste Disposal Facilities in such a manner as to prevent structural failure.

PART E: CONDITIONS APPLYING TO MODIFICATIONS AND CONSTRUCTION

1. The Licensee shall, at least sixty (60) days prior to construction of the New Solid Waste Disposal Facility and/or the Hydrocarbon Impacted Soil Storage and Treatment Facility, or any dams, dykes or structures intended to contain, withhold, divert or retain Water or Wastes, submit to the Board, for approval in writing, final design Plans and construction drawings signed and stamped by an Engineer.

2. The Licensee shall obtained approval from the Board in writing prior to the construction of any dams, dykes or structures intended to contain, withhold, divert or retain Water or Wastes.

3. The Licensee may, without written approval from the Board, carry out Modifications provided that such Modifications are consistent with the terms of this Licence and the following requirements are met:

a. The Licensee has notified the Board in writing of such proposed Modifications at least sixty (60) days prior to beginning the Modifications to include:
   i. A description of the facilities and/or works to be constructed;
   ii. The proposed location of the structure(s);
   iii. Identification of any potential impacts to the receiving environment;
   iv. A description of any monitoring required, including sampling locations, parameters measured and frequencies of sampling;
   v. Schedule for construction;
   vi. Drawings of engineered structures signed and stamped by an Engineer; and
   vii. Proposed sediment and erosion control measures.
b. The proposed Modifications do not place the Licensee in contravention of the Licence or the Act;
c. The Board has not, within sixty (60) days following notification of the proposed Modifications, informed the Licensee that review of the proposal will require more than sixty (60) days; and
d. The Board has not rejected the proposed Modifications;

4. Modifications for which any of the conditions referred to above have not been met can be carried out only with approval from the Board in writing.

5. The Licensee shall provide as-built plans and drawings of the construction and/or Modifications referred to in Part E of this Licence within ninety (90) days of completion of the Construction or Modification. These plans and drawings shall be signed and stamped by an Engineer.

PART F: CONDITIONS APPLYING TO OPERATIONS AND MAINTENACE

1. The Licensee shall, within sixty (60) days following Board approval of the Sewage Disposal Facility Report referred to in Part D, Item 5, submit to the Board, for approval in writing, a revision to the Plan entitled "Sewage Treatment Facility Operation and Maintenance (O&M) Plan, Hamlet of Arviat" May 2009, revised May 2010, to address the following:

   a. Requirements of the Licence;
   b. Sludge Management Plan referred to in Part D Item 5e; and
   c. Results of the Sewage Disposal Facility Report referred to in Part D Item 5.

2. The Licensee shall, within sixty (60) days following Board approval of the Solid Waste Disposal Facility Report referred to in Part D Item 14, submit to the Board, for approval in writing, a revision to the Plan entitled "Solid Waste Management Facility Operation and Maintenance (O&M) Plan, Hamlet of Arviat" January 2009, revised May 2010, to address the following:

   a. Requirements of the Licence;
   b. Bulky Waste Management Plan;

c. Hazardous Waste Management Plan including Hazardous Waste containment and segregation measures, and procedures for the movement of Hazardous Waste;
d. Recommendations for Water and wastewater containment, treatment, and drainage control as referred to in Part D Item 14(d); and
e. Results of the Solid Waste Disposal Facility Report referred to in Part D Item 14.

3. The Licensee shall, at least three (3) months prior to commissioning the New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility, submit to the Board, for approval in writing, a revised Solid Waste Management Facility Operations and Maintenance (O&M) Plan referred to in Part F Item 2 to address the New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility.

4. The Licensee shall, in preparation of the revised plan referred to in Part F, Item 3, consult Environment Canada for guidance related to Petroleum Hydrocarbon Impacted Soils storage and treatment facility design, siting, operation, monitoring, sampling and analytical methods, decommissioning and closure, as well as record keeping and reporting.

5. The Licensee shall, by December 31, 2010, submit to the Board for review, an Addendum to the approved Plan entitled "Environmental Emergency Contingency Plan, Hamlet of Arviat" May 2009, revised May 2010, to address reviewers' comments including the following:

   a. Procedures for the movement of Hazardous Waste;
   b. Contact information for the Government of Nunavut Department of Environment Manager of Pollution; and
   c. Detailed information regarding clean-up methods/procedures for spills on Water or ice.

6. If, during the period of this Licence, an unauthorized discharge of Waste and or Effluent occurs, or if such discharge is foreseeable, the Licensee shall:

   a. Employ as required, the approved Environmental Emergency Contingency Plan referred to in Part F Item 5;
   b. Report the incident immediately via the 24-Hour Spill Reporting Line (867) 920-8130 and to the Inspector at (867) 975-4295; and
   c. For each spill occurrence, submit a detailed report to the Inspector, no later than thirty (30) days after initially reporting the event, which includes the amount and type of spilled product, the GPS location of the spill, and the measures taken to contain, clean up and restore the spill site.

PART G: CONDITIONS APPLYING TO ABANDONMENT, RESTORATION AND CLOSURE

1. The Licensee shall, by December 31, 2010, submit to the Board, for review, an interim Abandonment and Restoration Plan for the Solid Waste Disposal Facility, Bulky Metals Area, Hazardous Waste Storage Area and any contaminated sites identified in the Solid Waste Management Report referred to in Part D Item 14 (c). The Plan shall incorporate, where applicable, the appropriate sections described in Part G Item 3.

2. The Licensee shall, by December 31, 2010, submit to the Board, for approval in writing, a Final Abandonment and Restoration Plan for the two abandoned sewage lagoons. The Plan shall incorporate, where applicable, the appropriate sections described in Part G Item 3.

3. The Licensee shall, at least six (6) months prior to abandoning any facilities or upon submission of final design drawings for the construction of new facilities to replace existing ones, submit to the Board, for approval in writing, a Final Abandonment and Restoration Plan for the facilities being decommissioned. The Plan shall incorporate, where applicable, information on the following:

    a. Water intake facilities;
    b. The water treatment and waste disposal sites and facilities;
    c. Former dump sites;
    d. Petroleum and chemical storage areas;
    e. Any site affected by waste spills;
    f. Leachate prevention;
    g. An implementation and completion schedule;
    h. Maps delineating all disturbed areas, and site facilities;
    i. Consideration of altered drainage patterns;
    j. Type and source of cover materials;
    k. Future area use;
    l. Hazardous Wastes; and
    m. A proposal identifying measures by which restoration costs will be financed by the Licensee upon abandonment.

4. The Licensee shall carry out progressive reclamation of any Water Supply Facilities and Waste Disposal Facilities no longer required for the Licensee's operations.

5. In order to promote growth of vegetation and the needed microclimate for seed deposition, all disturbed surfaces shall be prepared by ripping, grading, or scarifying the surface to conform to the natural topography.

6. The Licensee shall, prior to the use of reclaimed soils that have been contaminated by hydrocarbons, or soils referred to in Part D, Item 14(c), consult with the Government of Nunavut, Department of Environment and obtain written confirmation that the soil meets

the objectives as outlined in the Government of Nunavut's *Environmental Guideline for Contaminated Site Remediation*, March 2009 (Revised).

7. The Licensee shall complete the restoration work within the time schedule specified in an approved Abandonment and Restoration Plan, or as subsequently revised and approved by the Board in writing.

8. The Licensee shall complete all restoration work prior to the expiry of this Licence.

PART H: CONDITIONS APPLYING TO THE MONITORING PROGRAM

1. The Licensee shall maintain Monitoring Program Stations at the following locations:

Station Number	Description	Frequency	Status
ARV-1	Raw water supply at Wolf River prior to treatment.	Monthly	Active (Volume)
ARV-2a	Effluent from the discharge point of the Solid Waste Disposal Facility.	Quality Monthly during the months of May to August and prior to discharge of accumulated impacted water. Acute Toxicity Annually	Active (Quality and Acute Toxicity)
ARV-2b	Effluent from the discharge point of the New Solid Waste Disposal Facility.	Quality Monthly during the months of May to August and prior to discharge of accumulated impacted water. Acute Toxicity Annually	Active (Quality and Acute Toxicity)
ARV-3	Raw Sewage at truck offload point.	Monthly	Not active

ARV-4	Effluent from the discharge point of the Sewage Disposal Facility (end of Wetland).	Quality Monthly during the months of May to August. Acute Toxicity Annually	Active (Quality and Acute Toxicity)
ARV-5	Discharge from the Bulky Metal Waste Area.	Monthly during periods of observed flow.	New (Quality)
ARV-6	Discharge from the Hazardous Waste Storage Area.	Monthly during periods of observed flow.	New (Quality)
ARV-7	Water level in Wolf River.	Monthly during periods of open water.	New (Water level)
ARV-8	Water level in Sewage Disposal Facility lagoon.	Monthly during thawed conditions.	New (Sewage level)
ARV-9	Sewage Sludge removed from the Sewage Disposal Facility.	Monthly	New (Volume)
ARV-10	Effluent from the Final Discharge Point of the Hydrocarbon Impacted Soil Storage and Treatment Facility	To be determined in accordance with Part D Item 10	New (To be determined in accordance with Part D Item 10)
ARV-11	Effluent discharge from dewatering contaminated soil areas.	To be determined in accordance with Part D Item 14 (c)	New (To be determined in accordance with Part D Item 14 (c))

2. The Licensee shall, by December 31, 2010, maintain a water level Monitoring Program Station (ARV-7) at Wolf River.

3. The Licensee shall, by December 31, 2010, maintain a lagoon level Monitoring Program Station (ARV-8) at the Sewage Disposal Facility.

4. The Licensee shall provide the GPS co-ordinates (in degrees, minutes and seconds of latitude and longitude) of all locations where sources of Water are utilized for all purposes and at all Monitoring Program Stations.

5. The Licensee shall confirm the locations and GPS coordinates for all Monitoring Program Stations referred to in Part H Item 1 with an Inspector.

6. The Licensee shall determine the locations and GPS coordinates of any additional Monitoring Program Stations required for any new Waste Disposal Facilities with an Inspector.

7. The Licensee shall measure and record in cubic metres, the monthly and annual quantities of Water extracted for all purposes at Monitoring Program Station ARV-1.

8. The Licensee shall carry out, at a minimum, weekly inspections at Monitoring Program Stations ARV-2a, ARV-5, ARV-6, and Station ARV-2b upon commissioning of the New Solid Waste Disposal Facility, from May to August inclusive, to identify Effluent or Water flow in order to fulfill the monitoring requirements of Part H, Item 9. A record of inspections shall be retained and made available to an Inspector upon request.

9. The Licensee shall sample monthly at Monitoring Program Stations ARV-2a, ARV-4, ARV-5, ARV-6, and Station ARV-2b upon commissioning of the New Solid Waste Disposal Facility, during the months of May to August, inclusive. Samples shall be analyzed for the following parameters:

BOD_5	Faecal Coliforms
pH	Conductivity
Total Suspended Solids	Ammonia Nitrogen
Nitrate – Nitrite	Oil and Grease (visual)
Total Phenols	Sulphate
Sodium	Potassium
Magnesium	Calcium
Total Arsenic	Total Cadmium
Total Copper	Total Chromium
Total Iron	Total Lead
Total Mercury	Total Nickel
Total Zinc	Total Phosphorous

10. The Licensee shall conduct the following acute toxicity tests at Monitoring Program Stations ARV-2a and ARV-4, and Station ARV-2b upon commissioning of the New Solid Waste Disposal Facility, once annually between June and September, approximately mid-way through the discharge period:

    a. Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout (Reference Method EPS 1/RM/13), July 1990, published by the Department of the Environment, as amended in December 2000, and as may be further amended from time to time
    b. Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna (Reference Method EPS 1/RM/14), July 1990, published by the Department of the Environment, as amended in December 2000, and as may be further amended from time to time.

11. The Licensee shall, when flow volumes at Monitoring Program Stations ARV- 2a, ARV-2b and ARV-4 are not sufficient to conduct the tests required by Part H Item 10, collect samples upstream where adequate flow volume exists.

12. The Licensee shall record water elevation monthly, during open water at Monitoring Program Station ARV-7.

13. The Licensee shall record water elevations monthly during thawed conditions at Monitoring Program Station ARV-8.

14. The Licensee shall measure and record in cubic metres the monthly and annual quantities of Sewage sludge removed from the Sewage Disposal Facility at Monitoring Program Station ARV-9.

15. The Licensee shall submit to the Board for review, by December 31, 2010 a revision to the approved Plan entitled "Environmental Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan, Hamlet of Arviat" May 2009, revised May 2010, to address the following:

    a. All monitoring requirements listed under Part H of the Licence;
    b. A covering letter from an accredited laboratory confirming acceptance of the Quality Assurance/ Quality Control (QA/QC) Plan for analyses to be performed under this Licence as required under Part H, Item 17.

16. The Licensee shall, at least six (60) days prior to commissioning the New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility, submit to the Board, for approval in writing, a revision to the Environmental Monitoring Program and Quality Assurance/Quality Control (QA/QC) Plan, referred to in Part H Item 15, to address the New Solid Waste Disposal Facility and/or Hydrocarbon Impacted Soil Storage and Treatment Facility.

17. The Licensee shall annually review the QA/QC Plan referred to in Part H, Item 15 and modify it as necessary. The revised QA/QC Plan shall be submitted to the Board for review, accompanied by a current approval letter from an accredited lab and shall meet the standards as set out in Part H, Item 20 and Part H, Item 21 of the Licence.

18. The Licensee shall measure and record the volume of all contaminated soil, from all locations entering the Hydrocarbon Impacted Soil Storage and Treatment Facility.

19. The Licensee shall assess and record the concentration of Petroleum Hydrocarbon Impacted Soil entering any Hydrocarbon Impacted Soil Storage and Treatment Facility from all sources, as per the CCME *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil, User Guide, January 2008*.

20. All sampling, sample preservation and analyses shall be conducted in accordance with methods prescribed in the current edition of *Standard Methods for the Examination of Water and Wastewater*, or by such other methods approved by the Board.

21. All analyses shall be performed in a laboratory accredited according to ISO/IEC Standard 17025. The accreditation shall be current and in good standing.

22. The Licensee shall include all of the data and information required by the Monitoring Program in the Licensee's Annual Report, as required per Part B, Item 3(a) or as otherwise requested by an Inspector.

23. Modifications to the Monitoring Program may be made only upon written request and subsequent approval of the Board in writing.

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Appendix B
Climate Data

Climate Data

Rankin Inlet Climate Normals Data Summary

	an	Feb	Mar	Apr	May	un	ul	Aug	Sep	Oct	Nov	Dec	Annual Total
Total Precipitation (mm)	6.6	8.9	12.6	14.3	18.4	29.8	39.5	57.6	43.8	34.6	19.8	11.3	297.2
Rain (mm)	0.0	0.1	0.0	1.0	7.4	25.0	39.5	57.3	39.2	11.9	0.1	0.0	181.5
Snow (cm)	6.7	9.3	12.9	13.6	11.5	4.9	0.0	0.3	4.6	23.1	20.9	11.9	107.8
Wind Speeds (km hour)	23.9	23.9	23.4	22.4	22.1	19.8	19.2	21.1	24.2	26.5	25.3	24.0	
Average Temperatures (C)	-31.9	-30.1	-25.2	-16.3	-5.9	4.2	10.4	9.5	3.4	-5.3	-17.8	-26.7	

Canadian Climate Normals 1971-2000, Environment Canada, Rankin Inlet Airport Weather Station

Specific climate data for Arviat was not available. The closest weather station is located in Rankin Inlet, 225 km north of Arviat.

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Appendix C
Calculation Worksheets

Table C-1: Sewage Generation Rates for the Hamlet of Arviat

Planning Year	Calendar Year	Total Population[1]	Projected Sewage generation[2] (lpcd)	Projected Volume (litres/day)	Projected Volume (m^3/day)	Projected Volume (m^3/year)	Actual Volume[5] (m^3/year)	Projected Sludge Quantity (kg/annum)	Cumulative Sludge Volume[4] (m^3)	Available Volume of Lagoon (m^3)	Total Lagoon Retention Time (days)
	2005	1995	95	189,176	189	69,049	67,745	36,409	728	43,118	222
	2006	2060	96	197,342	197	72,030		37,595	1,480	39,797	197
	2007	2126	97	205,762	206	75,103	73,686	38,800	2,256	39,021	185
	2008	2195	98	214,704	215	78,367	74,900	40,059	3,057	38,220	174
0	2009	2,254	99	222,464	222	81,199	72667	41,136	3,880	37,397	164
	2010	2,296	99	228,051	228	83,238	74299	41,902	4,718	36,559	157
	2011	2,339	100	233,825	234	85,346		42,687	5,572	35,706	149
	2012	2,383	101	239,791	240	87,524		43,490	6,442	34,836	142
	2013	2,428	101	245,953	246	89,773		44,311	7,328	33,950	135
5	2014	2,474	102	252,314	252	92,095		45,151	8,231	33,047	128
	2015	2,521	103	258,879	259	94,491		46,008	9,151	32,126	122
	2016	2,571	103	265,935	266	97,066		46,921	10,089	31,188	115
	2017	2,622	104	273,210	273	99,721		47,852	11,046	30,231	109
	2018	2,674	105	280,707	281	102,458		48,801	12,022	29,255	102
10	2019	2,728	106	288,578	289	105,331		49,786	13,018	28,259	96
	2020	2,784	107	296,832	297	108,344		50,808	14,034	27,243	90
	2021	2,841	107	305,331	305	111,446		51,848	15,071	26,206	84
	2022	2,898	108	313,926	314	114,583		52,889	16,129	25,148	79
	2023	2,957	109	322,926	323	117,868		53,965	17,208	24,069	73
15	2024	3,017	110	332,184	332	121,247		55,060	18,309	22,968	68
	2025	3,076	111	341,394	341	124,609		56,137	19,432	21,845	63
	2026	3,136	112	350,866	351	128,066		57,232	20,577	20,700	58
	2027	3,196	113	360,446	360	131,563		58,327	21,743	19,534	53
	2028	3,257	114	370,295	370	135,158		59,440	22,932	18,345	49
	2029	3,319	115	380,421	380	138,854		60,572	24,144	17,134	44
20	2030	3,379	116	390,329	390	142,470		61,667	25,377	15,900	40

Notes:
1) Population in 2006 taken from Statistics Canada 2006 Census of Population. Predicted population based on Nunavut Bureau of Statistics Arviat predictions 2009-2036 (2010)
2) The projected sewage generation rate is based on the Nunavut water usage formula for municipalities that do not have piped water [RWU L/c/d x (1 + 0.00023 x population)] (MACA, 1988).
3) Residential Water Use rate estimated to be 90 L/c/d for municipalities where water is not distributed by a piping system. To fit the recorded water use data the RWU rate was lowered to 65 L/c/d.
4) A value of 5% dry solids is assumed for the liquid sludge accumulating at the bottom of the lagoon.
5) Actual volume of sewage generated assumed to be same as recorded water usage.

Calculation Worksheets

Climate Information

Annual Rainfall (m/year)	0.2972
Evapotranspiration (m/year)	0.200

*Canadian Climate Normals 1971-2000, Environment Canada, Rankin Inlet Airport Weather Station

* Specific evapotranspiration values for Arviat were not available, estimated using several references.

Arviat Sewage Lagoon

Surface Area of Lagoon (m^2)	18,980
Average usable depth of Lagoon (m)	3
Useable Volume of Lagoon (m^3)	43118.4
Rain (m^3/year)	5,641
Evapotranspiration (m^3/year)	3,796
Net Precipitation Input to Sewage Lagoon (m^3/year)	1,845

Runoff was not considered since the berms of the lagoon are raised and no runoff should enter lagoon.

