SCHEMATIC DESIGN REPORT

Natural Tundra Wetland Sewage Treatment Area Design

Coral Harbour, NU

Community & Government Services,
Government of Nunavut.

PROJECT NO. 1023336

NUNAMI
JACQUES WHITFORD LIMITED

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REPORT TO:

Community and Government Services
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ON:

Schematic Design
Natural Tundra Wetland Sewage Treatment Facility
Coral Harbour, NU

August 29, 2007

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EXECUTIVE SUMMARY

Nunami Jacques Whitford Ltd. (Nunami) was retained by the Department of Community and Government Services (CGS) of the Government of Nunavut (GN) to prepare a design for the Natural Tundra Wetland Sewage Treatment Area in Coral Harbour and to submit an application to licence the facility to the Nunavut Water Board (NWB). This report presents a schematic design for the facility for review by CGS.

The Hamlet of Coral Harbour has been disposing of its sewage at a location approximately 3 km north of the Community. Originally, sewage was discharged from trucks directly to the tundra where it flowed east through a wetland eventually reaching the ocean. Previous investigations have confirmed that the tundra wetland was successfully treating the sewage effluent. A detention cell was constructed in 2003 to provide typical lagoon treatment of sewage prior to discharge to the tundra wetland. The berms of the detention cell are not impervious and effluent seeps from the detention cell to the tundra wetland in an uncontrolled manner. Sewage effluent is treated in the tundra wetland as was the case prior to construction of the detention cell.

Sewage disposal and treatment in Coral Harbour is currently regulated by the Nunavut Water Board, under Water Licence NWB3COR0217, expiring October 2007. Effluent quality standards prescribed in the licence require compliance at discharge from the “Sewage Disposal Facilities”, which is currently considered to be the detention cell. As the detention cell provides only limited retention and treatment, effluent seeping from the cell does not comply with licence standards; however, compliance with the standards are achieved downstream in the wetland.

Nunami evaluated two options to achieve compliance: repair of the detention cell to function as a typical storage and treatment lagoon; and, enhancement of the natural tundra wetland. The natural tundra wetland system was selected as the preferred option for sewage treatment for the community. The wetland would be considered to be the “Sewage Treatment Facility”; compliance with Water Licence effluent quality standards would be achieved at the discharge of the facility, sampling station # 5. A preliminary design for enhancements to the wetland was prepared. Enhancements include the construction of three granular diversion berms to direct flows during periods of high flows and the installation of signage to advise the public of the treatment area. Upon approval of the preliminary design concept, Nunami will prepare construction drawings and tender documents for review by CGS. A schematic design of the enhancements has been prepared. The estimated cost for the enhancement to the wetland system is $153,000.

To advance the design and construction of enhancements to the wetland, it is recommended that:

1. The natural tundra wetland sewage treatment process be selected for formal implementation in Coral Harbour.
2. The preliminary design be advanced to the 50% complete design phase for further review.
3. An application to renew the Hamlet’s Water Licence, incorporating the tundra wetland sewage treatment area be prepared for submission to the Nunavut Water Board.

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1.0 INTRODUCTION

Nunami Jacques Whitford Ltd. (Nunami) was retained by the Department of Community and Government Services (CGS) of the Government of Nunavut (GN) to prepare a design for the Natural Tundra Wetland Sewage Treatment Area in Coral Harbour, Nunavut. The design and subsequent implementation is intended to enable the Hamlet to achieve compliance with effluent quality standards in its current and future Water Licences issued by the Nunavut Water Board (NWB). Upon approval of the design, Nunami will submit an application to renew the Hamlet's Water Licence, which regulates water use and waste disposal in the community. This report presents the schematic design for the Tundra Wetland Sewage Treatment Area for review by CGS. The next stages in the project will involve detailed design, submission of the water licence application and tendering of the physical works. Construction is expected to occur in fiscal year 2008/09.

The report is organized as follows: Section 2 provides background information about the tundra wetland and sewage generation forecasts. Regulatory requirements are identified in Section 3. Design options are presented in Section 4, followed by a schematic design of the recommended option in Section 5. Conclusions and recommendations are presented in Section 6, with standard closure reporting in Section 7. Drawings and 2007 effluent quality laboratory certificates are presented in Appendices.

2.0 BACKGROUND

2.1 Community Information

The Hamlet of Coral Harbour is located on the south shore of Southampton Island in the northern portion of Hudson Bay, Nunavut. The geographic co-ordinates of the community are 64^0 08'N, 83^0 10'W. The location of the community is illustrated on Drawing 1 in **Appendix A**.

The Hamlet is situated in the zone of continuous permafrost in the Canadian Shield. Tundra vegetation overlies bedrock, which is mainly Paleozoic marine limestone. There are gravel and fine deposits in low-lying areas, scattered boulders, muskeg and exposed rocks, often in the form of ridges a few meters to a hundred meters or more in length, usually oriented north-south. The area is characterized by low relief and many shallow surface water bodies.

The average annual precipitation in the Coral Harbour vicinity consists of 141 mm of rainfall and 1,319 mm of snowfall, resulting in an annual total of approximately 273 mm of precipitation as rain. The July mean high and low temperatures are 13.1^{o}C and 4.2^{o}C, respectively. The January mean high and low temperatures are -25.5^{o}C and -33.8^{o}C respectively.

The population of the community was estimated at 789 in 2006 by the Bureau of Statistics of the Government of Nunavut (Nunavut Bureau of Statistics, 2007). Economic activities include tourism, arts and crafts and public services. Electrical services are provided by the Nunavut Power Corporation, while the Hamlet provides trucked water, sewage and waste disposal services. The community has regularly scheduled air service. However, most supplies arrive annually by barge during the open water period.

Sewage is collected from the Hamlet's houses and other buildings by truck and discharged into the bermed sewage detention cell located approximately 3 km north of the community. The detention cell was constructed in 2003 and has an area of approximately 25,300 m^2. The detention cell is equipped with an outflow valve. The detention cell was designed to act as a storage lagoon with an annual discharge. However, the berms are not impermeable and effluent seeps through the berms in the east and south-east boundaries of the cell. Effluent leaving the detention cell flows through a tundra wetland consisting of boggy areas and a series of wetland ponds which provide sewage treatment, eventually reaching the ocean several kilomtres distant. Prior to construction of the detention cell in 2003, sewage was discharged onto the tundra in the location of the current cell and was treated in the wetland, as is practiced currently.

2.2 Sewage Generation Rates and Forecast

System analysis and design requires projection of wastewater generation rates for a 20-year planning horizon. The Nunavut Bureau of Statistics estimated a population of 789 in 2006. Table 1 illustrates population projections for the Hamlet of Coral Harbour for a 20 year period, based on an annual increase of 2.45%, as projected by the Nunavut Bureau of Statistics.

Table 1: Population Projections- Coral Harbour, Nunavut

Year	Population
2007	808
2012	912
2017	1,030
2022	1,162
2025	1,312

Projected sewage generation rates for the period between 2007 and 2027 are illustrated in Table 2 below. Sewage volumes are anticipated to be equal to water consumption volumes. The annual sewage generation is projected, based on a per capita water consumption rate of 100 Liters per capita per day (L/c/d.). The volume of sewage produced during a ten-month period each year is also included in the table.

Table 2: Sewage Generation Projections – Coral Harbour, Nunavut

Year	Population	Annual Water Consumption (m^3)	Annual Sewage Volume (m^3)	10-Month Sewage Volume (m^3)
2007	808	29492	29492	24240
2008	828	30215	30215	24834
2009	848	30955	30955	25442
2010	869	31713	31713	26066
2011	890	32490	32490	26704
2012	912	33286	33286	27359
2013	934	34102	34102	28029
2014	957	34937	34937	28715
2015	981	35793	35793	29419
2016	1005	36670	36670	30140
2017	1030	37568	37568	30878
2018	1054	38489	38489	31635
2019	1080	39432	39432	32410
2020	1107	40398	40398	33204
2021	1134	41388	41388	34017
2022	1162	42402	42402	34851
2023	1190	43441	43441	35705
2024	1219	44505	44505	36579
2025	1249	45595	45595	37476
2026	1280	46712	46712	38394
2027	1312	47857	47857	39334

2.3 Previous Studies of the Wetland

Several investigations of the Tundra Wetland Sewage Treatment Area in Coral Harbour have been undertaken in the past. Relevant information from previous investigations is summarized below.

UMA Engineering Ltd., Coral Harbour Sewage and Solid Waste Improvements (1994)

This study was summarized in the 2002 FSC Report, with the key findings including:

- Sewage discharge should be into a “lagoon” with discharge control. The main purpose of the lagoon would be to retain solids and it would not be expected to treat other contaminants.
- Existing natural wetlands downstream of the lagoon should provide adequate treatment.
- Mechanical treatment was not recommended due to extreme operating conditions, including temperature, the distance and limited access for maintenance, intermittent high strength waste, and limited availability of trained personnel.

Arctic Environmental Services Review of Natural Wetlands System (1994)

Arctic Environmental Services (AES) was commissioned by the Government of the Northwest Territories to determine the effectiveness of the existing natural wetlands treatment system and to identify any necessary changes to address public health concerns. Key findings included:

- The existing natural wetland provided good effluent treatment, with 90% removal of BOD/TSS and ammonia within 600 m from the sewage truck discharge point. The first two downstream ponds had a combined detention time of 94 days, and the next pond had a detention time of 236 days.
- There was no reason to enhance the flow patterns through the wetland system.
- A wastewater analysis indicated heavy metals were not present in effluent, but there was a negative impact on water quality from landfill leachate seeping from the Hamlet’s landfill located alongside the sewage discharge point.
- Flow from the sewage discharge point was to the east and south.

Ferguson Simek Clark (FSC) – Sewage Treatment and Solid Waste Improvements (2002)

The objective of this study was to develop a design for a new access road, dumpsite and sewage detention pond. Key findings included:

- The total area covered by the existing natural treatment wetland system was estimated at approximately 10.5 ha, which includes approximately 7 ha of ponds and the remaining 3.5 ha covered by soils. Primary vegetation in the area was reported to be cotton grasses and sedges.
- Effluent flows were predominantly to the southeast towards the ocean. Effluent flows were reported through the toe of the expanding solid waste facility.
- The existing natural wetland system is sufficient for treating sewage for the next 20 years.
- Flow attenuating berms to direct the effluent were recommended.

DIAND Water Licence Inspection Report (2003)

Key findings included the following non-compliance issues related to sewage treatment:

- The absence of containment for the leachate from the Hamlet’s landfill.
- Insufficient treatment of the sewage effluent.
- The absence of an Operation and Maintenance Manual for the Sewage and Solid Waste Facilities.

- The absence of sampling records from Monitoring Stations COR-2 and COR-3 for the months of May-August 2003.

The existing sewage detention cell was built during the summer of 2003.

DIAND Water Licence Inspection Report (2004)

Key findings included the following non-compliance issues related to sewage treatment:

- The absence of containment of leachate at the landfill.
- Inadequate segregation of wastes at the landfill.
- Insufficient treatment of sewage effluent.
- Leakage from the berms of the new sewage detention cell.

National Testing Services Laboratory Report (2004)

CGS collected samples of soil materials similar to those which may have been used in constructing the berms of the detention cell. Laboratory results, provided in **Appendix B,** showed negligible clay and silt content in them, which indicates that a berm built from the tested material is unlikely to be watertight.

Jacques Whitford Limited - Study of Wetland Sewage Treatment Area (2005)

Jacques Whitford conducted an investigation of the Tundra Wetland Sewage Treatment Area in 2004, involving a site investigation to evaluate effluent flow directions, collection and analysis of effluent and water samples throughout the wetland and an overall evaluation of the effectiveness of the wetland in meeting current and anticipated regulatory requirements. A geotechnical investigation of the detention cell berms and surrounding areas was also undertaken. Key findings of the study included:

- The tundra wetland is effectively treating sewage effluent from the detention cell to existing Water Licence effluent quality standards and anticipated criteria to be implemented by Environment Canada;
- Toxicity testing confirmed that effluent at the proposed compliance point in the wetland is not toxic to fish;
- Metals were detected in effluent, likely resulting from landfill leachate;
- The wetland could meet treatment requirements for a 20 year planning horizon
- Flow diversion berms should be installed in three key locations to divert effluent flows during periods of high flow (spring freshet).

Community and Government Services, Site Investigation Report for the Sewage Disposal System in the Hamlet of Coral Harbour (2005)

CGS Staff conducted effluent sampling at locations in the wetland (locations sampled by Jacques Whitford in 2004) in July and August 2005. Based on the analytical results from the samples collected, CGS concluded that effluent discharged from the detention cell met current water licence effluent quality standards and CCME Water Quality Guidelines for the Protection of Aquatic Life at the proposed compliance point in the wetland treatment area.

Community and Government Services, Analysis of the Sewage Wetland in Coral Harbour (2006)

CGS Staff conducted additional effluent sampling in June and July 2006 at locations sampled in 2005. CGS concluded, with the exception of some metals, effluent met current water licence effluent quality standards at the proposed compliance point in the wetland treatment area. Metals in excess of CCME guidelines were detected in some samples, likely a result of landfill leachate which also enters the tundra wetland.

DIAND Water Licence Inspection Report (2004)

The inspection reported that all sewage effluent samples were within licence limits and the Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories, 1992. Key findings included the following non-compliance issues:

- Signs identifying the sewage lagoon, landfill and SNP stations need to be installed.
- Barrels located inside the lagoon should be removed
- Monthly sampling at stations COR-2 and COR-3 during May to August should be performed
- Ponding in the solid waste landfill needs to be addressed
- Garbage scattered outside of the fenced area should be moved inside the fence.

2.4 Nunami Jacques Whitford 2007 Site Investigations

Nunami Jacques Whitford personnel conducted two site visits during spring and summer of 2007, as reported below.

2.4.1 Spring 2007 Sampling Event

Jacques Whitford's 2005 report indicated the need to gather effluent quality data during the spring to evaluate treatment performance during the spring period. Initially, a site visit was planned for the first week of June 2007 to coincide with the spring freshet. A colder than average spring occurred in 2007, requiring the site visit to be delayed until later in June (Environment Canada reported that mean daily average temperature in June 2007 was 1.8^{o}C compared to an average of 2.8^{o}C during the 30 year period between 1971 and 2000). Nunami personnel conducted the spring site visit between June 18 and 20 to document physical conditions in the wetland, confirm effluent flow directions and collect effluent samples for laboratory analysis.

Most of the wetland was snow free during the site visit; however, ice was still present in a portion of most of the ponds in the wetland. The detention cell still retained a large volume of ice from sewage deposition during the winter. Air temperatures ranged between -1.5^{o}C and 4.4^{o}C during the site visit. Geese and caribou were observed within the wetland during the site visit.

Effluent was observed to be traveling under the ice in the detention cell and seeping from the cell along the eastern and south-eastern berms of the detention cell, as had been observed during previous site visits. Effluent flowing from the seeps in the detention cell was also observed to be flowing in an east and southeast direction, as noted during previous investigations. Effluent samples were collected at the locations previously sampled by Jacques Whitford in 2004 and subsequently by CGS personnel in 2005 and 2006. The location of the sampling points are identified in Table 3 and illustrated on Figure 3.

Table 3: Effluent Sample Locations

Sample Identifier	Sample Location
1 (Detention Cell)	Within the sewage detention cell.
2 (Seep)	Outside of detention cell where effluent has leaked out.
3 (Flow point)	A pond within the wetland treatment area in which sewage effluent was observed entering
4 (Duck/Loon Lake)	Outflow downstream of location #3 within wetland treatment area.
5 (Proposed SNP Compliance Point)	Recommended location for SNP licence monitoring.

Results of the analysis of effluent samples are presented in the following tables. Table 4 presents the analytical results for parameters regulated under the current water licence as well as parameters required to be analyzed at Station COR – 3 (Discharge from the sewage disposal facilities) by the Water Licence.

Table 4: 2007 Effluent Sample Analysis - Water Licence Parameters

Parameter	Water Licence Effluent Discharge Criteria		Sample Identification (June 19, 2007)				
			#1 Lagoon	#2 Seep	#3	#4	#5 Proposed SNP
pH	**6 to 9**		7.4	7.4	7.55	7.76	8
Ammonia Nitrogen			39.9	40	33.2	0.031	2.02
BOD	**120**		130	120	42	<6	<6
Fecal Coliform (MPN/100ml)	**$1X10^6$CFU/dl**		>110,000	>110,000	46,000	<3	930
Total Phosphorus			6.13	5.89	4.27	<0.05	0.09
Nitrate + Nitrate - N			0.018	0.019	0.023	0.021	0.136
Total oil and Grease	**No visible sheen**		21	21	5	<1	<1
TSS	**180**		86	100	56	<5	<5
Conductivity (umhos/cm)			741	706	671	126	263
Sulphate (SO_4 dissolved)			41	38	21	10	<9

Notes: All units in mg/L, except as otherwise noted

As indicated by the results presented above, all parameters with the exception of BOD within the lagoon are below licence limits. At the seep immediately outside the lagoon, however, the BOD is within the licence limits. Water quality improves dramatically as the water flows through the natural wetland system. The period when these samples were taken was during the spring freshet, which is the most challenging time of the year for a natural wetland system to treat wastewater for the following reasons: 1) snowmelt and runoff water decreases hydraulic retention time in the wetland system, 2) the water is very cold (close to 0 deg C), and 3) the rate of plant and bacteria growth is much slower than later in the summer and fall. Samples taken and analyzed during the summer and fall in previous years show better water quality in the lagoon and throughout the natural wetland than the samples taken in the spring. This is because the water temperatures are warmer and the wetland plants and bacteria have acclimated and are growing at their peak rates of the year. The June 2007 sampling results confirm that compliance with licence criteria can be achieved in the spring and throughout the summer and fall at the proposed compliance point.

Table 5 on the following page illustrates the analytical results for metals in the effluent samples.

As illustrated by the table, there are some metals above CCME Water Quality Guidelines for the Protection of Freshwater Life; however, there are no exceedances of the CCME Guidelines for the Protection of Marine Aquatic Life. With the exception of copper, there are no exceedances at the proposed Surveillance Network Compliance Point (Sample Location #5).

Table 5: 2007 Effluent Sample Analysis - Metal Parameters

Parameter	CCME FAL [1]	CCME MAL [2]	Sample Identification				
			#1	#2	#3	#4	#5 Proposed SNP
Silver	0.0001		<0.001	0.00200	<0.001	<0.001	<0.001
Aluminum	0.0010		0.48000	0.38000	0.10000	0.03000	<0.02
Arsenic	0.0050	0.1250	0.00090	0.00060	0.00100	<0.0005	<0.0005
Boron			0.12000	0.10000	0.09000	<0.03	<0.03
Barium			0.00780	0.00390	0.00630	0.00530	0.00980
Beryllium			<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth			0.00040	0.00070	0.00030	<0.0002	<0.0002
Calcium			23.00000	19.10000	27.70000	17.40000	32.90000
Cadmium	0.00002	0.0001	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Cobalt			0.00110	0.00070	0.00090	<0.0002	<0.0002
Chromium	0.0089	0.0560	0.00100	0.00100	<0.001	<0.001	<0.001
Cesium			<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Copper	0.0020		0.04200	0.04200	0.02700	<0.001	0.00300
Iron	0.30		0.16000	0.48000	0.85000	<0.05	0.11000
Potassium			13.30000	14.10000	12.70000	1.40000	2.70000
Magnesium			3.33000	3.05000	3.14000	1.28000	2.46000
Manganese			0.04100	0.07320	0.11700	0.00140	0.00930
Molybdenum	0.0730		0.00140	0.00100	0.00100	0.00020	0.00050
Sodium			59.20000	57.70000	54.10000	6.38000	12.10000
Nickel	0.0250		0.00500	0.00300	0.00300	<0.002	<0.002
Phosphorus(P)			6.64000	5.89000	4.27000	<0.05	0.09000
Lead	0.0010		<0.0005	0.00130	0.00070	<0.0005	<0.0005
Rubidium			0.01780	0.01850	0.01500	0.00240	0.00360
Antimony			<0.001	<0.001	<0.001	<0.001	<0.001
Selenium	0.0010		0.00900	<0.001	<0.001	<0.001	<0.001
Tin			0.00730	0.00320	0.00170	0.00070	<0.0006
Strontium			0.03460	0.02430	0.04040	0.02250	0.04460
Tellurium			<0.001	<0.001	<0.001	<0.001	<0.001
Titanium			0.13700	0.00910	0.00880	<0.0009	<0.0009
Thallium	0.0008		<0.0001	0.00040	0.00080	<0.0001	<0.0001
Uranium			0.00060	0.00060	0.00040	<0.0001	0.00010
Vanadium			<0.001	0.00100	<0.001	<0.001	<0.001
Tungsten			0.00020	<0.0002	<0.0002	<0.0002	<0.0002
Zinc	0.0300		0.35000	0.07000	0.04000	<0.01	0.01000
Zirconium			0.00410	0.00240	0.00100	<0.0004	<0.0004
Phenols	0.0040		0.14800	0.09300	0.05500	0.00300	No data
Phosphorus			6.13	6.14	4.45	0.023	0.148

Notes: all units in mg/L

[1] CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006)

[2] CCME Canadian Water Quality Guidelines for the Protection of Marine Aquatic Life (2006)

2.4.2 Summer 2007 Site Visit

Nunami's Project Engineer visited the site during July 2007 to collect additional information for the design of structures to enhance the wetland for wastewater treatment.

During the site visit Nunami observed wastewater flows through the wetland to the east. Evidence of wastewater effluent flow to the south during the spring freshet was also identified; however, no actual flow in this direction was observed. The tundra wetland was observed to be fairly well defined as the water flowed through a series of small ponds and channels between bedrock outcrops. There was significant algae growth in ponds and channels close to the lagoon. As distance from the detention cell increased, the amount of algae and odour decreased. Field observations indicated that the tundra wetland was performing well. It is possible that over time, the leaking berm may seal itself through deposition of solids, algae, organic material and bacteria.

Leachate from the solid waste facility immediately south of the detention cell was observed to be flowing south towards town and east into the tundra wetland. The pond within the solid waste facility has decreased over time and it is likely that leachate volumes will decrease in the future as the water in the pond is displaced with waste. However, construction of several diversion berms could direct the leachate into the wetland and prevent the leachate from flowing south towards the community.

The location of proposed diversion berms was identified and located by GPS. Consultation on available construction materials and practical construction methods was also undertaken with a representative of Sudliq Developments, a local civil contractor.