Wetland Treatment Area

Surface Area of WTA (m^2)	72890
Depth to Permafrost (m)	1.2
Volume of Subsurface in WTA (m^3)	87469
Water Saturated Layer (m)	0.8
Volume of Groundwater in WTA (m^3)	58312

Rain (m^3/year)	21663
Evapotranspiration (m^3/year)	14578
Net Precipitation Input to WTA (m^3/year)	7085

Calculation Worksheets

Groundwater Velocity Calculations

ARV 4-1	D_{10} =	0.32	mm

* D_{10} taken from Grain Size Distribution Plot

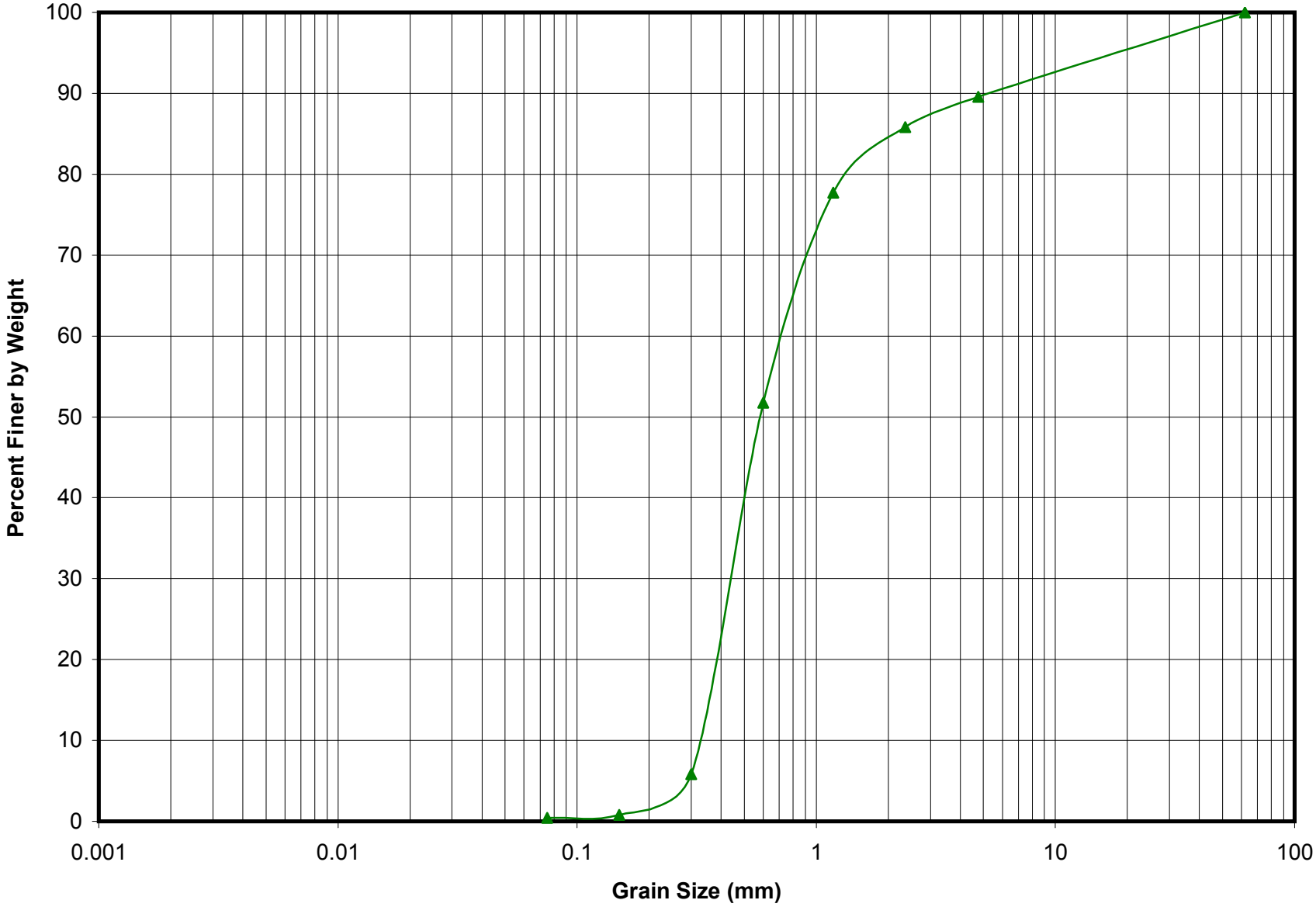
Hazen Approximation **$K = C \times D_{10}^2$**

Constant (cm/s)	C =	100	cm/sec^{-1}
Effective Grain Size (cm)	D_{10} =	0.0032	cm
Hydraulic Conductivity (cm/s)	K =	1.02E-03	cm/sec
		1.02E-05	m/sec

Darcy's Law **Q = - KiA**

Length of Wetland	dl =	280	m
Change in Elevation	dh =	11.5	m
Slope of Land	i = dh/dl =	0.04	
Thickness of Active Zone	A =	0.8	m
Specific Discharge	Q =	-3.36E-07	m/s
Groundwater Velocity	v =	4.21E-07	m/sec
		3.63E-02	m/day
Days when Ground is Thawed (May to Oct)	t =	150	days
Distance Contamination Moves in GW per Year	d =	5.45	m/year

Grain Size Distribution Plot - Soil Sample at ARV-4-1



Alberta Department of the Environment Wetland Treatment Predictive Model

$$\text{Required Area (ha)} = \frac{0.0365Q}{k} * \ln((Ci - C^*) / (Ce - C^*))$$

Sample 1

Design Flow (m^3/day) **Q= 790**

	TSS	BOD	FC
Influent Concentration (Ci)	104.0	98.0	1.31E+04
Target Effluent Quality (Ce)	100.00	80.00	10000
Wetland Background Input (C*)	14.35	8.69	100.00
Area Rate Constant at 5°C (k)	250.00	8.50	19.25
Required Wetland Area (ha)	**0.01**	**0.76**	**0.41**

Maxium calculated area from above (A_{max}) 0.76 ha

Sample 2

Design Flow (m^3/day) **Q= 790**

	TSS	BOD	FC
Influent Concentration (Ci)	55.0	94.5	192000
Target Effluent Quality (Ce)	100	80	10000
Wetland Background Input (C*)	11.27	8.51	100.00
Area Rate Constant at 5°C (k)	250.00	8.50	19.25
Required Wetland Area (ha)	**-0.08**	**0.63**	**4.44**

Maxium calculated area from above (A_{max}) 4.44 ha

Data Used:
Design flow based on estimated average daily discharge from lagoon in 2010.
Sample 1 influent concentrations based on Sept 2010 sample data.
Sample 2 influent concentrations based on Aug 2008 sample data.
Target Effluent Quality based on guidelines provided in Nunavut Water Board license .

Reference:

"Guidelines for the Approval and Design of Natural and Constructed Treatment Wetlands for Water Quality Improvement", Alberta Department of the Environment, Program Development Branch, Environmental Services Division, March 2000.

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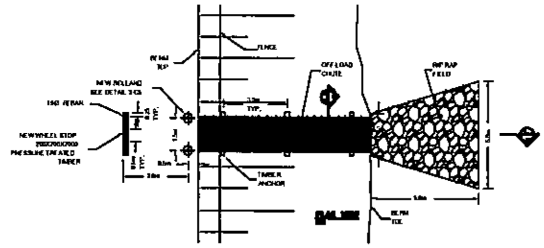
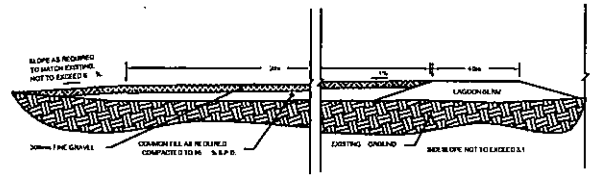
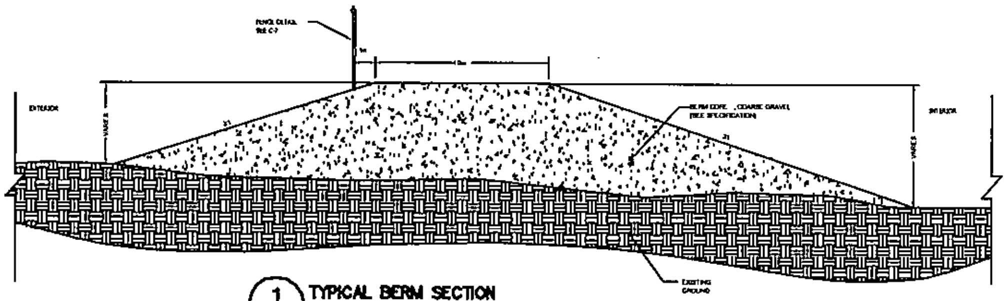
Appendix D
Design Concept and As-Built Drawings



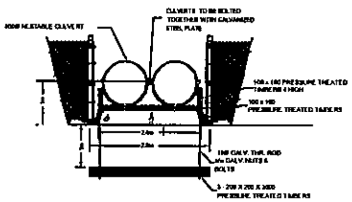
3 / EN2 OFFLOAD CHUTE



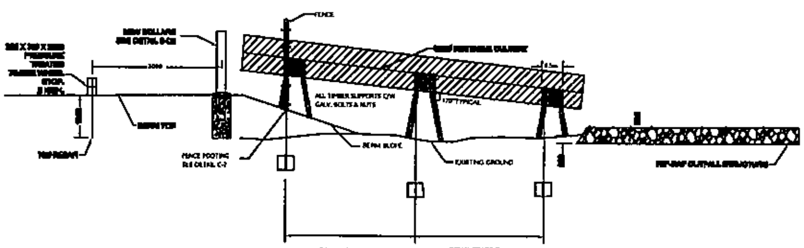
2 / EN2 TYPICAL TURNAROUND SECTION
N.T.S.



1 / EN2 TYPICAL BERM SECTION
1:50



OFF LOAD CHUTE SECTION



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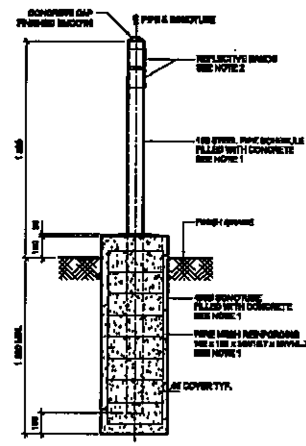


4 / EN2 BOLLARD DETAIL

NOTES

1. CONCRETE MUST HAVE 25 MPa COMPRESSIVE STRENGTH AFTER 28 DAYS
2. WIRE MESH MW18.7 X MW18.7
3. BOLLARDS MUST BE PAINTED RED WITH REFLECTIVE BANDS

FSC ARCHITECTS & ENGINEERS

Nunavut

ARVIAT SEWAGE LAGOON

ARVIAT, NU

DETAILS

AS SHOWN

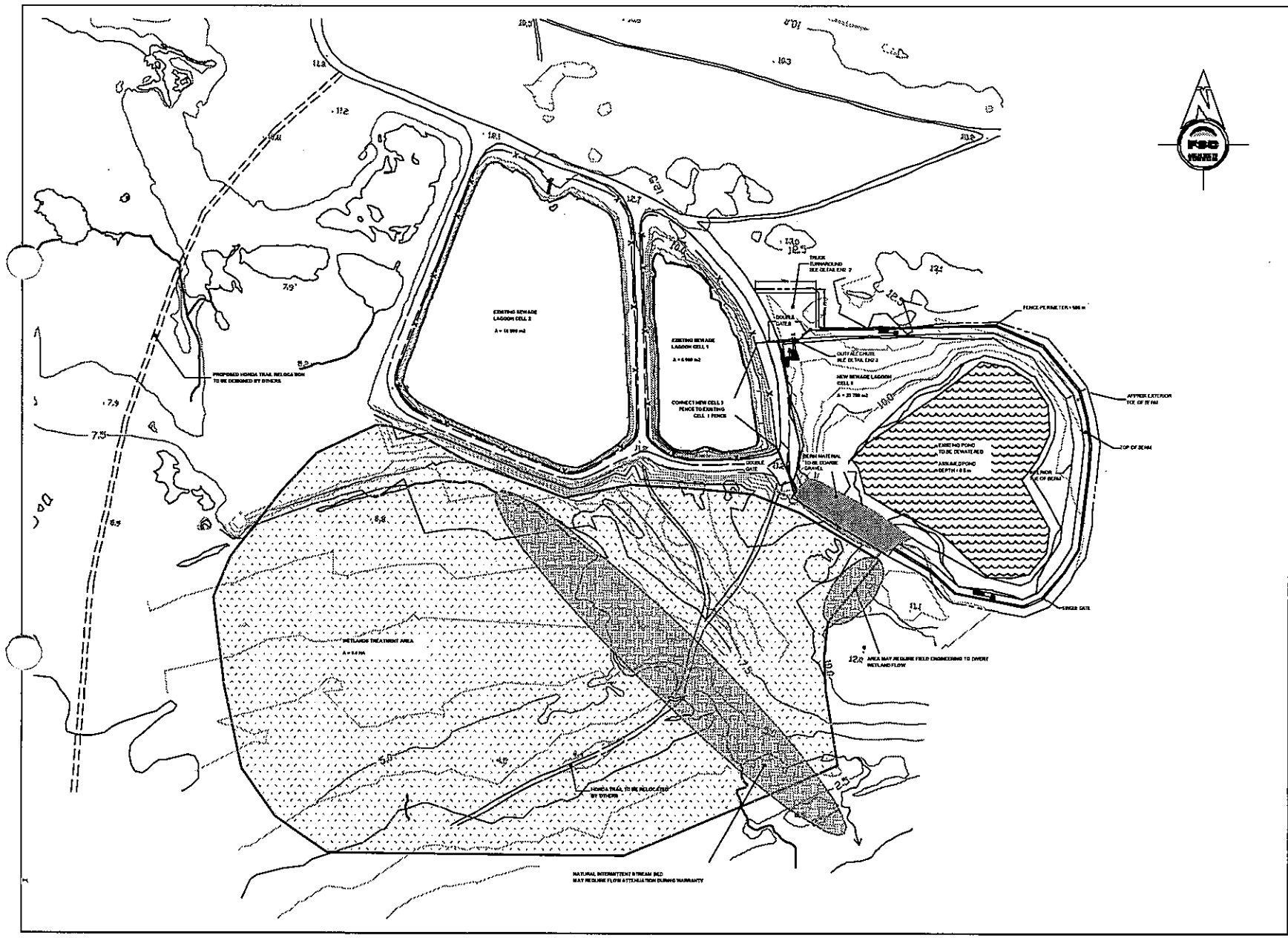
JULY 7, 2003

03-0140-C5.DWG

2003-0140

2 - 3

EN-2



FSC
ARCHITECTS &ENGINEERS

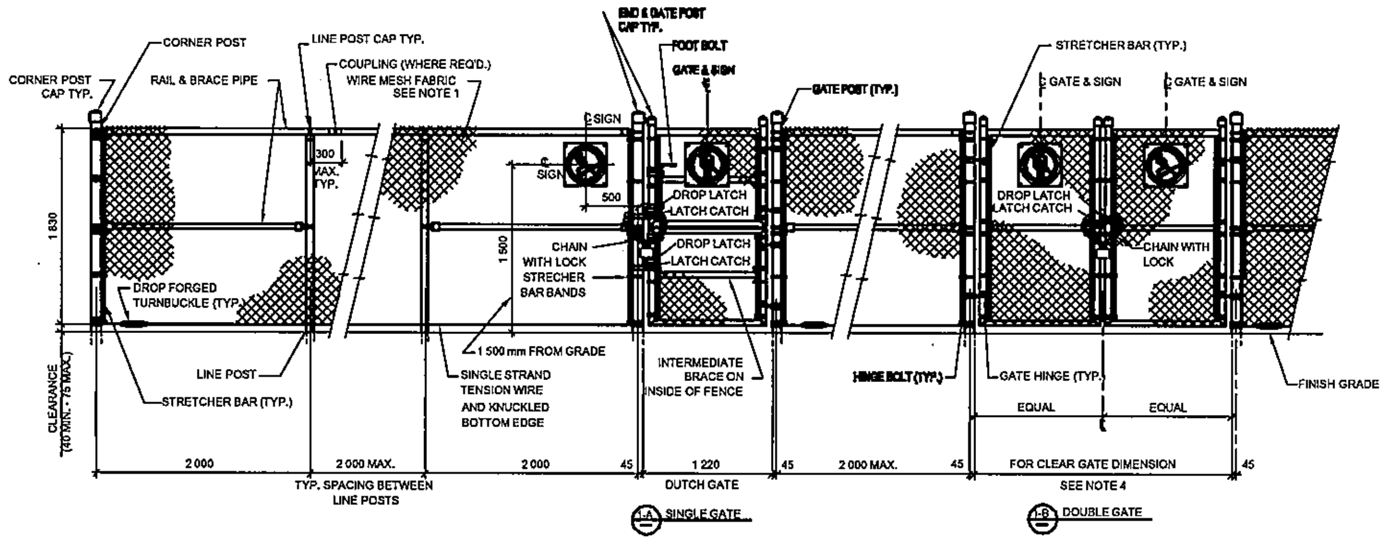
Nunavut

ARVIAT SEWAGE LAGOON

ARVIAT, NU

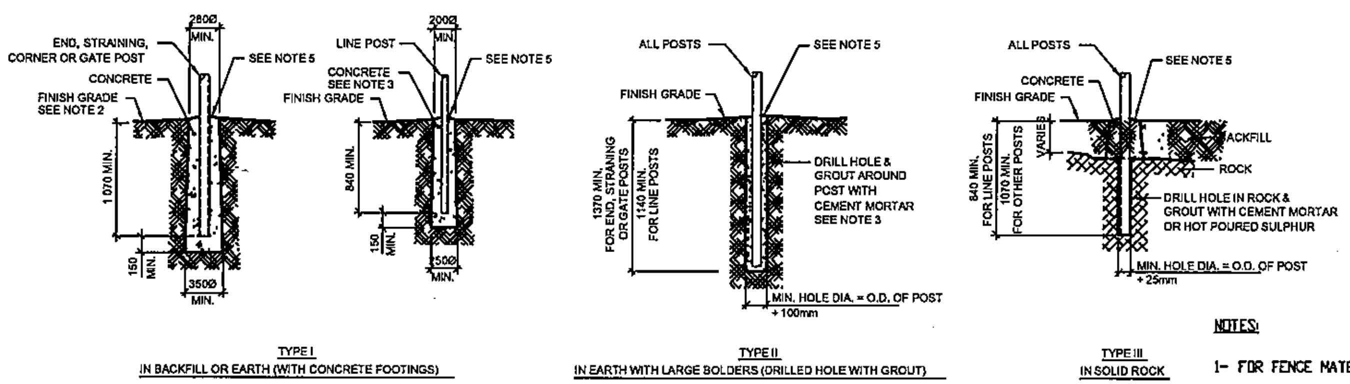
SITE LAYOUT

20/08	1:500
BD	JULY 7, 2023
PK	
05-0446-03.000	3003-040
1 = 3	EN1



1-A SINGLE GATE

1-B DOUBLE GATE



TYPE I
IN BACKFILL OR EARTH (WITH CONCRETE FOOTINGS)

TYPE II
IN EARTH WITH LARGE BOLDERS (DRILLED HOLE WITH GROUT)

TYPE III
IN SOLID ROCK

1-C FOOTING SECTIONS

NOTES:

1- FOR FENCE MATERIAL SEE SPECIFICATIONS.

2- FOR BACKFILL MATERIALS & SOIL CLASSIFICATION SEE SPECIFICATIONS.

3- FOR CONCRETE MATERIAL SEE SPECIFICATIONS.

4- FOR TYPE AND DIMENSION OF GATE REFER TO PARTICULAR PROJECT DRAWINGS.

5- TOP OF FOOTING DOMED 20 mm HIGH (TO SHED AWAY SURFACE WATER) (TYP.)

6- FENCE POSTS AND FENCING TO BE PLUMB AND STRAIGHT

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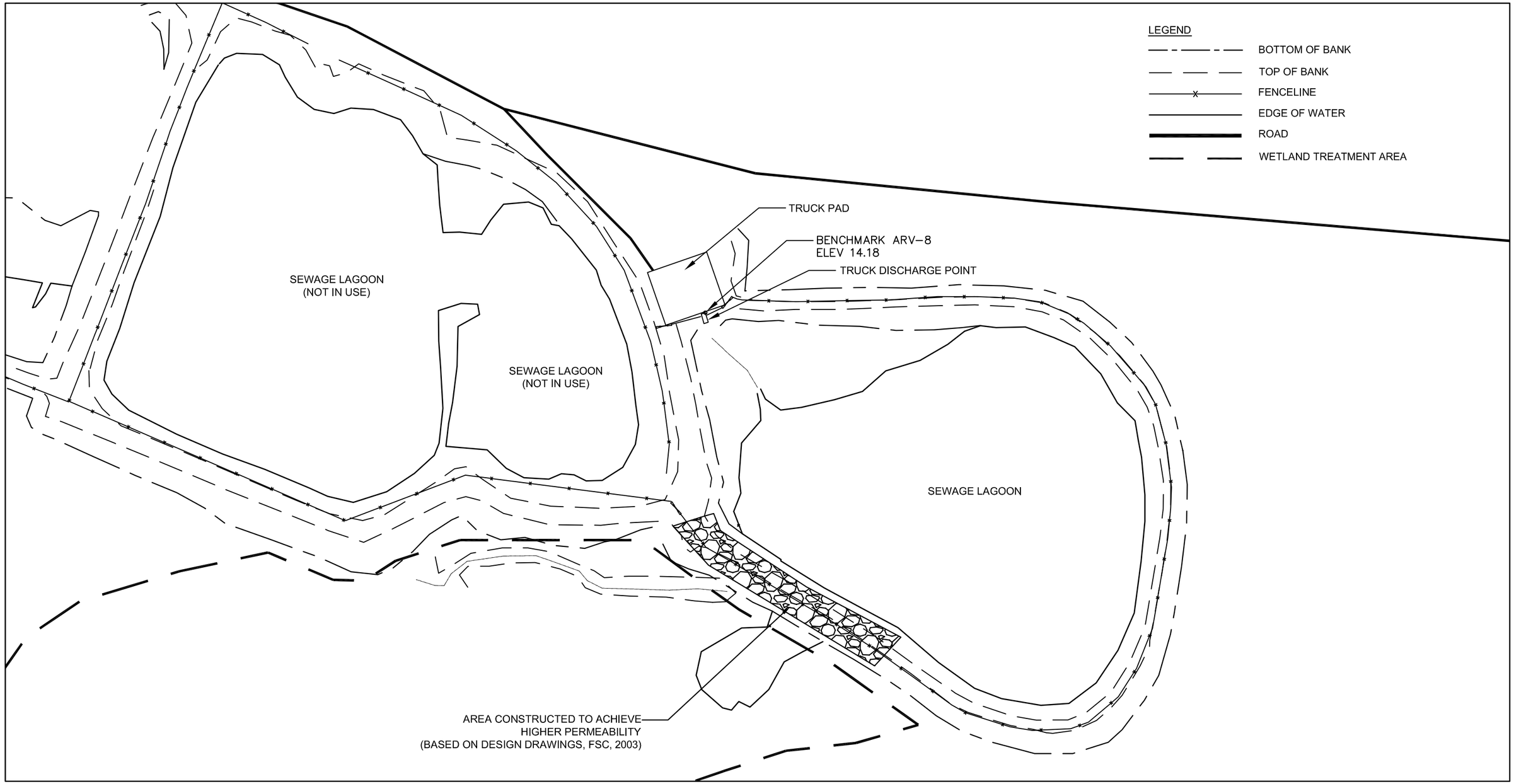
Nunavut

ARVIAT SEWAGE LAGOON

ARVIAT, NU

FENCE DETAIL

RK	NTS
SD	JULY 7, 2003
RK	
03-8140-03.DWG	2003-8140
3 of 3	EN-8



1. This drawing is th exclusive property of Nuna Burnside Engineering and Environmental Ltd. and the reproduction of any part without prior written consent of this office is strictly prohibited.
2. Drawing has been completed based on field observations by Nuna Burnside, and Design drawings completed by FSC Architects and Engineers in 2003. There is no information that can confirm the characteristics of the hidden interior of the berms.
3. This drawing is to be read and understood in conjunction with all other plans and documents applicable to this project.
4. Do not scale the drawings.