2.5 Summary

The Hamlet of Coral Harbour has been discharging sewage effluent in the same location since at least 1984 and likely for a longer period. Effluent was originally discharged directly onto the tundra and allowed to flow through a natural tundra wetland before eventually reaching the marine environment. A detention cell, designed to function as an annual storage lagoon, was constructed in 2003; however, its berms are not impermeable and other than retention of solids, the detention cell does not provide sewage treatment. Effluent leaches from the detention cell and flows over the tundra as it has done in the past. The treatment performance of the Natural Tundra Wetland Sewage Treatment Area has been subject to numerous studies since 1994. All investigations concluded that the wetland was effectively treating the sewage effluent and could continue to do so in the future. Review of analytical data from samples collected annually throughout the wetland since 2004 confirms that the wetland is currently treating sewage effluent to effluent quality standards contained in the Hamlet's current Water Licence. However, the Water Licence specifies compliance be achieved at the discharge from the "Sewage Disposal Facilities" which is considered to be the discharge from the detention cell. The current licence does not formally recognize the treatment provided by the Natural Tundra Wetland Sewage Treatment Area.

3.0 REGULATORY REQUIREMENTS

Effluent quality standards contained in the current Water Licence are presented in Table 6.

Table 6 Current Water Licence Effluent Quality Standards

Parameter	**Maximum Average Concentration**
Fecal Coliforms	1X 10^6 CFU/dl
BOD_5	120 mg/L
Total Suspended Solids	180 mg/L
Oil and Grease	No visible sheen
pH	Between 6 and 9

The Canadian Water Quality Guidelines for Freshwater Aquatic Life (CWQG [FAL]) apply to the discharge of the effluent from the last control point of the Hamlet's sewage treatment facilities. A critical contaminant addressed in these guidelines is ammonia nitrogen. Its maximum allowable concentrations are 2.2 mg/L and 1.37 mg/L at pH of 6.5 and 8.0, respectively, at 10^0C.

In addition to the requirements of CWQG [FAL] and the future Water Licence of the Hamlet, effluent from the Hamlet's WWT facilities should not be toxic to fish. Environment Canada is responsible for administering subsection 36(3) of the *Fisheries Act*, (commonly referred to as the "general prohibition"), in which it is a violation to deposit a deleterious substance into water frequented by fish, unless authorized by a regulation recognized by the *Act*.

Based on the analytical results from effluent samples collected over the past 4 years it is evident that current and anticipated discharge criteria can be achieved at the proposed compliance point in the wetland.

4.0 DESIGN OPTIONS

The purpose of facility design is to enable the community of Coral Harbour achieve compliance with the sewage effluent quality standards contained the Water Licence issued by the Nunavut Water Board. Two options have been identified which could allow the community to achieve compliance. These options are summarized and evaluated below.

4.1 Repair of Detention Cell

The current detention cell was originally designed to act as a sewage treatment lagoon, storing and treating effluent for a 10 month period prior to an annual discharge each fall. Storage and treatment lagoons are a common method for treating sewage in northern communities. The detention cell was constructed in 2003 and, as previously reported, is not impermeable. As a result the detention cell does not function as a storage and treatment lagoon.

A geotechnical investigation of the berms enclosing the detention cell was performed in 2004 and is reported in Jacques Whitford's 2005 report. The Geotechnical consultant identified three options to repair the berms to allow the detention cell to function as a typical lagoon:

1. Incorporate a zone of relatively impervious fine-grained material (e.g., clay) into the existing berms.
2. Install a liner in the detention cell.
3. Reconstruct the berms such that permafrost would agrade into the berms and present an impervious barrier.

This option would involve one of the above methods of repair, operation of the impervious detention cell as a storage and treatment lagoon with a 10 month annual storage period, followed by a discharge each fall.

4.2 Natural Tundra Wetland Sewage Treatment

Available documentation confirms that the Hamlet of Coral Harbour has been using the natural tundra wetland north of the community since 1984; however, it is likely that it has been used for a much longer period. Prior to 2003, sewage was dumped directly from trucks onto the tundra in the area of the current detention cell and flowed much as it currently does through the natural wetland, eventually reaching the ocean. Currently, sewage is discharged into the western portion of the detention cell and seeps out through the east and southeast berms and then flows through the natural wetland as it has for many years. Several studies of the treatment performance of the wetland have been undertaken since 1994, all concluding that the wetland successfully treats sewage effluent and could continue to meet the community's needs in the future. Analytical results from effluent samples collected annually, or more frequently throughout the wetland since 2004 demonstrated that the wetland is successfully treating sewage effluent to meet current and anticipated regulatory requirements.

The Natural Tundra Wetland Sewage Treatment Area is not recognized in the Hamlet's current Water Licence. The Water Licence requires compliance with the effluent quality standards be achieved at the discharge from the Sewage Treatment Facilities, presently considered to be the discharge from the detention cell. Incorporation of the wetland treatment facility would require acknowledgement that the compliance point be moved to the discharge from the wetland, Station 5 identified in Table 3 and Figure 3. In addition several concerns previously identified by regulators and the community would need to be addressed to enable the wetland to be formally incorporated, including posting signs to advise residents of the boundaries of the wetland and the installation of diversion berms to prevent flow from the wetland to the south towards the community during periods of high flow. With these enhancements, the wetland is considered a viable option to meet the Hamlet's sewage treatment requirements over the long term. It is also possible, that over time, the berms in the detention cell will become impervious, further increasing treatment potential of this option.

This option would involve continued discharge into the detention cell with treatment provided in the wetland as is currently the case. The licence compliance point would be established at sampling station # 5 in the wetland, the outflow of the wetland treatment area into a large lake within the larger wetland area. Three diversion berms would be constructed in low areas along the southern boundary of the wetland. Signage would be posted along the boundaries of the wetland to advise residents of the wetland treatment area.

4.3 Evaluation of Options

A standard set of criteria have been established from which to evaluate the design options presented above. These criteria are outlined below:

Compliance: Achieve compliance with current and future effluent quality standards established by the Nunavut Water Board.

Long Term Needs: Meet the Hamlet's sewage treatment needs for a minimum 20 year period.

Practicality: The option must be able to be implemented with local expertise and provide a reasonable expectation of being successful.

Public Safety: The option should protect the health and safety of community residents.

Cost: The option should be cost effective from both a capital and 0 & M perspective.

An evaluation of both options against each of these criteria is presented below.

4.3.1 Compliance

Storage and treatment lagoons are common methods used to treat sewage in many northern communities. Compliance with effluent discharge standards are expected to be met with this option.

The wetland is considered to be the "Sewage Treatment Facility" as envisioned in the Water Licence; as such compliance with effluent quality standards would be required to be met at the outflow of the facility, namely sampling station #5. Analytical results over the past 4 years demonstrate that the compliance has consistently been met at station #5 and often at locations within the "Sewage Treatment Facility".

4.3.2 Long Term Needs

Based on a desired decant of the detention cell in fall of each year, the detention cell should be sized with a storage capacity of 10 months (November to August) for the 20 year planning horizon. This would require a capacity of 39,334 m^3 for the year 2027. Standard operating conditions require a minimum 1 m freeboard to be maintained throughout operation.

The dimensions of the existing detention cell are approximately 170 m by 155 m with a planned average depth of 1.7 m. Allowing for reduced capacity due to the interior side slopes on the berms the estimated capacity of the detention cell is approximately 41,200 m^3. Based on sewage volume projections contained in Table 4, in Section 2.2 of this report, the current detention cell's capacity for 10 month annual storage is sufficient to meet the 20 year planning horizon. Capacity would be exceeded in the year 2029. However, options to repair the existing berms would need to be designed so as not to reduce the capacity of the detention cell.

The capacity of the wetland to treat sewage over the long-term can be calculated based on loading rates and area of treatment. In the past, a commonly accepted hydraulic loading rate (wastewater flow rate over wetland area) for natural wetlands treating domestic sewage was 27.6 ha of wetland surface area per 1000 m^3/d of sewage flow introduced (expressed more commonly as 0.36 cm/d), but more recent studies indicate that up to 7 cm/d can be appropriate if conditions are right, some pre-treatment has occurred, and the wetland can be "engineered" to ensure maximum contact between the wastewater being treated and the vegetation/microbial biofilm matrices in the wetland (Knight et al., 1987). However, a more conservative recommendation is for 50 ha/1000 m^3/d (0.2 cm/d) for municipal wastewaters (Kadlec & Knight, 1996), especially where cold weather conditions are encountered and there is untreated ammonia nitrogen in the wastewater being treated.

Based on the conservative natural wetland sizing criteria of 50 ha/1000 m^3/d (0.2 cm/d), the minimum size of a natural wetland to treat the 2027 annual sewage generation rate (47,857 m^3 or 131 m^3/d) would be 6.6 ha. The boundary of the proposed natural wetland treatment system encloses an area of approximately 480,000 m^2 of which 80,000 m^2 are shallow bodies of water and 400,000 m^2 are boggy areas. With the proposed berm construction and the tundra wetland area defined as illustrated in Figure 3, the working tundra wetland size is estimated to be at least 200,000 m^2 or 20 ha. The tundra wetland is much larger than the 6.6 ha of minimum natural wetland size needed under conservative assumptions. The detention cell constructed in 2003 has a surface area of approximately 2.6 ha. Based on these calculations and assumptions, the natural wetland has sufficient area to treat wastewater for the next 20 years.

4.3.3 Practicality

Options presented to make the detention cell impervious were originally evaluated in the 2005 Geotechnical Report. Option 1 (incorporating a layer of impervious material such as clay into the existing berms) was considered unlikely to be successful. Clay is not available locally and successfully incorporating an impervious clay layer into an existing structure is considered to be difficult. Option 2 would involve installing a liner into the existing cell. This option is considered to be difficult as the facility is currently in use and has an uneven floor with bedrock outcrops. The third option, would require reconstruction of the berms in a manner to allow permafrost to aggrade into the berms to provide an impervious barrier. While potentially effective, it would require additional engineering investigation to investigate bedrock properties, large volumes of additional material and maintenance of 2 to 3 m of freeboard to protect permafrost further reducing capacity. None of the options to reconstruct the existing detention cell berms are considered practical.

Limited improvements are proposed to the natural tundra wetland. Signage would be installed along the boundaries of the wetland and three diversion berms would be constructed to divert flows away from the south during periods of high flow. Diversion berms would incorporate a synthetic impervious liner to compensate for the lack of locally available fine material. Installation of signage and berm construction can be successfully accomplished by local contractors.

4.3.4 Public Safety

Reconstruction of the detention cell to allow it to operate as a storage and treatment lagoon would allow sewage to be contained for a ten month period and provide for a managed discharge. Discharged effluent should meet effluent discharge standards and would flow through the existing wetland. The public would have limited opportunity to come in contact with sewage effluent under this option.

The natural tundra wetland option provides continuous discharge from the detention cell during the period of the year when ambient temperatures are at or above freezing temperatures (approximately late May to early October). During the remainder of the year, effluent freezes within the lagoon and discharges upon melt during spring. Analysis of effluent samples indicates that effluent in the seepage ponds immediately outside the detention cells contain high concentrations of fecal coliforms; however, these concentrations degrade relatively quickly with distance from the detention cell. This option presents the opportunity for people to come in contact with sewage effluent in the wetland, and under high flows some effluent (diluted with meltwater) can flow towards the community. The risk to public health and safety with this option is considered low as residents are well aware of the location of the wetland treatment area and the installation of diversion berms will prevent the flow of effluent towards the community.

4.3.5 Cost

Given limited infrastructure resources available in Nunavut and the large capital expenditure for the original detention cell in 2003, cost is a very important factor in evaluating options.

While costs for the three options to repair the detention cell have not been fully developed, some general observations are presented here for consideration. Option 1 will require clay which is not available locally. Nunami was informed that the nearest source of clay is 90km from the community. It is not known if the source of clay is suitable to create a liner. The volume of clay required is proportional to both the area required to be lined and the hydraulic conductivity of the clay material. Installation of a liner in the detention cell would require the purchase, transport and installation of a synthetic liner and the placement of additional material to anchor and protect the liner. Expansion of the existing berms to promote permafrost aggradation would require considerable volumes of material to both widen and raise the height of the existing berms. It is likely that the size of the existing berms may need to be doubled. All of the repair options will also require removal and replacement of the perimeter fence, deconstruction of a portion of the existing berms to provide equipment access and the construction of a temporary sewage disposal detention cell during the construction period. All of the repair options are considered to have high capital costs. Ongoing O&M costs would involve annual maintenance and repair of impervious barriers for Options 1 and 2 and monitoring of permafrost aggradation and possible berm repairs for Option 3.

Development of the natural wetland treatment would require the preparation and installation of signage and construction of three diversion berms. The berms would be constructed of locally available material, incorporating an imported synthetic liner. The construction cost estimate for this option includes:

Table 7 Cost Estimate, Natural Tundra Wetland Treatment Area

Item	**Unit Cost**	**Units**	**Total**
Signs	$500	6	$ 3,000
Granular Material for Berm Construction	$55/m^3	1,600m^3	$ 88,000
Sand for Berm Construction	$22/m^3	650m^3	$ 14,300
Liner	$15/m^2	1,700m^2	$ 25,500
Liner Transportation (Wpg- Coral Harbour)	$2,000	Lump Sum	$ 2,000
Sub-total			$132,800
Contingency (15%)			$ 19,920
Total Estimate			**$152,720**

The estimated capital cost is expected to be approximately **$153,000**. Annual O&M costs would be neglible, and would be related to repair of signage and maintenance of diversion berms.

4.3.6 Evaluation Summary

A summary of the evaluation is presented in the following table

Table 8 Evaluation Summary

Option	**Evaluation Criteria**				
	Compliance	**Long Term**	**Practicality**	**Safe**	**Cost**
Repair Detention Cell	Yes	22 years capacity	Uncertain	High	High
Enhance Wetland	Yes	Yes	Yes	Acceptable	Low

While the two options presented can both achieve compliance with effluent discharge criteria, enhancement of the natural tundra wetland is recommended as it presents the most practical and cost effective sewage treatment method to meet the Community's needs over the long term. Preliminary design information on this option is presented in the following section.

5.0 SCHEMATIC DESIGN OF PREFERRED OPTION

The current and proposed Coral Harbour sewage treatment facilities consist of a storage detention cell and tundra wetland treatment system. While some improvements are necessary, it is considered that this system can effectively treat the Hamlet's sewage for a 20-year period in compliance with applicable legislation. This option requires acknowledgement that the wetland constitutes the "Sewage Treatment Facility" and that compliance is achieved at its discharged, namely sampling station # 5.

The proposed wastewater treatment system begins at the current disposal location. Sewage haulers transport untreated sewage to the existing sewage detention cell and dispose of the wastewater in the cell. The detention cell begins the treatment process. Effluent then seeps through the detention cell berms and enters the natural tundra wetland. During the spring freshet, partially treated water runs toward the Hamlet. Flow diversion berms are proposed to direct this water back to the east and towards the proposed compliance point. The location of these berms is shown in Figure 3 in Appendix A.

The berms will be constructed on the native ground material and will be located between bedrock outcrop areas. Flow currently travels in the areas between the bedrock outcrops and the diversion berms are intended to reroute the water toward the east. Coarse gravel will be placed on the ground to a height of 500 mm. A 300 mm layer of sand will be placed on top of the gravel layer. An impermeable high density polyethylene (HDPE) liner will be placed on the sand layer. The liner will be anchored into the berm and into the native ground material as best as practical. The liner will then be covered by another 300 mm layer of sand. The entire berm will then be covered with 600 mm of coarse gravel to provide erosion control and provide a surface for driving on the berms to inspect their effectiveness and complete maintenance, if necessary. A cross section of the diversion berm is shown in Figure 4 in Appendix A.

By leaving the native ground material in place, the permafrost layer should build up over time and provide an impermeable layer to prevent water from flowing under the liner material. The liner will be anchored as deep as possible; however, shallow bedrock will limit the anchor trench depth in some areas. The liner will also be anchored in the diversion berm to hold it in place during the next layer of material placement.

Six signs are proposed to be constructed and installed along the perimeter of the wetland to advise the public of the existence of the wetland treatment area. Proposed wording for the signs is as follows: "Natural Tundra Wetland Sewage Treatment Area, Public Use Not Recommended". This message would appear in English and Inuktitut.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The Hamlet of Coral Harbour has been disposing of its sewage at a location approximately 3 km north of the Community. Originally, sewage was discharged from trucks directly to the tundra where it flowed east through a wetland eventually reaching the ocean. Previous investigations have confirmed that the tundra wetland was successfully treating the sewage effluent. A detention cell was constructed in 2003 to provide treatment of sewage prior to discharge to the tundra wetland. The berms of the detention cell are not impervious and effluent seeps from the detention cell to the tundra wetland in an uncontrolled manner. Sewage effluent is treated in the tundra wetland as was the case prior to construction of the detention cell.

The Sewage disposal and treatment in Coral Harbour is currently regulated by the Nunavut Water Board, under Water Licence NWB3COR0217, expiring October 2007. Effluent quality standards prescribed in the licence require compliance at discharge from the “Sewage Disposal Facilities”, which is currently considered to be the detention cell. As the detention cell provides only limited retention and treatment, effluent seeping from the cell does not comply with licence standards; however, compliance with the standards are achieved downstream in the wetland. In support of its application to renew its Water Licence, the Hamlet of Coral Harbour needs a facility design that will allow it to achieve compliance with effluent quality standards.

Nunami evaluated two options to achieve compliance: repair of the detention cell to function as a typical storage and treatment lagoon; and, enhancement of the natural tundra wetland. The natural tundra wetland system was selected as the preferred option for sewage treatment for the community. The wetland would be considered to be the “Sewage Treatment Facility”; compliance with Water Licence effluent quality standards would be achieved at the discharge of the facility, sampling station # 5. A preliminary design for enhancements to the wetland was prepared. Enhancements include the construction of three granular diversion berms to direct flows during periods of high flows and the installation of signage to advise the public of the treatment area. A schematic design of the enhancements has been prepared. The estimated cost for the enhancement to the wetland system is **$153,000.** Upon approval of the preliminary design concept, Nunami will prepare construction drawings and tender documents for review by CGS.

6.1 Recommendations

It is recommended that:

1. The natural tundra wetland sewage treatment process be selected for formal implementation in Coral Harbour.
2. The preliminary design be advanced to the 50% complete design phase for further review.
3. An application to renew the Hamlet’s Water Licence, incorporating the tundra wetland sewage treatment area be prepared for submission to the Nunavut Water Board.

7.0 CLOSURE

This report has been prepared by Nunami Jacques Whitford Ltd. for the sole benefit of the Department of Community and Government Services, Kivalliq Region, of the Government of Nunavut. This report may not be relied upon by any other person or entity without the express written consent of Community and Government Services.

Any uses that a third party makes of this report, or any reliance on decisions to be made based on it, are the responsibility of such third parties. Nunami Jacques Whitford Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The conclusions presented represent the best judgment of Nunami based on current site conditions observed on the date cited within this report. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

We trust that the report meets your current requirements. Should you have any questions or concerns regarding the above, please do not hesitate to contact the undersigned.

Respectfully submitted,

NUNAMI JACQUES WHITFORD LTD.

Original signed by Matt Wildman	***Original signed by Jim Higgins***
Matt Wildman Project Engineer	Jim Higgins, P.hD., P.Eng. Principal, Sr. Engineer