No.	Issue / Revision	Date
1	Client Review and Approval	Dec, 2010

Client
HAMLET OF ARVIAT

HAMLET OF ARVIAT, NUNAVUT

Drawing/Project Title
SEWAGE LAGOON DETAIL
RECORD OF CONSTRUCTION

NUNA BURNSIDE

Rev 0

Drawn	Checked	Designed	Checked
CD	SC	SC	GP

Scale 1:1,500

Project No. N–0157460

Drawing No. D-1

N–015746 SDFR 2010 PLAN DETAILS.dwg
Date Plotted: Dec 22, 2010–1:00pm

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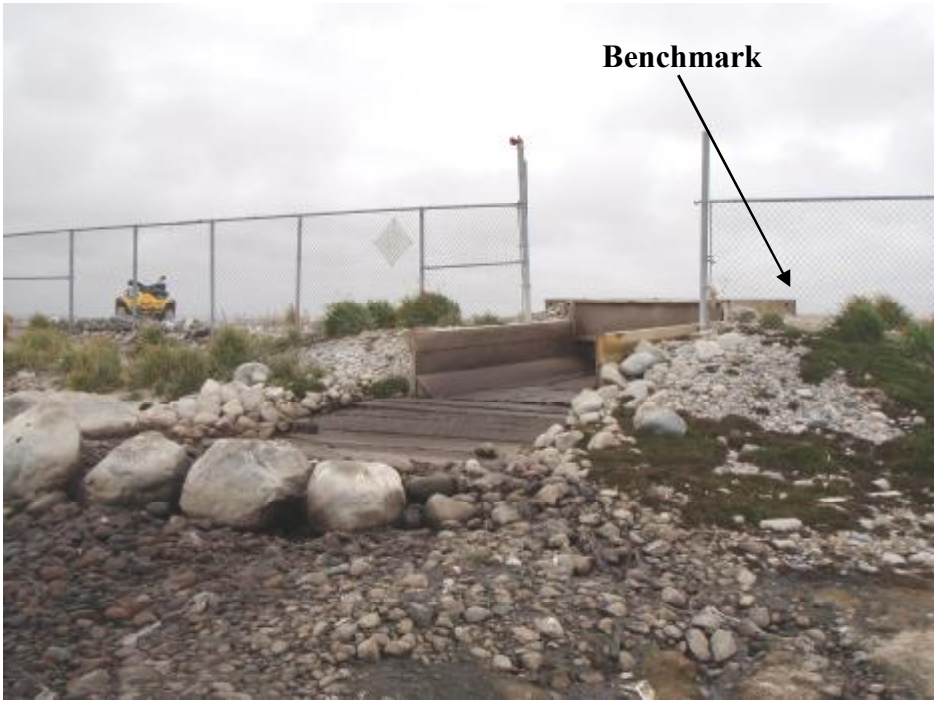
Appendix E
Photographs

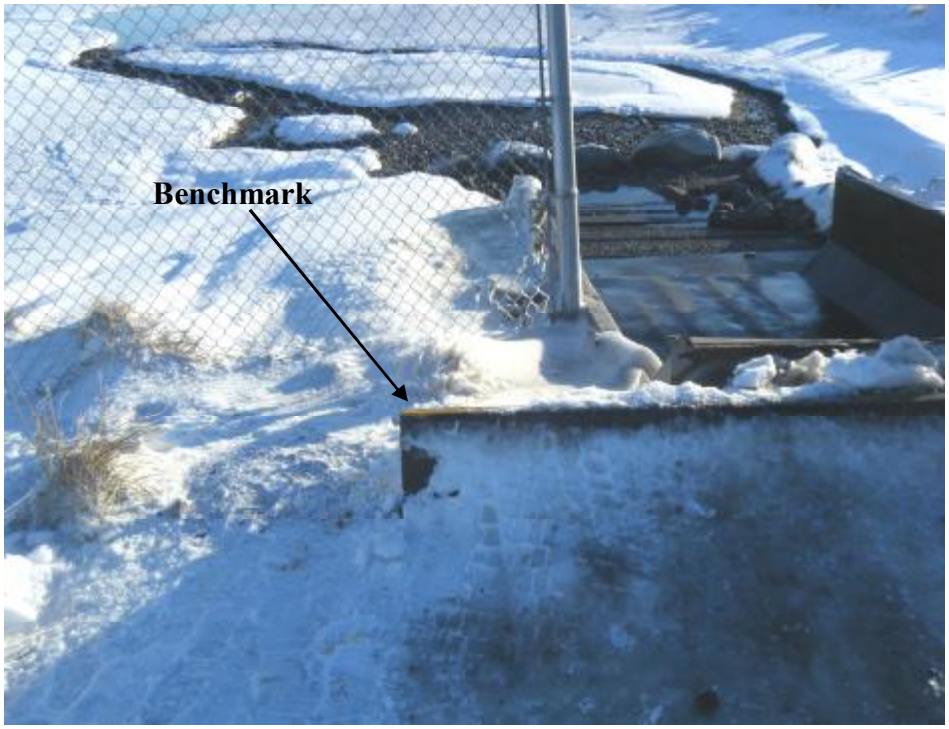
Sewage Lagoon as constructed before commissioning.
Date: 10/14/2004


Current condition of Sewage Lagoon.
Date: 9/10/2010

Raw sewage being dumped at truck off load point.
Date: 9/10/2010



Monitoring Station ARV-8 Date: 9/10/2010
Benchmark used to survey water level in Sewage Disposal.
Facility Lagoon



Monitoring Station ARV-8 Date: 11/02/2010
Benchmark used to survey water level in Sewage Disposal.
Facility Lagoon

Surveying benchmark point at truck discharge.
Date: 11/02/2010

Sewage Disposal Facility – Sewage lagoon Date: 9/10/2010
Looking north at spillway into Sewage Lagoon.

Sewage Lagoon Berm Date: 9/10/2010
Western berm of lagoon, looking south.

Sewage Lagoon Berm Date: 9/10/2010
Southeast trending berm of lagoon, looking southeast.

Sewage Lagoon Berm Date: 9/10/2010
Southern point of lagoon, looking east.

Sewage Lagoon Berm Date: 9/10/2010
Eastern berm of lagoon, looking north.

Sewage Lagoon Berm Date: 9/10/2010
Looking west towards truck discharge point.

Sewage Lagoon Berm Date: 9/7/2010
West side of berm looking north towards Hudson Bay.

Monitoring Station ARV-4 Date: 9/10/2010
Sampling location for effluent from the discharge point of the Sewage Lagoon.

Wetland Treatment Area Date: 9/10/2010
Sampling location SL-WET-3.

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Appendix F
Sampling Results

Table F-1 Summary of Water Quality Analysis
Sewage Lagoon and Wetland

Parameter	Unit	CCME Standards (Fresh water)	NWB Effluent Quality Limits (ARV-4)	7 23 2010 ARV-4	9 1 2010 ARV-4	9 10 2010 SL-1	9 10 2010 ARV-4
Colour	TCU			266	-	208	-
Electrical Conductivity	S/cm			827	1130	737	1020
pH	N/A		6 - 9	7.68	7.43	7.9	8.12
Turbidity	NTU			38	-	23	-
Total Suspended Solids	mg/L		100	**104**	91.1	**156**	**169**
Alkalinity (as CaCO3)	mg/L			305	-	253	-
Bicarbonate (as CaCO3)	mg/L			305	-	253	-
Total Hardness (as CaCO3)	mg/L			41	-	30	-
Ammonia as N	mg/L			72.1	47.9	49.7	28.2
Nitrate as N	mg/L			<0.05	<0.25	<0.05	1.23
Nitrite as N	mg/L			<0.05	<0.25	<0.05	0.284
Calcium	mg/L			8.57	14.3	7.1	22.7
Chloride	mg/L			71.2	-	55.8	-
Fluoride	mg/L			<0.05	-	0.42	-
Magnesium	mg/L			4.83	9.17	2.96	14.4
Orthophosphate as P	mg/L			6.89	-	<0.1	-
Potassium	mg/L			19.7	23.3	17.9	24.7
Reactive Silica	mg/L			11.2	-	14.7	-
Sodium	mg/L			61.3	98.4	54.3	116
Sulphate	mg/L			0.98	9.3	11.1	6.99
Total Dissolved Solids	mg/L			322	-	298	-
Total Organic Carbon	mg/L			157	-	113	-
Total Phosphorus	mg/L			6.63	6.53	7.23	5.81
BOD (5)	mg/L		80	**98**	40	**420**	65
Fecal Coliforms	CFU/100ml		10000	**13100**	-	-	-
	MPN/100ml			**-**	110000	15000	2100
Escherichia coli	CFU/100ml			17700	-	-	-
	MPN/100ml			-	-	-	-
Aluminum	mg/L	0.1		**1.9**	**0.366**	**0.256**	**0.325**
Arsenic	mg/L	0.005		**0.02**	**0.0128**	<0.003	**0.0107**
Barium	mg/L			0.723	0.0424	0.006	0.0349
Boron	mg/L			0.223	0.22	0.162	0.254
Cadmium	mg/L	0.00054-0.00004[1]		<0.002	0.000138	<0.002	<0.00010
Chromium Total	mg/L			0.015	0.0012	<0.003	0.0018
Chromium VI	mg/L	0.001		<0.005	-	-	-
Cobalt	mg/L			-	0.0025	-	0.00229
Copper	mg/L	0.002-0.004[1]		**0.246**	**0.0547**	0.067	0.0394
Iron	mg/L	0.30		**56.4**	**8.09**	**0.455**	**5.9**
Lead	mg/L	0.001-0.007[1]		**0.057**	0.00202	<0.002	0.00152
Manganese	mg/L			1.65	0.428	0.047	0.349
Mercury	mg/L	0.000026		<0.0001	<0.00005	<0.0001	<0.000050
Molybdenum	mg/L	0.073		<0.002	0.0021	<0.002	0.0008
Nickel	mg/L	0.025-0.15[1]		0.018	0.0078	0.004	0.0088
Selenium	mg/L	0.001		<0.004	<0.001	<0.004	<0.0010
Silver	mg/L	0.0001		<0.002	**0.00035**	<0.002	**0.00025**
Strontium	mg/L			0.561	0.128	0.022	0.323
Thallium	mg/L	0.0008		<0.006	<0.0001	<0.006	<0.00010
Titanium	mg/L			0.016	0.0205	0.005	0.0196
Uranium	mg/L			<0.002	0.00041	<0.002	0.00044
Vanadium	mg/L			0.02	0.00707	<0.002	0.0047
inc	mg/L	0.03		**0.226**	**0.0462**	**0.06**	0.0241
Phenols	mg/L	0.004		**0.187**	**0.075**	**-**	<0.01
Total Oil and Grease	mg/L		No visible sheen	21	6.7	-	1.3

BOLD - indicates exceedence of CCME standards

BOLD and shaded- indicates exceedence of NWB licence requirements

CCME - Canadian Water Quality Guidelines for the Protection of Aquatic Life, Updated 2007

[1] Value depends on water hardness, see CCME Guidelines

For reporting detection limits refer to Certificates of Analysis

Table F-1 Summary of Water Quality Analysis
Sewage Lagoon and Wetland

Parameter	Unit	CCME Standards (Fresh water)	NWB Effluent Quality Limits (ARV-4)	9 9 2010 SL-WET-4	9 9 2010 SL-WET-1	9 9 2010 SL-WET-2	9 9 2010 SL-WET-3	11 2 2010 ARV-4
Colour	TCU			209	107	100	131	-
Electrical Conductivity	S/cm			1030	793	1020	957	2510
pH	N/A		6 - 9	8.18	7.89	7.82	7.84	7.92
Turbidity	NTU			20	3.1	4.1	5.2	-
Total Suspended Solids	mg/L		100	78	44	<10	<10	**368**
Alkalinity (as CaCO3)	mg/L			306	193	186	200	-
Bicarbonate (as CaCO3)	mg/L			306	193	186	200	-
Total Hardness (as CaCO3)	mg/L			70	75	118	134	-
Ammonia as N	mg/L			71.9	36.5	25.7	18.3	-
Nitrate as N	mg/L			0.4	1	0.3	0.39	-
Nitrite as N	mg/L			-	-	-	-	-
Calcium	mg/L			12	15.9	20.9	24.4	-
Chloride	mg/L			140	120	204	186	-
Fluoride	mg/L			0.5	<0.05	<0.05	<0.05	-
Magnesium	mg/L			9.76	8.66	15.9	17.7	-
Orthophosphate as P	mg/L			2.33	1.53	1.71	0.55	-
Potassium	mg/L			21.7	15.6	14.8	14.7	-
Reactive Silica	mg/L			14.2	12.3	11.4	8.67	-
Sodium	mg/L			94.2	75.5	111	110	-
Sulphate	mg/L			11.5	18.4	37.3	26.6	-
Total Dissolved Solids	mg/L			436	368	496	484	-
Total Organic Carbon	mg/L			61.4	28.3	21	22.7	-
Total Phosphorus	mg/L			4.54	0.98	1.56	1.45	-
BOD (5)	mg/L		80	20	9.0	21.2	5.6	30
Fecal Coliforms	CFU/100ml		10000	-	-	-	-	5
	MPN/100ml			9300	15	4	9	-
Escherichia coli	CFU/100ml			-	-	-	-	14
	MPN/100ml			4300	15	4	9	-
Aluminum	mg/L	0.1		**0.143**	0.059	0.033	0.054	-
Arsenic	mg/L	0.005		**0.011**	**0.007**	0.005	**0.006**	-
Barium	mg/L			0.015	0.006	0.007	0.009	-
Boron	mg/L			0.23	0.179	0.176	0.162	-
Cadmium	mg/L	0.00054-0.00004[1]		<0.002	<0.002	<0.002	<0.002	-
Chromium Total	mg/L			0.007	0.008	0.006	0.005	-
Chromium VI	mg/L	0.001		-	-	-	-	-
Cobalt	mg/L			-	-	-	-	-
Copper	mg/L	0.002-0.004[1]		0.007	0.012	0.006	0.005	-
Iron	mg/L	0.30		**2.55**	**0.503**	**1.41**	**1.28**	-
Lead	mg/L	0.001-0.007[1]		<0.002	<0.002	<0.002	<0.002	-
Manganese	mg/L			0.274	0.226	0.412	0.461	-
Mercury	mg/L	0.000026		<0.0001	<0.0001	<0.0001	<0.0001	-
Molybdenum	mg/L	0.073		<0.002	<0.002	<0.002	<0.002	-
Nickel	mg/L	0.025-0.15[1]		0.006	0.004	0.003	0.005	-
Selenium	mg/L	0.001		<0.004	<0.004	<0.004	<0.004	-
Silver	mg/L	0.0001		<0.002	<0.002	<0.002	<0.002	-
Strontium	mg/L			0.111	0.142	0.237	0.214	-
Thallium	mg/L	0.0008		<0.006	<0.006	<0.006	<0.006	-
Titanium	mg/L			0.005	0.003	0.002	0.003	-
Uranium	mg/L			<0.002	<0.002	<0.002	<0.002	-
Vanadium	mg/L			0.006	0.004	0.003	0.003	-
inc	mg/L	0.03		0.022	0.007	<0.005	<0.005	-
Phenols	mg/L	0.004		-	-	-	-	-
Total Oil and Grease	mg/L		No visible sheen	-	-	-	-	-

BOLD - indicates exceedence of CCME standards
BOLD and shaded- indicates exceedence of NWB licence requirements
CCME - Canadian Water Quality Guidelines for the Protection of Aquatic Life, Updated 2007
[1] Value depends on water hardness, see CCME Guidelines
For reporting detection limits refer to Certificates of Analysis

Table F-2 Summary of Analysis
Sewage Lagoon Sludge

Parameter	Unit	Reported Detection Limits	Guidelines			Active Lagoon
			CCME Class A Compost	CCME Class B Compost	CCME Industrial	9 10 2010
Antimony	g/g	0.8				2.10
Arsenic	g/g	1	1300	7500	12	1.00
Barium	g/g	2			2000	56
Beryllium	g/g	0.5				<0.5
Boron	g/g	5				<5
Boron (Hot Water Extractable)	g/g	0.1				0.88
Cadmium	g/g	0.5	21000		22	<0.5
Chromium	g/g	2			87	14.00
Cobalt	g/g	0.5	3400	15000		2.60
Copper	g/g	1	40000	-	91	**171**
Lead	g/g	1	15000	50000	600	9.00
Molybdenum	g/g	0.5	500	2000		1.20
Nickel	g/g	1	6200	18000	50	9.00
Selenium	g/g	0.4	200	1400	2.9	**3.0**
Silver	g/g	0.2				2.70
Thallium	g/g	0.4			1	<0.4
Uranium	ug/g	0.5			300	0.90
Vanadium	g/g	1			130	13
inc	g/g	5	70000	185000	360	242
Chromium, Hexavalent	g/g	0.2			1.4	<0.2
Cyanide, Free	g/g	0.05			8	<0.05
Mercury	g/g	0.01	80	500	50	0.31
Electrical Conductivity (2:1)	mS/cm	0.002				0.79
Sodium Adsorption Ratio (2:1)	N/A	N/A				2.38
pH, 2:1 CaCl2 Extraction	pH Units					5.51
Chloride (2:1)	g/g	2				94
Nitrate + Nitrite	g/g	1				<1

Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health - Industrial Land Use, Subsurface, Fine Grained
Guidelines for Compost Quality, CCME 2005

Arviat Wetland Treatment Area Sampling Data - 2008
Baseline Sampling

Baseline Samples	Date of Collection	Total Coliforms (cfu 100mls)	E.coli (cfu 100mls)	COD (mg L)	Nitrite (mg L as NO2-N)	Nitrate (mg L as N03-N)	Ammonia (mg L as NH3-N)	T N (mg L as N)
1	29-Jun-08	4520000	60000	411	0.13	0.1	58.2	
2	29-Jun-08	1300000	60000	328	0.082	0.5	57.2	
3	29-Jun-08	32	<12	148	<0.015	0.2	<0.4	
1	7-Jul-08	8680000	160000	383	0.06	<0.1	59.4	
2	7-Jul-08	634000	56000	334	0.05	0.7	58.6	
3	7-Jul-08	4	<4	154	0.018	1.6	4.2	
1	14-Jul-08	5960000	60000	326	0.12	1.2	57	
2	14-Jul-08	1480000	56000	278	0.074	0.2	53.6	
3	14-Jul-08	>2424	69	124	0.072	0.5	4.2	
1	21-Jul-08	13880000	260000	335	0.05	<0.1	56	47.44
2	21-Jul-08	678000	38000	305	0.042	0.3	58.4	51.06
3	21-Jul-08	>4848	1020	157	0.026	0.2	11.7	8.995
1	28-Jul-08	15880000	320000	276	0.046	<0.1	53.2	61.64
2	28-Jul-08	364000	10000	222	0.072	1.5	56.4	48.62
3	28-Jul-08	4152	1612	42.7	0.06	0.6	11.2	11.075
1	5-Aug-08	5100000	220000	287	0.052	0.8	56.4	29.44
2	5-Aug-08	158000	10000	175	0.026	0.4	65	17.34
3	5-Aug-08	>9696	44	53.4	0.092	1.6	9.4	2.585
1	11-Aug-08	>48480000	660000	278	0.04	1.4	58.6	67.8
2	11-Aug-08	192000	22000	174	0.094	0.1	65.8	54.04
3	11-Aug-08	24240	4510	66.2	0.101	0.9	8	2.93
1	18-Aug-08	10300000	150000	171.8	0.046	<0.1	52.2	37.64
2	18-Aug-08	240000	13000	254	0.034	3	209.4	60.82
3	18-Aug-08	500	60	171	0.028	3.6	40.4	22.24
1	2-Sep-08	250000	<150000	140	0.069	0.2	51.2	50.48
2	2-Sep-08	1616000	18667	186	0.022	2.4	54.3	54.92
3	2-Sep-08	4690	2190	61.4	0.045	0.4	11.5	5.675
1	10-Sep-08	800000	<150000	256	0.02		49.4	33.96
2	10-Sep-08	195000	15000	156	0.022		65.4	49.82
3	10-Sep-08	280	130	54.7	0.037		17.1	14.545

Source: Sir Sanford Fleming College and University of Waterloo, International Polar Year Research

Arviat Wetland Treatment Area Sampling Data - 2008
Baseline Sampling

Baseline Samples	Date of Collection	Phosphate (mg L as PO4)	Total Phosphorus (mg L as P04)	Total Phosphorus (mg L as P)	CBOD5 (mg L)	DO (mg L)	TSS (mg 100ml)	TSS (mg 1 L)
1	29-Jun-08	18.8	23.90	7.80	291.39	0.25	9.1	91
2	29-Jun-08	22.2	30.50	9.95	193.39	2.98	6	60
3	29-Jun-08	0.32	3.50	1.14	23.78	11.84	2.6	26
1	7-Jul-08	19.7	24.70	8.06	96.4	0.79	37.7	377
2	7-Jul-08	20	23.20	7.57	104	1.27	3	30
3	7-Jul-08	0.54	11.00	3.59	24.03	8.65	7.4	74
1	14-Jul-08	19.8	22.50	7.34	115.68	0.65	3.8	38
2	14-Jul-08	17.7	20.40	6.66	163.14	0.75	4.67	46.7
3	14-Jul-08	3.56	4.43	1.45	14.51	9.33	0.6	6
1	21-Jul-08	20.6	25.8	8.42	144.85	1.07	7	70
2	21-Jul-08	18.9	22.6	7.37	164.79	3.87	5.2	52
3	21-Jul-08	4.6	6.9	2.25	16.35	10.23	1	10
1	28-Jul-08	18.8	37	12.07	143.8	1.49	15.6	156
2	28-Jul-08	20.6	38	12.40	102.05	1.88	14.5	145
3	28-Jul-08	2.7	3.5	1.14	18.01	9.71	4.5	45
1	5-Aug-08	19.2	6	1.96	91.18	0.83	10.4	104
2	5-Aug-08	29.1	25	8.16	70.18	0.3	7.2	72
3	5-Aug-08	2.3	3	0.98	6.92	8.31	0	0
1	11-Aug-08	17.3	22.1	7.21	68.75	1.85	2.75	27.5
2	11-Aug-08	16.15	19.3	6.30	94.5	1.06	5.5	55
3	11-Aug-08	2.02	2.95	0.96	10.1	9.28	0.6	6
1	18-Aug-08	17.2	24	7.83	32.53		9	90
2	18-Aug-08	18.8	44.6	14.55	44.82	0.93	10	100
3	18-Aug-08	4.65	27.5	8.97	24.27	4.24	3.7	37
1	2-Sep-08	15.3	24	7.83	48.83	6.57		0
2	2-Sep-08	14.9	106.5	34.74	57	1.86		0
3	2-Sep-08	4.08	5.2	1.70	7.07	9.1		
1	10-Sep-08	15.7	24	7.83	29.7	5.3		
2	10-Sep-08	13.2	23	7.50	33.51	2.62		
3	10-Sep-08	4.08	4.85	1.58	10.69	9.71		