APPENDIX A

Drawings

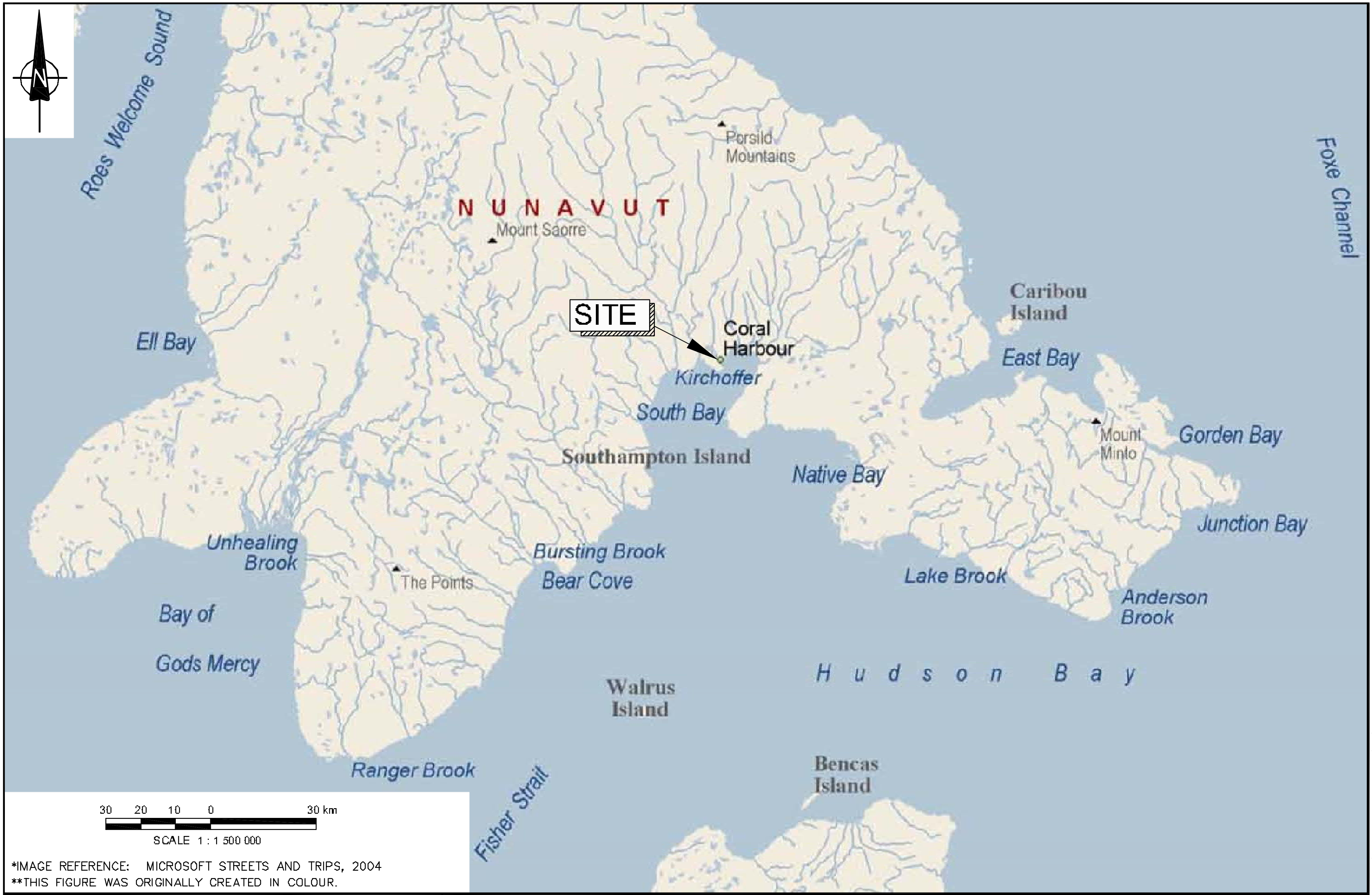


*IMAGE REFERENCE: MICROSOFT STREETS AND TRIPS, 2004

**THIS FIGURE WAS ORIGINALLY CREATED IN COLOUR.

Jacques Whitford

SCALE: 1 : 1 500 000

DATE: 06/12/04

DRAWN BY: LDP

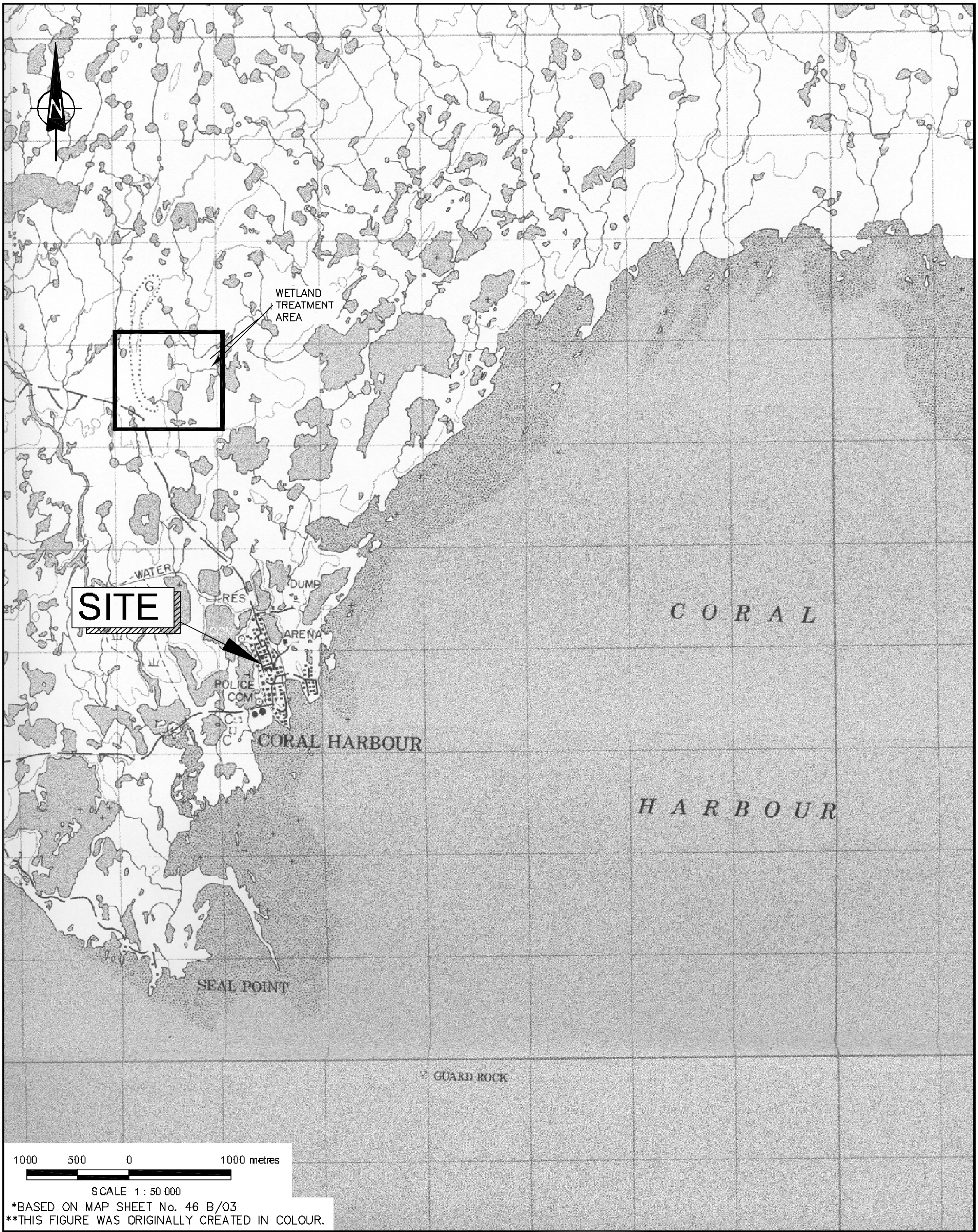
APPROVED BY:

CLIENT : GOVERNMENT OF NUNAVUT DEPARTMENT OF COMMUNITY
AND GOVERNMENT SERVICES

TITLE : SITE LOCATION PLAN
CORAL HARBOUR SEWAGE SYSTEM
CORAL HARBOUR, NORTHWEST TERRITORIES

DRAWING NO. 1

\\Other_off\NTY\NTY71091\71091-1.dwg 06/12/04



*BASED ON MAP SHEET No. 46 B/03
**THIS FIGURE WAS ORIGINALLY CREATED IN COLOUR.

Jacques Whitford

SCALE: 1 : 50 000
DATE: 08/12/04
DRAWN BY: LDP
APPROVED BY:

CLIENT : **GOVERNMENT OF NUNAVUT DEPARTMENT OF COMMUNITY AND GOVERNMENT SERVICES**

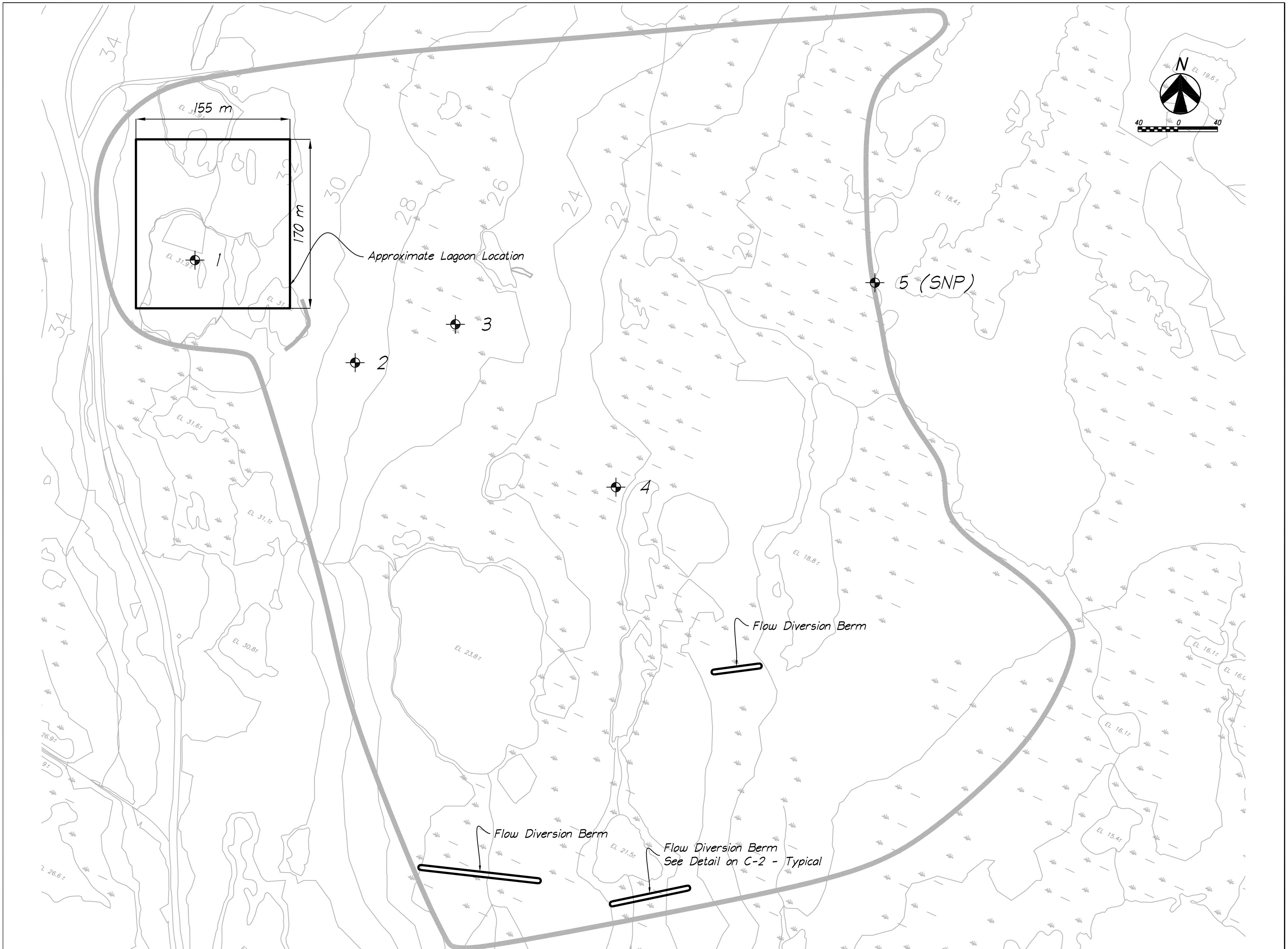
TITLE :

SITE PLAN

CORAL HARBOUR SEWAGE SYSTEM
CORAL HARBOUR, NORTHWEST TERRITORIES

DRAWING NO. 2

\\Other_off\NTY\NTY71091\71091-3.dwg 06/12/04



Draft - Not For Construction

Jacques Whitford
NAWE

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4444 Centerville Road, Suite 140
White Bear Lake, MN 55127
651-255-5050
651-255-5060 (fax)

Rev	Date	Description
0	8/15/07	Issue for Review

GOVERNMENT OF NUNAVUT DEPARTMENT OF COMMUNITY AND GOVERNMENT SERVICES
PROPOSED SYSTEM IMPROVEMENTS
CORAL HARBOUR SEWAGE SYSTEM
CORAL HARBOUR, NORTHWEST TERRITORIES