Source: Sir Sanford Fleming College and University of Waterloo, International Polar Year Research

Arviat Wetland Treatment Area Sampling Data - 2008
Baseline Sampling

Baseline Samples	Date of Collection	pH	Cond. (uS)	TDS calc (mg L)
1	29-Jun-08	7.63	843	556.38
2	29-Jun-08	7.45	864	570.24
3	29-Jun-08	9.49	908	599.28
1	7-Jul-08	7.72	851	561.66
2	7-Jul-08	7.57	953	628.98
3	7-Jul-08	7.39	946	624.36
1	14-Jul-08	7.71	870	574.2
2	14-Jul-08	7.63	982	648.12
3	14-Jul-08	7.5	811	535.26
1	21-Jul-08	7.66	904	596.64
2	21-Jul-08	7.41	1036	683.76
3	21-Jul-08	7.12	1125	742.5
1	28-Jul-08	7.67	877	578.82
2	28-Jul-08	7.36	1099	725.34
3	28-Jul-08	7.02	1549	1022.34
1	5-Aug-08	7.57	869	573.54
2	5-Aug-08	7.11	1254	827.64
3	5-Aug-08	6.96	1269	837.54
1	11-Aug-08	7.51	836	551.76
2	11-Aug-08	7.32	1159	764.94
3	11-Aug-08	7.02	1349	890.34
1	18-Aug-08	7.61	846	558.36
2	18-Aug-08	7.12	1296	855.36
3	18-Aug-08	6.63	1300	858
1	2-Sep-08	7.56	821	541.86
2	2-Sep-08	7.14	1381	911.46
3	2-Sep-08	6.8	1584	1045.44
1	10-Sep-08	7.47	828	546.48
2	10-Sep-08	7.09	1398	922.68
3	10-Sep-08	6.54	178.3	117.678

Source: Sir Sanford Fleming College and University of Waterloo, International Polar Year Research

Arviat Wetland Treatment Area Sampling Data - 2008
Intensive Sampling Data

Sample	Date of Collection	Total Coliforms (cfu 100mls)	E.coli (cfu 100mls)	COD (mg L)	Nitrite (mg L as NO2-N)	Nitrate (mg L as N03-N)	Ammonia (mg L as NH3-N)
A1a	22-Aug-08	>16160	4933	68	<0.015	0.139	0.46
1b	22-Aug-08	7827	107	54.8	0.044	0.19	2.76
1c	22-Aug-08	793	200	299	<0.015	0.22	0.54
2a	22-Aug-08	>24240	110	131.6	0.034	0.24	0.4
2b	22-Aug-08	>24240	900	68.8	0.038	0.18	1.66
2c	22-Aug-08	8580	1360	199	0.02	0.12	2.38
3a	22-Aug-08	5870	2550	91.4	<0.015	0.054	0.1
3b	22-Aug-08	>24240	>24240	178	0.026	0.23	2.42
3c	22-Aug-08	4180	110	102	0.032	0.11	0.46
4ab	22-Aug-08	9380	190	99.2	0.09	0.28	16.1
4a	22-Aug-08	1867	393	140	0.018	0.45	3.9
4b	22-Aug-08	1410	110	115	0.086	0.17	1.8
4c	22-Aug-08	1380	160	99	0.028	0.19	2.64
4d	22-Aug-08	1820	720	80	0.064	0.17	14.1
5a	22-Aug-08	1300	<60	98.4	0.058	0.23	17.5
5b	22-Aug-08	42900	400	121	0.026	0.11	4.54
5c	22-Aug-08	14467	2633	100	0.028	0.24	0.12
5d	22-Aug-08	>121200	>121200	125	0.034	0.23	4.64
base 3	22-Aug-08	11740	2400	44	0.13	0.17	<0.02
5e	22-Aug-08	440	100	95.2	0.014	0.36	16.3
6ab	22-Aug-08	>484800	<600	280	0.014	0.67	28.8
6ac	22-Aug-08	21700	250	96.9	0.072	1.73	3.36
6ad	22-Aug-08	46900	300	269	0.04	0.33	1.22
6a	22-Aug-08	1740	<60	98.5	0.05	0.32	16.8
6b	22-Aug-08	3133	367	137	0.03	0.32	6.64
6d	22-Aug-08	267	100	1019	0.018	0.2	0.32
6e	22-Aug-08	24700	18800	103	0.054	0.34	19.7
7ab	22-Aug-08	59000	<3000	273	0.096	0.2	39.9
7ac	22-Aug-08	4000	<1500	109	0.024	0.17	37
7a	22-Aug-08	600	<600	85.1	0.008	0.15	31.7
7b	22-Aug-08	45500	2750	192	0.06	0.2	26.1
7c	22-Aug-08	68000	21500	452	0.034	0.14	18.9
7d	22-Aug-08	6500	<1500	114	0.03	0.15	5.2
7e	22-Aug-08	7600	<1200	498	0.02	0.24	<0.02
7f	22-Aug-08	62667	2667	134	0.02	0.62	<0.02
8a	22-Aug-08	97333	<2000	116	0.03	0.71	0.44
8b	22-Aug-08	144667	<1000	101	0.054	1.14	13.6
9a	22-Aug-08	26000	<1500	228	0.448	0.88	13.4
base 2	22-Aug-08	166000	6000	219	0.032	0.49	73.6
base 1	22-Aug-08	>121200000	5100000	254	0.032	2.7	114.2
ref a	22-Aug-08	>16160	307	28.4	<0.015	0.48	0.08
ref b	22-Aug-08	615	40	31.8	<0.015	0.42	0.14

Source: Sir Sanford Fleming College and University of Waterloo, International Polar Year Research

Arviat Wetland Treatment Area Sampling Data - 2008
Intensive Sampling Data

Sample	Date of Collection	T N (mg L as N)	Phosphate (mg L as PO4)	Total Phosphorus (mg L as P04)	Total Phosphorus (mg L as P)	CBOD5 (mg L)	DO (mg L)	TSS (mg 100ml)
A1a	22-Aug-08	28.34	6.7	0.60	0.20		5.33	7.2500
1b	22-Aug-08		1.73	9.00	2.94	20.27	9.79	1.6000
1c	22-Aug-08		25.5	147.80	48.22		7.94	43.6667
2a	22-Aug-08		3.47	13.50	4.40	26.79	7.94	6.2000
2b	22-Aug-08	7.66	0.8	4.90	1.60		11.26	0.4000
2c	22-Aug-08		11.3	55.50	18.11		6.89	2.5455
3a	22-Aug-08		0.2	2.30	0.75	24.84	11.48	2.0000
3b	22-Aug-08	8.11	5.3	16.50	5.38		7.77	1.0000
3c	22-Aug-08		0.5	3.60	1.17	45.18	6.79	32.5000
4ab	22-Aug-08		5	2.40	0.78	34.44	10	0.4000
4a	22-Aug-08	8.64	9.1	7.90	2.58		6.64	58.6667
4b	22-Aug-08		9.6	7.90	2.58	52.98	7.19	2.8000
4c	22-Aug-08		5.6	6.20	2.02		5.07	2.2000
4d	22-Aug-08		<0.02	3.75	1.22	36.03	10.54	0.2857
5a	22-Aug-08		6.2	5.00	1.63	46.38	7.62	1.4545
5b	22-Aug-08	1.55	18.4	15.60	5.09		6.99	0.5455
5c	22-Aug-08		0.6	2.90	0.95		8.71	6.1818
5d	22-Aug-08		0.2	2.20	0.72	56.43	7.6	1.6667
base 3	22-Aug-08		0.9	3.00	0.98			1.3000
5e	22-Aug-08		2	3.40	1.11		6.65	1.5000
6ab	22-Aug-08		10.6	53.00	17.29		1.37	13.7143
6ac	22-Aug-08		4.1	6.40	2.09	79.82	5.49	2.0000
6ad	22-Aug-08	3.22	5.6	101.10	32.98		6.89	1.4545
6a	22-Aug-08		7.3	5.80	1.89		9.7	0.3000
6b	22-Aug-08		10	41.90	13.67	114.57	4.75	0.6000
6d	22-Aug-08	1.68	2.5	26.50	8.65		6.54	1.5556
6e	22-Aug-08		9.7	31.20	10.18	106.07	4.89	1.1000
7ab	22-Aug-08		10.3	71.60	23.36		1.26	2.7273
7ac	22-Aug-08		4.5	16.00	5.22	65.43	5.97	
7a	22-Aug-08	9.32	6.3	20.00	6.52		5.84	0.4000
7b	22-Aug-08		34.2	85.00	27.73	145.58	5.56	2.2000
7c	22-Aug-08		11.4	126.30	41.20		2.29	25.6667
7d	22-Aug-08		23.2	42.90	14.00		5.71	4.5000
7e	22-Aug-08		7.7	37.00	12.07	97.58	5.8	5.3333
7f	22-Aug-08	5.2	4.5	26.30	8.58		5.59	2.0000
8a	22-Aug-08		1.7	19.00	6.20		5.89	33.5000
8b	22-Aug-08		1.2	4.10	1.34	31.82	8.37	0.5000
9a	22-Aug-08	3.73	7	14.00	4.57		7.81	2.0000
base 2	22-Aug-08		11.6	20.90	6.82		1.14	4.2500
base 1	22-Aug-08		20.8	21.60	7.05		0.67	4.2857
ref a	22-Aug-08	0.58	<0.02	0.55	0.18	8.71	10.63	0.4000
ref b	22-Aug-08	0.62	<0.02	0.45	0.15	6.27	11.23	0.6000

Source: Sir Sanford Fleming College and University of Waterloo, International Polar Year Research

Arviat Wetland Treatment Area Sampling Data - 2008
Intensive Sampling Data

Sample	Date of Collection	TSS (mg 1 L)	ORP	pH	Cond. (uS)	TDS calc (mg L)
A1a	22-Aug-08	72.500	492.2	6.54	603	397.98
1b	22-Aug-08	16.000	471.7	6.79	677	446.82
1c	22-Aug-08	436.667	439.1	6.46	669	441.54
2a	22-Aug-08	62.000	409.3	5.99	626	413.16
2b	22-Aug-08	4.000	367.7	7.2	721	475.86
2c	22-Aug-08	25.455	336	6.72	864	570.24
3a	22-Aug-08	20.000	265.4	8.43	538	355.08
3b	22-Aug-08	10.000	296.8	6.64	999	659.34
3c	22-Aug-08	325.000	275	6.3	496	327.36
4ab	22-Aug-08	4.000	280.6	7.18	878	579.48
4a	22-Aug-08	586.667	302.5	6.48	795	524.7
4b	22-Aug-08	28.000	293.2	6.6	898	592.68
4c	22-Aug-08	22.000	270.6	6.6	1469	969.54
4d	22-Aug-08	2.857	279.4	6.93	1500	990
5a	22-Aug-08	14.545	263.2	7.05	727	479.82
5b	22-Aug-08	5.455	271.4	6.62	563	371.58
5c	22-Aug-08	61.818	317.2	6	324	213.84
5d	22-Aug-08	16.667	269.4	6.81	2016	1330.56
base 3	22-Aug-08	13.000	373.20	6.82	656	432.96
5e	22-Aug-08	15.000	247.40	6.58	2575	1699.5
6ab	22-Aug-08	137.143	186.20	6.97	685	452.1
6ac	22-Aug-08	20.000	257.10	6.17	836	551.76
6ad	22-Aug-08	14.545	256.60	6.38	691	456.06
6a	22-Aug-08	3.000	241.00	7.08	642	423.72
6b	22-Aug-08	6.000	234.70	6.54	503	331.98
6d	22-Aug-08	15.556	261.50	6.34	412	271.92
6e	22-Aug-08	11.000	206.90	6.9	654	431.64
7ab	22-Aug-08	27.273	94.10	7.02	697	460.02
7ac	22-Aug-08	0.000	185.70	7.27	717	473.22
7a	22-Aug-08	4.000	206.00	7.04	687	453.42
7b	22-Aug-08	22.000	200.80	6.88	735	485.1
7c	22-Aug-08	256.667	146.30	6.8	634	418.44
7d	22-Aug-08	45.000	200.00	6.51	577	380.82
7e	22-Aug-08	53.333	203.00	6.53	412	271.92
7f	22-Aug-08	20.000	222.00	6.31	233.9	154.374
8a	22-Aug-08	335.000	209.20	6.4	441	291.06
8b	22-Aug-08	5.000	200.10	6.95	572	377.52
9a	22-Aug-08	20.000	148.30	8.72	604	398.64
base 2	22-Aug-08	42.500	104.00	7.31	1029	679.14
base 1	22-Aug-08	42.857	76.00	7.69	805	531.3
ref a	22-Aug-08	4.000	194.10	7.31	361	238.26
ref b	22-Aug-08	6.000	188.20	8.08	422	278.52

Source: Sir Sanford Fleming College and University of Waterloo, International Polar Year Research

AGAT Laboratories

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MISSISSAUGA, ONTARIO
CANADA L4 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 10T421969

PROJECT NO: Arviat

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Jim Walls

Microbiological Analysis (water)

DATE SAMPLED: Jul 23, 2010 | DATE RECEIVED: Jul 24, 2010 | DATE REPORTED: Aug 04, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-4 1889491
Escherichia coli	CFU/1mL	1	1	17700
Total Coliforms	CFU/1mL	1	1	TNTC
Fecal Coliform	CFU/1mL	1	1	13100
Heterotrophic Plate Count	CFU/mL		10	TNTC

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to SDWA -Schedule 23

1889491 The bacteria counts refer to a 1 mL sample aliquot diluted to 100 mL prior to filtration and incubation. A larger aliquot resulted in an overgrown plates.

Certified By: Elizabeth Rolokowska

AGAT Laboratories

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CANADA L4 1Y2
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AGAT WORK ORDER: 10T421969
PROJECT NO: Arviat

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Jim Walls

Oil and Grease water

DATE SAMPLED: Jul 23, 2010 | DATE RECEIVED: Jul 24, 2010 | DATE REPORTED: Aug 04, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-2 1889489	ARV-4 1889491
Oil and Grease (animal/vegetable)	mg/L		0.5	5.2	19
Oil and Grease (mineral) in water	mg/L		0.5	<0.5	1.5
Oil and Grease (Total) in water	mg/L		0.5	5.2	21

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By: Jordy Takewaki

AGAT Laboratories

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CANADA L4 1Y2
TEL (905)712-5100
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AGAT WORK ORDER: 10T421969
PROJECT NO: Arviat

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Jim Walls

BURNSIDE - Water Quality Assessment + BOD, TSS, Phenols & Cr VI

DATE SAMPLED: Jul 23, 2010 | DATE RECEIVED: Jul 24, 2010 | DATE REPORTED: Aug 04, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-2 1889489	ARV-4 1889491
Aluminum	mg/L		0.004	0.020	1.90
Arsenic	mg/L		0.003	0.005	0.020
Barium	mg/L		0.002	0.050	0.723
Boron	mg/L		0.010	1.22	0.223
Cadmium	mg/L		0.002	<0.002	<0.002
Calcium	mg/L		0.05	248	8.57
Chromium	mg/L		0.003	0.013	0.015
Copper	mg/L		0.003	0.007	0.246
Iron	mg/L		0.010	0.936	56.4
Potassium	mg/L		0.05	44.7	19.7
Magnesium	mg/L		0.05	39.7	4.83
Mercury	mg/L		0.0001	<0.0001	<0.0001
Manganese	mg/L		0.002	0.983	1.65
Molybdenum	mg/L		0.002	<0.002	<0.002
Sodium	mg/L		0.05	178	61.3
Nickel	mg/L		0.003	0.004	0.018
Total Phosphorus	mg/L		0.05	0.64	6.63
Lead	mg/L		0.002	0.028	0.057
Selenium	mg/L		0.004	<0.004	<0.004
Silver	mg/L		0.002	<0.002	<0.002
Strontium	mg/L		0.005	1.68	0.561
Thallium	mg/L		0.006	<0.006	<0.006
Titanium	mg/L		0.002	0.010	0.016
Uranium	mg/L		0.002	<0.002	<0.002
Vanadium	mg/L		0.002	<0.002	0.020
inc	mg/L		0.005	0.077	0.226
Fluoride	mg/L		0.05	<0.05	<0.05
Chloride	mg/L		0.10	244	71.2
Nitrite as N	mg/L		0.05	<0.05	<0.05
Ortho phosphate as P	mg/L		0.10	0.33	6.89
Bromide	mg/L		0.05	1.87	<0.05
Nitrate as N	mg/L		0.05	<0.05	<0.05
Sulphate	mg/L		0.10	539	0.98

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MISSISSAUGA, ONTARIO
CANADA L4 1Y2
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AGAT WORK ORDER: 10T421969
PROJECT NO: Arviat

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Jim Walls

BURNSIDE - Water Quality Assessment + BOD, TSS, Phenols & Cr VI

DATE SAMPLED: Jul 23, 2010 | DATE RECEIVED: Jul 24, 2010 | DATE REPORTED: Aug 04, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-2 1889489	ARV-4 1889491
pH	pH Units		NA	8.07	7.68
Ammonia as N	mg/L		0.02	11.0	72.1
Total Organic Carbon	mg/L		0.5	52.0	157
Electrical Conductivity	uS/cm		2	2010	827
Total Dissolved Solids	mg/L		20	1570	322
Saturation pH				6.36	7.76
% Difference/ Ion Balance			0.1	3.0	5.9
Total Hardness (as CaCO3)	mg/L		10	783	41
Langlier Index				1.71	-0.08
Carbonate (as CaCO3)	mg/L		5	<5	<5
Bicarbonate (as CaCO3)	mg/L		5	440	305
Turbidity	NTU		0.5	8.1	38
Alkalinity (as CaCO3)	mg/L		5	440	305
Hydroxide (as CaCO3)	mg/L		5	<5	<5
Reactive Silica	mg/L		0.05	9.17	11.2
Colour	TCU		5	102	266
BOD (5)	mg/L		5	13	98
Total Suspended Solids	mg/L		10	14	104
Phenols	mg/L		0.001	0.005	0.187
Chromium VI	mg/L		0.005	<0.005	<0.005

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

AGAT Laboratories

Guideline Violation

AGAT WORK ORDER: 10T421969

PROJECT NO: Arviat

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ATTENTION TO: Jim Walls

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
1889491	ARV-4	SDWA -Schedule 23	Microbiological Analysis (water)	Escherichia coli	1	17700
1889491	ARV-4	SDWA -Schedule 23	Microbiological Analysis (water)	Fecal Coliform	1	13100

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

Certificate of Analysis

R.J. BURNSIDE

ATTN: STEPHANIE CHARITY / JIM WALLS

292 SPEEDVALE AVE., WEST
UNIT #7
GUELPH ON N1H 1C4

Report Date: 14-SEP-10 13:45 (MT)
Version: FINAL

Lab Work Order #: L927467 **Date Received:** 02-SEP-10

Project P.O. #: NOT SUBMITTED
Job Reference: N-015746
Legal Site Desc:
CofC Numbers:

Other Information:

Comments:

Paul Nicolas
Account Manager

Manitoba Technology Centre Ltd.
Part of the **ALS Laboratory Group**
1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4
Phone: +1 204 255 9720 Fax: +1 204 255 9721 www.alsglobal.com
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ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L927467-1 ARV-2 Sampled By: CLIENT on 01-SEP-10 @ 15:45 Matrix: WATER							
Physical Tests							
Conductivity	2520		0.40	umhos/cm		03-SEP-10	R1459503
pH	8.11		0.10	pH units		03-SEP-10	R1459503
Total Suspended Solids	<5.0		5.0	mg/L		08-SEP-10	R1461947
Anions and Nutrients							
Ammonia as N	12.9		0.050	mg/L		14-SEP-10	R1465344
Nitrate and Nitrite as N	<0.35		0.35	mg/L		07-SEP-10	
Nitrate-N	<0.25		0.25	mg/L		03-SEP-10	R1459992
Nitrite-N	<0.25		0.25	mg/L		03-SEP-10	R1459992
Sulfate	461		2.5	mg/L		03-SEP-10	R1459992
Bacteriological Tests							
Fecal Coliforms	430		3	MPN/100mL		06-SEP-10	R1459728
Total Metals							
Aluminum (Al)-Total	0.0219		0.0050	mg/L	07-SEP-10	07-SEP-10	R1460846
Antimony (Sb)-Total	0.00405		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Arsenic (As)-Total	0.00468		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Barium (Ba)-Total	0.0471		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Boron (B)-Total	1.49		0.010	mg/L	07-SEP-10	07-SEP-10	R1460846
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L	07-SEP-10	07-SEP-10	R1460846
Calcium (Ca)-Total	244		0.10	mg/L	07-SEP-10	07-SEP-10	R1460846
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	07-SEP-10	07-SEP-10	R1460846
Cobalt (Co)-Total	0.00051		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Copper (Cu)-Total	0.00129		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Iron (Fe)-Total	0.516		0.020	mg/L	07-SEP-10	07-SEP-10	R1460846
Lead (Pb)-Total	0.000153		0.000090	mg/L	07-SEP-10	07-SEP-10	R1460846
Lithium (Li)-Total	0.0363		0.0020	mg/L	07-SEP-10	07-SEP-10	R1460846
Magnesium (Mg)-Total	43.0		0.010	mg/L	07-SEP-10	07-SEP-10	R1460846
Manganese (Mn)-Total	0.663		0.00030	mg/L	07-SEP-10	07-SEP-10	R1460846
Mercury (Hg)-Total	<0.000050		0.000050	mg/L	03-SEP-10	03-SEP-10	R1459886
Molybdenum (Mo)-Total	0.00039		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Nickel (Ni)-Total	0.0024		0.0020	mg/L	07-SEP-10	07-SEP-10	R1460846
Phosphorus (P)-Total	0.62		0.20	mg/L	07-SEP-10	07-SEP-10	R1460846
Potassium (K)-Total	43.9		0.020	mg/L	07-SEP-10	07-SEP-10	R1460846
Rubidium (Rb)-Total	0.0411		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Selenium (Se)-Total	<0.0010		0.0010	mg/L	07-SEP-10	07-SEP-10	R1460846
Silicon (Si)-Total	5.34		0.050	mg/L	07-SEP-10	07-SEP-10	R1460846
Silver (Ag)-Total	<0.00010		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Sodium (Na)-Total	228		0.030	mg/L	07-SEP-10	07-SEP-10	R1460846
Strontium (Sr)-Total	1.53		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L927467-1 ARV-2 Sampled By: CLIENT on 01-SEP-10 @ 15:45 Matrix: WATER							
Total Metals							
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Thorium (Th)-Total	<0.00010		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Tin (Sn)-Total	<0.00020		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Titanium (Ti)-Total	0.00166		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Tungsten (W)-Total	<0.0010		0.0010	mg/L	07-SEP-10	07-SEP-10	R1460846
Uranium (U)-Total	0.00064		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Vanadium (V)-Total	0.00071		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Zinc (Zn)-Total	0.0203		0.0050	mg/L	07-SEP-10	07-SEP-10	R1460846
Zirconium (Zr)-Total	0.00047		0.00040	mg/L	07-SEP-10	07-SEP-10	R1460846
Aggregate Organics							
Biochemical Oxygen Demand	6.4		1.0	mg/L	03-SEP-10	08-SEP-10	R1460687
Total Oil and Grease	2.4	DLM	2.0	mg/L	10-SEP-10	10-SEP-10	R1459975
Phenols (4AAP)	<0.0010		0.0010	mg/L	08-SEP-10	08-SEP-10	R1461126
L927467-2 ARV-4 Sampled By: CLIENT on 01-SEP-10 @ 15:45 Matrix: WATER							
Physical Tests							
Conductivity	1130		0.40	umhos/cm		03-SEP-10	R1459503
pH	7.43		0.10	pH units		03-SEP-10	R1459503
Total Suspended Solids	91.1		5.0	mg/L		08-SEP-10	R1461947
Anions and Nutrients							
Ammonia as N	47.9		0.050	mg/L		14-SEP-10	R1465344
Nitrate and Nitrite as N	<0.35		0.35	mg/L		07-SEP-10	
Nitrate-N	<0.25		0.25	mg/L		03-SEP-10	R1459992
Nitrite-N	<0.25		0.25	mg/L		03-SEP-10	R1459992
Sulfate	9.3		2.5	mg/L		03-SEP-10	R1459992
Bacteriological Tests							
Fecal Coliforms	110000		3	MPN/100mL		06-SEP-10	R1459728
Total Metals							
Aluminum (Al)-Total	0.366		0.0050	mg/L	07-SEP-10	07-SEP-10	R1460846
Antimony (Sb)-Total	0.00038		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Arsenic (As)-Total	0.0128		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Barium (Ba)-Total	0.0424		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Bismuth (Bi)-Total	0.00020		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Boron (B)-Total	0.220		0.010	mg/L	07-SEP-10	07-SEP-10	R1460846
Cadmium (Cd)-Total	0.000138		0.000010	mg/L	07-SEP-10	07-SEP-10	R1460846
Calcium (Ca)-Total	14.3		0.10	mg/L	07-SEP-10	07-SEP-10	R1460846
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Chromium (Cr)-Total	0.0012		0.0010	mg/L	07-SEP-10	07-SEP-10	R1460846
Cobalt (Co)-Total	0.00250		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Copper (Cu)-Total	0.0547		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L927467-2 ARV-4 Sampled By: CLIENT on 01-SEP-10 @ 15:45 Matrix: WATER							
Total Metals							
Iron (Fe)-Total	8.09		0.020	mg/L	07-SEP-10	07-SEP-10	R1460846
Lead (Pb)-Total	0.00202		0.000090	mg/L	07-SEP-10	07-SEP-10	R1460846
Lithium (Li)-Total	0.0108		0.0020	mg/L	07-SEP-10	07-SEP-10	R1460846
Magnesium (Mg)-Total	9.17		0.010	mg/L	07-SEP-10	07-SEP-10	R1460846
Manganese (Mn)-Total	0.428		0.00030	mg/L	07-SEP-10	07-SEP-10	R1460846
Mercury (Hg)-Total	<0.000050		0.000050	mg/L	03-SEP-10	03-SEP-10	R1459886
Molybdenum (Mo)-Total	0.00210		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Nickel (Ni)-Total	0.0078		0.0020	mg/L	07-SEP-10	07-SEP-10	R1460846
Phosphorus (P)-Total	6.53		0.20	mg/L	07-SEP-10	07-SEP-10	R1460846
Potassium (K)-Total	23.3		0.020	mg/L	07-SEP-10	07-SEP-10	R1460846
Rubidium (Rb)-Total	0.0255		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Selenium (Se)-Total	<0.0010		0.0010	mg/L	07-SEP-10	07-SEP-10	R1460846
Silicon (Si)-Total	6.52		0.050	mg/L	07-SEP-10	07-SEP-10	R1460846
Silver (Ag)-Total	0.00035		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Sodium (Na)-Total	98.4		0.030	mg/L	07-SEP-10	07-SEP-10	R1460846
Strontium (Sr)-Total	0.128		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Thorium (Th)-Total	0.00024		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Tin (Sn)-Total	0.00083		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Titanium (Ti)-Total	0.0205		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Tungsten (W)-Total	<0.0010		0.0010	mg/L	07-SEP-10	07-SEP-10	R1460846
Uranium (U)-Total	0.00041		0.00010	mg/L	07-SEP-10	07-SEP-10	R1460846
Vanadium (V)-Total	0.00707		0.00020	mg/L	07-SEP-10	07-SEP-10	R1460846
Zinc (Zn)-Total	0.0462		0.0050	mg/L	07-SEP-10	07-SEP-10	R1460846
Zirconium (Zr)-Total	0.00122		0.00040	mg/L	07-SEP-10	07-SEP-10	R1460846
Aggregate Organics							
Biochemical Oxygen Demand	40.0		6.0	mg/L	03-SEP-10	08-SEP-10	R1460687
Total Oil and Grease	6.7	DLM	2.0	mg/L	10-SEP-10	10-SEP-10	R1459975
Phenols (4AAP)	0.0750		0.0010	mg/L	08-SEP-10	08-SEP-10	R1461126

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ANIONS5-IC-WP	Water	Anions scan (IC)	EPA 300.1 IC
This analysis is carried out using procedures adapted from EPA Method 300.1 "Determination of Inorganic Anions in Drinking Water by Ion Chromatography".			
BOD-WP	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B
The sample is incubated for 5 days at 20 degrees Celcius. Comparison of dissolved oxygen content at the beginning and end of incubation provides a measure of biochemical oxygen demand. If carbonaceous BOD is requested, TCMP is added to the sample to chemically inhibit nitrogenous oxygen demand. If soluble BOD is requested, the sample is filtered prior to analysis. Surface waters have a DL of 1 mg/L. Effluents are diluted according to their history and will have a sample DL of 6 mg/L or greater, depending on the dilutions used.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
FC-MPN-WP	Water	Fecal Coliform	APHA 9221A-C
The Most Probable Number (MPN) method is based on the Multiple Tube Fermentation technique. The results of examination of replicate tubes and dilutions of a sample are reported after confirmations specific to total coliform, fecal coliform and E. coli are performed. Results are reported in MPN/100 mL for water and MPN/gram for food and solid samples.			
HG-T-CVAF-WP	Water	Mercury Total	EPA245.7 V2.0
Mercury in filtered and unfiltered waters is oxidized with Bromine monochloride and analyzed by cold-vapour atomic fluorescence spectrometry.			
MET-T-L-MS-WP	Water	Total Metals by ICP-MS	U.S. EPA 200.8-TL
Total Metals by ICP-MS: This analysis is carried out using sample preparation procedures adapted from Standard Methods for the examination of Water and Wastewater Method 3030E and analytical procedures adapted from U.S EPA Method 200.8 for analyis of metals by inductively coupled-mass spectrometery.			
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F
Ammonia - Colourimeric using Salicylate-nitroprusside and hypochlorite, in an alkaline phosphate buffer.			
NO2+NO3-CALC-WP	Water	Nitrate+Nitrite	CALCULATION
OGG-IR-WP	Water	Total Oil and Grease	APHA METHOD 5520C
PH-WP	Water	pH	APHA 4500H
pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.			
PHENOLS-4AAP-WT	Water	Phenols (4AAP)	EPA 9066
An automated method is used to distill the sample. The distillate is then buffered to pH 9.4 which reacts with 4AAP and potassium ferricyanide to form a red complex which is measured colorimetrically.			
SOLIDS-TOTSUS-WP	Water	Total Suspended Solids	APHA 2540
The residue retained by a prepared 1.5 um Whatman 934-AH glass microfibre filter dried at 105 degrees C.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS LABORATORY GROUP - WINNIPEG, MANITOBA, CANADA
WT	ALS LABORATORY GROUP - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

R.J. BURNSIDE
ATTN: Stephanie Charity
292 SPEEDVALE AVE., WEST
UNIT #7
GUELPH ON N1H 1C4
Phone: 519-823-4995

Date Received: 14-SEP-10
Report Date: 21-SEP-10 09:07 (MT)
Version: FINAL

Certificate of Analysis

Lab Work Order #: L930982
Project P.O. #: NOT SUBMITTED
Job Reference: N-0157460
Legal Site Desc:
C of C Numbers:

Paul Nicolas
Account Manager

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L930982-1 LF-1 Sampled By: SC on 09-SEP-10 @ 11:50 Matrix: WATER							
Bacteriological Tests							
Fecal Coliforms	23		3	MPN/100mL		17-SEP-10	R1470963
Aggregate Organics							
Biochemical Oxygen Demand	27.4		1.0	mg/L	15-SEP-10	20-SEP-10	R1471932
L930982-2 LF-2 Sampled By: SC on 09-SEP-10 @ 12:05 Matrix: WATER							
Bacteriological Tests							
Fecal Coliforms	9		3	MPN/100mL		17-SEP-10	R1470963
Aggregate Organics							
Biochemical Oxygen Demand	6.0		1.0	mg/L	15-SEP-10	20-SEP-10	R1471932
L930982-3 LF-3 Sampled By: SC on 09-SEP-10 @ 13:43 Matrix: WATER							
Bacteriological Tests							
Fecal Coliforms	4		3	MPN/100mL		17-SEP-10	R1470963
Aggregate Organics							
Biochemical Oxygen Demand	2.6		1.0	mg/L	15-SEP-10	20-SEP-10	R1471932
L930982-4 SL-WET-1 Sampled By: SC on 09-SEP-10 @ 14:45 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	15		3	MPN/100mL		17-SEP-10	R1470963
Fecal Coliforms	15		3	MPN/100mL		17-SEP-10	R1470963
Aggregate Organics							
Biochemical Oxygen Demand	9.0		1.0	mg/L	15-SEP-10	20-SEP-10	R1471932
L930982-5 SL-WET-2 Sampled By: SC on 09-SEP-10 @ 14:25 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	4		3	MPN/100mL		17-SEP-10	R1470963
Fecal Coliforms	4		3	MPN/100mL		17-SEP-10	R1470963
Aggregate Organics							
Biochemical Oxygen Demand	21.2		6.0	mg/L	15-SEP-10	20-SEP-10	R1471932
L930982-6 SL-WET-3 Sampled By: SC on 09-SEP-10 @ 15:10 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	9		3	MPN/100mL		17-SEP-10	R1470963
Fecal Coliforms	9		3	MPN/100mL		17-SEP-10	R1470963
Aggregate Organics							
Biochemical Oxygen Demand	5.6		1.0	mg/L	15-SEP-10	20-SEP-10	R1471932
L930982-7 SL-WET-4 Sampled By: SC on 09-SEP-10 @ 15:45 Matrix: WATER							
Bacteriological Tests							

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L930982-7 SL-WET-4 Sampled By: SC on 09-SEP-10 @ 15:45 Matrix: WATER							
Bacteriological Tests							
Escherichia Coli	4300		3	MPN/100mL		17-SEP-10	R1470963
Fecal Coliforms	9300		3	MPN/100mL		17-SEP-10	R1470963
Aggregate Organics							
Biochemical Oxygen Demand	20.0		1.0	mg/L	15-SEP-10	20-SEP-10	R1471932

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
EHR	Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-WP	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B

The sample is incubated for 5 days at 20 degrees Celcius. Comparison of dissolved oxygen content at the beginning and end of incubation provides a measure of biochemical oxygen demand. If carbonaceous BOD is requested, TCMP is added to the sample to chemically inhibit nitrogenous oxygen demand. If soluble BOD is requested, the sample is filtered prior to analysis. Surface waters have a DL of 1 mg/L. Effluents are diluted according to their history and will have a sample DL of 6 mg/L or greater, depending on the dilutions used.

EC-MPN-WP	Water	Escherichia Coli	APHA 9221A-C

The Most Probable Number (MPN) method is based on the Multiple Tube Fermentation technique. The results of examination of replicate tubes and dilutions of a sample are reported after confirmations specific to total coliform, fecal coliform and E. coli are performed. Results are reported in MPN/100 mL for water
and MPN/gram for food and solid samples.

FC-MPN-WP	Water	Fecal Coliform	APHA 9221A-C

The Most Probable Number (MPN) method is based on the Multiple Tube Fermentation technique. The results of examination of replicate tubes and dilutions of a sample are reported after confirmations specific to total coliform, fecal coliform and E. coli are performed. Results are reported in MPN/100 mL for water and MPN/gram for food and solid samples.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS LABORATORY GROUP - WINNIPEG, MANITOBA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

R.J. BURNSIDE & ASSOCIATES LTD
ATTN: STEPHANIE CHARITY / JIM WALLS
292 SPEEDVALE AVE., WEST
UNIT #7
GUELPH ON N1H 1C4
Phone: 519-823-4995

Date Received: 13-SEP-10
Report Date: 22-SEP-10 15:38 (MT)
Version: FINAL

Certificate of Analysis

Lab Work Order #: L930600
Project P.O. #: NOT SUBMITTED
Job Reference: N-015746
Legal Site Desc:
C of C Numbers:

Paul Nicolas
Account Manager

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L930600-1 ARV-2							
Sampled By: STEPHANIE CHARITY on 10-SEP-10 @ 11:35							
Matrix: WASTE WATER							
Nitrate + Nitrite							
Anions scan (IC)							
Nitrite-N	<0.25		0.25	mg/L		14-SEP-10	R1467253
Nitrate-N	<0.25		0.25	mg/L		14-SEP-10	R1467253
Sulfate	475		2.5	mg/L		14-SEP-10	R1467253
Nitrate+Nitrite							
Nitrate and Nitrite as N	<0.35		0.35	mg/L		15-SEP-10	
Miscellaneous Parameters							
Ammonia as N	13.3		0.050	mg/L		21-SEP-10	R1473786
Biochemical Oxygen Demand	<6.0		6.0	mg/L	13-SEP-10	18-SEP-10	R1470801
Conductivity	2630		0.40	umhos/cm		13-SEP-10	R1465201
Fecal Coliforms	38		3	MPN/100mL		16-SEP-10	R1470203
Mercury (Hg)-Total	<0.000050		0.000050	mg/L	17-SEP-10	17-SEP-10	R1473006
Phenols (4AAP)	0.0020		0.0010	mg/L	15-SEP-10	15-SEP-10	R1467205
Total Oil and Grease	<1.0		1.0	mg/L	16-SEP-10	17-SEP-10	R1470248
Total Suspended Solids	8.0		5.0	mg/L		16-SEP-10	R1469793
pH	8.21		0.10	pH units		13-SEP-10	R1465201
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.0095		0.0050	mg/L	14-SEP-10	14-SEP-10	R1466569
Antimony (Sb)-Total	0.00410		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Arsenic (As)-Total	0.00482		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Barium (Ba)-Total	0.0458		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Boron (B)-Total	1.34		0.010	mg/L	14-SEP-10	14-SEP-10	R1466569
Cadmium (Cd)-Total	<0.000010		0.000010	mg/L	14-SEP-10	14-SEP-10	R1466569
Calcium (Ca)-Total	230		0.10	mg/L	14-SEP-10	14-SEP-10	R1466569
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Chromium (Cr)-Total	<0.0010		0.0010	mg/L	14-SEP-10	14-SEP-10	R1466569
Cobalt (Co)-Total	0.00051		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Copper (Cu)-Total	0.00149		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Iron (Fe)-Total	0.529		0.020	mg/L	14-SEP-10	14-SEP-10	R1466569
Lead (Pb)-Total	0.000145		0.000090	mg/L	14-SEP-10	14-SEP-10	R1466569
Lithium (Li)-Total	0.0318		0.0020	mg/L	14-SEP-10	14-SEP-10	R1466569
Magnesium (Mg)-Total	49.0		0.010	mg/L	14-SEP-10	14-SEP-10	R1466569
Manganese (Mn)-Total	0.599		0.00030	mg/L	14-SEP-10	14-SEP-10	R1466569
Molybdenum (Mo)-Total	0.00036		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Nickel (Ni)-Total	<0.0020		0.0020	mg/L	14-SEP-10	14-SEP-10	R1466569
Phosphorus (P)-Total	0.56		0.20	mg/L	14-SEP-10	14-SEP-10	R1466569
Potassium (K)-Total	44.0		0.020	mg/L	14-SEP-10	14-SEP-10	R1466569
Rubidium (Rb)-Total	0.0375		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Selenium (Se)-Total	<0.0010		0.0010	mg/L	14-SEP-10	14-SEP-10	R1466569
Silicon (Si)-Total	4.79		0.050	mg/L	14-SEP-10	14-SEP-10	R1466569
Silver (Ag)-Total	<0.00010		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Sodium (Na)-Total	243		0.030	mg/L	14-SEP-10	14-SEP-10	R1466569
Strontium (Sr)-Total	1.66		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Thorium (Th)-Total	<0.00010		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Tin (Sn)-Total	0.00022		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Titanium (Ti)-Total	0.00299		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Tungsten (W)-Total	<0.0010		0.0010	mg/L	14-SEP-10	14-SEP-10	R1466569

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L930600-1 ARV-2							
Sampled By: STEPHANIE CHARITY on 10-SEP-10 @ 11:35							
Matrix: WASTE WATER							
Total Metals by ICP-MS							
Uranium (U)-Total	0.00063		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Vanadium (V)-Total	0.00061		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Zinc (Zn)-Total	0.0160		0.0050	mg/L	14-SEP-10	14-SEP-10	R1466569
Zirconium (Zr)-Total	0.00043		0.00040	mg/L	14-SEP-10	14-SEP-10	R1466569
L930600-2 ARV-4							
Sampled By: STEPHANIE CHARITY on 10-SEP-10 @ 11:15							
Matrix: WASTE WATER							
Nitrate + Nitrite							
Anions scan (IC)							
Nitrite-N	0.284		0.050	mg/L		14-SEP-10	R1467253
Nitrate-N	1.23		0.050	mg/L		14-SEP-10	R1467253
Sulfate	6.99		0.50	mg/L		14-SEP-10	R1467253
Nitrate+Nitrite							
Nitrate and Nitrite as N	1.51		0.071	mg/L		15-SEP-10	
Miscellaneous Parameters							
Ammonia as N	28.2		0.050	mg/L		21-SEP-10	R1473786
Biochemical Oxygen Demand	65.0		6.0	mg/L	13-SEP-10	18-SEP-10	R1470801
Conductivity	1020		0.40	umhos/cm		13-SEP-10	R1465201
Fecal Coliforms	2100		3	MPN/100mL		16-SEP-10	R1470203
Mercury (Hg)-Total	<0.000050		0.000050	mg/L	17-SEP-10	17-SEP-10	R1473006
Phenols (4AAP)	<0.01	DLM	0.010	mg/L	15-SEP-10	15-SEP-10	R1467205
Total Oil and Grease	1.3		1.0	mg/L	16-SEP-10	17-SEP-10	R1470248
Total Suspended Solids	169		5.0	mg/L		16-SEP-10	R1469793
pH	8.12		0.10	pH units		13-SEP-10	R1465201
Total Metals by ICP-MS							
Aluminum (Al)-Total	0.325		0.0050	mg/L	14-SEP-10	14-SEP-10	R1466569
Antimony (Sb)-Total	0.00033		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Arsenic (As)-Total	0.0107		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Barium (Ba)-Total	0.0349		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Beryllium (Be)-Total	<0.00020		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Bismuth (Bi)-Total	<0.00020		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Boron (B)-Total	0.254		0.010	mg/L	14-SEP-10	14-SEP-10	R1466569
Cadmium (Cd)-Total	0.000092		0.000010	mg/L	14-SEP-10	14-SEP-10	R1466569
Calcium (Ca)-Total	22.7		0.10	mg/L	14-SEP-10	14-SEP-10	R1466569
Cesium (Cs)-Total	<0.00010		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Chromium (Cr)-Total	0.0018		0.0010	mg/L	14-SEP-10	14-SEP-10	R1466569
Cobalt (Co)-Total	0.00229		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Copper (Cu)-Total	0.0394		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Iron (Fe)-Total	5.90		0.020	mg/L	14-SEP-10	14-SEP-10	R1466569
Lead (Pb)-Total	0.00152		0.000090	mg/L	14-SEP-10	14-SEP-10	R1466569
Lithium (Li)-Total	0.0067		0.0020	mg/L	14-SEP-10	14-SEP-10	R1466569
Magnesium (Mg)-Total	14.4		0.010	mg/L	14-SEP-10	14-SEP-10	R1466569
Manganese (Mn)-Total	0.349		0.00030	mg/L	14-SEP-10	14-SEP-10	R1466569
Molybdenum (Mo)-Total	0.00080		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Nickel (Ni)-Total	0.0088		0.0020	mg/L	14-SEP-10	14-SEP-10	R1466569
Phosphorus (P)-Total	5.81		0.20	mg/L	14-SEP-10	14-SEP-10	R1466569
Potassium (K)-Total	24.7		0.020	mg/L	14-SEP-10	14-SEP-10	R1466569
Rubidium (Rb)-Total	0.0279		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Selenium (Se)-Total	<0.0010		0.0010	mg/L	14-SEP-10	14-SEP-10	R1466569
Silicon (Si)-Total	6.32		0.050	mg/L	14-SEP-10	14-SEP-10	R1466569