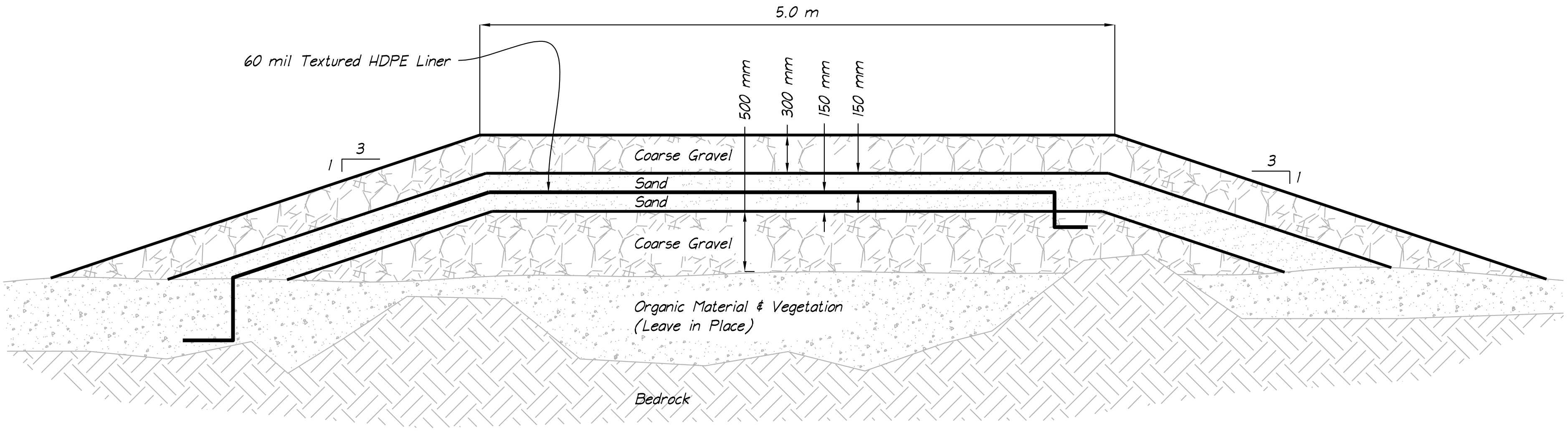
Site Map

#3

1023336-Fig 1.dwg

K:\1023336 Coral Harbour\dwg\1023336-Fig 1.dwg

Copyright (C) 2007 Jacques Whitford NAWE, Inc



Draft - Not For Construction

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Rev	Date	Description
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GOVERNMENT OF NUNAVUT DEPARTMENT OF COMMUNITY AND GOVERNMENT SERVICES
PROPOSED SYSTEM IMPROVEMENTS
CORAL HARBOUR SEWAGE SYSTEM
CORAL HARBOUR, NORTHWEST TERRITORIES

Typical Diversion Berm Cross Section

#4

1023336-Fig 1.dwg

K:\1023336 Coral Harbour\dwg\1023336-Fig 1.dwg

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APPENDIX B

Certificates of Analysis – 2007 Effluent Samples

ANALYTICAL REPORT

JACQUES WHITFORD LTD.

ATTN: BRIAN ARQUILLA

Reported On: 26-JUL-07 09:01 AM

201, 5103 - 51ST AVE

YELLOWKNIFE NT X1A 2P3

Lab Work Order #: **L520329**

Date Received: **20-JUN-07**

Project P.O. #:

Job Reference: 101336 - CORAL HARBOUR

Legal Site Desc: ***YELLOW DOT***

CofC Numbers:

Other Information:

Comments:

APPROVED BY: Paul Nicolas

PAUL NICOLAS

Project Manager

THIS REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL WITHOUT THE WRITTEN AUTHORITY OF THE LABORATORY.
ALL SAMPLES WILL BE DISPOSED OF AFTER 30 DAYS FOLLOWING ANALYSIS. PLEASE CONTACT THE LAB IF YOU REQUIRE ADDITIONAL SAMPLE STORAGE TIME.

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L520329-1 LAGOON 1								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Ammonia (NH3) - Dissolved	39.9		0.003	mg/L	20-JUN-07	26-JUN-07	CLM	R540745
Biochemical Oxygen Demand	130		1	mg/L	21-JUN-07	26-JUN-07	IML	R540428
Fecal Coliform	>110000		3	MPN/100mL		23-JUN-07	LJK	R540005
Metal scan								
Silver (Ag)-Total	<0.001		0.001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Aluminum (Al)-Total	0.48		0.02	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Arsenic (As)-Total	0.0009		0.0005	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Boron (B)-Total	0.12		0.03	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Barium (Ba)-Total	0.0078		0.0003	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Beryllium (Be)-Total	<0.001		0.001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Bismuth (Bi)-Total	0.0004		0.0002	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Calcium (Ca)-Total	23.0		0.1	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Cadmium (Cd)-Total	<0.0002		0.0002	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Cobalt (Co)-Total	0.0011		0.0002	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Chromium (Cr)-Total	0.001		0.001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Cesium (Cs)-Total	<0.0001		0.0001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Copper (Cu)-Total	0.042		0.001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Iron (Fe)-Total	0.16		0.05	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Potassium (K)-Total	13.3		0.1	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Magnesium (Mg)-Total	3.33		0.01	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Manganese (Mn)-Total	0.0410		0.0003	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Molybdenum (Mo)-Total	0.0014		0.0002	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Sodium (Na)-Total	59.2		0.03	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Nickel (Ni)-Total	0.005		0.002	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Phosphorus (P)-Total	6.64	RAMB	0.05	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Lead (Pb)-Total	<0.0005		0.0005	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Rubidium (Rb)-Total	0.0178		0.0002	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Antimony (Sb)-Total	<0.001		0.001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Selenium (Se)-Total	0.009		0.001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Tin (Sn)-Total	0.0073		0.0006	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Strontium (Sr)-Total	0.0346		0.0001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Tellurium (Te)-Total	<0.001		0.001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Titanium (Ti)-Total	0.137		0.0009	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Thallium (Tl)-Total	<0.0001		0.0001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Uranium (U)-Total	0.0006		0.0001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Vanadium (V)-Total	<0.001		0.001	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Tungsten (W)-Total	0.0002		0.0002	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Zinc (Zn)-Total	0.35		0.01	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Zirconium (Zr)-Total	0.0041		0.0004	mg/L	22-JUN-07	23-JUN-07	DAG	R539848
Phenols (4AAP)	0.148		0.001	mg/L	26-JUN-07	26-JUN-07	BJM	R539997
Phosphorus, Total	6.13		0.001	mg/L		27-JUN-07	DVH	R541355
Redox Potential	<1		1	mV	26-JUN-07	26-JUN-07	L.S	R540247
Total Kjeldahl Nitrogen	57.9		0.2	mg/L	20-JUN-07	27-JUN-07	LDE	R540862
Total Nitrogen	58.0		0.2	mg/L		27-JUN-07		
Total Oil and Grease	21		1	mg/L	27-JUN-07	27-JUN-07	MDM	R540065
Total Suspended Solids	86		5	mg/L		27-JUN-07	BJL	R541051
Routine Dissolved								
Alkalinity								
Alkalinity, Total (as CaCO3)	253		1	mg/L		21-JUN-07	DVH	R538732
Bicarbonate (HCO3)	309		2	mg/L		21-JUN-07	DVH	R538732
Carbonate (CO3)	<0.6		0.6	mg/L		21-JUN-07	DVH	R538732

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L520329-1 LAGOON 1								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Routine Dissolved								
Alkalinity								
Hydroxide (OH)	<0.4		0.4	mg/L		21-JUN-07	DVH	R538732
Chloride Dissolved								
Chloride (Cl) - Dissolved	46		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
Conductivity								
Conductivity	741		0.4	umhos/cm		21-JUN-07	DVH	R538732
Hardness (as CaCO3)	66.0		0.2	mg/L		22-JUN-07		
Metals for Ion balance								
Calcium (Ca)-Dissolved	21.2		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Potassium (K)-Dissolved	14.4		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Magnesium (Mg)-Dissolved	3.20		0.01	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Sodium (Na)-Dissolved	62.1		0.02	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Nitrate + Nitrite Dissolved								
Nitrate+Nitrite-N - Dissolved	0.018	RAMB	0.005	mg/L	20-JUN-07	21-JUN-07	CLM	R538843
Sulphate Dissolved								
Sulphate (SO4) - Dissolved	41		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
TDS (Calculated)	339		5	mg/L		29-JUN-07		
pH								
PH	7.40		0.01	pH units		21-JUN-07	DVH	R538732
L520329-2 SEEP 2								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Ammonia (NH3) - Dissolved	40.0		0.003	mg/L	20-JUN-07	26-JUN-07	CLM	R540745
Biochemical Oxygen Demand	120		1	mg/L	21-JUN-07	26-JUN-07	IML	R540428
Fecal Coliform	>110000		3	MPN/100mL		23-JUN-07	LJK	R540005
Metal scan								
Silver (Ag)-Total	0.002		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Aluminum (Al)-Total	0.38		0.02	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Arsenic (As)-Total	0.0006		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Boron (B)-Total	0.10		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Barium (Ba)-Total	0.0039		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Beryllium (Be)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Bismuth (Bi)-Total	0.0007		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Calcium (Ca)-Total	19.1		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cadmium (Cd)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cobalt (Co)-Total	0.0007		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Chromium (Cr)-Total	0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cesium (Cs)-Total	<0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Copper (Cu)-Total	0.042		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Iron (Fe)-Total	0.48		0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Potassium (K)-Total	14.1		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Magnesium (Mg)-Total	3.05		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Manganese (Mn)-Total	0.0732		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Molybdenum (Mo)-Total	0.0010		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Sodium (Na)-Total	57.7		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Nickel (Ni)-Total	0.003		0.002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phosphorus (P)-Total	5.89	RAMB	0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Lead (Pb)-Total	0.0013		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Rubidium (Rb)-Total	0.0185		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Antimony (Sb)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Selenium (Se)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L520329-2 SEEP 2								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Metal scan								
Tin (Sn)-Total	0.0032		0.0006	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Strontium (Sr)-Total	0.0243		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tellurium (Te)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Titanium (Ti)-Total	0.0091		0.0009	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Thallium (Tl)-Total	0.0004		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Uranium (U)-Total	0.0006		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Vanadium (V)-Total	0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tungsten (W)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zinc (Zn)-Total	0.07		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zirconium (Zr)-Total	0.0024		0.0004	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phenols (4AAP)	0.093		0.001	mg/L	26-JUN-07	26-JUN-07	BJM	R539997
Phosphorus, Total	6.14		0.001	mg/L		27-JUN-07	DVH	R541355
Redox Potential	<1		1	mV	26-JUN-07	26-JUN-07	L.S	R540247
Total Kjeldahl Nitrogen	55.0		0.2	mg/L	20-JUN-07	27-JUN-07	LDE	R540862
Total Nitrogen	55.0		0.2	mg/L		27-JUN-07		
Total Oil and Grease	21		1	mg/L	27-JUN-07	27-JUN-07	MDM	R540065
Total Suspended Solids	100		5	mg/L		27-JUN-07	BJL	R541051
Routine Dissolved								
Alkalinity								
Alkalinity, Total (as CaCO3)	242		1	mg/L		21-JUN-07	DVH	R538732
Bicarbonate (HCO3)	296		2	mg/L		21-JUN-07	DVH	R538732
Carbonate (CO3)	<0.6		0.6	mg/L		21-JUN-07	DVH	R538732
Hydroxide (OH)	<0.4		0.4	mg/L		21-JUN-07	DVH	R538732
Chloride Dissolved								
Chloride (Cl) - Dissolved	45		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
Conductivity								
Conductivity	706		0.4	umhos/cm		21-JUN-07	DVH	R538732
Hardness (as CaCO3)	55.5		0.2	mg/L		22-JUN-07		
Metals for Ion balance								
Calcium (Ca)-Dissolved	17.5		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Potassium (K)-Dissolved	13.9		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Magnesium (Mg)-Dissolved	2.84		0.01	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Sodium (Na)-Dissolved	58.4		0.02	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Nitrate + Nitrite Dissolved								
Nitrate+Nitrite-N - Dissolved	0.019	RAMB	0.005	mg/L	20-JUN-07	21-JUN-07	CLM	R538843
Sulphate Dissolved								
Sulphate (SO4) - Dissolved	38		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
TDS (Calculated)	323		5	mg/L		29-JUN-07		
pH								
PH	7.40		0.01	pH units		21-JUN-07	DVH	R538732
L520329-3 3 CORAL HARBOUR								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Ammonia (NH3) - Dissolved	33.2		0.003	mg/L	20-JUN-07	26-JUN-07	CLM	R540745
Biochemical Oxygen Demand	42		1	mg/L	21-JUN-07	26-JUN-07	IML	R540428
Fecal Coliform	46000		3	MPN/100mL		23-JUN-07	LJK	R540005
Metal scan								
Silver (Ag)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Aluminum (Al)-Total	0.10		0.02	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Arsenic (As)-Total	0.0010		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L520329-3 3 CORAL HARBOUR								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Metal scan								
Boron (B)-Total	0.09		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Barium (Ba)-Total	0.0063		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Beryllium (Be)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Bismuth (Bi)-Total	0.0003		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Calcium (Ca)-Total	27.7		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cadmium (Cd)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cobalt (Co)-Total	0.0009		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Chromium (Cr)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cesium (Cs)-Total	<0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Copper (Cu)-Total	0.027		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Iron (Fe)-Total	0.85		0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Potassium (K)-Total	12.7		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Magnesium (Mg)-Total	3.14		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Manganese (Mn)-Total	0.117		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Molybdenum (Mo)-Total	0.0010		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Sodium (Na)-Total	54.1		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Nickel (Ni)-Total	0.003		0.002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phosphorus (P)-Total	4.27	RAMB	0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Lead (Pb)-Total	0.0007		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Rubidium (Rb)-Total	0.0150		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Antimony (Sb)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Selenium (Se)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tin (Sn)-Total	0.0017		0.0006	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Strontium (Sr)-Total	0.0404		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tellurium (Te)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Titanium (Ti)-Total	0.0088		0.0009	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Thallium (Tl)-Total	0.0008		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Uranium (U)-Total	0.0004		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Vanadium (V)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tungsten (W)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zinc (Zn)-Total	0.04		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zirconium (Zr)-Total	0.0010		0.0004	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phenols (4AAP)	0.055		0.001	mg/L	25-JUN-07	25-JUN-07	BJM	R539997
Phosphorus, Total	4.45		0.001	mg/L		27-JUN-07	DVH	R541355
Redox Potential	<1		1	mV	26-JUN-07	26-JUN-07	L.S	R540247
Total Kjeldahl Nitrogen	43.4		0.2	mg/L	20-JUN-07	27-JUN-07	LDE	R540862
Total Nitrogen	43.4		0.2	mg/L		27-JUN-07		
Total Oil and Grease	5		1	mg/L	27-JUN-07	27-JUN-07	MDM	R540065
Total Suspended Solids	56		5	mg/L		27-JUN-07	BJL	R541051
Routine Dissolved								
Alkalinity								
Alkalinity, Total (as CaCO3)	238		1	mg/L		21-JUN-07	DVH	R538732
Bicarbonate (HCO3)	290		2	mg/L		21-JUN-07	DVH	R538732
Carbonate (CO3)	<0.6		0.6	mg/L		21-JUN-07	DVH	R538732
Hydroxide (OH)	<0.4		0.4	mg/L		21-JUN-07	DVH	R538732
Chloride Dissolved								
Chloride (Cl) - Dissolved	41		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
Conductivity								
Conductivity	671		0.4	umhos/cm		21-JUN-07	DVH	R538732
Hardness (as CaCO3)	76.2		0.2	mg/L		22-JUN-07		
Metals for Ion balance								