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L930600-2 ARV-4							
Sampled By: STEPHANIE CHARITY on 10-SEP-10 @ 11:15							
Matrix: WASTE WATER							
Total Metals by ICP-MS							
Silver (Ag)-Total	0.00025		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Sodium (Na)-Total	116		0.030	mg/L	14-SEP-10	14-SEP-10	R1466569
Strontium (Sr)-Total	0.323		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Tellurium (Te)-Total	<0.00020		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Thallium (Tl)-Total	<0.00010		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Thorium (Th)-Total	0.00032		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Tin (Sn)-Total	0.00082		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Titanium (Ti)-Total	0.0196		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Tungsten (W)-Total	<0.0010		0.0010	mg/L	14-SEP-10	14-SEP-10	R1466569
Uranium (U)-Total	0.00044		0.00010	mg/L	14-SEP-10	14-SEP-10	R1466569
Vanadium (V)-Total	0.00470		0.00020	mg/L	14-SEP-10	14-SEP-10	R1466569
Zinc (Zn)-Total	0.0241		0.0050	mg/L	14-SEP-10	14-SEP-10	R1466569
Zirconium (Zr)-Total	0.00199		0.00040	mg/L	14-SEP-10	14-SEP-10	R1466569
L930600-3 OLD LAGOON 1							
Sampled By: STEPHANIE CHARITY on 10-SEP-10 @ 14:45							
Matrix: WASTE WATER							
Miscellaneous Parameters							
Biochemical Oxygen Demand	7.2		6.0	mg/L	13-SEP-10	18-SEP-10	R1470801
Fecal Coliforms	1500		3	MPN/100mL		16-SEP-10	R1470183
L930600-4 OLD LAGOON 2							
Sampled By: STEPHANIE CHARITY on 10-SEP-10 @ 14:30							
Matrix: WASTE WATER							
Miscellaneous Parameters							
Biochemical Oxygen Demand	<6.0		6.0	mg/L	13-SEP-10	18-SEP-10	R1470801
Fecal Coliforms	<3		3	MPN/100mL		16-SEP-10	R1470183
L930600-5 SL-1							
Sampled By: STEPHANIE CHARITY on 10-SEP-10 @ 15:00							
Matrix: WASTE WATER							
Miscellaneous Parameters							
Biochemical Oxygen Demand	420		6.0	mg/L	13-SEP-10	18-SEP-10	R1470801
Fecal Coliforms	15000		3	MPN/100mL		16-SEP-10	R1470183

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Qualifiers for Individual Samples Listed:

Sample Numbe	Client ID	Qualifier	Description
L930600-1	ARV-2	EHR	Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested

Sample Parameter Qualifier Key:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ANIONS5-IC-WP	Water	Anions scan (IC)	EPA 300.1 IC
This analysis is carried out using procedures adapted from EPA Method 300.1 "Determination of Inorganic Anions in Drinking Water by Ion Chromatography".			
BOD-WP	Water	Biochemical Oxygen Demand (BOD)	APHA 5210 B
The sample is incubated for 5 days at 20 degrees Celcius. Comparison of dissolved oxygen content at the beginning and end of incubation provides a measure of biochemical oxygen demand. If carbonaceous BOD is requested, TCMP is added to the sample to chemically inhibit nitrogenous oxygen demand. If soluble BOD is requested, the sample is filtered prior to analysis. Surface waters have a DL of 1 mg/L. Effluents are diluted according to their history and will have a sample DL of 6 mg/L or greater, depending on the dilutions used.			
EC-WP	Water	Conductivity	APHA 2510B
Conductivity of an aqueous solution refers to its ability to carry an electric current. Conductance of a solution is measured between two spatially fixed and chemically inert electrodes.			
FC-MPN-WP	Water	Fecal Coliform	APHA 9221A-C
The Most Probable Number (MPN) method is based on the Multiple Tube Fermentation technique. The results of examination of replicate tubes and dilutions of a sample are reported after confirmations specific to total coliform, fecal coliform and E. coli are performed. Results are reported in MPN/100 mL for water and MPN/gram for food and solid samples.			
HG-T-CVAF-WP	Water	Mercury Total	EPA245.7 V2.0
Mercury in filtered and unfiltered waters is oxidized with Bromine monochloride and analyzed by cold-vapour atomic fluorescence spectrometry.			
MET-T-L-MS-WP	Water	Total Metals by ICP-MS	U.S. EPA 200.8-TL
Total Metals by ICP-MS: This analysis is carried out using sample preparation procedures adapted from Standard Methods for the examination of Water and Wastewater Method 3030E and analytical procedures adapted from U.S EPA Method 200.8 for analyis of metals by inductively coupled-mass spectrometery.			
NH3-COL-WP	Water	Ammonia by colour	APHA 4500 NH3 F
Ammonia - Colourimeric using Salicylate-nitroprusside and hypochlorite, in an alkaline phosphate buffer.			
NO2+NO3-CALC-WP	Water	Nitrate+Nitrite	CALCULATION
OGG-IR-WP	Water	Total Oil and Grease	APHA METHOD 5520C
PH-WP	Water	pH	APHA 4500H
pH of a sample is the determination of the activity of the hydrogen ions by potentiometric measurement using a standard hydrogen electrode and a reference electrode.			
PHENOLS-4AAP-WT	Water	Phenols (4AAP)	EPA 9066
An automated method is used to distill the sample. The distillate is then buffered to pH 9.4 which reacts with 4AAP and potassium ferricyanide to form a red complex which is measured colorimetrically.			
SOLIDS-TOTSUS-WP	Water	Total Suspended Solids	APHA 2540
The residue retained by a prepared 1.5 um Whatman 934-AH glass microfibre filter dried at 105 degrees C.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WP	ALS LABORATORY GROUP - WINNIPEG, MANITOBA, CANADA
WT	ALS LABORATORY GROUP - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 10T434899
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg 153 Petroleum Hydrocarbon F1 - F4 in Water (With PAHs)

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 22, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	BW-1 1988754
C6 - C10 (F1)	g/L		25	<25
C6 - C10 (F1 minus BTEX)	g/L		25	<25
C>10 - C16 (F2)	g/L		100	<100
C>10 - C16 (F2 minus Naphthalene)	g/L		100	<100
C6 - C16 (F1 + F2)	g/L		100	<100
C>16 - C34 (F3)	g/L		100	<100
C>16 - C34 (F3 minus PAHs)	g/L		100	<100
C>34 - C50 (F4)	g/L		100	<100
C>16 - C50 (F3 + F4)	g/L		100	<100
Gravimetric Heavy Hydrocarbons	g/L		500	NA

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1988754
The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
Total C6-C50 results are corrected for BTEX and PAH contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434899
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg. 153 PAHs in Water

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 22, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	BW-1 1988754
Naphthalene	g/L		0.12	<0.12
Acenaphthylene	g/L		0.11	<0.11
Acenaphthene	g/L		0.10	<0.10
Fluorene	g/L		0.09	<0.09
Phenanthrene	g/L		0.10	<0.10
Anthracene	g/L		0.07	<0.07
Fluoranthene	g/L		0.12	<0.12
Pyrene	g/L		0.12	<0.12
Benzo(a)anthracene	g/L		0.08	<0.08
Chrysene	g/L		0.05	<0.05
Benzo(b)fluoranthene	g/L		0.05	<0.05
Benzo(k)fluoranthene	g/L		0.06	<0.06
Benzo(a)pyrene	g/L		0.01	<0.01
Indeno(1,2,3-cd)pyrene	g/L		0.03	<0.03
Dibenzo(a,h)anthracene	g/L		0.09	<0.09
Benzo(g,h,i)perylene	g/L		0.06	<0.06
2-and 1-methyl Napthalene	g/L		0.20	<0.20
Surrogate	**Unit**	**Acceptable Limits**		
Chrysene-d12	%	60-130		97

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434899
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Regulation 153 - Volatile Organic Compounds in Water

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 22, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	BW-1 1988754
Dichlorodifluoromethane	g/L		0.20	20
Chloromethane	g/L		0.40	<0.40
Vinyl Chloride	g/L		0.17	<0.17
Bromomethane	g/L		0.20	<0.20
Chloroethane	g/L		0.20	<0.20
Trichlorofluoromethane	g/L		0.40	17
Acetone	g/L		1.0	<1.0
1,1 Dichloroethylene	g/L		0.30	<0.30
Methylene Chloride	g/L		0.30	<0.30
trans- 1,2-dichloroethylene	g/L		0.20	<0.20
Methyl tert-butyl ether	g/L		0.20	<0.20
1,1-Dichloroethane	g/L		0.30	<0.30
Methyl Ethyl Ketone	g/L		1.0	<1.0
cis- 1,2-Dichloroethylene	g/L		0.20	<0.20
Chloroform	g/L		0.20	<0.20
1,2 - Dichloroethane	g/L		0.20	<0.20
1,1,1-Trichloroethane	g/L		0.30	<0.30
Carbon Tetrachloride	g/L		0.20	<0.20
Benzene	g/L		0.20	<0.20
1,2-Dichloropropane	g/L		0.20	<0.20
Trichloroethylene	g/L		0.20	<0.20
Bromodichloromethane	g/L		0.20	<0.20
cis-1,3-Dichloropropene	ug/L		0.20	<0.20
Methyl Isobutyl Ketone	g/L		1.0	<1.0
trans-1,3-Dichloropropene	g/L		0.30	<0.30
1,1,2-Trichloroethane	g/L		0.20	<0.20
Toluene	g/L		0.20	<0.20
2-Hexanone	g/L		0.30	<0.30
Dibromochloromethane	g/L		0.10	<0.10
Ethylene Dibromide	g/L		0.20	<0.20
Tetrachloroethylene	g/L		0.20	<0.20
1,1,1,2-Tetrachloroethane	g/L		0.10	<0.10
Chlorobenzene	g/L		0.10	<0.10

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434899
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Regulation 153 - Volatile Organic Compounds in Water

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 22, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	BW-1 1988754
Ethylbenzene	g/L		0.10	<0.10
m & p-Xylene	g/L		0.20	<0.20
Bromoform	g/L		0.10	<0.10
Styrene	g/L		0.10	<0.10
1,1,2,2-Tetrachloroethane	g/L		0.10	<0.10
o-Xylene	g/L		0.10	<0.10
1,3-Dichlorobenzene	g/L		0.10	<0.10
1,4-Dichlorobenzene	g/L		0.10	<0.10
1,2-Dichlorobenzene	g/L		0.10	<0.10
1,2,4-Trichlorobenzene	g/L		0.30	<0.30
1,3-Dichloropropene (Cis + Trans)	g/L		0.30	<0.30
Xylene Mixture (Total)	g/L		0.20	<0.20
n-Hexane	g/L		0.20	<0.20
Surrogate	**Unit**	**Acceptable Limits**		
Toluene-d8	% Recovery	60-130		100
4-Bromofluorobenzene	% Recovery	70-130		92

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434899
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

BURNSIDE - Water Quality Assessment

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 22, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	LF-1 1988705	LF-2 1988707	LF-3 1988716	SL-Wet1 1988725	SL-Wet2 1988736	SL-Wet3 1988742	SL-Wet4 1988748
Aluminum	mg/L		0.004	<0.004	0.006	0.004	0.059	0.033	0.054	0.143
Arsenic	mg/L		0.003	<0.003	0.003	0.003	0.007	0.005	0.006	0.011
Barium	mg/L		0.002	0.045	0.041	0.035	0.006	0.007	0.009	0.015
Boron	mg/L		0.010	0.736	0.805	0.773	0.179	0.176	0.162	0.230
Cadmium	mg/L		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Calcium	mg/L		0.05	283	225	169	15.9	20.9	24.4	12.0
Chromium	mg/L		0.003	<0.003	0.006	0.006	0.008	0.006	0.005	0.007
Copper	mg/L		0.003	<0.003	<0.003	<0.003	0.012	0.006	0.011	0.027
Iron	mg/L		0.010	<0.010	0.074	0.020	0.503	1.41	1.28	2.55
Potassium	mg/L		0.05	20.8	30.6	37.5	15.6	14.8	14.7	21.7
Magnesium	mg/L		0.05	24.5	42.1	43.1	8.66	15.9	17.7	9.76
Mercury	mg/L		0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Manganese	mg/L		0.002	0.045	0.216	0.226	0.226	0.412	0.461	0.274
Molybdenum	mg/L		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Sodium	mg/L		0.05	82.5	171	204	75.5	111	110	94.2
Nickel	mg/L		0.003	<0.003	0.003	<0.003	0.004	0.003	0.005	0.006
Total Phosphorus	mg/L		0.05	1.57	0.34	0.20	0.98	1.56	1.45	4.54
Lead	mg/L		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Selenium	mg/L		0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Silver	mg/L		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Strontium	mg/L		0.005	2.54	1.71	1.31	0.142	0.237	0.214	0.111
Thallium	mg/L		0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006
Titanium	mg/L		0.002	0.008	0.007	0.006	0.003	0.002	0.003	0.005
Uranium	mg/L		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Vanadium	mg/L		0.002	<0.002	<0.002	<0.002	0.004	0.003	0.003	0.006
inc	mg/L		0.005	0.007	0.013	0.009	0.007	<0.005	<0.005	0.022
Fluoride	mg/L		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.50
Chloride	mg/L		0.10	114	267	334	120	204	186	140
Nitrite as N	mg/L		0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ortho phosphate as P	mg/L		0.10	<0.10	<0.10	<0.10	1.53	1.71	0.55	2.33
Bromide	mg/L		0.05	1.42	2.63	2.58	<0.05	1.16	<0.05	<0.05
Nitrate as N	mg/L		0.05	<0.05	0.81	<0.05	1.00	0.30	0.39	0.40
Sulphate	mg/L		0.10	650	518	469	18.4	37.3	26.6	11.5

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AGAT WORK ORDER: 10T434899
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

BURNSIDE - Water Quality Assessment

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 22, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	LF-1 1988705	LF-2 1988707	LF-3 1988716	SL-Wet1 1988725	SL-Wet2 1988736	SL-Wet3 1988742	SL-Wet4 1988748
pH	pH Units		NA	7.90	8.03	8.27	7.89	7.82	7.84	8.18
Ammonia as N	mg/L		0.02	<0.02	1.23	0.26	36.5	25.7	18.3	71.9
Total Organic Carbon	mg/L		0.5	36.5	25.8	26.5	28.3	21.0	22.7	61.4
Electrical Conductivity	uS/cm		2	1750	2040	2070	793	1020	957	1030
Total Dissolved Solids	mg/L		20	1440	1520	1450	368	496	484	436
Saturation pH				6.59	6.53	6.70	7.70	7.52	7.43	7.53
% Difference/ Ion Balance			0.1	3.6	3.8	5.6	0.6	4.5	3.6	3.8
Total Hardness (as CaCO3)	mg/L		10	808	735	599	75	118	134	70
Langlier Index				1.31	1.50	1.57	0.19	0.30	0.41	0.65
Carbonate (as CaCO3)	mg/L		5	<5	<5	<5	<5	<5	<5	<5
Bicarbonate (as CaCO3)	mg/L		5	252	322	263	193	186	200	306
Turbidity	NTU		0.5	0.9	3.3	1.6	3.1	4.1	5.2	20.0
Alkalinity (as CaCO3)	mg/L		5	252	322	263	193	186	200	306
Hydroxide (as CaCO3)	mg/L		5	<5	<5	<5	<5	<5	<5	<5
Reactive Silica	mg/L		0.05	15.9	8.84	9.34	12.3	11.4	8.67	14.2
Colour	TCU		5	30	55	49	107	100	131	209

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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AGAT WORK ORDER: 10T434899
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

Chromium VI & TSS (Water)

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 22, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	LF-1 1988705
Chromium VI	mg/L		0.005	<0.005
Total Suspended Solids	mg/L		10	288

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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AGAT WORK ORDER: 10T434899
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

Chromium VI, Phenols & TSS (Water)

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 22, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	LF-2 1988707	LF-3 1988716
Chromium VI	mg/L		0.005	<0.005	<0.005
Phenols	mg/L		0.001	0.002	0.001
Total Suspended Solids	mg/L		10	21	<10

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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AGAT WORK ORDER: 10T434899
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

TSS (Water)

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 22, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	SL-Wet1 1988725	SL-Wet2 1988736	SL-Wet3 1988742	SL-Wet4 1988748
Total Suspended Solids	mg/L		10	44	<10	<10	78

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg. 153 Metals & Inorganics in Soil - Table 1

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	Old Lagoon 1-Soil 1988833	Old Lagoon 2-Soil 1988834	Active Lagoon 1988835
Antimony	g/g	1.0	0.8	1.4	2.8	2.1
Arsenic	g/g	17	1	3	3	1
Barium	g/g	210	2	140	89	56
Beryllium	g/g	1.2	0.5	<0.5	<0.5	<0.5
Boron	g/g		5	10	12	<5
Boron (Hot Water Extractable)	g/g		0.10	2.62	3.96	0.88
Cadmium	g/g	1.0	0.5	1.6	1.1	<0.5
Chromium	g/g	71	2	19	17	14
Cobalt	g/g	21	0.5	3.9	4.4	2.6
Copper	g/g	85	1	273	251	171
Lead	g/g	120	1	45	20	9
Molybdenum	g/g	2.5	0.5	2.8	3.3	1.2
Nickel	g/g	43	1	13	13	9
Selenium	g/g	1.9	0.4	2.5	1.8	3.0
Silver	g/g	0.42	0.2	5.8	4.8	2.7
Thallium	g/g	2.5	0.4	<0.4	<0.4	<0.4
Uranium	ug/g		0.5	1.1	1.6	0.9
Vanadium	g/g	91	1	13	18	13
inc	g/g	160	5	533	369	242
Chromium, Hexavalent	g/g	2.5	0.2	<0.2	<0.2	<0.2
Cyanide, Free	g/g	0.12	0.05	<0.05	<0.05	<0.05
Mercury	g/g	0.23	0.01	1.00	0.41	0.31
Electrical Conductivity (2:1)	mS/cm	0.57	0.002	0.703	1.56	0.792
Sodium Adsorption Ratio (2:1)	N/A	2.4	N/A	1.63	1.70	2.38
pH, 2:1 CaCl2 Extraction	pH Units			6.36	6.09	5.51
Chloride (2:1)	g/g	330	2	83	161	94
Nitrate + Nitrite	g/g	61	1	<1	<1	<1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)

1988833-1988835 EC, SAR, Chloride & Nitrate/Nitrite were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the extract obtained from the 2:1 leaching procedure (2 parts 0.01M CaCl2:1 part soil).

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CANADA L4 1Y2
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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg. 153 Metals in Soil

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	BW-P1-A 1988818	BW-P1-B 1988823	BW-P2-A 1988827	BW-P2-B 1988830	HW-1 1988837	HW-2 1988842	HW-3 1988845
Antimony	g/g	1.0	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	g/g	17	1	3	1	2	1	2	4	2
Barium	g/g	210	2	26	35	31	31	22	23	21
Beryllium	g/g	1.2	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Boron	g/g		5	<5	<5	<5	<5	<5	<5	<5
Cadmium	g/g	1.0	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	g/g	71	2	11	15	13	12	8	15	9
Cobalt	g/g	21	0.5	2.7	3.9	3.2	3.2	2.4	2.7	2.4
Copper	g/g	85	1	11	10	18	9	7	6	9
Lead	g/g	120	1	4	4	9	5	4	3	3
Molybdenum	g/g	2.5	0.5	0.7	<0.5	0.6	<0.5	<0.5	1.0	0.5
Nickel	g/g	43	1	6	9	8	7	5	7	5
Selenium	g/g	1.9	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Silver	g/g	0.42	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	g/g	2.5	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Uranium	ug/g		0.5	1.2	1.4	1.0	1.3	0.9	0.9	1.2
Vanadium	g/g	91	1	14	18	14	16	12	13	14
inc	g/g	160	5	25	34	54	20	159	125	31

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

Phenols in Soil

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	BW-P1-A 1988818	BW-P1-B 1988823	BW-P2-A 1988827	BW-P2-B 1988830	HW-1 1988837	HW-2 1988842	HW-3 1988845
Phenols, Total	mg/kg		1	<1	<1	<1	<1	<1	<1	<1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

(P & T) BTEX - Soil (GC/MS)

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	BW-P1-A 1988818	BW-P1-B 1988823	BW-P2-A 1988827	BW-P2-B 1988830	HW-1 1988837	HW-2 1988842	HW-3 1988845
Benzene	g/g	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Toluene	g/g	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ethylbenzene	g/g	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
m & p-Xylene	g/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Xylene	g/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Xylene Mixture (Total)	g/g	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate	Unit	Acceptable Limits								
Toluene-d8	% Recovery	60-130		113	106	112	94	100	113	99
4-Bromofluorobenzene	% Recovery	70-130		115	103	109	122	120	104	113

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)
1988818-1988845 Results are based on the dry weight of the soil.

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg 153 Petroleum Hydrocarbon F1 - F4 in Water (With PAHs)

DATE SAMPLED: Sep 10, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-2 1988848
C6 - C10 (F1)	g/L		25	<25
C6 - C10 (F1 minus BTEX)	g/L		25	<25
C>10 - C16 (F2)	g/L		100	<100
C>10 - C16 (F2 minus Naphthalene)	g/L		100	<100
C6 - C16 (F1 + F2)	g/L		100	<100
C>16 - C34 (F3)	g/L		100	<100
C>16 - C34 (F3 minus PAHs)	g/L		100	<100
C>34 - C50 (F4)	g/L		100	<100
C>16 - C50 (F3 + F4)	g/L		100	<100
Gravimetric Heavy Hydrocarbons	g/L		500	NA

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1988848
The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
Total C6-C50 results are corrected for BTEX and PAH contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Certified By: Jordy Takewaki

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CANADA L4 1Y2
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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg. 153 - Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil (PAHs Incl.)

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	BW-P1-A 1988818	BW-P1-B 1988823	BW-P2-A 1988827	BW-P2-B 1988830	HW-1 1988837	HW-2 1988842	HW-3 1988845
C6 - C10 (F1)	g/g		5	<5	11	<5	<5	<5	<5	<5
C6 - C10 (F1 minus BTEX)	g/g		5	<5	11	<5	<5	<5	<5	<5
C>10 - C16 (F2)	g/g		10	1200	3400	240	130	<10	<10	<10
C>10 - C16 (F2 minus Naphthalene)	g/g		10	1200	3400	240	130	<10	<10	<10
C>16 - C34 (F3)	g/g		50	430	1800	9100	130	26000	32000	24000
C>16 - C34 (F3 minus PAHs)	g/g		50	430	1800	9100	130	26000	32000	24000
C>34 - C50 (F4)	g/g		50	<50	<50	730	79	4800	6000	4400
Gravimetric Heavy Hydrocarbons	g/g		50	NA	NA	NA	NA	NA	NA	NA
Moisture Content	%		0.1	7.2	8.4	4.2	3.0	7.5	2.2	6.3

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1988818-1988845 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
Total C6 - C50 results are corrected for BTEX and PAH contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Certified By: Jordy Takewaki

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FAX (905)712-5122
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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg. 153 PAHs in Soil

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	BW-P1-A 1988818	BW-P1-B 1988823	BW-P2-A 1988827	BW-P2-B 1988830	HW-1 1988837	HW-2 1988842	HW-3 1988845
Naphthalene	g/g		0.03	<0.03	0.04	0.04	<0.03	0.03	<0.03	0.05
Acenaphthylene	g/g		0.02	<0.02	0.04	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	g/g		0.03	<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Fluorene	g/g		0.02	0.02	0.15	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	g/g		0.02	<0.02	0.03	<0.02	<0.02	<0.02	<0.02	<0.02
Anthracene	g/g		0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	g/g		0.02	<0.02	0.03	<0.02	<0.02	0.02	<0.02	<0.02
Pyrene	g/g		0.02	0.02	0.06	0.03	<0.02	0.04	0.02	0.03
Benzo(a)anthracene	g/g		0.02	<0.02	<0.02	<0.02	<0.02	0.21	0.11	0.14
Chrysene	g/g		0.02	<0.02	<0.02	<0.02	<0.02	0.11	0.07	0.10
Benzo(b)fluoranthene	g/g		0.02	<0.02	<0.02	<0.02	<0.02	0.07	0.05	0.04
Benzo(k)fluoranthene	g/g		0.02	<0.02	<0.02	<0.02	<0.02	0.02	<0.02	0.02
Benzo(a)pyrene	g/g		0.02	<0.02	<0.02	<0.02	<0.02	0.13	0.09	0.07
Indeno(1,2,3-cd)pyrene	g/g		0.02	<0.02	<0.02	<0.02	<0.02	0.05	0.03	0.03
Dibenz(a,h)anthracene	g/g		0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(g,h,i)perylene	g/g		0.02	<0.02	<0.02	<0.02	<0.02	0.08	0.05	0.04
2-and 1-methyl Naphthalene	g/g		0.05	<0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05
Surrogate	Unit	Acceptable Limits								
Chrysene-d12	%	60-130		79	89	100	93	89	95	89

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
1988818-1988845 Results are based on the dry weight of the soil.

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Reg. 153 PAHs in Water

DATE SAMPLED: Sep 10, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-2 1988848
Naphthalene	g/L		0.12	<0.12
Acenaphthylene	g/L		0.11	<0.11
Acenaphthene	g/L		0.10	<0.10
Fluorene	g/L		0.09	<0.09
Phenanthrene	g/L		0.10	<0.10
Anthracene	g/L		0.07	<0.07
Fluoranthene	g/L		0.12	<0.12
Pyrene	g/L		0.12	<0.12
Benzo(a)anthracene	g/L		0.08	<0.08
Chrysene	g/L		0.05	<0.05
Benzo(b)fluoranthene	g/L		0.05	<0.05
Benzo(k)fluoranthene	g/L		0.06	<0.06
Benzo(a)pyrene	g/L		0.01	<0.01
Indeno(1,2,3-cd)pyrene	g/L		0.03	<0.03
Dibenzo(a,h)anthracene	g/L		0.09	<0.09
Benzo(g,h,i)perylene	g/L		0.06	<0.06
2-and 1-methyl Napthalene	g/L		0.20	<0.20
Surrogate	**Unit**	**Acceptable Limits**		
Chrysene-d12	%	60-130		98

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Regulation 153 - Volatile Organic Compounds in Water

DATE SAMPLED: Sep 10, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-2 1988848
Dichlorodifluoromethane	g/L		0.80	<0.80
Chloromethane	g/L		1.60	<1.60
Vinyl Chloride	g/L		0.68	<0.68
Bromomethane	g/L		0.80	<0.80
Chloroethane	g/L		0.80	<0.80
Trichlorofluoromethane	g/L		1.60	<1.60
Acetone	g/L		4.0	<4.0
1,1 Dichloroethylene	g/L		1.20	<1.20
Methylene Chloride	g/L		1.20	<1.20
trans- 1,2-dichloroethylene	g/L		0.80	<0.80
Methyl tert-butyl ether	g/L		0.80	<0.80
1,1-Dichloroethane	g/L		1.20	<1.20
Methyl Ethyl Ketone	g/L		4.0	<4.0
cis- 1,2-Dichloroethylene	g/L		0.80	<0.80
Chloroform	g/L		0.80	<0.80
1,2 - Dichloroethane	g/L		0.80	<0.80
1,1,1-Trichloroethane	g/L		1.20	<1.20
Carbon Tetrachloride	g/L		0.80	<0.80
Benzene	g/L		0.80	<0.80
1,2-Dichloropropane	g/L		0.80	<0.80
Trichloroethylene	g/L		0.80	<0.80
Bromodichloromethane	g/L		0.80	<0.80
cis-1,3-Dichloropropene	ug/L		0.80	<0.80
Methyl Isobutyl Ketone	g/L		4.0	<4.0
trans-1,3-Dichloropropene	g/L		1.20	<1.20
1,1,2-Trichloroethane	g/L		0.80	<0.80
Toluene	g/L		0.80	<0.80
2-Hexanone	g/L		1.20	<1.20
Dibromochloromethane	g/L		0.40	<0.40
Ethylene Dibromide	g/L		0.80	<0.80
Tetrachloroethylene	g/L		0.80	<0.80
1,1,1,2-Tetrachloroethane	g/L		0.40	<0.40
Chlorobenzene	g/L		0.40	<0.40

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

O. Regulation 153 - Volatile Organic Compounds in Water

DATE SAMPLED: Sep 10, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-2 1988848
Ethylbenzene	g/L		0.40	<0.40
m & p-Xylene	g/L		0.80	<0.80
Bromoform	g/L		0.40	<0.40
Styrene	g/L		0.40	<0.40
1,1,2,2-Tetrachloroethane	g/L		0.40	<0.40
o-Xylene	g/L		0.40	<0.40
1,3-Dichlorobenzene	g/L		0.40	<0.40
1,4-Dichlorobenzene	g/L		0.40	<0.40
1,2-Dichlorobenzene	g/L		0.40	<0.40
1,2,4-Trichlorobenzene	g/L		1.20	<1.20
1,3-Dichloropropene (Cis + Trans)	g/L		1.20	<1.20
Xylene Mixture (Total)	g/L		0.80	<0.80
n-Hexane	g/L		0.80	<0.80
Surrogate	**Unit**	**Acceptable Limits**		
Toluene-d8	% Recovery	60-130		99
4-Bromofluorobenzene	% Recovery	70-130		92

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

1988848 Dilution factor=4
The sample was diluted because the sample was foamy. The reporting detection limit has been corrected for the dilution factor used.

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

PCBs (soil)

DATE SAMPLED: Sep 09, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	BW-P1-A 1988818	BW-P1-B 1988823	BW-P2-A 1988827	BW-P2-B 1988830	HW-1 1988837	HW-2 1988842	HW-3 1988845
PCBs	g/g		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate	Unit	Acceptable Limits								
Decachlorobiphenyl	%	60-130		97	120	80	90	63	82	89

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard
1988818-1988845 Results are based on the dry weight of soil extracted.

Certified By: Jordy Takewaki

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

BURNSIDE - Water Quality Assessment

DATE SAMPLED: Sep 10, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	Old Lagoon 1-Water 1988850	Old Lagoon 2-Water 1989165	SL-1 1989172
Aluminum	mg/L		0.004	0.142	0.234	0.256
Arsenic	mg/L		0.003	0.004	<0.003	<0.003
Barium	mg/L		0.002	0.011	0.007	0.006
Boron	mg/L		0.010	0.108	0.082	0.162
Cadmium	mg/L		0.002	<0.002	<0.002	<0.002
Calcium	mg/L		0.05	19.3	12.5	7.10
Chromium	mg/L		0.003	<0.003	<0.003	<0.003
Copper	mg/L		0.003	0.009	0.009	0.067
Iron	mg/L		0.010	2.15	1.31	0.455
Potassium	mg/L		0.05	12.1	8.48	17.9
Magnesium	mg/L		0.05	7.91	4.99	2.96
Mercury	mg/L		0.0001	<0.0001	<0.0001	<0.0001
Manganese	mg/L		0.002	0.266	0.052	0.047
Molybdenum	mg/L		0.002	<0.002	<0.002	<0.002
Sodium	mg/L		0.05	47.3	29.9	54.3
Nickel	mg/L		0.003	0.004	<0.003	<0.003
Total Phosphorus	mg/L		0.05	1.96	1.93	7.23
Lead	mg/L		0.002	<0.002	<0.002	<0.002
Selenium	mg/L		0.004	<0.004	<0.004	<0.004
Silver	mg/L		0.002	<0.002	<0.002	<0.002
Strontium	mg/L		0.005	0.107	0.057	0.022
Thallium	mg/L		0.006	<0.006	<0.006	<0.006
Titanium	mg/L		0.002	0.003	0.004	0.005
Uranium	mg/L		0.002	<0.002	<0.002	<0.002
Vanadium	mg/L		0.002	<0.002	<0.002	<0.002
inc	mg/L		0.005	0.006	0.013	0.060
Fluoride	mg/L		0.05	0.21	0.15	0.42
Chloride	mg/L		0.10	60.9	38.6	55.8
Nitrite as N	mg/L		0.05	<0.05	0.12	<0.05
Ortho phosphate as P	mg/L		0.10	<0.10	<0.10	<0.10
Bromide	mg/L		0.05	0.19	0.15	<0.05
Nitrate as N	mg/L		0.05	<0.05	0.67	<0.05

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

BURNSIDE - Water Quality Assessment

DATE SAMPLED: Sep 10, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	Old Lagoon 1-Water 1988850	Old Lagoon 2-Water 1989165	SL-1 1989172
Sulphate	mg/L		0.10	11.2	10.3	11.1
pH	pH Units		NA	7.95	7.73	7.90
Ammonia as N	mg/L		0.02	20.9	7.64	49.7
Total Organic Carbon	mg/L		0.5	28.7	23.9	113
Electrical Conductivity	uS/cm		2	523	324	737
Total Dissolved Solids	mg/L		20	294	200	298
Saturation pH				7.72	8.20	7.95
% Difference/ Ion Balance			0.1	2.7	1.1	0.6
Total Hardness (as CaCO3)	mg/L		10	81	52	30
Langlier Index				0.23	-0.47	-0.05
Carbonate (as CaCO3)	mg/L		5	<5	<5	<5
Bicarbonate (as CaCO3)	mg/L		5	161	83	253
Turbidity	NTU		0.5	6.7	4.7	23.0
Alkalinity (as CaCO3)	mg/L		5	161	83	253
Hydroxide (as CaCO3)	mg/L		5	<5	<5	<5
Reactive Silica	mg/L		0.05	9.25	7.02	14.7
Colour	TCU		5	110	86	208

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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AGAT WORK ORDER: 10T434896
PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

TSS (Water)

DATE SAMPLED: Sep 10, 2010 | DATE RECEIVED: Sep 13, 2010 | DATE REPORTED: Sep 24, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	Old Lagoon 1-Water 1988850	Old Lagoon 2-Water 1989165	SL-1 1989172
Total Suspended Solids	mg/L		10	<10	<10	156

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

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Guideline Violation

AGAT WORK ORDER: 10T434896

PROJECT NO: N-015746

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD

ATTENTION TO: Stephanie Charity

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
1988833	Old Lagoon 1-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Antimony	1.0	1.4
1988833	Old Lagoon 1-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Cadmium	1.0	1.6
1988833	Old Lagoon 1-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Copper	85	273
1988833	Old Lagoon 1-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	0.703
1988833	Old Lagoon 1-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Mercury	0.23	1.00
1988833	Old Lagoon 1-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Molybdenum	2.5	2.8
1988833	Old Lagoon 1-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Selenium	1.9	2.5
1988833	Old Lagoon 1-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Silver	0.42	5.8
1988833	Old Lagoon 1-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	inc	160	533
1988834	Old Lagoon 2-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Antimony	1.0	2.8
1988834	Old Lagoon 2-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Cadmium	1.0	1.1
1988834	Old Lagoon 2-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Copper	85	251
1988834	Old Lagoon 2-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	1.56
1988834	Old Lagoon 2-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Mercury	0.23	0.41
1988834	Old Lagoon 2-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Molybdenum	2.5	3.3
1988834	Old Lagoon 2-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Silver	0.42	4.8
1988834	Old Lagoon 2-Soil	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	inc	160	369
1988835	Active Lagoon	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Antimony	1.0	2.1
1988835	Active Lagoon	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Copper	85	171
1988835	Active Lagoon	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	0.792
1988835	Active Lagoon	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Mercury	0.23	0.31
1988835	Active Lagoon	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Selenium	1.9	3.0
1988835	Active Lagoon	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Silver	0.42	2.7
1988835	Active Lagoon	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	inc	160	242

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AGAT WORK ORDER: 10T449096

PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

Microbiological Analysis (water)

DATE SAMPLED: Nov 02, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-2 2104291
Fecal Coliform	CFU/100mL	1	1	TNTC

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to SDWA -Schedule 23

2104291 TNTC – Too numerous to count, refers to overgrown colonies.

Certified By: Elizabeth Rolakowska

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AGAT WORK ORDER: 10T449096
PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

Microbiological Analysis (water)

DATE SAMPLED: Nov 02, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-4 2104288
Escherichia coli	CFU/100mL	1	1	14
Total Coliforms	CFU/1mL	1	1	4400
Fecal Coliform	CFU/100mL	1	1	5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to SDWA -Schedule 23

2104288 TC counts refer to a 1 ml sample aliquot diluted prior to filtration; a larger aliquot resulted in overgrown colonies. The RDL has been adjusted.

Certified By: Elizabeth Rolokowska

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FAX (905)712-5122
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AGAT WORK ORDER: 10T449096
PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

Particle Size Analysis

DATE SAMPLED: Nov 01, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Soil

Parameter	Unit	G / S	RDL	ARV-5-1 2104259	ARV-5-2 2104261	ARV-4-1 2104263
Sieve Analysis - 4.75 mm	%		N/A	7.98	0.00	10.42
Sieve Analysis - 2.36 mm	%		N/A	1.85	0.05	3.75
Sieve Analysis - 1.18 mm	%		N/A	2.15	0.10	8.09
Sieve Analysis - 600 microns	%		N/A	3.29	0.19	25.98
Sieve Analysis - 300 microns	%		N/A	7.47	1.47	45.95
Sieve Analysis - 150 microns	%		N/A	9.57	3.16	5.03
Sieve Analysis - 75 microns	%		N/A	14.71	11.28	0.34
Sieve Analysis - Retaining Pan	%		N/A	52.98	83.75	0.44

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

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AGAT WORK ORDER: 10T449096
PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

O. Reg 153 Petroleum Hydrocarbon F1 - F4 in Water (-BTEX)

DATE SAMPLED: Nov 01, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-5 2104265	RDL	ARV-5-2 2104274
C6 - C10 (F1)	g/L		25	<25	50	<50
C6 - C10 (F1 minus BTEX)	g/L		25	<25	50	<50
C>10 - C16 (F2)	g/L		100	<100	100	<100
C6 - C16 (F1 + F2)	g/L		100	<100	100	<100
C>16 - C34 (F3)	g/L		100	<100	100	<100
C>34 - C50 (F4)	g/L		100	<100	100	<100
C>16 - C50 (F3 + F4)	g/L		100	<100	100	<100
Gravimetric Heavy Hydrocarbons	g/L		500	NA	500	NA

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

2104265-2104274 The C6-C10 fraction is calculated using Toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and nC34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16 - C50 and are only determined if the chromatogram of the C34 - C50 Hydrocarbons indicated that hydrocarbons >C50 are present.
Total C6-C50 results are corrected for BTEX and PAH contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified without the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Certified By: Jordy Takewaki

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 10T449096
PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

O. Regulation 153 - Volatile Organic Compounds in Water

DATE SAMPLED: Nov 01, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-5 2104265	RDL	ARV-5-2 2104274
Dichlorodifluoromethane	g/L		0.40	<0.40	2.00	<2.00
Chloromethane	g/L		0.80	<0.80	4.00	<4.00
Vinyl Chloride	g/L		0.34	<0.34	1.70	<1.70
Bromomethane	g/L		0.40	<0.40	2.00	<2.00
Chloroethane	g/L		0.40	<0.40	2.00	<2.00
Trichlorofluoromethane	g/L		0.80	<0.80	4.00	<4.00
Acetone	g/L		2.0	<2.0	10.0	<10.0
1,1 Dichloroethylene	g/L		0.60	<0.60	3.00	<3.00
Methylene Chloride	g/L		0.60	<0.60	3.00	<3.00
trans- 1,2-dichloroethylene	g/L		0.40	<0.40	2.00	<2.00
Methyl tert-butyl ether	g/L		0.40	<0.40	2.00	<2.00
1,1-Dichloroethane	g/L		0.60	<0.60	3.00	<3.00
Methyl Ethyl Ketone	g/L		2.0	<2.0	10.0	<10.0
cis- 1,2-Dichloroethylene	g/L		0.40	<0.40	2.00	<2.00
Chloroform	g/L		0.40	<0.40	2.00	<2.00
1,2 - Dichloroethane	g/L		0.40	<0.40	2.00	<2.00
1,1,1-Trichloroethane	g/L		0.60	<0.60	3.00	<3.00
Carbon Tetrachloride	g/L		0.40	<0.40	2.00	<2.00
Benzene	g/L		0.40	<0.40	2.00	<2.00
1,2-Dichloropropane	g/L		0.40	<0.40	2.00	<2.00
Trichloroethylene	g/L		0.40	<0.40	2.00	<2.00
Bromodichloromethane	g/L		0.40	<0.40	2.00	<2.00
cis-1,3-Dichloropropene	ug/L		0.40	<0.40	2.00	<2.00
Methyl Isobutyl Ketone	g/L		2.0	<2.0	10.0	<10.0
trans-1,3-Dichloropropene	g/L		0.60	<0.60	3.00	<3.00
1,1,2-Trichloroethane	g/L		0.40	<0.40	2.00	<2.00
Toluene	g/L		0.40	<0.40	2.00	<2.00
2-Hexanone	g/L		0.60	<0.60	3.00	<3.00
Dibromochloromethane	g/L		0.20	<0.20	1.00	<1.00
Ethylene Dibromide	g/L		0.40	<0.40	2.00	<2.00
Tetrachloroethylene	g/L		0.40	<0.40	2.00	<2.00
1,1,1,2-Tetrachloroethane	g/L		0.20	<0.20	1.00	<1.00
Chlorobenzene	g/L		0.20	<0.20	1.00	<1.00

Certified By: Jordy Takewaki

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4 1Y2
TEL (905)712-5100
FAX (905)712-5122
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Certificate of Analysis

AGAT WORK ORDER: 10T449096
PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

O. Regulation 153 - Volatile Organic Compounds in Water

DATE SAMPLED: Nov 01, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-5 2104265	RDL	ARV-5-2 2104274
Ethylbenzene	g/L		0.20	<0.20	1.00	<1.00
m & p-Xylene	g/L		0.40	<0.40	2.00	<2.00
Bromoform	g/L		0.20	<0.20	1.00	<1.00
Styrene	g/L		0.20	<0.20	1.00	<1.00
1,1,2,2-Tetrachloroethane	g/L		0.20	<0.20	1.00	<1.00
o-Xylene	g/L		0.20	<0.20	1.00	<1.00
1,3-Dichlorobenzene	g/L		0.20	<0.20	1.00	<1.00
1,4-Dichlorobenzene	g/L		0.20	<0.20	1.00	<1.00
1,2-Dichlorobenzene	g/L		0.20	<0.20	1.00	<1.00
1,2,4-Trichlorobenzene	g/L		0.60	<0.60	3.00	<3.00
1,3-Dichloropropene (Cis + Trans)	g/L		0.60	<0.60	3.00	<3.00
Xylene Mixture (Total)	g/L		0.40	<0.40	2.00	<2.00
n-Hexane	g/L		0.40	<0.40	2.00	<2.00
Surrogate	**Unit**	**Acceptable Limits**				
Toluene-d8	% Recovery	60-130		76		74
4-Bromofluorobenzene	% Recovery	70-130		89		85

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

2104265 Dilution factor=2
The sample was diluted becauce it was foamy. The reporting detection limit has been corrected for the dilution factor used.

2104274 Dilution factor=10
The sample was diluted becauce it was foamy. The reporting detection limit has been corrected for the dilution factor used.