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L520329-3 3 CORAL HARBOUR								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Routine Dissolved								
Metals for Ion balance								
Calcium (Ca)-Dissolved	25.5		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Potassium (K)-Dissolved	13.0		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Magnesium (Mg)-Dissolved	3.02		0.01	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Sodium (Na)-Dissolved	57.3		0.02	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Nitrate + Nitrite Dissolved								
Nitrate+Nitrite-N - Dissolved	0.023	RAMB	0.005	mg/L	20-JUN-07	21-JUN-07	CLM	R538843
Sulphate Dissolved								
Sulphate (SO4) - Dissolved	21		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
TDS (Calculated)	303		5	mg/L		29-JUN-07		
pH								
PH	7.55		0.01	pH units		21-JUN-07	DVH	R538732
L520329-4 4 CORAL HARBOUR								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Ammonia (NH3) - Dissolved	0.031		0.003	mg/L	20-JUN-07	21-JUN-07	CLM	R538843
Biochemical Oxygen Demand	<6		1	mg/L	21-JUN-07	26-JUN-07	IML	R540428
Fecal Coliform	<3		3	MPN/100mL		23-JUN-07	LJK	R540005
Metal scan								
Silver (Ag)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Aluminum (Al)-Total	0.03		0.02	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Arsenic (As)-Total	<0.0005		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Boron (B)-Total	<0.03		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Barium (Ba)-Total	0.0053		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Beryllium (Be)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Bismuth (Bi)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Calcium (Ca)-Total	17.4		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cadmium (Cd)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cobalt (Co)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Chromium (Cr)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cesium (Cs)-Total	<0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Copper (Cu)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Iron (Fe)-Total	<0.05		0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Potassium (K)-Total	1.4		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Magnesium (Mg)-Total	1.28		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Manganese (Mn)-Total	0.0014		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Molybdenum (Mo)-Total	0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Sodium (Na)-Total	6.38		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Nickel (Ni)-Total	<0.002		0.002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phosphorus (P)-Total	<0.05	RAMB	0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Lead (Pb)-Total	<0.0005		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Rubidium (Rb)-Total	0.0024		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Antimony (Sb)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Selenium (Se)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tin (Sn)-Total	0.0007		0.0006	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Strontium (Sr)-Total	0.0225		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tellurium (Te)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Titanium (Ti)-Total	<0.0009		0.0009	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Thallium (Tl)-Total	<0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Uranium (U)-Total	<0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Vanadium (V)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L520329-4 4 CORAL HARBOUR								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Metal scan								
Tungsten (W)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zinc (Zn)-Total	<0.01		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zirconium (Zr)-Total	<0.0004		0.0004	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phenols (4AAP)	0.003		0.001	mg/L	25-JUN-07	25-JUN-07	BJM	R539997
Phosphorus, Total	0.023		0.001	mg/L		27-JUN-07	DVH	R541355
Redox Potential	70		1	mV	26-JUN-07	26-JUN-07	L.S	R540247
Total Kjeldahl Nitrogen	1.0		0.2	mg/L	20-JUN-07	27-JUN-07	LDE	R540862
Total Nitrogen	1.0		0.2	mg/L		27-JUN-07		
Total Oil and Grease	<1		1	mg/L	27-JUN-07	27-JUN-07	MDM	R540065
Total Suspended Solids	<5		5	mg/L		27-JUN-07	BJL	R541051
Routine Dissolved								
Alkalinity								
Alkalinity, Total (as CaCO3)	60		1	mg/L		21-JUN-07	DVH	R538732
Bicarbonate (HCO3)	73		2	mg/L		21-JUN-07	DVH	R538732
Carbonate (CO3)	<0.6		0.6	mg/L		21-JUN-07	DVH	R538732
Hydroxide (OH)	<0.4		0.4	mg/L		21-JUN-07	DVH	R538732
Chloride Dissolved								
Chloride (Cl) - Dissolved	<9		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
Conductivity								
Conductivity	126		0.4	umhos/cm		21-JUN-07	DVH	R538732
Hardness (as CaCO3)	50.0		0.2	mg/L		22-JUN-07		
Metals for Ion balance								
Calcium (Ca)-Dissolved	17.8		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Potassium (K)-Dissolved	1.55		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Magnesium (Mg)-Dissolved	1.33		0.01	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Sodium (Na)-Dissolved	6.86		0.02	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Nitrate + Nitrite Dissolved								
Nitrate+Nitrite-N - Dissolved	0.021	RAMB	0.005	mg/L	20-JUN-07	21-JUN-07	CLM	R538843
Sulphate Dissolved								
Sulphate (SO4) - Dissolved	10		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
TDS (Calculated)	72		5	mg/L		29-JUN-07		
pH								
PH	7.76		0.01	pH units		21-JUN-07	DVH	R538732
L520329-5 5 CORAL HARBOUR								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Ammonia (NH3) - Dissolved	2.02		0.003	mg/L	20-JUN-07	21-JUN-07	CLM	R538843
Biochemical Oxygen Demand	<6		1	mg/L	21-JUN-07	26-JUN-07	IML	R540428
Fecal Coliform	930		3	MPN/100mL		23-JUN-07	LJK	R540005
Metal scan								
Silver (Ag)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Aluminum (Al)-Total	<0.02		0.02	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Arsenic (As)-Total	<0.0005		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Boron (B)-Total	<0.03		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Barium (Ba)-Total	0.0098		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Beryllium (Be)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Bismuth (Bi)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Calcium (Ca)-Total	32.9		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cadmium (Cd)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cobalt (Co)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L520329-5 5 CORAL HARBOUR								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Metal scan								
Chromium (Cr)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cesium (Cs)-Total	<0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Copper (Cu)-Total	0.003		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Iron (Fe)-Total	0.11		0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Potassium (K)-Total	2.7		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Magnesium (Mg)-Total	2.46		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Manganese (Mn)-Total	0.0093		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Molybdenum (Mo)-Total	0.0005		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Sodium (Na)-Total	12.1		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Nickel (Ni)-Total	<0.002		0.002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phosphorus (P)-Total	0.09	RAMB	0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Lead (Pb)-Total	<0.0005		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Rubidium (Rb)-Total	0.0036		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Antimony (Sb)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Selenium (Se)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tin (Sn)-Total	<0.0006		0.0006	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Strontium (Sr)-Total	0.0446		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tellurium (Te)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Titanium (Ti)-Total	<0.0009		0.0009	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Thallium (Tl)-Total	<0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Uranium (U)-Total	0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Vanadium (V)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tungsten (W)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zinc (Zn)-Total	0.01		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zirconium (Zr)-Total	<0.0004		0.0004	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phosphorus, Total	0.148		0.001	mg/L		27-JUN-07	DVH	R541355
Redox Potential	75		1	mV	26-JUN-07	26-JUN-07	L.S	R540247
Total Kjeldahl Nitrogen	3.9		0.2	mg/L	20-JUN-07	27-JUN-07	LDE	R540862
Total Nitrogen	4.0		0.2	mg/L		27-JUN-07		
Total Oil and Grease	<1		1	mg/L	27-JUN-07	27-JUN-07	MDM	R540065
Total Suspended Solids	<5		5	mg/L		27-JUN-07	BJL	R541051
Routine Dissolved								
Alkalinity								
Alkalinity, Total (as CaCO3)	105		1	mg/L		21-JUN-07	DVH	R538732
Bicarbonate (HCO3)	128		2	mg/L		21-JUN-07	DVH	R538732
Carbonate (CO3)	<0.6		0.6	mg/L		21-JUN-07	DVH	R538732
Hydroxide (OH)	<0.4		0.4	mg/L		21-JUN-07	DVH	R538732
Chloride Dissolved								
Chloride (Cl) - Dissolved	16		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
Conductivity								
Conductivity	263		0.4	umhos/cm		21-JUN-07	DVH	R538732
Hardness (as CaCO3)	96.6		0.2	mg/L		22-JUN-07		
Metals for Ion balance								
Calcium (Ca)-Dissolved	34.4		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Potassium (K)-Dissolved	2.94		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Magnesium (Mg)-Dissolved	2.59		0.01	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Sodium (Na)-Dissolved	13.2		0.02	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Nitrate + Nitrite Dissolved								
Nitrate+Nitrite-N - Dissolved	0.136	RAMB	0.005	mg/L	20-JUN-07	21-JUN-07	CLM	R538843
Sulphate Dissolved								
Sulphate (SO4) - Dissolved	<9		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L520329-5 5 CORAL HARBOUR								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Routine Dissolved								
TDS (Calculated)	130		5	mg/L		29-JUN-07		
pH								
PH	8.00		0.01	pH units		21-JUN-07	DVH	R538732
L520329-6 SEEP 2 REP								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Ammonia (NH3) - Dissolved	40.1		0.003	mg/L	20-JUN-07	26-JUN-07	CLM	R540745
Biochemical Oxygen Demand	120		1	mg/L	21-JUN-07	26-JUN-07	IML	R540428
Fecal Coliform	>110000		3	MPN/100mL		23-JUN-07	LJK	R540005
Metal scan								
Silver (Ag)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Aluminum (Al)-Total	0.37		0.02	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Arsenic (As)-Total	0.0006		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Boron (B)-Total	0.09		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Barium (Ba)-Total	0.0041		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Beryllium (Be)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Bismuth (Bi)-Total	0.0007		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Calcium (Ca)-Total	18.8		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cadmium (Cd)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cobalt (Co)-Total	0.0006		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Chromium (Cr)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Cesium (Cs)-Total	<0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Copper (Cu)-Total	0.041		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Iron (Fe)-Total	0.45		0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Potassium (K)-Total	13.6		0.1	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Magnesium (Mg)-Total	2.98		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Manganese (Mn)-Total	0.0650		0.0003	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Molybdenum (Mo)-Total	0.0010		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Sodium (Na)-Total	57.0		0.03	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Nickel (Ni)-Total	0.003		0.002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phosphorus (P)-Total	5.77	RAMB	0.05	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Lead (Pb)-Total	0.0012		0.0005	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Rubidium (Rb)-Total	0.0182		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Antimony (Sb)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Selenium (Se)-Total	0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tin (Sn)-Total	0.0036		0.0006	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Strontium (Sr)-Total	0.0243		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tellurium (Te)-Total	<0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Titanium (Ti)-Total	0.0218		0.0009	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Thallium (Tl)-Total	<0.0001		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Uranium (U)-Total	0.0006		0.0001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Vanadium (V)-Total	0.001		0.001	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Tungsten (W)-Total	<0.0002		0.0002	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zinc (Zn)-Total	0.08		0.01	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Zirconium (Zr)-Total	0.0030		0.0004	mg/L	25-JUN-07	25-JUN-07	DAG	R540227
Phenols (4AAP)	0.083		0.001	mg/L	22-JUN-07	22-JUN-07	BJM	R539997
Phosphorus, Total	6.06		0.001	mg/L		27-JUN-07	DVH	R541355
Redox Potential	<1		1	mV	26-JUN-07	26-JUN-07	L.S	R540247
Total Kjeldahl Nitrogen	58.1		0.2	mg/L	20-JUN-07	27-JUN-07	LDE	R540862
Total Nitrogen	58.1		0.2	mg/L		27-JUN-07		

ALS LABORATORY GROUP ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	By	Batch
L520329-6 SEEP 2 REP								
Sampled By: BA on 19-JUN-07								
Matrix: Water								
Total Oil and Grease	16		1	mg/L	27-JUN-07	27-JUN-07	MDM	R540065
Total Suspended Solids	60		5	mg/L		27-JUN-07	BJL	R541051
Routine Dissolved								
Alkalinity								
Alkalinity, Total (as CaCO3)	243		1	mg/L		21-JUN-07	DVH	R538732
Bicarbonate (HCO3)	296		2	mg/L		21-JUN-07	DVH	R538732
Carbonate (CO3)	<0.6		0.6	mg/L		21-JUN-07	DVH	R538732
Hydroxide (OH)	<0.4		0.4	mg/L		21-JUN-07	DVH	R538732
Chloride Dissolved								
Chloride (Cl) - Dissolved	42		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
Conductivity								
Conductivity	700		0.4	umhos/cm		21-JUN-07	DVH	R538732
Hardness (as CaCO3)	55.0		0.2	mg/L		22-JUN-07		
Metals for Ion balance								
Calcium (Ca)-Dissolved	17.4		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Potassium (K)-Dissolved	13.6		0.05	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Magnesium (Mg)-Dissolved	2.79		0.01	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Sodium (Na)-Dissolved	57.5		0.02	mg/L	21-JUN-07	22-JUN-07	DAG	R538862
Nitrate + Nitrite Dissolved								
Nitrate+Nitrite-N - Dissolved	0.023	RAMB	0.005	mg/L	20-JUN-07	21-JUN-07	CLM	R538843
Sulphate Dissolved								
Sulphate (SO4) - Dissolved	38		9	mg/L	20-JUN-07	28-JUN-07	TJJ	R541653
TDS (Calculated)	318		5	mg/L		29-JUN-07		
pH								
PH	7.48		0.01	pH units		21-JUN-07	DVH	R538732

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

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
RAMB	Result Adjusted For Method Blank

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
ALK-TOT-WP	Water	Alkalinity		APHA 2320B

Alkalinity of water is a measure of its acid neutralizing capacity. Alkalinity is imparted by bicarbonate, carbonate and hydroxide components of water. It is determined by titration with a standard solution of strong mineral acid to the successive HCO3- and H2CO3 endpoints indicated electrometrically.

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
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 dissolved 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.

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
CL-DIS-WP	Water	Chloride Dissolved		APHA4500/LACHAT

Chloride - Colourimetric using Mercuric Thiocyanate

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
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.

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
ETL-HARDNESS-DIS-WP	Water	Hardness Calculated		Calculated
ETL-N-TOT-WP	Water	Total Nitrogen Calculated		Calculated
ETL-ROU-DIS-LOW-WP	Water	Metals for Ion balance		EPA 200.8 Rev 5.4 May 1994
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 Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
IONBALANCE-OP05-WP	Water			APHA 1030E
MET-SCAN-TOT-LOW-WP	Water	Metal scan		EPA 200.8 Rev 5.4 May 1994
N-TOTKJ-WP	Water	Total Kjeldahl Nitrogen		Quickchem method 10-107-06-2-E Lachat

Samples are digested with a sulphuric acid solution, cooled, diluted with water, and analyzed for ammonia. Total Kjeldahl nitrogen is the sum of free-ammonia and organic nitrogen compounds which are converted to ammonium sulphate through this digestion process. Analysis is performed by Flow Injection
Analysis (FIA). The pH of the digested sample is raised to a known, basic pH by neutralization with a concentrated buffer solution. This neutralization converts the ammonium cation to ammonia. The ammonia produced is heated with saliclyate and hypochlorite to produce blue colour which is proportional to the ammonia concentration.

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
N2N3-DIS-WP	Water	Nitrate + Nitrite Dissolved		APHA4500;2005/LACHAT;1997,1999
NH3-DIS-WP	Water	Ammonia Dissolved		LACHAT;2003

Ammonia - Colourimeric using Salicylate-nitroprusside and hypochlorite, in an alkaline phosphate buffer.

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
OGG-IR-WP	Water	Total Oil and Grease		APHA METHOD 5520C
P-TOTAL-WP	Water	Phosphorus, Total		APHA, 1998

Samples are digested using a sulphuric acid-persulphate mixture to convert organic phosphorous to orthophosphate. The samples are analyzed by either the Flow Injection Analysis (FIA) or the Segmented Flow Analysis (SFA) method. The absorbance measured by the instrument is proportional to the concentration of orthophosphate in the sample, and is reported as phosphorous. Samples are analyzed for total or total dissolved phosphorous depending on the sample pretreatment.

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
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.

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
PHENOLS-4AAP-WT	Water	Phenols (4AAP)		APHA 5530
REDOX-POTENTIAL-WT	Water	Redox Potential		APHA 2580

Reference Information

SO4-DIS-WP	Water	Sulphate Dissolved	APHA4500/LACHAT

Sulphate - Turbidimetric

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.

** Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

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

GLOSSARY OF REPORT TERMS
Surr - A surrogate is an organic compound that is similar to the target analyte(s) in chemical composition and behavior but not normally detected in environmental samples. Prior to sample processing, samples are fortified with one or more surrogate compounds.
The reported surrogate recovery value provides a measure of method efficiency. The Laboratory control limits are determined under column heading D.L.
mg/kg (units) - unit of concentration based on mass, parts per million.
mg/L (units) - 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.
UNLESS OTHERWISE STATED, SAMPLES ARE NOT CORRECTED FOR CLIENT FIELD BLANKS.
Although test results are generated under strict QA/QC protocols, any unsigned test reports, faxes, or emails are considered preliminary.

ALS Laboratory Group has an extensive QA/QC program where all analytical data reported is analyzed using approved referenced procedures followed by checks and reviews by senior managers and quality assurance personnel. However, since the results are obtained from chemical measurements and thus cannot be guaranteed, ALS Laboratory Group assumes no liability for the use or interpretation of the results.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

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Winnipeg, Manitoba, Canada R2J 3T4
Tel: (204) 255-9720
Fax (204) 255-9721
Toll Free: 1-800-607-7555

CHAIN OF CUSTODY ANALYTICAL REQUEST FORM

DATE SUBMITTED: ____________ DATE REQUIRED: ____________

[redacted]

PRICING (CHECK ONE)
AS PER QUOTE #: Q15188 ☐
AS PER LIST PRICE: ☐

ANALYSIS REQUESTED:
LAB USE ONLY

L520329

SAMPLE ID	SAMPLED BY	DATE / TIME SAMPLED	SAMPLE TYPE	Routine	Nutrients	Phenols	Oil + Grea	Metals + T	Bacteria T	SAMPLE RECEIVED (Y OR N)	SAMPLE BROKEN (Y OR N)	LAB SAMPLE NO.
1 Lagoon	B.A.	June 19/07	Water									
Seep 2												
3 Coral Harbour												
4 Coral Harbour												
5 Coral Harbour												
Seep 2 Rep												
			PRESERVED / FILTERED									

NOTES & CONDITIONS:
1. Quote number must be provided to ensure proper pricing.
2. All hazardous samples submitted must be labeled to comply with WHMIS regulations. This must include the nature of the hazard, as well as a contact name and phone number that the lab can contact for further information.
3. ALS's liability limited to cost of analysis.

NOTE: Failure to properly complete all portions of this form may delay analysis.

[redacted]

NO. SAMPLES SUBMITTED: ____________
NO. BOTTLES/SAMPLES: ____________

RELINQUISHED BY:	DATE / TIME	RECEIVED BY:	DATE / TIME
	DATE TIME	ALS LAB:	DATE June 20/07 TIME 10:30
	DATE TIME	ALS LAB:	DATE TIME

E-MAIL: YES ☐ NO ☐
E-MAIL ADDRESS: brian.arguilla @ jaques.witford.com
P.O. NO.: ____________
JOB NO.: 101936 - Coral Harpour

SAMPLE CONDITION UPON RECEIPT: ☑ ACCEPTABLE ☐ NON ACCEPTABLE
FROZEN: ____ [✓ COLD:] ____ AMBIENT: ____
OTHER (BREAKAGE, LEAKAGE, ETC.): ____________
Samples Are Not Preserved.

WHITE - File Copy
GREEN - Final Report
PINK - Invoicing
BLUE - Client Support
YELLOW - Customer

REV. OCT. / 2006