Certified By: Jordy Takewaki

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MISSISSAUGA, ONTARIO
CANADA L4 1Y2
TEL (905)712-5100
FAX (905)712-5122
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AGAT WORK ORDER: 10T449096
PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

BOD (Water)

DATE SAMPLED: Nov 02, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-2 2104291
BOD (5)	mg/L		5	34

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

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5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

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AGAT WORK ORDER: 10T449096
PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

BOD, EC, pH & TSS (Water)

DATE SAMPLED: Nov 02, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-4 2104288
BOD (5)	mg/L		5	30
Electrical Conductivity	uS/cm		2	2510
pH	pH Units		NA	7.92
Total Suspended Solids	mg/L		10	368

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

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5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4 1Y2
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FAX (905)712-5122
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AGAT WORK ORDER: 10T449096
PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

Water Quality Assessment

DATE SAMPLED: Nov 01, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-5 2104265	RDL	ARV-5-2 2104274
Aluminum	mg/L		0.004	3.92	0.040	6.13
Arsenic	mg/L		0.003	0.008	0.003	0.012
Barium	mg/L		0.002	0.073	0.002	0.074
Boron	mg/L		0.010	0.045	0.010	0.769
Cadmium	mg/L		0.002	<0.002	0.002	0.003
Calcium	mg/L		0.05	45.5	0.05	106
Chromium	mg/L		0.003	0.010	0.003	0.111
Copper	mg/L		0.003	0.010	0.003	0.039
Iron	mg/L		0.010	5.85	0.100	131
Potassium	mg/L		0.05	7.66	0.05	57.1
Magnesium	mg/L		0.05	32.7	0.05	290
Mercury	mg/L		0.0001	<0.0001	0.0001	<0.0001
Manganese	mg/L		0.002	0.490	0.002	0.831
Molybdenum	mg/L		0.002	<0.002	0.002	0.003
Sodium	mg/L		0.05	160	0.05	1640
Nickel	mg/L		0.003	0.012	0.003	0.049
Total Phosphorus	mg/L		0.05	0.87	0.05	2.42
Lead	mg/L		0.002	0.008	0.002	0.010
Selenium	mg/L		0.004	<0.004	0.004	<0.004
Silver	mg/L		0.002	<0.002	0.002	<0.002
Strontium	mg/L		0.005	0.408	0.005	1.50
Thallium	mg/L		0.006	<0.006	0.006	<0.006
Titanium	mg/L		0.002	0.114	0.002	0.132
Uranium	mg/L		0.002	<0.002	0.002	0.004
Vanadium	mg/L		0.002	0.022	0.002	0.056
inc	mg/L		0.005	0.068	0.005	0.079
Fluoride	mg/L		0.05	<0.05	0.50	<0.50
Chloride	mg/L		0.10	340	1.00	3110
Nitrite as N	mg/L		0.05	<0.05	0.50	<0.50
Ortho phosphate as P	mg/L		0.10	<0.10	1.00	<1.00
Bromide	mg/L		0.05	1.28	0.50	12.3
Nitrate as N	mg/L		0.05	<0.05	0.50	<0.50
Sulphate	mg/L		0.10	55.9	1.00	636

Certified By:

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5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4 1Y2
TEL (905)712-5100
FAX (905)712-5122
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AGAT WORK ORDER: 10T449096
PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

Water Quality Assessment

DATE SAMPLED: Nov 01, 2010 | DATE RECEIVED: Nov 03, 2010 | DATE REPORTED: Nov 11, 2010 | SAMPLE TYPE: Water

Parameter	Unit	G / S	RDL	ARV-5 2104265	RDL	ARV-5-2 2104274
pH	pH Units		NA	6.61	NA	6.31
Ammonia as N	mg/L		0.02	<0.02	0.02	20.8
Total Organic Carbon	mg/L		0.5	53.6	0.5	240
Electrical Conductivity	uS/cm		2	1200	2	9230
Total Dissolved Solids	mg/L		20	816	20	5930
Saturation pH				7.83		6.66
% Difference/ Ion Balance			0.1	1.7	0.1	<0.1
Total Hardness (as CaCO3)	mg/L		10	248	10	1460
Langlier Index				-1.22		-0.35
Carbonate (as CaCO3)	mg/L		5	<5	5	<5
Bicarbonate (as CaCO3)	mg/L		5	47	5	118
Turbidity	NTU		0.5	369	0.5	239
Alkalinity (as CaCO3)	mg/L		5	47	5	118
Hydroxide (as CaCO3)	mg/L		5	<5	5	<5
Reactive Silica	mg/L		0.05	13.8	0.05	31.8
Colour	TCU		5	113	5	1050

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

Certified By:

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5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4 1Y2
TEL (905)712-5100
FAX (905)712-5122
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Guideline Violation

AGAT WORK ORDER: 10T449096

PROJECT NO: NAO157460.0002

CLIENT NAME: R.J. BURNSIDE & ASSOCIATES LTD.

ATTENTION TO: Stephanie Charity

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
2104288	ARV-4	SDWA -Schedule 23	Microbiological Analysis (water)	Escherichia coli	1	14
2104288	ARV-4	SDWA -Schedule 23	Microbiological Analysis (water)	Fecal Coliform	1	5
2104288	ARV-4	SDWA -Schedule 23	Microbiological Analysis (water)	Total Coliforms	1	4400

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

TOXICITY TEST REPORT
Daphnia magna

Work Order : 217681
Sample Number : 28312

SAMPLE IDENTIFICATION

Company :	R.J Burnside & Associates Ltd.	Time Collected :	17:30
Location :	Orangeville ON	Date Collected :	2010-09-08
Substance :	ARV Sewage Lagoon	Date Received :	2010-09-10
Sampling Method :	Not given	Date Tested :	2010-09-10
Sampled By :	R.J.	Temp. on arrival :	7.0 °C
Sample Description :	Cloudy, green, earthy odour.		

Test Method : Reference Method for Determining Acute Lethality of Effluents to *Daphnia magna.* Environment Canada EPS 1/RM/14 (Second Edition, December 2000).

48-h TEST RESULTS

Substance	Effect	Value
Control	Mean Immobility	0.0 %
	Mean Mortality	0.0 %
100%	Mean Immobility	0.0 %
	Mean Mortality	0.0 %

The results reported relate only to the sample tested.

SODIUM CHLORIDE REFERENCE TOXICANT DATA

Organism Batch :	Dm10-17		
Date Tested (yyyy/mm/dd) :	2010-09-13	Historical Mean LC50 :	6.7 g/L
LC50 (95% Confidence Limits) :	6.5 g/L (6.1 - 6.9)	Warning Limits (± 2SD) :	6.1 - 7.4 g/L
Statistical Method :	Probit	Analyst(s) :	LB/SM

Daphnia magna CULTURE HEALTH DATA

Time to First Brood :	7.6 days	Mean Young Per Brood :	30.6
Culture Mortality :	0% (previous 7 days)		

TEST CONDITIONS

Sample Treatment :	None	Number of Replicates :	3
pH Adjustment :	None	Test Organisms / Replicate :	10
Test Aeration :	None	Total Organisms / Test Level :	30
Organism Batch :	Dm10-17	Organism Loading Rate :	15.0 mL/organism

Date: 2010-09-29
yyyy-mm-dd

Approved by: K Dube
Project Manager

Work Order: 217681
Sample Number: 28312

	Hardness (mg/L as $CaCO_3$)	Hardness Adjustment	pH	D.O. (mg/L)	Cond. (µmhos/cm)	Temp. (°C)	O_2 Sat. (%)*	Total Pre-Aeration Time (h) @ 30 mL/min/L
Initial Water Chemistry:	120	None	7.7	3.7	931	20.0	42	0:00

0 hours

Date & Time 2010-09-10 14:30
Technician: LB

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.	O_2 Sat. (%)*	Hardness
100A	0	0	7.7	3.7	931	20.0	42	120
100B	0	0	7.7	3.7	931	20.0		
100C	0	0	7.7	3.7	931	20.0		
Control A	0	0	8.5	8.6	397	21.0		
Control B	0	0	8.5	8.6	397	21.0		
Control C	0	0	8.5	8.6	397	21.0	99	220

Notes: Indigenous organisms, were attempted to be removed from 100% effluent prior to test initiation.
Dark coloured sample.

24 hours

Date & Time 2010-09-11 14:30
Technician: DK

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100A	0	1	–	–	–	21.0
100B	0	0	–	–	–	21.0
100C	0	0	–	–	–	21.0
Control A	0	0	–	–	–	21.0
Control B	0	0	–	–	–	21.0
Control C	0	0	–	–	–	21.0

Notes:

48 hours

Date & Time 2010-09-12 14:30
Technician: DK

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100A	0	0	8.6	9.6	912	20.0
100B	0	0	8.6	9.6	914	20.0
100C	0	0	8.6	10.0	907	20.0
Control A	0	0	8.5	8.5	395	20.0
Control B	0	0	8.6	8.6	399	20.0
Control C	0	0	8.6	8.5	402	20.0

Notes: >30 live organisms counted. No dead daphnids or carapaces found within sample.

# of control organisms showing stress: 0
Daphnia Batch #: Dm10-17

Number immobile does not include number of mortalities.

– = not measured
* adjusted for actual temp. & barometric pressure

Test Data Reviewed By: KEH
Date: 2010-09-29

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

TOXICITY TEST REPORT
Rainbow Trout

Work Order : 217681
Sample Number : 28312

SAMPLE IDENTIFICATION

Company :	R.J Burnside & Associates Ltd.	Time Collected :	17:30
Location :	Orangeville ON	Date Collected :	2010-09-08
Substance :	ARV Sewage Lagoon	Date Received :	2010-09-10
Sampling Method :	Not given	Date Tested :	2010-09-10
Sampled By :	R.J.	Temp. on arrival :	7.0°C
Sample Description :	Cloudy, green, earthy odour.		

Test Method : Reference Method for Determining Acute Lethality of Liquid Effluents to Rainbow Trout. Environment Canada, EPS 1/RM/13 (2nd Edition, December 2000, with May 2007 amendments).

96-h TEST RESULTS

Substance	Effect	Value
Control	Mean Immobility	0.0 %
	Mean Mortality	0.0 %
100%	Mean Immobility	0.0 %
	Mean Mortality	100.0 %

The results reported relate only to the sample tested.

POTASSIUM CHLORIDE REFERENCE TOXICANT DATA

Organism Batch :	T10-12		
Date Tested (yyyy-mm-dd) :	2010-09-01	Historical Mean LC50 :	4004 mg/L
LC50 (95% Confidence Limits) :	3560 mg/L (3187 - 3961)	Warning Limits (± 2SD) :	3365 - 4766 mg/L
Statistical Method :	Probit	Analyst(s) :	MP/FS/TL

TEST FISH

Control Fish Sample Size :	10	Cumulative stock tank mortality:	0 % (prev. 7 days)
Mean Fish Weight (± 2 SD) :	0.91 ± 0.44 g	Mean Fish Fork Length (± 2 SD) :	45.2 ± 7.3 mm
Range of Weights :	0.59 - 1.27 g	Range of Fork Lengths (mm) :	40 - 50 mm
Fish Loading Rate :	0.4 g/L		

TEST CONDITIONS

Sample Treatment :	None	Volume Tested (L) :	21
pH Adjustment :	None	Number of Replicates :	1
Test Aeration :	Yes	Organisms Per Replicate :	10
Pre-aeration/Aeration Rate :	6.5 ± 1 mL/min/L	Total Organisms Per Test Level :	10
Organism Batch :	T10-12		

Date: 2010-09-20
yyyy-mm-dd

Approved by: _____
Project Manager

Work Order: 217681
Sample Number: 28312

Total Pre-Aeration Time (h)		pH	D.O. (mg/L)	Cond. (µmhos/cm)	Temp. (°C)	O_2 Sat. (%)*
2:00	**Initial Water Chemistry:**	7.4	2.6	835	16.0	–
	Chemistry after 30min air:	7.4	4.5	826	16.0	49

0 hours

Date & Time 2010-09-10 16:10
Technician: FS

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.	O_2 Sat. (%)*
100	0	0	7.4	7.3	825	15.5	76
Control	0	0	7.9	9.6	535	15.0	100

Notes:

24 hours

Date & Time 2010-09-11 16:10
Technician: DK

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100	9	0	7.8	7.2	811	15.5
Control	0	0	–	–	–	15.5

Notes:

48 hours

Date & Time 2010-09-12 16:10
Technician: DK

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100	10	0	7.9	7.8	821	15.0
Control	0	0	–	–	–	15.0

Notes:

72 hours

Date & Time 2010-09-13 16:10
Technician: FS

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100	10	0	–	–	–	–
Control	0	0	–	–	–	15.0

Notes:

96 hours

Date & Time 2010-09-14 16:10
Technician: FS

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100	10	0	–	–	–	–
Control	0	0	8.2	9.4	519	15.0

Notes:

# of control organisms showing stress: 0
Trout Batch #: T10-12

"–" = not measured
Number immobile does not include number of mortalities.
* adjusted for actual temp. & barometric pressure

Test Data Reviewed By: KFH
Date: 2010-09-16

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

TOXICITY TEST REPORT
Daphnia magna

Work Order : 217681
Sample Number : 28313

SAMPLE IDENTIFICATION

Company :	R.J Burnside & Associates Ltd.	Time Collected :	17:45
Location :	Orangeville ON	Date Collected :	2010-09-08
Substance :	ARV Landfill	Date Received :	2010-09-10
Sampling Method :	Not given	Date Tested :	2010-09-10
Sampled By :	R.J.	Temp. on arrival :	7.0 °C
Sample Description :	Cloudy, green, earthy odour.		

Test Method : Reference Method for Determining Acute Lethality of Effluents to *Daphnia magna.* Environment Canada EPS 1/RM/14 (Second Edition, December 2000).

48-h TEST RESULTS

Substance	Effect	Value
Control	Mean Immobility	0.0 %
	Mean Mortality	0.0 %
100%	Mean Immobility	0.0 %
	Mean Mortality	0.0 %

The results reported relate only to the sample tested.

SODIUM CHLORIDE REFERENCE TOXICANT DATA

Organism Batch :	Dm10-17		
Date Tested (yyyy/mm/dd) :	2010-09-13	Historical Mean LC50 :	6.7 g/L
LC50 (95% Confidence Limits) :	6.5 g/L (6.1 - 6.9)	Warning Limits (± 2SD) :	6.1 - 7.4 g/L
Statistical Method :	Probit	Analyst(s) :	LB/SM

Daphnia magna CULTURE HEALTH DATA

Time to First Brood :	7.6 days	Mean Young Per Brood :	30.6
Culture Mortality :	0% (previous 7 days)		

TEST CONDITIONS

Sample Treatment :	None	Number of Replicates :	3
pH Adjustment :	None	Test Organisms / Replicate :	10
Test Aeration :	None	Total Organisms / Test Level :	30
Organism Batch :	Dm10-17	Organism Loading Rate :	15.0 mL/organism

Date: 2010-09-27
yyyy-mm-dd

Approved by: K Dube
Project Manager

Work Order: 217681
Sample Number: 28313

	Hardness (mg/L as $CaCO_3$)	Hardness Adjustment	pH	D.O. (mg/L)	Cond. (µmhos/cm)	Temp. (°C)	O_2 Sat. (%)*	Total Pre-Aeration Time (h) @ 30 mL/min/L
Initial Water Chemistry:	820	None	7.9	6.2	2471	21.0	72	0:00

0 hours

Date & Time 2010-09-10 14:35
Technician: LB

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.	O_2 Sat. (%)*	Hardness
100A	0	0	7.9	6.2	2471	21.0	72	820
100B	0	0	7.9	6.2	2471	21.0		
100C	0	0	7.9	6.2	2471	21.0		
Control A	0	0	8.5	8.6	397	21.0		
Control B	0	0	8.5	8.6	397	21.0		
Control C	0	0	8.5	8.6	397	21.0	99	220

Notes: Indigenous organisms, were attempted to be removed from 100% effluent prior to test initiation.
Dark coloured sample.

24 hours

Date & Time 2010-09-11 14:35
Technician: DK

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100A	0	0	–	–	–	21.0
100B	0	0	–	–	–	21.0
100C	0	0	–	–	–	21.0
Control A	0	0	–	–	–	21.0
Control B	0	0	–	–	–	21.0
Control C	0	0	–	–	–	21.0

Notes:

48 hours

Date & Time 2010-09-12 14:35
Technician: DK

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100A	0	0	8.4	9.7	2218	20.0
100B	0	0	8.4	9.8	2236	20.0
100C	0	0	8.5	9.8	2257	20.0
Control A	0	0	8.4	8.7	399	20.0
Control B	0	0	8.5	8.6	406	20.0
Control C	0	0	8.5	8.6	395	20.0

Notes:

# of control organisms showing stress: 0
Daphnia Batch #: Dm10-17

Number immobile does not include number of mortalities.

– = not measured
* adjusted for actual temp. & barometric pressure

Test Data Reviewed By: KEH
Date: 2010-09-23

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

TOXICITY TEST REPORT
Rainbow Trout

Work Order : 217681
Sample Number : 28313

SAMPLE IDENTIFICATION

Company :	R.J Burnside & Associates Ltd.	Time Collected :	17:45
Location :	Orangeville ON	Date Collected :	2010-09-08
Substance :	ARV Landfill	Date Received :	2010-09-10
Sampling Method :	Not given	Date Tested :	2010-09-10
Sampled By :	R.J.	Temp. on arrival :	7.0°C
Sample Description :	Cloudy, green, earthy odour.		

Test Method : Reference Method for Determining Acute Lethality of Liquid Effluents to Rainbow Trout. Environment Canada, EPS 1/RM/13 (2nd Edition, December 2000, with May 2007 amendments).

96-h TEST RESULTS

Substance	Effect	Value
Control	Mean Immobility	0.0 %
	Mean Mortality	0.0 %
100%	Mean Immobility	0.0 %
	Mean Mortality	100.0 %

The results reported relate only to the sample tested.

POTASSIUM CHLORIDE REFERENCE TOXICANT DATA

Organism Batch :	T10-12		
Date Tested (yyyy-mm-dd) :	2010-09-01	Historical Mean LC50 :	4004 mg/L
LC50 (95% Confidence Limits) :	3560 mg/L (3187 - 3961)	Warning Limits (± 2SD) :	3365 - 4766 mg/L
Statistical Method :	Probit	Analyst(s) :	MP/FS/TL

TEST FISH

Control Fish Sample Size :	10	Cumulative stock tank mortality:	0 % (prev. 7 days)
Mean Fish Weight (± 2 SD) :	0.72 ± 0.20 g	Mean Fish Fork Length (± 2 SD) :	42.8 ± 5.1 mm
Range of Weights :	0.62 - 0.95 g	Range of Fork Lengths (mm) :	40 - 48 mm
Fish Loading Rate :	0.4 g/L		

TEST CONDITIONS

Sample Treatment :	None	Volume Tested (L) :	17
pH Adjustment :	None	Number of Replicates :	1
Test Aeration :	Yes	Organisms Per Replicate :	10
Pre-aeration/Aeration Rate :	6.5 ± 1 mL/min/L	Total Organisms Per Test Level :	10
Organism Batch :	T10-12		

Date: 2010-09-20
yyyy-mm-dd

Approved by: K Dube
Project Manager

Work Order: 217681
Sample Number: 28313

Total Pre-Aeration Time (h)		pH	D.O. (mg/L)	Cond. (µmhos/cm)	Temp. (°C)	O_2 Sat. (%)*
1:30	Initial Water Chemistry:	7.7	5.5	2290	16.0	–
	Chemistry after 30min air:	7.9	6.4	2165	16.0	68

0 hours

Date & Time 2010-09-10 15:40
Technician: FS

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.	O_2 Sat. (%)*
100	0	0	7.8	7.1	2152	16.0	74
Control	0	0	7.9	9.6	535	15.0	100

Notes:

24 hours

Date & Time 2010-09-11 15:40
Technician: DK

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100	4	0	–	–	–	15.5
Control	0	0	–	–	–	15.5

Notes:

48 hours

Date & Time 2010-09-12 15:40
Technician: DK

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100	8	0	8.1	8.4	2055	15.0
Control	0	0	–	–	–	15.0

Notes:

72 hours

Date & Time 2010-09-13 15:40
Technician: FS

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100	9	1	–	–	–	15.0
Control	0	0	–	–	–	15.0

Notes: Remaining test organism in 100% effluent is on side at bottom of test chamber.

96 hours

Date & Time 2010-09-14 15:40
Technician: FS

Test Conc. (%)	Mortality	Immobility	pH	D.O.	Cond.	Temp.
100	10	0	8.1	8.2	2036	15.0
Control	0	0	8.3	9.3	544	15.0

Notes:

# of control organisms showing stress: 0
Trout Batch #: T10-12

"–" = not measured
Number immobile does not include number of mortalities.
* adjusted for actual temp. & barometric pressure

Test Data Reviewed By: KEH
Date: 2010-09-16

CHAIN OF CUSTODY RECORD

AQUATOX

AquaTox Work Order No: 217681

Shipping Address: AquaTox Testing & Consulting Inc.
11B Nicholas Beaver Road, RR #3
Guelph, Ontario Canada N1H 6H9

Voice: (519) 763-4412 **Fax:** (519) 763-4419

P.O. Number: N-O 15746
Field Sampler Name (print): Jim Walls
Signature:
Affiliation: R.J. Burnside + Assoc
Sample Storage (prior to shipping): cooler w/ ice
Custody Relinquished by: Stephanie Charity
Date/Time Shipped:

Client: R.J. Burnside + Assoc
292 Speedvale Ave W
Guelph ON
Phone: 519-823-4995
Fax: 519-836-5477
Contact: Stephanie Charity

Sample Identification					Analyses Requested									Sample Method and Volume		
Date Collected (yyyy-mm-dd)	Time Collected (e.g. 14:30, 24 hr clock)	Sample Name	AquaTox Sample Number	Temp. on arrival	Rainbow Trout Single Concentration	Rainbow Trout LC50	*Daphnia magna* Single Concentration	*Daphnia magna* LC50	Fathead Minnow Survival & Growth	*Ceriodaphnia dubia* Survival & Reproduction	*Lemna minor* Growth	*Pseudokirchneriella subcapitata* Growth	Microtox	Grab	Composite	# of Containers and Volume (eg. 2 x 1L, 3 x 10L, etc.)
2010 09 08	17:30	ARV-2	28312	7.0	X		X							X		1 x 20L
2010 09 08	11:45	ARV-4	28313	7.0	X		X							X		1 x 20L

For Lab Use Only
Received By:
Date:
Time:
Storage Location:
Storage Temp.(°C):

Please list any special requests or instructions: