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SUPPLEMENTAL ENVIRONMENTAL SITE ASSESSMENT

JOHNSON POINT
NORTHWEST TERRITORIES

Submitted to:

Indian and Northern Affairs Canada
Contaminants and Remediation Directorate
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EXECUTIVE SUMMARY

In July 2007, Golder Associates Ltd. in association with IMG-Golder Corporation (Golder) was retained by Indian and Northern Affairs Canada (INAC) to conduct a supplementary Environmental Site Assessment (ESA) at Johnson Point, NWT. The Site is located on the east coast of Banks Island, approximately 270 kilometres northeast of Sachs Harbour at 72^0 45' north latitude and $118^0$30' west longitude, within the zone of continuous permafrost. Johnson Point was originally constructed as a staging area and base for oil and gas exploration activities in the 1970s, and was actively used until the early 1980s. Since that time, several companies have used the airstrip at Johnson Point as an alternate landing location, and the site has been used as a staging area for exploration activities further inland.

The primary objective of this Supplementary ESA was to collect additional information as required to finalize the Remedial Action Plan being developed by others. Based on the results of previous assessments, the following outstanding issues were identified in the Golder proposal dated 8 June 2007, and modified on June 22, 2007.

- Sediment Sampling: To confirm or disprove potential inputs to freshwater environments from historic activities.
- Characterization of hydrocarbon contaminated soil: To provide the necessary information to evaluate treatment options.
- Groundwater sampling: To provide an updated record of groundwater quality.
- Paint Leachability Testing: To collect paint samples from structures with lead based paint.
- Site Survey: To provide coordinates of any new sampling locations for inclusion on base plans for reference.
- Benthic sampling in the pond adjacent to the apron, as well as a background pond.
- Water quality sampling for assessment of potability.

The site investigation team mobilized from Inuvik to Sachs Harbour on the evening of 03 August 07. Due to weight restrictions provided at the airport by the charter company, the surveyor and associated equipment were not allowed on the flight. The team mobilized to Johnson Point in the late morning of 04 August 07, as departure was delayed due to fog conditions. Due to the potential that a landing at Sachs Harbour on return would not be possible, additional weight restrictions on cargo were enforced to allow for the additional fuel. This, coupled with the reduced time on site, did not allow for groundwater sampling.

The results of the additional sampling and analyses are provided as follows:

Hydrocarbon Impacted Sediments

Sediment samples were collected from the Apron pond, adjacent to the west side of the Apron, and analytical results indicated hydrocarbon concentrations in excess of background levels for the F2 to F4 fractions, and in excess of ecological direct contact soil guidelines in the area directly adjacent to the Apron. It was noted that the pond is only 0.5 m deep, and therefore will freeze to the full depth. As a result, it is not expected to support significant aquatic life. It is noted that although elevated hydrocarbon concentrations were measured in the sediment, surface water dissolved hydrocarbon concentrations (BTEX, F1, F2) in two samples were less than the method detection limit, with the

exception of F2 hydrocarbons in one location, adjacent to the apron. Removal of hydrocarbon impacted soils from the Apron area should mitigate against future inputs to the pond, and the existing F2 contamination would naturally attenuate over time. Excavation of the sediments in this area if required, would be difficult to carry out and would likely result in excessive siltation of the pond in the short term. Excavation of sediments in this area is likely not warranted.

Hydrocarbon contamination was also measured in sediments within the flood plain of the Unnamed River, located to the east of the apron area. One area, at STR-05, is likely associated with an isolated spill as it is predominantly F3/F4 contamination. The impacted area is anticipated to be less than 10 m^2 with a volume of approximately 2 to 3 m^3. The hydrocarbon impacts associated with JP07-03 and JP07-02 may encompass an area of 400 to 600 m^2 (40 m by 10 to 15 m) and the volume may be in excess of 150 m^3. Although, elevated hydrocarbon concentrations were measured in the sediment, surface water dissolved hydrocarbon concentrations (BTEX, F1, and F2) were below the method detection limit.

Potential remedial options for the Unnamed River impacted area include do nothing; covering with erosion protection material to mitigate against transport of contaminated sediment to the marine environment, or excavation and removal of impacted sediments. The selection of the preferred remedial option should weigh the potential environmental benefits (removal of limited source of hydrocarbon contamination) with potential negative impacts associated with increased erosion, physical disturbance, and ease and cost of implementation of the remedial solution for the site specific conditions at Johnson Point, and with consideration of all aspects of the Remedial Action Plan (such as access, availability of borrow material).

Treatment of Hydrocarbon Contaminated Soil

The characterization of hydrocarbon impacted soil at Johnson Point indicates that although viable hydrocarbon degrading bacteria are present; the soils are nutrient deficient. Nutrient amendments, consisting of both nitrogen and phosphate, will be required for any bio-treatment options, to achieve a carbon-nitrogen-phosphorous ratio (C:N:P) in the range of 100:7.5:0.5.

Analyses of groundwater from the contaminated area at the Apron indicated that organic parameters (hydrocarbons) exceeded wastewater discharge criteria, as would generally be expected. Concentrations of inorganic elements were below criteria. Groundwater recovered during contaminated soil excavation will require treatment to remove organics prior to discharge.

Disposal of Painted Materials

The results of leachability testing indicate that the orange Nodwells, and the light green building in the tank farm area (shop like building, footprint dimensions 7 m x 15 m) exceed criteria for leachable lead and are considered hazardous waste materials under Transport Canada TDG Regulations and require disposal off-site. The remaining structures are considered non-hazardous. Based on EBA results for total lead, the majority of painted facilities and equipment exceed the NWT guidelines for total lead of 600 mg/kg. It is noted that these guidelines only apply to disposal of waste materials on Commissioner's Land in the NWT.

Assessment of Potable Water

The analytical results of two samples of water collected from the Unnamed River confirmed that from a water quality perspective that the river could be used as a potable water source. Water withdrawal rates should not exceed 10% of the daily flow rate, when Arctic char or other fish are present in the river during spawning. Spawning occurs in the fall time period as fish migrate upstream to freshwater bodies. Low flows may be expected near the end of the thaw season (August-September). Water lines will require screened intakes in accordance with Department of Fisheries and Oceans requirements. (DFO 2007).

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1 INTRODUCTION

In July 2007, Golder Associates Ltd. in association with IMG-Golder Corporation (Golder) was retained by Indian and Northern Affairs Canada (INAC) to conduct a supplementary Environmental Site Assessment (ESA) at Johnson Point, NWT (the Site). The Site is located on the east coast of Banks Island, approximately 270 kilometres northeast of Sachs Harbour at 72^0 45' north latitude and $118^0$30' west longitude as shown on Figure 1. An areal view of the site is provided in Figure 2. The site is within the zone of continuous permafrost. Johnson Point was originally constructed as a staging area and base for oil and gas exploration activities in the 1970s, and was actively used until the early 1980s. Since that time, several companies have used the airstrip at Johnson Point as an alternate landing location, and the site has been used as a staging area for exploration activities further inland.

The primary objective of this Supplementary ESA was to collect additional information as required to finalize the Remedial Action Plan and Specifications and Drawings being developed by others.

1.1 Project Objectives

Previous activities at Johnson Point have impacted the environment in the vicinity of the site. Landfills, debris piles, fuel tanks, buildings and other features are potential sources of soil contamination and hazardous materials. Previous assessments of the site identified the presence of buried materials and confirmed the presence of contaminated soils and hazardous materials at the site.

In 2006, EBA conducted a Phase III ESA, including geophysical surveys, to characterize and quantify the extent of contamination at the site and to prepare for remediation activities. This ESA by EBA supplemented previous work by IEG Environmental Ltd. Based on the results of these assessments, the following outstanding issues were identified in the Golder proposal dated 8 June 2007.

- Sediment Sampling: To confirm or disprove potential inputs to freshwater and marine environments from historic activities.
- Characterization of hydrocarbon contaminated soil: To provide the necessary information to evaluate treatment options.
- Groundwater sampling: To provide an updated record of groundwater quality.
- Paint Leachability Testing: To collect samples of paint including substrate from structures with lead based paint.
- Site Survey: To provide coordinates of any new sampling locations for inclusion on base plans for reference.

In subsequent discussions with INAC, additional work items were included in the scope of work as follows:

- Benthic sampling in the pond adjacent to the apron, as well as a background pond.
- Water quality sampling for assessment of potability.
- Water level survey in the pond adjacent to the apron.

1.2 Scope of Report

The remainder of this report is structured as follows:

- Section 2 provides a summary of the issues of concern based on previous reports, and identifies relevant criteria, where appropriate.
- In Section 3, an overview of the investigation is provided and the number of samples collected and analysed is provided. The site investigation results are described.
- In Section 4, a summary of the site investigation activities and conclusions are provided.

In the Annexes to the ESA, the following information is provided.

- Annex A presents the Inuvialuit Involvement Summary.
- Annex B provides the Environmental Health and Safety Indicators.
- Annex C provides a summary of all analytical data and original laboratory documentation.
- An evaluation of the laboratory QA/QC is presented in Annex D.
- Annex E provides select site photographs.

2 ISSUES OF CONCERN AND RELEVANT ASSESSMENT CRITERIA

2.1 Sediment

2.1.1 Issues of Concern

Based on a review of EBA data, background sediment sample concentrations were elevated with respect to petroleum hydrocarbons. These samples were collected from a pond located north of the airstrip, referred to as the Background Pond (EBA) on Figure 2. Total TPH concentrations of 230 and 380 mg/kg were reported, and were comprised of the F2 to F4 fractions.

In addition, Golder recommended that additional samples be collected at EBA sediment sample location #5 in the Unnamed River, which is located downgradient of the tank farm, to confirm or disprove migration of hydrocarbon contaminants. It was also recommended that a marine sediment sample be collected from the Prince of Wales Strait, downgradient of the Apron area.

Concentrations of TPH F2, F3 and F4 fractions were elevated in a sample taken from the Apron Pond with a maximum TPH concentration of 2216 mg/kg (Sediment Sample #1, EBA). Only one sample was collected from this pond during the 2006 ESA, and additional information was required to determine the extent of contamination.

2.1.2 Relevant Assessment Criteria

Neither the CCME sediment guidelines for protection of aquatic life nor the Canada Wide Standard for Petroleum Hydrocarbons in Soil (CWS PHC) provide hydrocarbon fraction criteria for assessment of sediment quality. In the new Alberta Tier I/Tier II criteria (Alberta Environment 2007), a user is allowed to generate sediment quality criteria for petroleum hydrocarbons, fractions F1 and F2. Criteria are determined by calculating the sediment concentration that would correspond to a pore-water concentration equivalent to the water quality criteria for the contaminant, and is based on equilibrium partitioning. In accordance with this methodology, no criteria are generated for the F3 and F4 fractions, as these fractions are considered essentially insoluble. As this method does not consider any dilution, it is considered overly conservative, and is not used.

Jacques Whitford provided an ecological Site Specific Target Level (SSTL) for this site of 4570 mg/kg TPH; however, this target level was specific to protection of terrestrial wildlife and is not considered appropriate for hydrocarbons in sediment.

In the absence of fraction specific criteria for sediment, or a sediment SSTL, it is recommended that sediment concentrations be initially compared to background concentrations. Where concentrations are consistent with background levels, it is assumed that there is no significant impact. For further reference, comparison will be made to soil quality criteria for used for protection of ecological direct soil contact (residential/parkland land use) as taken from Alberta Tier I/II Guidelines (2007). These guidelines are based on the draft version of the CCME (2007) guidelines. As the revised values in the CCME CWS PHC can not be cited at the writing of this report, the Alberta guidelines, which have been ratified, are used.

Table 1 summarizes the proposed sediment quality guidelines. The CCME CWS PHC 2001 are provided for reference only.

Table 1 Proposed Hydrocarbon Fraction Guidelines for Sediment – Johnson Point, NWT

Parameter Hydrocarbon	Average Background Concentration mg/kg	Fine-Grained Soil mg/kg	Coarse-Grained Soil mg/kg
F1 (AB) CCME 2001	<5	210 (260)	210 (130)
F2 (AB) CCME 2001	15	150 (900)	150 (450)
F3 (AB) CCME 2001	148	1300 (800)	300 (400)
F4 (AB) CCME 2001	51	5600 (5600)	2800 (2800)

The CCME provides inorganic element sediment guidelines for the protection of aquatic life in freshwater and marine environments, and will be used for comparison, as applicable.

Surface water samples are compared to Canadian Drinking Water Quality Guidelines, and the CCME Guidelines for Protection of Aquatic Life, and Protection of Agricultural Water Uses – Livestock. The latter guidelines, are considered indicative, not necessarily representative, of protection of wildlife that may use surface water bodies as a drinking water source.

2.2 Treatment of Contaminated Soil

Characterization of hydrocarbon contaminated soil is required to determine the optimal treatment alternative. Although Johnson Point is located within the Northern Arctic Eco-zone, previous studies have demonstrated that micro-organisms are capable of degrading hydrocarbons at the low temperatures typical of this zone. Potential factors limiting the success of bio-degradation in these regions include availability of essential nutrients and soil moisture levels (Greer et al 2007).

In order to evaluate potential treatment options, the following analytical tests were carried out:

- Physical parameters including soil moisture content and soil texture;
- Bacterial Population by Most Probably Number (MPN) Method;
- DNA Profiling;
- Soil pH and nutrient concentration (Total Organic Carbon, nitrogen, and phosphorus); and
- F1, F2, F3 and F4 hydrocarbon fractions for characterization of contamination.

2.3 Painted Waste Materials

At northern sites, lead-based and PCB-amended paints were used on many structures, facilities and equipment. Disposal requirements for materials painted with PCB-amended paint are based on the Canadian Environmental Protection Act, which precludes the disposal of waste materials containing greater than 50 ppm PCBs. Lead-based paints are common on metal structures as the paint primer

typically contains high concentrations of lead. The NWT has designated lead-based painted materials as any materials containing greater than 600 mg/kg lead in the paint, and does not allow disposal of these materials on Commissioner's Land within the NWT. Where waste materials are to be transported off-site, the Transportation of Dangerous Goods Act and Regulations applies. Waste materials are classified as dangerous goods if the concentration of leachable lead exceeds 5 mg/L. Based on work completed by UMA in support of DND's DEW Line Cleanup Work, the leachable lead concentration is derived from a sample that includes both the paint and substrate. Previous studies at Johnson Point did not analyze for leachable lead concentrations. Additional samples of paint and substrate were required for these analyses.

2.4 Potable Water

Analyses of water sources are required to determine their suitability as a drinking water source for contractor personnel during the cleanup of the site. Analytical requirements include water chemistry, inorganic element concentrations and biological parameters. Due to the proximity of the water sources to hydrocarbon impacted areas, analyses of hydrocarbon parameters is also required. Results are compared to the latest edition of the CCME Guidelines for Drinking Water Quality.

3 SITE INVESTIGATION RESULTS

3.1 Introduction

The site investigation team mobilized from Inuvik to Sachs Harbour on the evening of 03 August 07. Due to weight restrictions provided at the airport by the charter company, the surveyor and associated equipment were not allowed on the flight. As back-up, a hand-held GPS unit was used to identify sampling locations in the field. The team mobilized to Johnson Point in the late morning of 04 August 07, as departure was delayed due to fog conditions. Due to the potential that a landing at Sachs Harbour on return would not be possible, weight restrictions on cargo were enforced to allow for the additional fuel. This, coupled with the reduced time on site, did not allow for groundwater sampling. Benthic sampling was also removed from the program due to time constraints.

The activities carried out at Johnson Point included:

- Sediment and surface water sampling in the pond adjacent to the west side of the apron (Apron Pond), the Unnamed River to the east of the apron, in a background pond (Background Pond, Golder 2007), and along the Prince of Wales Strait, down-gradient of the Apron.
- Confirmation of the depth of water in the Apron pond.
- Sampling of hydrocarbon impacted areas to allow evaluation of potential treatment options.
- Sampling of painted structures to determine disposal requirements.
- Sampling of surface water from the Unnamed River to determine its suitability as a drinking water source.

The remainder of this section is organized as follows:

- Background Assessment – Sediment and Surface Water
- Apron Pond Assessment
- Unnamed River Area Assessment
- Hydrocarbon Contaminated Areas Characterization
- Paint Sampling and Analyses
- Assessment of Potential Drinking Water Sources

3.2 Background Assessment – Sediment and Surface Water

In 2006, EBA collected background sediment samples from a pond located north of the east end of the airstrip, as shown on Figure 2. Concentrations of hydrocarbon fractions F2 to F4 were measured in two samples with total TPH values ranging from 230 to 380 mg/kg. There were no apparent anthropogenic sources of hydrocarbons in this area, but it is not known whether these are biogenic hydrocarbons resulting from the degradation of plant material (typically in the C27 to C33 range).

In 2007, Golder collected two background sediment samples from a pond located west of the Apron Pond (Background Pond Golder 2007) as indicated on Figures 2 and 3. Samples were analysed for hydrocarbons and inorganic elements. Results are provided in **Table 2**. Total concentrations of hydrocarbons ranged from 110 to 140 mg/kg, and were predominantly comprised of the F3 fraction.

A surface water sample collected from this pond in 2007 did not contain BTEX or F1, F2 hydrocarbon fractions above the method detection limit **(Table 3)**. The surface water sample was also analysed for total concentrations of inorganic elements. All results were below the guidelines for protection of freshwater aquatic life, with the exception of selenium, and aluminum. The selenium concentration was 1.5 times the guideline value, and aluminum was 4 times the guidelines value. There are no apparent anthropogenic sources of selenium (mining operations, incineration), therefore, the selenium is expected to be naturally occurring. There are no naturally occurring sources of aluminum (HSDB 2007), suggesting it may be associated with debris. However, no debris was observed in this pond. EBA did not analyse surface water samples for inorganic elements. Although surface water samples were also collected from the Unnamed River and could be considered background, water chemistry would be different as one source is flowing and other stagnant. Therefore, Unnamed River water quality samples are not used for comparison.

3.3 Apron Pond Assessment

A pond, approximately 100 m by 200 m in dimension, is present adjacent to the Apron area, and is referred to as the Apron Pond. In the 2006 assessment by EBA, one sediment sample taken from the pond contained elevated concentrations of petroleum hydrocarbons fraction F1 to F4, with the F2 fraction most elevated. Concentrations of ethylbenzene and xylenes were also measured in the sediment. Hydrocarbons were not detected in the surface water sample analysed from this area in 2006. Additional sediment samples were collected in 2007 to delineate the extent of hydrocarbon impacts to the pond. Sediment samples were analysed for hydrocarbon fractions, BTEX and inorganic elements. Two surface water samples were also collected and analysed for routine chemistry, hydrocarbon fractions, BTEX and total concentrations of inorganic elements.

Surface water and sediment sample locations are indicated on Figure 4. Analytical results exceeding sediment/surface water quality guidelines or in excess of maximum background concentrations (inorganic elements) are provided in **Tables 4 and 5**, respectively. All analytical results are provided in Annex C.

Sediment samples were collected across the width and length of the pond. Measurable concentrations of hydrocarbon fractions F2 to F4 were measured in all samples with the exception of CP-1, which only contained F3 and F4 hydrocarbons. Based on visual observations, the sediment samples are predominantly silt sized (fine grained). Sample CP-7, collected near the surface water run-off from the apron to the pond also contained F1 hydrocarbons and the highest concentration of F2 hydrocarbons. The maximum concentrations measured were as follows: F1 - 7 mg/kg, F2 - 340 mg/kg, F3 - 500 mg/kg, and F4 - 220 mg/kg. Hydrocarbon concentrations were elevated when compared to background concentrations, with the exception of Sample CP-1, which was collected in the western portion of the pond.

Table 2
Background - Freshwater Sediment Analytical Results
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters			Organics								
			Benzene	Toluene	Ethyl-benzene	Xylenes	F1	F2	F3	F4	Total PHC
Guidelines (mg/kg)											
Sediment - Freshwater Aquatic Life[2]			-	-	-	-	-	-	-	-	-
Fine Grained Soil - Eco Contact - TPH			-	-	-	-	**210**	**150**	**1300**	**5600**	-
Coarse Grained Soil - Eco Contact - TPH			-	-	-	-	**210**	**150**	**300**	**2800**	-
Laboratory Method Detection Limit			0.005	0.01	0.01	0.02	5	5	5	5	
Sample Identification	**Location**	**Depth (m)**									
EBA #5	Background Pond		<0.005	<0.020	<0.010	<0.020	<10	23	112	78	213
EBA #5	Background Pond		n/a	n/a	n/a	n/a	n/a	24	258	98	380
SED-BP-1	Background Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	<5	140	8	148
SED-BP-2	Background Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	11	80	19	110
Average Background							<5	15	148	51	

Chemical Parameters			Inorganic Elements								
			Arsenic	Cadmium	Cobalt	Chromium	Copper	Mercury	Nickel	Lead	Zinc
Guidelines (mg/kg)											
Sediment - Freshwater Aquatic Life[2]			**5.9**	**0.6**	-	**37.3**	**35.7**	**0.17**	-	**35**	**123**
DCC Tier I Criteria			-	-	-	-	-	-	-	**200**	
DCC Tier II Criteria			**30**	**5**	**50**	**250**	**100**	**2**	**100**	**500**	**500**
Laboratory Method Detection Limit			0.2	0.5	1	0.5	2	0.05	2	5	10
Sample Identification	**Location**	**Depth (m)**									
EBA #5	Background Pond	n/a									
EBA #5	Background Pond	n/a									
SED-BP-1	Background Pond	0 - 0.3	3.5	<0.5	5	11.1	13	<0.05	13	5	30
SED-BP-2	Background Pond	0 - 0.3	5.5	<0.5	10	16.5	16	<0.05	23	9	50

Notes:

1. Jacques Whitford Human Health and Ecological Risk Assessment for Johnson Point Staging Facility (2007) Site Specific Target Level for Ecological Risk for Total Petroleum Hydrocarbons

2. Canadian Council of Ministers of the Environment Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Updated 2005.

3. DEW Line Clean-up Criteria ("DCC") as provided in INAC Abandoned Military Site Remediation Protocol (2005),

4. Detection Limit Adusted: Samples had high moisture content

n/a = not analysed

Concentrations in mg/kg unless otherwise noted

Table 3
Surface Water Analytical Results
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters		Organics						Water Chemistry Parameters					
		Benzene	Toluene	Ethylbenzene	Xylenes	F1	F2	Calcium	Potassium	Magnesium	Sodium	Iron	Manganese
Guidelines (mg/L)[1]													
Drinking Water Quality		0.005	<0.024	<0.0024	<0.300	-	-	-	-	-	<200	<0.3	<0.05
Protection of Aquatic Life - Freshwater		0.37	0.002	0.09	-	-	-	-	-	-	-	0.3	-
Protection of Agricultural Water Uses - Livestock		-	-	-	-	-	-	1000	-	-	-	5	0.2
Laboratory Method Detection Limit		0.0005	0.0005	0.0005	0.0005	0.1	0.05						
Sample Identification	**Location**												
SW-BP-1	Background Pond	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05	43.6	5.2	32.1	57	0.267	0.005

Chemical Parameters		Inorganic Elements																			
		Silver	Aluminum	Arsenic	Boron	Barium	Beryllium	Cadmium	Cobalt	Chromium	Copper	Mercury	Lithium	Molybdenum	Nickel	Lead	Antimony	Selenium	Thallium	Uranium	Zinc
Guidelines (mg/L)[1]																					
Drinking Water Quality		-	0.1/0.2	0.025	5	1	-	0.005	-	0.05	<1	0.001	-	-	-	0.01	0.006	0.01	-	0.02	<5
Protection of Aquatic Life - Freshwater		0.0001	0.005-0.1	0.005	-	-	-	0.000017	-	-	0.002-0.004	0.000026	-	0.073	0.025-0.15	0.001-0.007	-	0.001	0.0008	-	0.03
Protection of Agricultural Water Uses - Livestock		-	5	0.025	5	-	0.1	0.08	1	-	0.5-5	0.003	2.5	0.5	1	0.1	-	0.05	-	0.2	50
Laboratory Method Detection Limit		<0.0004	0.01	0.0004	0.05	0.003	0.001	0.0002	0.002	0.005	0.001	0.0002	0.01	0.005	0.002	0.0001	0.0004	0.0004	0.0001	0.0001	0.004
Sample Identification	**Location**																				
SW-BP-1	Background Pond	<0.0004	**0.41**	0.0011	0.07	0.059	<0.001	<0.0002	<0.002	<0.005	0.002	<0.0002	0.01	<0.005	<0.002	0.0003	0.0005	0.0015	<0.0001	0.0004	<0.004

Notes:
1. Canadian Council of Ministers of the Environment Canadian Environmental Quality Guidelines for the Protection of Drinking Water, Freshwater Aquatic Life, and Agricultural Water Uses, Updated 2005.

Blue and Bolded exceeds the Drinking Water Guideline

Shaded exceeds the Freshwater Aquatic Life Guideline

Table 4
Sediment Analytical Results - Apron Area
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters			Organics									Inorganic Elements	
			Benzene	Toluene	Ethyl-benzene	Xylenes	F1	F2	F3	F4	Total PHC	Copper	Lead
Guidelines (mg/kg)													
Sediment - Freshwater Aquatic Life[2]			-	-	-	-	-	-	-	-	-	**35.7**	**35**
Fine Grained Soil - Ecological Contact			-	-	-	-	**210**	**150**	**1300**	**5600**	-		
Coarse Grained Soil - Ecological Contact			-	-	-	-	**210**	**150**	**300**	**2800**	-		
Laboratory Method Detection Limit			0.005	0.01	0.01	0.02	5	5	5	5		2	5
Sample Identification	**Location**	**Depth (m)**											
Average (PHC) Maximum (inorganic) Background							**<5**	**15**	**148**	**51**		**16**	**9**
SED-CP-1	Apron Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	<5	66	29	95	11	<5
SED-CP-2	Apron Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	10	**360**	**200**	570	13	7
SED-CP-3	Apron Pond	0 - 0.3	<0.01[4]	<0.02	<0.02	<0.04	<5	**35**	**500**	**220**	755	**17**	**15**
SED-CP-4	Apron Pond	0 - 0.3	<0.01[4]	<0.02	<0.02	<0.04	<5	**56**	**440**	**190**	686	11	8
SED-CP-5	Apron Pond	0 - 0.3	<0.01[4]	<0.02	<0.02	<0.04	<5	**61**	**410**	**170**	641	12	8
SED-CP-6	Apron Pond	0 - 0.3	<0.01[4]	<0.02	<0.02	<0.04	<5	**19**	**160**	**68**	247	6	<5
SED-CP-7	Apron Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	7	**340**	**440**	**170**	957	5	<5

Notes:

1. n/a

2. Canadian Council of Ministers of the Environment Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Updated 2005.

3.Alberta Environment 2007 - Ecological Soil Contact, fine-grained and coarse grained soil

4. Detection Limit Adusted: Samples had high moisture content

Green and bolded exceeds background sediment average - hydrocarbons, maximum for inorganic elements

Blue and bolded exceeds direct ecological soil contact guidelines

Concentrations in mg/kg unless otherwise noted

Table 5
Surface Water Analytical Results - Apron Pond
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters		Organics						Water Chemistry Parameters	Inorganic Elements			
		Benzene	Toluene	Ethylbenzene	Xylenes	F1	F2	Iron	Aluminum	Mercury	Selenium	Thallium
Guidelines (mg/L)[1]												
Drinking Water Quality		0.005	<0.024	<0.0024	<0.300	-	-	<0.3	0.1/0.2	0.001	0.01	-
Protection of Aquatic Life - Freshwater		0.37	0.002	0.09	-	-	-	0.3	0.005-0.1	0.000026	0.001	0.0008
Protection of Agricultural Water Uses - Livestock		-	-	-	-	-	-	5	5	0.003	0.05	-
Laboratory Method Detection Limit		0.0005	0.0005	0.0005	0.0005	0.1	0.05		0.01	0.0002	0.0004	0.0001
Sample Identification	**Location**											
SW-BP-1	Background Pond	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05	0.267	**0.41**	<0.0002	0.0015	<0.0001
SW-CP-1	Apron Pond	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05	0.146	0.09	<0.0002	0.0029	<0.0001
SW-CP-2	Apron Pond	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	0.05	**0.335**	0.2	0.0005	0.0046	0.0013

Notes:

1. Canadian Council of Ministers of the Environment Canadian Environmental Quality Guidelines for the Protection of Drinking Water, Freshwater Aquatic Life, Marine Aquatic Life and Agricultural Water Uses, Updated 2005.

Blue and Bolded exceeds the Drinking Water Guideline

Shaded exceeds the Freshwater Aquatic Life Guideline

F3 and F4 fractions are essentially insoluble; suggesting that contaminated sediment entered the pond through erosion and is being dispersed by wave action or other advective mechanisms. F2 concentrations in Sample CP-7 exceeded the criteria for fine-grained surface soils. All other hydrocarbon concentrations were below the guidelines. The results for hydrocarbon analyses for the sample CP-7 are generally consistent with that recorded by EBA in 2006. The hydrocarbon impacted sediments, with concentrations greater than guidelines, appear to be confined to a localized area at the east end of the Apron Pond.

The analyses of the surface water from the pond indicated elevated total concentrations of aluminium, mercury, selenium and thallium above freshwater aquatic life criteria. Compared to concentrations measured in the background pond, concentrations of aluminium were less and selenium concentrations were 2 to 3 times greater. Neither mercury nor thallium were detected in the background pond. Concentrations are below the guidelines for agricultural water use (livestock watering). All other inorganic element parameters were below criteria. Dissolved F2 hydrocarbons were detected at the method detection limit concentration of 0.05 mg/L in one sample taken near the surface water drainage from the apron into the pond.

The elevated concentrations of inorganic elements are likely associated with the presence of debris in the pond. Although concentrations are above freshwater aquatic life criteria, the pond is shallow (0.5 m deep maximum) and therefore freezes to the full depth over winter. It is not expected to support significant aquatic life. As concentrations are below agricultural watering guidelines, environmental impact is unlikely. Remediation of the Apron Area would mitigate against future inputs of hydrocarbons to the Apron Pond, and the existing F2 contamination would naturally attenuate over time. Excavation of sediments in this area is likely not warranted.

3.4 Unnamed River Assessment

An Unnamed River is located on the eastern boundary of the site. Based on information available on Spatially Integrated Dataset (SID) on-line [http://nwt-tno.inac-ainc.gc.ca/ism-sid/index_e.asp] and aerial images [Google Earth], 2007, the watershed for the unnamed river appears to extend approximately 20 kilometers inland. The Unnamed River also receives run-off from the Tank Farm and Apron areas, which provide small contributions relative to the entire watershed. Surface water and sediment sample locations are indicated on Figure 4. Both sediment and surface water samples were analysed for hydrocarbon parameters and inorganic elements. Analytical results exceeding sediment quality guidelines are provided in **Table 6**. All analytical results are provided in Annex C.

The analyses of the surface water from the Unnamed River contained elevated concentrations of aluminium slightly above freshwater aquatic life guidelines. All other inorganic and hydrocarbon parameters were below guidelines or the method detection limit.

Sediment samples were collected in two primary areas during the site investigation. Samples STR-1 and STR-2 were taken in an area likely to receive surface water run-off from the Tank Farm, and Samples STR-4 and STR-5 were collected near the Apron Area. One sample was also collected of marine sediments south of the Apron, within the Prince of Wales Strait. Sediments consisted of sandy silt with some clay. Analytical test results for Sample STR-4 and STR-5 exceeded background concentrations for hydrocarbon fractions. It is recognized that the background samples from the pond were collected from areas of standing water as compared to flowing water, and this will result in different concentrations. Inorganic element concentrations were generally consistent with or lower than the concentrations measured in the background pond, as would be expected due to the presence

of flowing water. Significantly elevated concentrations of F3 and F4 were measured in sample STR-5 with concentrations of 9100 and 640 mg/kg respectively, with the F3 fraction exceeding the fine-grained soil guideline for ecological contact.

In a subsequent visit by the INAC representative, additional sediment samples were collected along the Unnamed River to provide further information on the extent of hydrocarbon contamination. The locations for samples JP-07-01 to JP-07-06 are also indicated on Figure 4. All samples contained measurable concentrations of the F3 fraction. Measured concentrations of the F2 fraction were greater than background in samples JP-07-01 to 03, and measured F3 fractions were greater than background in samples JP-07-02/03 and 06. Sample JP-07-03, collected upstream of STR-4 and STR-5, contained elevated F2 and F3 hydrocarbon fractions of 3010 mg/kg and 1170 mg/kg respectively. Elevated concentrations of F2 and F3 were also measured in Sample JP-07-02 taken further downstream with concentrations of 313 and 555 mg/kg respectively. The F2 concentrations in both samples exceeded the fine-grained soil guidelines for ecological contact. All other concentrations were below the guideline.

Samples with hydrocarbon concentrations in excess of guidelines are highlighted on Figure 5. The impacted area associated with Sample STR-5 appears to be localized, as Sample STR-4 located approximately 2 m distant is elevated above background levels but less than guidelines. This would be consistent with F3/F4 contamination. The impacted area is anticipated to be less than 10 m^2 with a volume of approximately 2 to 3 m^3. The hydrocarbon impacts associated with JP07-03 and JP07-02 may be more significant; however, there is insufficient sample density to determine the extent of contamination. Sample JP07-02 is located approximately 40 m downstream of JP07-03. On the assumption that sediments are contaminated between these two locations, the estimated area of impact is in the order of 400 to 600 m^2 (40 m by 10 to 15 m) and the volume may be in excess of 150 m^3.

Based on discussions with DFO/INAC (September 2007), it is understood that remediation options for this area should minimize, where possible, disturbance to the river, and mitigate against future transport of contaminated sediments/water to the ocean. Given the fine grained nature of the sediments, it can not be guaranteed that erosion would not occur over time, without suitable erosion protection placed over the contaminated area (Schmidt 2007). With no erosion protection, there would be the potential for transport of contaminated sediments to the marine environment**.**

Table 6
Sediment Analytical Results - Unnamed River East of Apron
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters			Organics									
			Benzene	Toluene	Ethylbenzene	Xylenes	F1	F2	F3	F4	Total PHC	Naphthalene
Guidelines (mg/kg)												
Site Specific Target Levels - Ecological Health[1]			-	-	-	-	-	-	-	-	4570	
Sediment - Freshwater Aquatic Life[2]			-	-	-	-	-	-	-	-	-	-
DEW Line Clean-up Tier I Criteria[3,] (f/g eco-TPH)			-	-	-	-	210	150	1300	5600	-	-
DEW Line Clean-up Tier II Criteria (c/g eco-TPH)			-	-	-	-	210	150	300	2800	-	
Laboratory Method Detection Limit			0.005	0.01	0.01	0.02	5	5	5	5		0.01
Sample Identification	**Location**	**Depth (m)**										
Average Background			<0.005	<0.02	<0.01	<0.02	<5	15	148	51	214	
SED-STR-4	Unnamed River	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	7	**1100**	33	**1140**	
SED-STR-5	Unnamed River	0 - 0.3	<0.005	<0.01	<0.01	**0.02**	**6**	10	**9100**	**640**	**9756**	
JP-07-01	Unnamed River	0.1-0.2	<0.004	<0.005	**0.011**	**0.05**	<12	**31**	85	21	137	0.07
JP-07-02	Unnamed River	0.1-0.2	<0.004	<0.005	<0.01	**0.02**	<12	**313**	**555**	24	**892**	
JP-07-03	Unnamed River	0.1-0.2	<0.004	<0.005	<0.01	<0.01	**37**	**3010**	**1170**	10	**4227**	
JP-07-06	Unnamed River	0.05-0.15	<0.004	<0.005	<0.01	<0.01	<12	**74**	**123**	18	**215**	

Notes:

1. Jacques Whitford Human Health and Ecological Risk Assessment for Johnson Point Staging Facility (2007) Site Specific Target Level for Ecological Risk for Total Petroleum Hydrocarbons

2. Canadian Council of Ministers of the Environment Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Updated 2005.

3. DEW Line Clean-up Criteria ("DCC") as provided in INAC Abandoned Military Site Remediation Protocol (2005), fine-grained and coarse grained eco-soil

4. Detection Limit Adusted: Samples had high moisture content

Green and bolded exceeds background sediment

Blue and bolded exceeds direct ecological soil contact guidelines

Concentrations in mg/kg unless otherwise noted

On this basis, potential remedial options include:

- Do nothing. At the present time, no impacts on surface water quality have been measured relative to hydrocarbon contamination. As this is a historic hydrocarbon impacted area, it suggests that impact has been minimal and no further remedial action is required.
- Cover area with erosion protection material to mitigate against erosion and transport of contaminated sediments. This option is not cost-effective, nor easy to implement given that no suitable coarse grained materials are present on site.
- Excavate impacted areas. Excavation of impacted areas has the potential to accelerate erosion in the area; which would lead to increased silt loading in the river.

The selection of the preferred remedial option should weigh the potential environmental benefits (removal of limited source of hydrocarbon contamination) with potential negative impacts associated with increased erosion, physical disturbance to habitat, and ease and cost of implementation of the remedial solution for the site specific conditions at Johnson Point, and with consideration of all aspects of the Remedial Action Plan (such as access, availability of borrow material).

3.5 Hydrocarbon Contaminated Soil Assessment

To assist in developing remedial options for the treatment of hydrocarbon contaminated soil, composite soil samples were collected from the hydrocarbon impacted areas at the Tank Farm and Apron Area and were analysed for BTEX, hydrocarbon fractions, nutrients and total organic carbon. In addition, microbial analyses were also carried out to ascertain the number and type of microbes present in the soil. The results are presented in Annex C.

As is typical of northern sites, nutrient concentrations were low, with available phosphorous (P) of less than 1 mg/kg, and available nitrogen in the range of 2 mg/kg (N). Total hydrocarbon concentrations were 3030 mg/kg (Tank Farm) and 1904 mg/kg (Apron Area), and were predominantly comprised of the F1 and F2 fractions. With desirable ratios of hydrocarbon (C) to N to P typically in the range of 100:7.5:0.5 (Poland et al 2007), both nitrogen and phosphorous are required for bioremediation.

Bacterial analyses were also conducted on the composite soil samples. The results indicate a higher density of hydrocarbon degrading bacteria in the sample collected from the apron area as compared to that taken at the tank farm, and significantly different bacterial communities. The soils appear to be relatively healthy in that there is some diversity in bacterial populations.

A groundwater sample was also collected from a monitoring well in the apron area and analysed for hydrocarbons, phenols, total and dissolved metals to assist in determining whether treatment of groundwater encountered during contaminated soil excavation requires treatment. The results are provided in Annex C. Analytical results were compared to anticipated wastewater discharge guidelines (based on previous work). Concentrations of dissolved F1 and F2 (5.4 mg/L) exceeded waste water discharge criteria of 5 mg/L.

3.6 Paint Sampling and Analyses

In 2006, EBA collected samples of paint from representative structures at the Johnson Point site. These samples were analysed for total PCBs and total Lead. Many of the paint samples contained significantly elevated concentrations of lead. To determine appropriate disposal requirements, twenty-five additional samples of paint including substrate were collected and analysed for leachable lead. A summary of these results is provided in **Table 7**. Where it could be reasonably assumed that paint samples were collected from the same facility/structure as EBA, the total lead concentration as per EBA (2007) was included on the table.

Leachable lead concentrations ranged from less than the method detection limit of 0.5 mg/L to over 50 mg/L; however, the majority of samples analysed had leachable lead concentrations less than 5 mg/L. There does not appear to be a correlation between leachable lead and total lead concentration. Samples of orange paint and metal substrate taken from the Nodwells had concentrations of leachable lead in the range of 4.2 to 4.8 mg/L. One substrate/paint sample collected from the light green building in the tank farm area (with a footprint of approximately 7 m x 15 m), had a leachable lead concentration of over 50 mg/L. Photographs of building/features sampled are included in Annex E.

3.7 Potable Water Assessment

Surface water samples were collected from the Unnamed River to the east of the site at two locations to determine suitability for use as a water source during cleanup. Samples were analysed for hydrocarbons, inorganic elements, routine water chemistry and microbiological parameters. Results are presented in Annex C.

Analytical results were compared to the CCME Drinking Water Guidelines. With the exception of aluminium, all parameters were below drinking water guidelines. The aluminium guideline is an aesthetic objective and an operational guidance value, designed to apply only to drinking water treatment plants using aluminum-based coagulants.

Table 7
Paint Analytical Results
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Sample Identification	Description	Leachable Lead	PCB	Lead - EBA Results	Comments
#2	Orange paint on metal nodwell	<0.5	-	*42100*	Metal typ. 2 mm to 5 mm thick, cab, gas tank, sample taken from front metal piece
#3	Orange paint on 1/2 orange nodwell	4.8	-	*42100*	On metal, 1 mm thick
#4	Blue paint on wood	<0.5	-	*710*	Taken from wood wall inside nodwells, 7 mm thick fully adhered
#5	White wood stripping on nodwell ceiling	<0.5	-	*641*	From ceiling, good condition, 5 mm thick wood
#6	Orange paint on nodwell	4.2	-	*42100*	Exterior nodwell, 1 mm thick metal
#7	White paint on nodwell wall	<0.5	-	-	White paint on wood wall, 3 mm thick
#8	White paint on wood from trailers	<0.5	-	-	Interior paint on wood
#9	Blue paint on trailer exterior	<0.5	-	-	Exterior paint - on metal cladding
#10	White paint on metal trailer exterior	0.5	-	*1550*	Exterior paint - on metal cladding
#11	Dark green paint on wood buildings	2.2	-	*17600*	Weathered paint on 11 mm wood
#12/12B	Red/orange paint from tanks	<0.5	<0.3	590	On metal, some areas rusted beneath paint
#13	tanks	<0.5	-	-	Sample 8 mm dia. Metal
#14	Silver Paint from tank	<0.5	-	*1560*	Taken by door of NE tank, near 7 red tanks
#15	Orange paint on heating oil tanks	<0.5	-	*11000*	4 mm thick, only partially covered in paint, slightly adhered
#16	Orange paint on sleds at tank farm	2.3	-	-	on wood, some metal is present, paint is weathered
#17	Light green paint on bldg near tank farm	56.6	-	*53100*	Exterior is weathered, interior o.k.
#18	Grey/white paint on wood at airstrip	<0.5	-	-	wood is 5 mm thick
#19	White paint on wood shed at airstrip	0.9	-	*7670*	Paint in good condition
#21	Red paint on wood at airstrip	0.8	-	-	Not easily flaking
#22	Yellow paint on siding on airstrip nodwell	0.9	-	-	Metal cladding 1 mm thick, 3 nodwells
#23	White paint on wood inside orange nodwell	<0.5	-		
#24	Yellow paint on bulldozer	<0.5	-	*44500*	Yellow paint on metal
#25	White paint on tank	<0.5		-	Only one tank, metal
#26	Orange paint on metal rod from sleds	<0.5	-	*5980*	
#27	Silver paint on backing plates from tank	<0.5	-	-	
#28	blue paint on hacksaw blade	-	-	<10	

Notes:
Concentrations in mg/kg unless otherwise noted
Total Lead concentrations taken from EBA (2007) report. Sample locations may differ from those used for leachability testing

4 SUMMARY AND CONCLUSIONS

The objective of the supplemental Environmental Site Assessment at Johnson Point was to collect additional information as required to finalize the Remedial Action Plan and Drawings and Specifications for the cleanup of the site. The primary tasks included:

- Hydrocarbon contamination assessment in the apron pond sediments;
- Collection and analyses of additional sediment samples from the Unnamed River;
- Characterization of hydrocarbon contaminated soil;
- Paint/substrate sampling and analyses; and
- Assessment of potable water sources.

Hydrocarbon Impacted Sediments

Sediment samples from across the width and length of the pond contain hydrocarbon concentrations in excess of background levels for the F2 to F4 fractions, and in excess of ecological direct contact soil guidelines in the area directly adjacent to the Apron. It was noted that the pond is only 0.5 m deep, and therefore will freeze to the full depth. As a result, it is not expected to support significant aquatic life. It is noted that although elevated hydrocarbon concentrations were measured in the sediment, surface water dissolved hydrocarbon concentrations (BTEX, F1, F2) in two samples were less than the method detection limit, with the exception of F2 hydrocarbons in one location, adjacent to the apron. Removal of hydrocarbon impacted soils from the Apron area should mitigate against future inputs to the pond, and the existing F2 contamination would naturally attenuate over time. Excavation of the sediments in this area if required, would be difficult to carry out, and would likely result in excessive silting of the pond in the short term. Excavation of impacted sediments in this area is likely not warranted.

Hydrocarbon contamination was also measured with sediments within the flood plain of the Unnamed River, located to the east of the apron area. Elevated concentrations of F2 and F3 were measured in two locations. Given that F3 contamination is relatively immobile, the contamination at STR-05 is likely associated with an isolated spill. The impacted area is anticipated to be less than 10 m^2 with a volume of approximately 2 to 3 m^3. The hydrocarbon impacts associated with JP07-03 and JP07-02 may encompass an area of 400 to 600 m^2 (40 m by 10 to 15 m) and the volume may be in excess of 150 m^3. Although, elevated hydrocarbon concentrations were measured in the sediment, surface water dissolved hydrocarbon concentrations (BTEX, F1, and F2) were below the method detection limit.

On this basis, potential remedial options include:

- Do nothing. At the present time, no impacts on surface water quality have been measured relative to hydrocarbon contamination. As this is a historic hydrocarbon impacted area, it suggests that impact has been minimal and no further remedial action is required.
- Cover area with erosion protection material to mitigate against erosion and transport of contaminated sediments. This option is likely not cost-effective, nor easily implementable given that no suitable coarse grained materials are present on site.

- Excavate impacted areas. Excavation of impacted areas has the potential to accelerate erosion in the area; which would lead to increased silt loading in the river over time. In addition, there is a lack of suitable coarse grained materials for use as backfill in the excavated areas.

The selection of the preferred remedial option should weigh the potential environmental benefits (removal of limited source of hydrocarbon contamination) with potential negative impacts associated with increased erosion and physical disturbance. Consideration should also be given to the ease of implementation and costs of the remedial solution relative to the site specific conditions at Johnson Point.

Treatment of Hydrocarbon Contaminated Soil

The characterization of hydrocarbon impacted soil at Johnson Point indicates that the viable hydrocarbon degrading bacteria are present; however, the soils are nutrient deficient. With desirable ratios of hydrocarbon (C) to N to P typically in the range of 100:7.5:0.5 (Poland et al 2007), both nitrogen and phosphorous are required for bioremediation.

Analyses of groundwater from the contaminated area at the Apron indicated that organic parameters (hydrocarbons) exceeded wastewater discharge criteria. Concentrations of inorganic elements were acceptable. Groundwater recovered during soil excavation will require treatment to remove organics prior to discharge.

Disposal of Painted Materials

The results of leachability testing indicate that the orange Nodwells, and the light green building in the tank farm area (shop-like building, footprint of approximately 7 m by 15 m) exceed criteria for leachable lead and are considered hazardous waste materials. The remaining materials are considered non-hazardous. Based on EBA results for total lead, the majority of painted facilities and equipment exceed the NWT guidelines for total lead of 600 mg/kg. It is noted that these guidelines only apply to the disposal on Commissioner's Land in the NWT.

Assessment of Potable Water

The analytical results of two samples of water collected from the Unnamed River confirmed from a water chemistry perspective that the river could be used as a potable water source. Water withdrawal rates should not exceed 10% of the daily flow rate, when Arctic char are present in the river during spawning. Arctic char spawn in the fall in freshwater, when they migrate upstream from the sea to gravel shoals in lakes, or river pools (Scott and Crossman, 1973) as cited in (DFO Selected Anadromous Species of the Northwest Territories). The eggs hatch in the spring and the young char eventually migrate downstream to the sea. Low flows may be expected near the end of the thaw season (August-September). Water lines will require screened intakes in accordance with Department of Fisheries and Oceans requirements. (DFO 2007)

5 CLOSURE

We trust this report meets your current requirements. Please contact the undersigned should additional information be required.

REGISTERED PROFESSIONAL ENGINEER
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LICENSEE
N.W.T.

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PERMIT TO PRACTICE
GOLDER ASSOCIATES LTD.
Signature
Date Nov 30, 2007
PERMIT NUMBER: P 428
The Association of Professional Engineers, Geologists and Geophysicists of the NWT / NU

6 REFERENCES

Alberta Environment, 2007. Alberta Tier 1and 2 Soil and Groundwater Remediation Guidelines. June 2007.

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Schmidt, N. 2007. Personal communication with Dr. Nathan Schmidt, P.Eng. re: hydrology.

7 LIMITATIONS AND USE OF REPORT

This report was prepared for the exclusive use of Indian and Northern Affairs Canada and its authorized agents. IMG-Golder Corporation and Golder Associates Ltd. or its employees will not be responsible for any use of the information contained in this report or any reliance on or decisions made based on it by an unauthorized third party. The report, which specifically includes all tables and figures, is based on data and information collected during the Site Investigation Program conducted by IMG-Golder Corporation in association with Golder Associates Ltd. personnel and is based solely on the Site conditions encountered at the time of the sampling program in August 2007, supplemented by historical information and data obtained by Golder as described in this report.

The services performed as described in this report were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practicing under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

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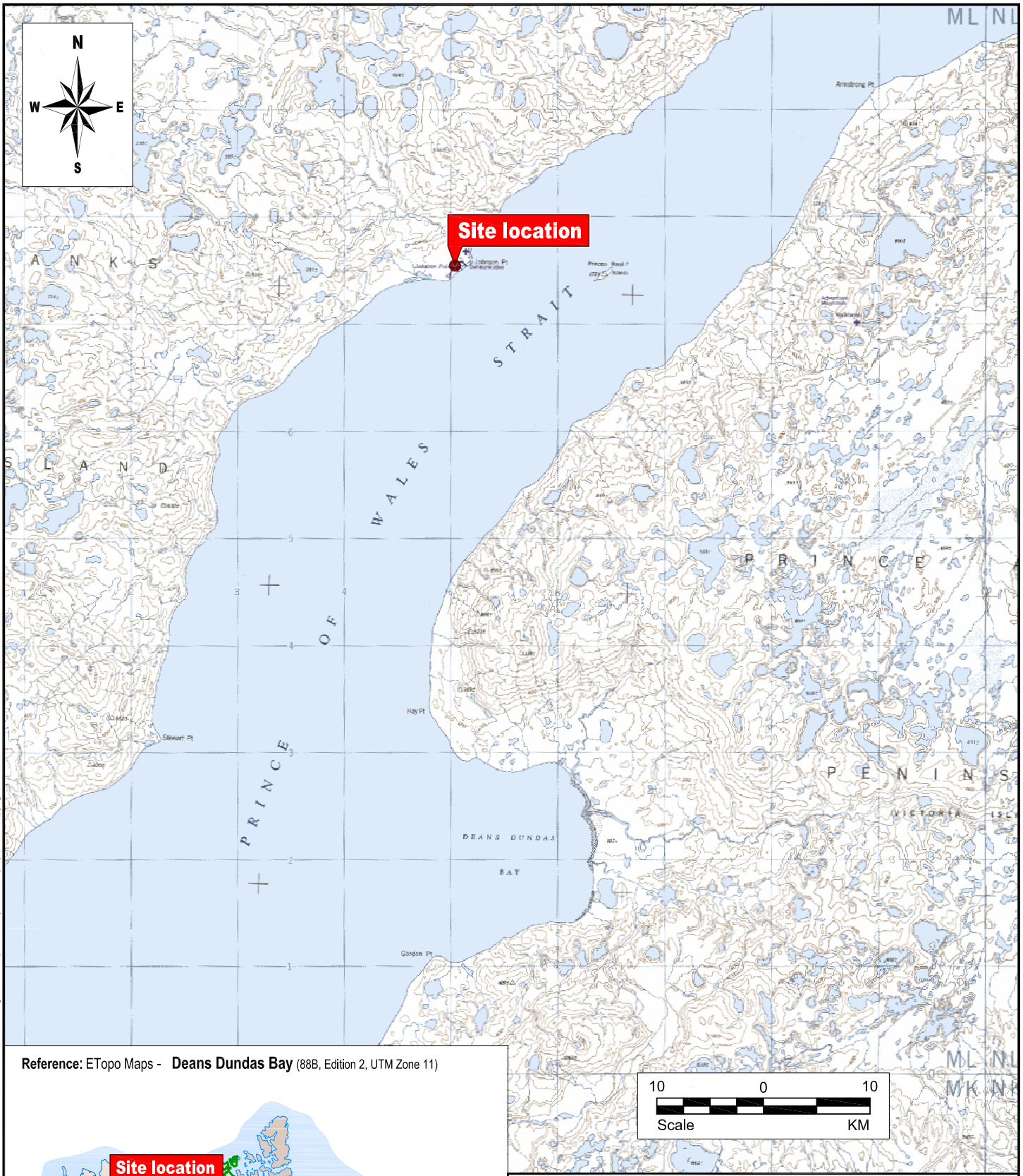
The content of this report is based on information collected during our investigation, our present understanding of the site conditions, and our professional judgment in light of such information at the time of this report. This report provides a professional opinion and, therefore, no warranty is either expressed, implied, or made as to the conclusions, advice and recommendations offered in this report. This report does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statues are subject to change.

The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered in future work, including excavations, borings, or other studies, Golder should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.

FIGURES



Reference: ETopo Maps - **Deans Dundas Bay** (88B, Edition 2, UTM Zone 11)

Not To Scale

Project

Indian and Northern Affairs Canada
Johnson Point Supplemental Investigation
Johnson Point, Banks Island, NWT

Title

Site Location Plan

Golder Associates
Edmonton, Alberta

Project No.	07-1377-0075		File No.	1731787	
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Review					

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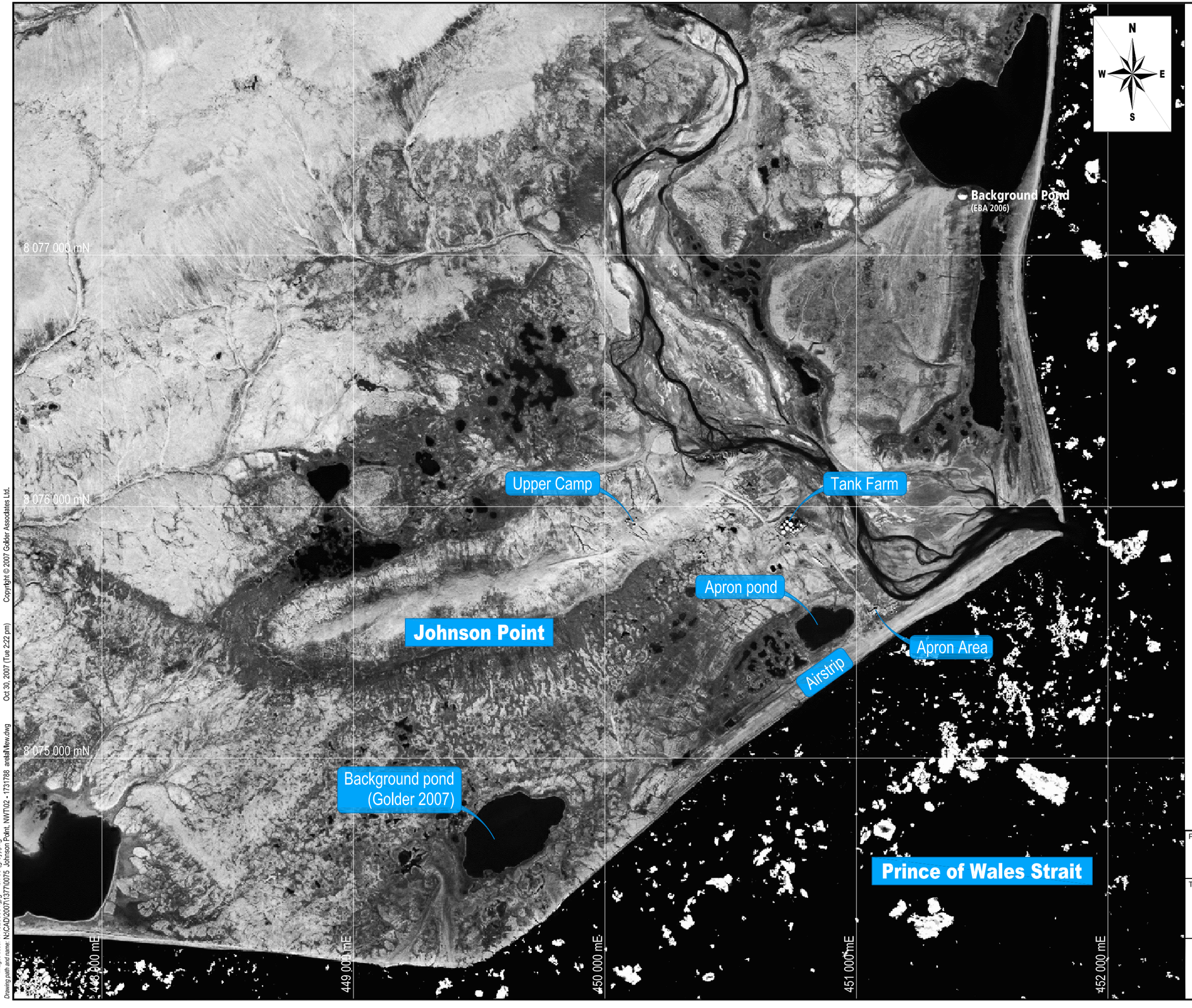

Reference: Image supplied by EBA Engineering Consultants Ltd.

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Scale Metres

Project
Indian and Northern Affairs Canada
Johnson Point Supplemental Investigation
Johnson Point, Banks Island, NWT

Title
Aerial View of Johnson Point

Golder Associates
Edmonton, Alberta

Project No.	07-1377-0075		File No.	1731788	
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Review					

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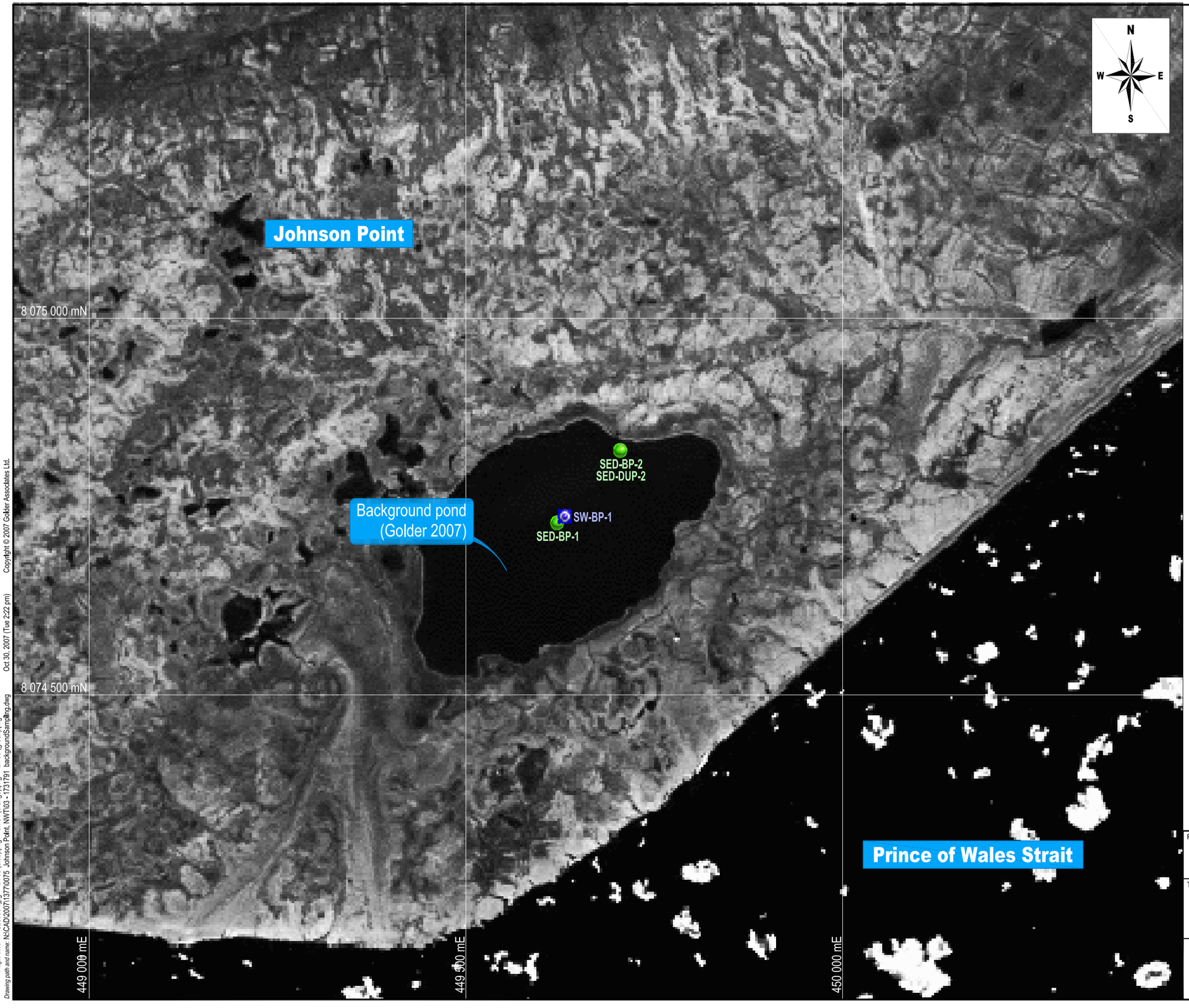

Reference: **Image supplied by EBA Engineering Consultants Ltd.**

LEGEND

- Sediment sample location
- Surface water sample location

100 0 100
Scale Metres

Project
Indian and Northern Affairs Canada
Johnson Point Supplemental Investigation
Johnson Point, Banks Island, NWT

Title
Background Sediment and Surface Water Sample Locations

Golder Associates
Edmonton, Alberta

Project No.	07-1377-0075		File No.	1731791	
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Review					

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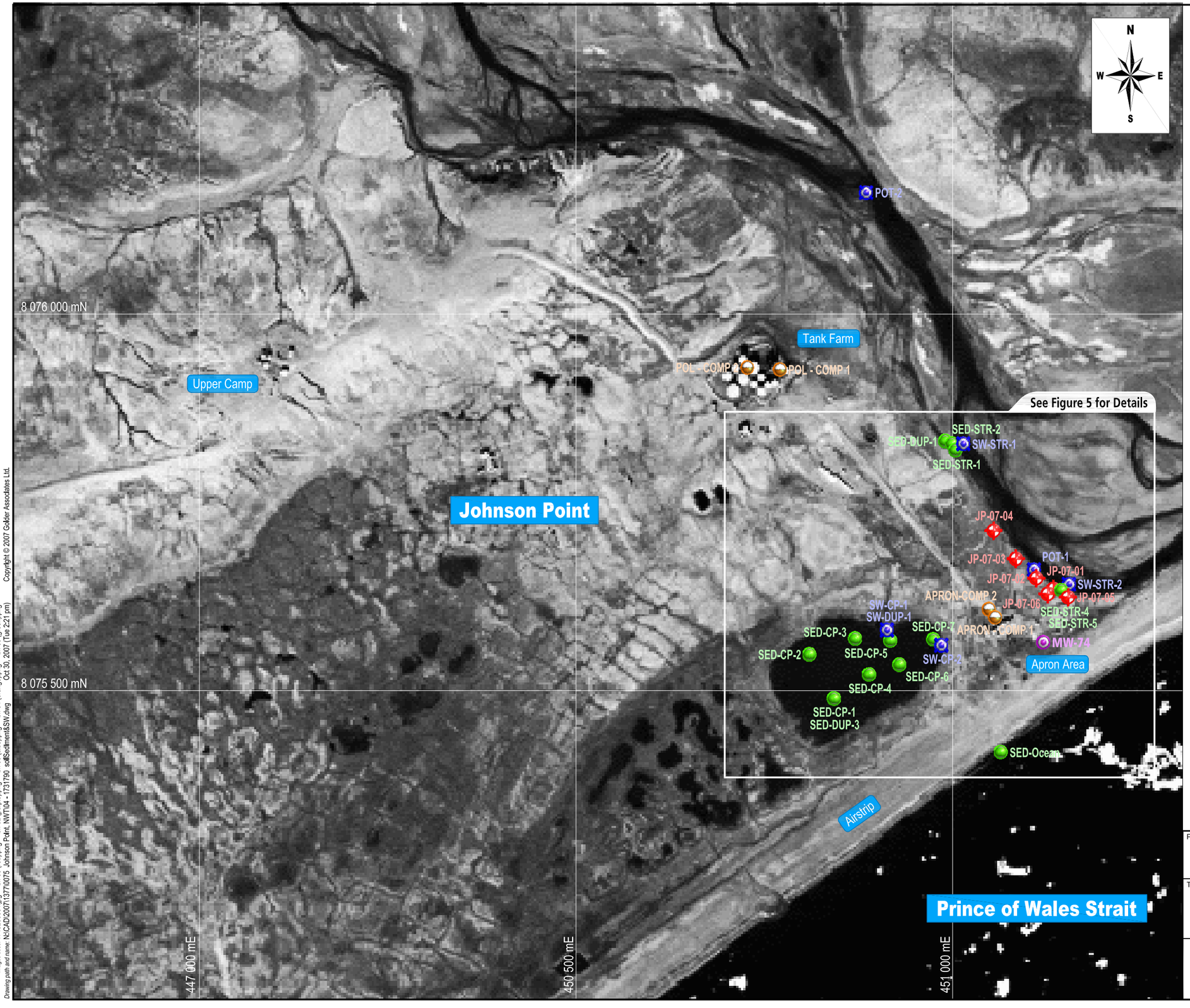

Reference: **Image supplied by EBA Engineering Consultants Ltd.**

LEGEND

- Sediment sample location
- Soil sample location
- Surface water sample location
- INAC Sampling Locations, August 2007
- Monitoring well sample location

100 0 100
Scale Metres

Project
Indian and Northern Affairs Canada
Johnson Point Supplemental Investigation
Johnson Point, Banks Island, NWT

Title
Soil, Sediment and Surface Water Sample Locations

Golder Associates
Edmonton, Alberta

Project No.		07-1377-0075	File No.		1731790
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Check					
Review					

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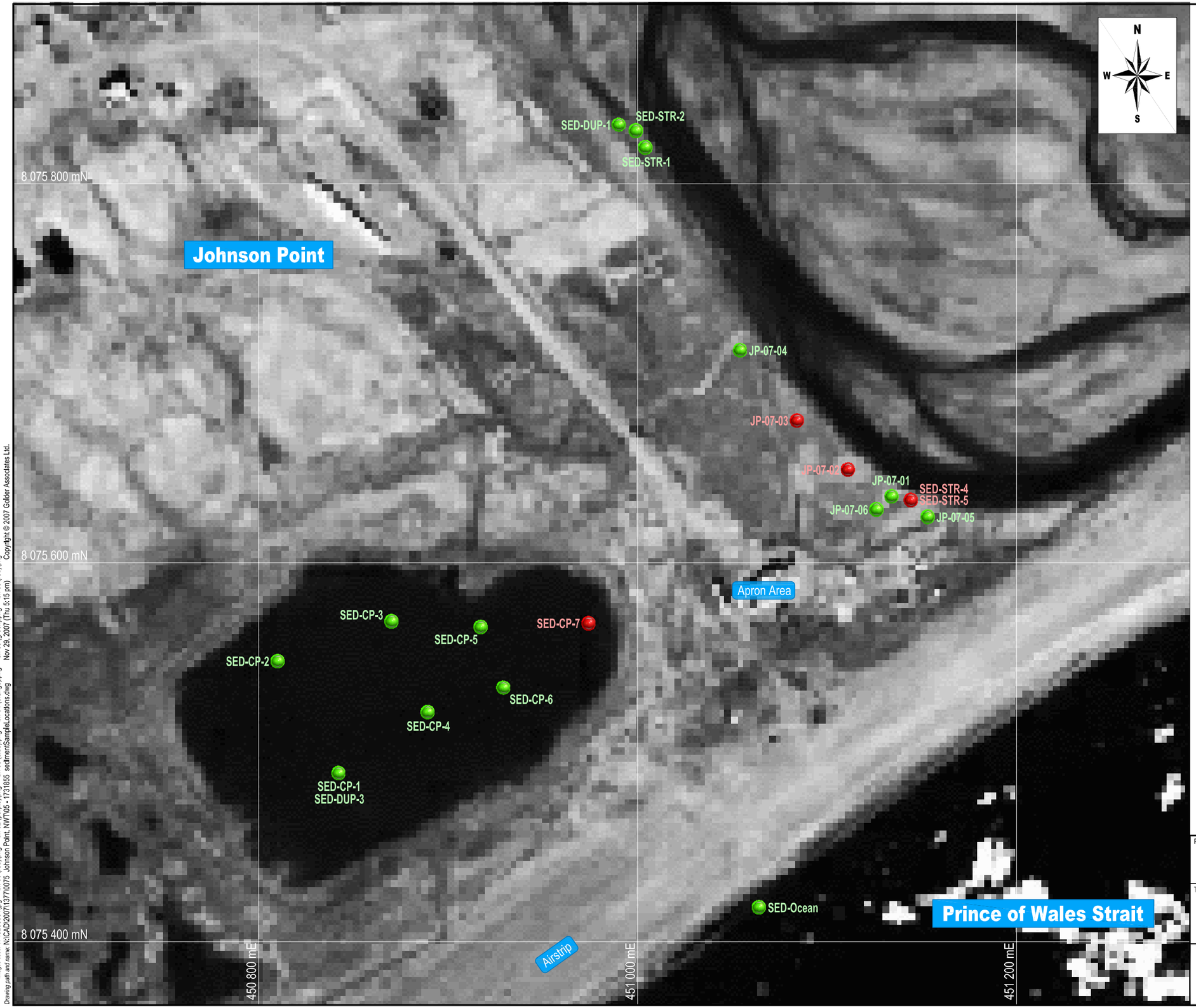


Reference: **Image supplied by EBA Engineering Consultants Ltd.**

LEGEND

- Sediment sample location - Hydrocarbon concentrations less than criteria
- Sediment sample location - Hydrocarbon concentrations exceed criteria

40 0 40
Scale Metres

Project
Indian and Northern Affairs Canada
Johnson Point Supplemental Investigation
Johnson Point, Banks Island, NWT

Title
Sediment Sample Locations Exceeding Ecological Draft Contact Guidelines

Golder Associates
Edmonton, Alberta

Project No.		07-1377-0075	File No.		1731855
Design	AT	20/08/07	Scale	As shown	Rev. 0
Cadd	RW	20/08/07			
Check					
Review					

Figure: 5

Images used: 1740200001.jpg - bh 00 (red).png - bh 02 (purple).png - bh 03 (blue).png - bh 04 (orange).png - bh 09 (green).png - bh 09 (red).png -
Drawing path and name: N:\CAD\2007\13770075 Johnson Point, NWT\05 - 1731855 sedimentSampleLocations.dwg Nov 29, 2007 (Thu 5:15 pm)

ANNEX A

INUVIALUIT INVOLVEMENT SUMMARY

Quarterly Report Q2

Socio-economic measures

Project: Johnson Point - Supplemental Environmental ESA

Company: Golder Associates Ltd./IMG Golder

Indicator			Q1	Q2	Q3	Year-to-Date
Total employment	Number			9		9
	(person-days)			46.3		46.3
Northern employment (includes Aboriginal)	Number			4		4
	(person-d)			45		45
Northern Aboriginal employment	Number			0		0
	(person-h)			0		0
Southern Aboriginal employment	Number			0		0
	(person-days)			0		0
Total training	Number of persons			2		2
	Duration (h)			36		36
	Type (specify)	On-the-job				
Northern training	Number of persons			2		2
	Duration (h)			36		36
	Type (specify)	On-the Job				
Northern Aboriginal training	Number of persons			0		0
	Duration (h)			0		0
	Type (specify)					
Northern suppliers (includes Aboriginal)	Number			8		8
	Value ($)			3,852.88		3852.88
Northern Aboriginal suppliers	Number			3		3
	Value ($)			1,347.00		$ 1,347.00

ANNEX B

ENVIRONMENTAL HEALTH AND SAFETY INDICATORS

Quarterly Report Q2

Environment, Health and Safety Indicators

Project: Johnson Point - Supplemental Phase III ESA

Company: Golder Associates Ltd./IMG Golder

Indicator		Q1	Q2	Q3	Year-to-Date
Lost-time accidents	Number		0		0
	Time lost (person-h)		0		0
Days since last time-lost accident	(d)		0		0
Total hours worked in quarter	(person-h)		347		347
Near misses	Number		0		0
Significant environment incidents	Number		0		0
	Volume spilled or released (L)		0		0
Outstanding compliance issues	Number		0		0
Inspections	Number performed		0		0
	Number of non-compliances		0		0
Audits	Number performed		0		0
	Number of non-compliances		0		0
Awareness training	EHS policy and procedures (person-h)		0		0
H&S training	HAZWOPER (person-h)		0		0
	WHMIS (person-h)		0		0
	First Aid (person-h)		0		0
	Wildlife safety (person-h)		0		0
	Water safety (person-h)		0		0
	Fire response (person-h)		0		0
	Other (specify) (person-h)		0		0
Environmental training	Spills response (person-h)		0		0
	Other (specify) (person-h)	On the job	36		36
Other corrective actions	New procedures (specify)		0		0
	Other initiatives (specify)		0		0

ANNEX C

ANALYTICAL DATA

Table C.1
Sediment Analytical Results
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters			Organics									
			Benzene	Toluene	Ethylbenzene	Xylenes	F1	F2	F3	F4	Total PHC	Naphthalene
Guidelines (mg/kg)												
Site Specific Target Levels - Ecological Health[1]			-	-	-	-	-	-	-	-	**4570**	
Sediment - Freshwater Aquatic Life[2]			-	-	-	-	-	-	-	-	-	-
Sediment - Marine Aquatic Life			-	-	-	-	-	-	-	-	-	-
DEW Line Clean-up Tier I Criteria[3] (f/g eco-TPH)			-	-	-	-	**210**	**150**	**1300**	**5600**	-	-
DEW Line Clean-up Tier II Criteria (c/g eco-TPH)			-	-	-	-	**210**	**150**	**300**	**2800**	-	
Laboratory Method Detection Limit			0.005	0.01	0.01	0.02	5	5	5	5		0.01
Sample Identification	**Location**	**Depth (m)**										
EBA #5	Background Pond		<0.005	<0.020	<0.010	<0.020	<10	23	112	78	213	
EBA #5	Background Pond		n/a	n/a	n/a	n/a	n/a	24	258	98	380	
SED-BP-1	Background Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	<5	140	8	148	
SED-BP-2	Background Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	11	80	19	110	
Average Background							<5	15	148	51		
SED-STR-1	Unnamed River	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	<5	8	<5	8	
SED-STR-2	Unnamed River	0 - 0.3	<0.005	<0.01	<0.01	<0.02	8	<5	<5	<5	8	
SED-STR-3	Unnamed River	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	<5	7	<5	7	
SED-STR-4	Unnamed River	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	7	**1100**	33	1140	
SED-STR-5	Unnamed River	0 - 0.3	<0.005	<0.01	<0.01	0.02	6	10	**9100**	**640**	**9756**	
SED-Ocean	Prince of Wales Strait	0 - 0.3	<0.005	<0.01	<0.01	<0.02	7	11	34	<5	52	
JP-07-01	Unnamed River	0.1-0.2	<0.004	<0.005	0.011	0.05	<12	**31**	85	21	137	0.07
JP-07-02	Unnamed River	0.1-0.2	<0.004	<0.005	<0.01	0.02	<12	**313**	**555**	24	892	
JP-07-03	Unnamed River	0.1-0.2	<0.004	<0.005	<0.01	<0.01	37	**3010**	**1170**	10	4227	
JP-07-04	Unnamed River	0.05-0.15	<0.004	<0.005	<0.01	<0.01	<12	<10	25	<10	25	
JP-07-05	Unnamed River	0.1-0.2	<0.004	<0.005	<0.01	<0.01	<12	<10	51	<10	51	
JP-07-06	Unnamed River	0.05-0.15	<0.004	<0.005	<0.01	<0.01	<12	74	**123**	18	215	
SED-CP-1	Apron Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	<5	66	29	95	
SED-CP-2	Apron Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	<5	10	**360**	**200**	570	
SED-CP-3	Apron Pond	0 - 0.3	<0.01[4]	<0.02	<0.02	<0.04	<5	**35**	**500**	**220**	755	
SED-CP-4	Apron Pond	0 - 0.3	<0.01[4]	<0.02	<0.02	<0.04	<5	**56**	**440**	**190**	686	
SED-CP-5	Apron Pond	0 - 0.3	<0.01[4]	<0.02	<0.02	<0.04	<5	**61**	**410**	**170**	641	
SED-CP-6	Apron Pond	0 - 0.3	<0.01[4]	<0.02	<0.02	<0.04	<5	**19**	**160**	**68**	247	
SED-CP-7	Apron Pond	0 - 0.3	<0.005	<0.01	<0.01	<0.02	7	**340**	**440**	**170**	957	
Duplicate Samples												
SED-DUP-1	SED-STR-3	0-0.3	<0.005	<0.01	<0.01	<0.02	<5	<5	<5	<5	0	
SED-DUP-2	SED-BP-1	0-0.3	<0.005	<0.01	<0.01	<0.02	<5	<5	130	130	260	
SED-DUP-3	SED-CP-1	0-0.3	<0.005	<0.01	<0.01	<0.02	<5	9	130	71	210	

Chemical Parameters			Inorganic Elements																
			Silver	Arsenic	Barium	Beryllium	Cadmium	Cobalt	Chromium	Copper	Mercury	Molybdenum	Lead	Antimony	Selenium	Tin	Thallium	Uranium	Vanadium	Zinc
Guidelines (mg/kg)																				
Site Specific Target Levels - Ecological Health[1]			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sediment - Freshwater Aquatic Life[2]			-	**5.9**	-	-	**0.6**	-	**37.3**	**35.7**	**0.17**	-	**35**	-	-	-	-	-	-	**123**
Sediment - Marine Aquatic Life			-	**7.24**	-	-	**0.7**	-	**52.3**	**18.7**	**0.13**	-	**30.2**	-	-	-	-	-	-	**124**
DEW Line Clean-up Tier I Criteria[3]			-	-	-	-	-	-	-	-	-	-	**200**	-	-	-	-	-	-	
DEW Line Clean-up Tier II Criteria			-	**30**	-	-	**5**	**50**	**250**	**100**	**2**	-	**500**	-	-	-	-	-	-	**500**
Laboratory Method Detection Limit			1	0.2	5	1	0.5	1	0.5	2	0.05	1	5	0.2	0.2	5	1	2	1	10
Sample Identification	**Location**	**Depth (m)**																		
SED-STR-1	Unnamed River	0 - 0.3	<1	1.9	16	<1	<0.5	3	5.9	5	<0.05	<1	<5	<0.2	<0.2	<5	<1	<2	22	10
SED-STR-2	Unnamed River	0 - 0.3	<1	3.3	26	<1	<0.5	4	9.9	7	<0.05	<1	<5	<0.2	<0.2	<5	<1	<2	85	20
SED-STR-3	Unnamed River	0 - 0.3	<1	2.6	22	<1	<0.5	4	7.2	6	<0.05	<1	<5	<0.2	<0.2	<5	<1	<2	28	20
SED-STR-4	Unnamed River	0 - 0.3	<1	2.3	39	<1	<0.5	4	5.7	6	<0.05	<1	<5	<0.2	<0.2	<5	<1	<2	17	20
SED-STR-5	Unnamed River	0 - 0.3	<1	2.6	49	<1	<0.5	5	8.1	10	<0.05	<1	5	<0.2	<0.2	<5	<1	<2	19	30
JP-07-01	Stream		0.1	3.2	69	0.3	0.08	5	10.9	10	---	<1	5.3	<0.2	<0.3	1	0.1		25.8	21
SED-Ocean	Prince of Wales Strait	0 - 0.3	<1	2.8	23	<1	<0.5	3	6	5	<0.05	<1	<5	<0.2	<0.2	<5	<1	<2	17	20
SED-BP-1	Background Pond	0 - 0.3	<1	3.5	43	<1	<0.5	5	11.1	13	<0.05	<1	5	<0.2	<0.2	<5	<1	<2	2	30
SED-BP-2	Background Pond	0 - 0.3	<1	5.5	72	<1	<0.5	10	16.5	16	<0.05	<1	9	<0.2	<0.2	<5	<1	<2	25	50
SED-CP-1	Apron Pond	0 - 0.3	<1	3.2	59	<1	<0.5	3	6.5	11	<0.05	<1	<5	<0.2	<0.2	<5	<1	<2	16	20
SED-CP-2	Apron Pond	0 - 0.3	<1	2.9	47	<1	<0.5	7	13.8	13	<0.05	<1	7	<0.2	<0.2	<5	<1	<2	27	40
SED-CP-3	Apron Pond	0 - 0.3	<1	4.7	84	<1	<0.5	7	13.7	17	<0.05	<1	15	<0.2	<0.2	<5	<1	<2	27	50
SED-CP-4	Apron Pond	0 - 0.3	<1	3	65	<1	<0.5	5	9.5	11	<0.05	<1	8	<0.2	<0.2	<5	<1	<2	20	30
SED-CP-5	Apron Pond	0 - 0.3	<1	3.8	59	<1	<0.5	5	10	12	<0.05	<1	8	<0.2	<0.2	<5	<1	<2	21	30
SED-CP-6	Apron Pond	0 - 0.3	<1	2.1	51	<1	<0.5	3	5.1	6	<0.05	<1	<5	<0.2	<0.2	<5	<1	<2	11	20
SED-CP-7	Apron Pond	0 - 0.3	<1	2.5	34	<1	<0.5	3	6.6	5	<0.05	<1	<5	<0.2	0.2	<5	<1	<2	20	20
Duplicate Samples																				
SED-DUP-1	SED-STR-3	0-0.3	<1	**9.6**	274	2	<0.5	13	29.5	28	<0.05	<1	13	<0.2	1.2	<5	<1	<2	55	70
SED-DUP-2	SED-BP-1	0-0.3	<1	4.6	35	<1	<0.5	5	9.3	9	<0.05	<1	<5	<0.2	<0.2	<5	<1	<2	19	20
SED-DUP-3	SED-CP-1	0-0.3	<1	3	40	<1	<0.5	4	8.5	8	<0.05	<1	<5	<0.2	<0.2	<5	<1	<2	20	20

Notes:

1. Jacques Whitford Human Health and Ecological Risk Assessment for Johnson Point Staging Facility (2007) Site Specific Target Level for Ecological Risk for Total Petroleum Hydrocarbons

2. Canadian Council of Ministers of the Environment Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, Updated 2005.

3. DEW Line Clean-up Criteria ("DCC") as provided in INAC Abandoned Military Site Remediation Protocol (2005), fine-gra

4. Detection Limit Adusted: Samples had high moisture content

Green and bolded exceeds background sediment

Blue and bolded exceeds direct ecological soil contact guidelines

Concentrations in mg/kg unless otherwise noted

Table C.2
Surface Water Analytical Results
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters		Organics						Water Chemistry Parameters					
		Benzene	Toluene	Ethylbenzene	Xylenes	F1	F2	Calcium	Potassium	Magnesium	Sodium	Iron	Manganese
Guidelines (mg/L)[1]													
Drinking Water Quality		0.005	<0.024	<0.0024	<0.300	-	-	-	-	-	<200	<0.3	<0.05
Protection of Aquatic Life - Freshwater		0.37	0.002	0.09	-	-	-	-	-	-	-	0.3	-
Protection of Agricultural Water Uses - Livestock		-	-	-	-	-	-	1000	-	-	-	5	0.2
Laboratory Method Detection Limit		0.0005	0.0005	0.0005	0.0005	0.1	0.05						
Sample Identification	**Location**												
SW-BP-1	Background Pond	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05	43.6	5.2	32.1	57	0.267	0.005
SW-CP-1	Apron Pond	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05	82.2	9.6	63.8	167	0.146	0.017
SW-CP-2	Apron Pond	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	0.05	81.6	9.5	64.1	165	**0.335**	0.015
SW-STR-1	Unnamed River	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05	28.2	1.1	10.8	3	0.063	0.001
SW-STR-2	Unnamed River	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05	27.3	0.9	10.6	2	0.104	0.003
Duplicate Samples													
SW-DUP-1	SW-CP-1	<0.0005	<0.0005	<0.0005	<0.0005	<0.1	<0.05	81.4	9.4	63.6	164	0.12	0.015

Chemical Parameters		Inorganic Elements																					
		Silver	Aluminum	Arsenic	Boron	Barium	Beryllium	Cadmium	Cobalt	Chromium	Copper	Mercury	Lithium	Molybdenum	Nickel	Lead	Antimony	Selenium	Tin	Titanium	Thallium	Uranium	Vanadium	Zinc
Guidelines (mg/L)[1]																							
Drinking Water Quality		-	0.1/0.2	0.025	5	1	-	0.005	-	0.05	<1	0.001	-	-	-	0.01	0.006	0.01	-	-	-	0.02	-	<5
Protection of Aquatic Life - Freshwater		0.0001	0.005-0.1	0.005	-	-	-	0.000017	-	-	0.002-0.004	0.000026	-	0.073	0.025-0.15	0.001-0.007	-	0.001	-	-	0.0008	-	-	0.03
Protection of Agricultural Water Uses - Livestock		-	5	0.025	5	-	0.1	0.08	1	-	0.5-5	0.003	2.5	0.5	1	0.1	-	0.05	-	-	-	0.2	0.1	50
Laboratory Method Detection Limit		<0.0004	0.01	0.0004	0.05	0.003	0.001	0.0002	0.002	0.005	0.001	0.0002	0.01	0.005	0.002	0.0001	0.0004	0.0004	0.05	0.001	0.0001	0.0001	0.001	0.004
Sample Identification	**Location**																							
SW-BP-1	Background Pond	<0.0004	**0.41**	0.0011	0.07	0.059	<0.001	<0.0002	<0.002	<0.005	0.002	<0.0002	0.01	<0.005	<0.002	0.0003	0.0005	0.0015	<0.05	0.014	<0.0001	0.0004	0.001	<0.004
SW-CP-1	Apron Pond	<0.0004	0.09	0.0026	0.11	0.14	<0.001	<0.0002	<0.002	<0.005	0.002	<0.0002	0.01	<0.005	0.004	0.0002	0.0005	0.0029	<0.05	0.002	<0.0001	0.0006	0.001	<0.004
SW-CP-2	Apron Pond	<0.0004	0.2	0.0026	0.12	0.14	<0.001	<0.0002	<0.002	0.006	0.002	0.0005	0.02	<0.005	0.004	0.0008	0.0013	0.0046	<0.05	0.008	0.0013	0.0007	0.002	0.026
SW-STR-1	Stream	<0.0004	0.11	<0.0004	<0.05	0.025	<0.001	<0.0002	<0.002	<0.005	<0.001	<0.0002	<0.01	<0.005	<0.002	<0.0001	<0.0004	0.0006	<0.05	0.002	<0.0001	0.0002	<0.001	<0.004
SW-STR-2	Stream	<0.0004	0.12	<0.0004	<0.05	0.024	<0.001	<0.0002	<0.002	<0.005	<0.001	<0.0002	<0.01	<0.005	<0.002	0.0001	<0.0004	<0.0004	<0.05	0.004	<0.0001	0.0002	<0.001	<0.004
Duplicate Samples																								
SW-DUP-1	SW-CP-1	<0.0004	0.07	0.0024	0.12	0.139	<0.001	<0.0002	<0.002	<0.005	0.002	<0.0002	0.01	<0.005	0.004	0.0002	0.0005	0.0031	<0.05	0.002	<0.0001	0.0006	0.001	0.009

Notes:

1. Canadian Council of Ministers of the Environment Canadian Environmental Quality Guidelines for the Protection of Drinking Water, Freshwater Aquatic Life, Marine Aquatic Life and Agricultural Water Uses, Updated 2005.

Blue and Bolded exceeds the Drinking Water Guideline

Shaded exceeds the Freshwater Aquatic Life Guideline

Table C.3
Soil Analytical Results - Apron and POL Areas
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters			Organics									Soil Characterization and Nutrients										Total Hetero-trophic Bacteria	Hydrocarbon Degrading Bacteria
			Benzene	Toluene	Ethylbenzene	Xylenes	F1	F2	F3	F4	Total PHC	Texture	Moisture (%)	pH	Organic Carbon	Available Phosphorous	Available Ammonium-N	Total Available Nitrogen	Nitrate-N	Nitrite-N	Nitrate+Nitrite-N		
Guidelines (mg/kg)																						**MPN/g**	**MPN/g**
Site Specific Target Levels - Ecological Health [1]			-	-	-	-	-	-	-	-	4570	-	-	-	-	-	-	-	-	-	-		
DEW Line Clean-up Criteria I [2]			-	-	-	-	230	150	-	-	-	-	-	-	-	-	-	-	-	-	-		
DEW Line Clean-up Criteria II [2]			-	-	-	-	15,000	8000	18,000	25,000	-	-	-	-	-	-	-	-	-	-	-		
Laboratory Method Detection Limit			0.005	0.01	0.01	0.02	5	5	5	5			0.1	1	0.01%	1	0.5	0.5	0.4	0.4	0.4		
Sample Identification	**Location**	**Depth (m)**																					
POL-COMP	POL Area	0 - 0.6	<0.005	<0.01	<0.01	<0.02	**840**	**1700**	310	180	3030	sand	5.9	7.9	1.15%	<1	1	2.1	1.1	<0.4	1.2	17,000	17,000
APRON-COMP	Apron Area	0 - 0.6	<0.005	<0.01	0.97	4.3	**620**	**890**	370	19	1904	sand/clay	11	8.1	0.76	<1	0.5	2	1.5	<0.4	1.6	1,300,000	700,000

Notes:
1. Site Specific Target Levels provided by Jacques Whitford and Associates (2007),
2. DEW Line Clean-up Criteria ("DCC") as provided in INAC Abandoned Military Site Remediation Protocol (2005)
Green and Bolded exceeds the DCCI Criteria
Concentrations in mg/kg unless otherwise noted

Table C.4
Soil Analytical Results - Nutrients and Total Organic Carbon
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters				Nutrients								Total Organic Carbon
				% Moisture	pH	Available Ammonium-N	Available Phosphate-P	Total Available Nitrogen	Nitrate-N	Nitrite-N	Nitrate + Nitrite - N	
Units				%	pH	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%
Laboratory Method Detection Limit				0.1	0.1	0.5	1	0.5	0.4	0.4	0.4	0.01
Sample Identification	**Location**	**Depth (m)**	**Soil Texture**									
Contaminated Soil												
POL-COMP	POL Area	0 - 0.6	sand	5.9	7.9	1	<1	2.1	1.1	<0.4	1.2	1.15
APRON-COMP	Apron Area	0 - 0.6	sand/clay	11	8.1	0.5	<1	2	1.5	<0.4	1.6	0.76
JP-07-1	Unnamed River	0.1-0.2	sand	16.6								0.4

Table C.5
Groundwater Analytical Results
Supplementary Environmental Site Assessment
BAR-D, Atkinson Point, NWT

Chemical Parameters		Organics								Inorganic Elements														
		Benzene	Toluene	Ethylbenzene	Xylenes	F1	F2	Phenols		Calcium	Potassium	Magnesium	Sodium	Iron	Manganese	Silver	Aluminum	Arsenic	Cadmium	Cobalt	Chromium	Copper	Mercury	Nickel	Lead	Zinc
Guidelines (mg/L)																										
Wastewater Discharge Criteria - reference UMA 2006						5												0.1T	0.01D	0.05D	0.1D	0.2D	0.0006T	0.2D	0.05D	0.5T
Laboratory Method Detection Limit		0.0005	0.0005	0.0005	0.0005	0.1	0.05			0.5	0.1	0.1	1	0.005	0.001	0.0001	0.01	0.0004	0.0001	0.002	0.005	0.001	0.0001	0.002	0.0001	0.002
Sample Identification	**Location**																									
MW74	Apron Area	0.155	8.03	0.808	7.76	**4.8**	**0.61**	0.138	**Dissolved**	94.8	17.3	149	840	<0.005	1.1	<0.0001	<0.01	<0.0004	<0.0001	0.003	<0.005	0.002	<0.0001	0.01	<0.0001	0.009
									Total	433	31.4	339	810	136	4.19	<0.0004	51.9	0.0433	0.0006	0.051	0.1	0.111	0.0003	0.135	0.0641	0.304

Notes:
Bold and highlighted exceeds Wastewater Discharge Guidelines

Table C.6
Paint Analytical Results
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Sample Identification	Description	Leachable Lead	PCB	Lead - EBA Results	Comments
#2	Orange paint on metal nodwell	<0.5	-	*42100*	Metal typ. 2 mm to 5 mm thick, cab, gas tank, sample taken from front metal piece
#3	Orange paint on 1/2 orange nodwell	4.8	-	*42100*	On metal, 1 mm thick
#4	Blue paint on wood	<0.5	-	*710*	Taken from wood wall inside nodwells, 7 mm thick fully adhered
#5	White wood stripping on nodwell ceiling	<0.5	-	*641*	From ceiling, good condition, 5 mm thick wood
#6	Orange paint on nodwell	4.2	-	*42100*	Exterior nodwell, 1 mm thick metal
#7	White paint on nodwell wall	<0.5	-	-	White paint on wood wall, 3 mm thick
#8	White paint on wood from trailers	<0.5	-	-	Interior paint on wood
#9	Blue paint on trailer exterior	<0.5	-	-	Exterior paint - on metal cladding
#10	White paint on metal trailer exterior	0.5	-	*1550*	Exterior paint - on metal cladding
#11	Dark green paint on wood buildings	2.2	-	*17600*	Weathered paint on 11 mm wood
#12/12B	Red/orange paint from tanks	<0.5	<0.3	590	On metal, some areas rusted beneath paint
#13	tanks	<0.5	-	-	Sample 8 mm dia. Metal
#14	Silver Paint from tank	<0.5	-	*1560*	Taken by door of NE tank, near 7 red tanks
#15	Orange paint on heating oil tanks	<0.5	-	*11000*	4 mm thick, only partially covered in paint, slightly adhered
#16	Orange paint on sleds at tank farm	2.3	-	-	on wood, some metal is present, paint is weathered
#17	Light green paint on bldg near tank farm	56.6	-	*53100*	Exterior is weathered, interior o.k.
#18	Grey/white paint on wood at airstrip	<0.5	-	-	wood is 5 mm thick
#19	White paint on wood shed at airstrip	0.9	-	*7670*	Paint in good condition
#21	Red paint on wood at airstrip	0.8	-	-	Not easily flaking
#22	Yellow paint on siding on airstrip nodwell	0.9	-	-	Metal cladding 1 mm thick, 3 nodwells
#23	White paint on wood inside orange nodwell	<0.5	-		
#24	Yellow paint on bulldozer	<0.5	-	*44500*	Yellow paint on metal
#25	White paint on tank	<0.5		-	Only one tank, metal
#26	Orange paint on metal rod from sleds	<0.5	-	*5980*	
#27	Silver paint on backing plates from tank	<0.5	-	-	
#28	blue paint on hacksaw blade	-	-	<10,000 ug	Note: lab is converting units

Concentrations in mg/kg unless otherwise noted
Total Lead concentrations taken from EBA (2007) report. Sample locations may differ from those used for leachability testing

Table C.7
Surface Water Potability Results - Unnamed River
Supplementary Environmental Site Assessment
Johnson Point, Banks Island, NWT

Chemical Parameters		Water Chemistry Parameters							Biological Parameters[2]	
		Calcium	Chloride	Fluoride	Potassium	Magnesium	Sodium	Sulphate	Total Coliforms	E. Coli
Guidelines (mg/L)[1]										
Drinking Water Quality		-	≤250	1.5	-	-	≤200	≤500	0	0
Laboratory Method Detection Limit		0.5	1		0.1	0.1	1	0.5		
Sample Identification	Location									
POT-1	Downstream	27.9	4	<0.05	1.8	10.5	3	12.6	<1	<1
POT-2	Upstream	27.9	3	<0.05	2	10.6	3	12.6	<1	<1

Chemical Parameters		Total Dissolved Solids	Hardness as $CaCO_3$ (calc)	Ion Balance	Iron Extractable	Manganese Extractable	Nitrate + Nitrite - N	Nitrate-N	Nitrite-N	Turbidity (NTU)[3]	pH	Conductivity (uS/cm)	HCO_3	CO_3	Hydroxide (OH)	Alkalinity
Drinking Water Quality		≤500	-	-	<0.3	<0.05	-	45	-	-	6.5-8.5	-	-	-	-	-
Laboratory Method Detection Limit					0.05	0.01	0.1	0.1	0.05	0.1	0.1	0.2	5	5	5	5
Sample Identification	Location															
POT-1	Downstream	119	113	105	<0.05	<0.01	<0.1	<0.1	<0.05	3.6	8.3	229	119	<5	<5	99
POT-2	Upstream	118	113	107	<0.05	<0.01	<0.1	<0.1	<0.05	1.8	8.3	226	118	<5	<5	98

HCO_3 = bicarbonate
CO_3 = carbonate
≤ denotes aesthetic guideline

1. All concentrations in mg/L unless otherwise noted
2. Biological Parameters as CFU/100 ml, where CFU = colony forming units
3. Turbidity measured in NTU = Nephelometric Turbidity Units

ANNEX D

QA/QC

Quality Assurance/Quality Control

To evaluate the analytical precision, quality assurance and quality control (QA/QC) samples were collected for sediment and surface water sampled at the Site.

The measure of the reproducibility or precision of the data is quantified by the Relative Percent Difference (RPD). The RPD was calculated as follows:

$$RPD = \left(\frac{[X_1 - X_2]}{\left(\frac{(X_1 + X_2)}{2} \right)} \right) \times 100$$

Where: RPD = Relative Percent Difference

X_1 = sample value

X_2 = duplicate or replicate value

Theoretically, the samples should have identical chemical concentrations (i.e., RPD = 0). However, due to factors such as sample matrix heterogeneity, natural variations or variations in sample collection, handling or analysis, a minor variation in chemical concentration may occur (i.e., RPD > 0). The RPD selected to meet the data quality objectives of this project was set at 20% for inorganic parameters and 30% for organic parameters. RPD values greater than the project objective of 20% and 30% usually indicate poor reproducibility. However, the reproducibility of duplicate analyses at concentrations near the method detection limit (MDL) can be poor (Keith, 1991), resulting in RPD values of greater than 20% and 30%. Therefore, RPD values of greater than the project objective are acceptable if the differences in concentrations of the duplicate analyses are less than approximately ten times the MDL.

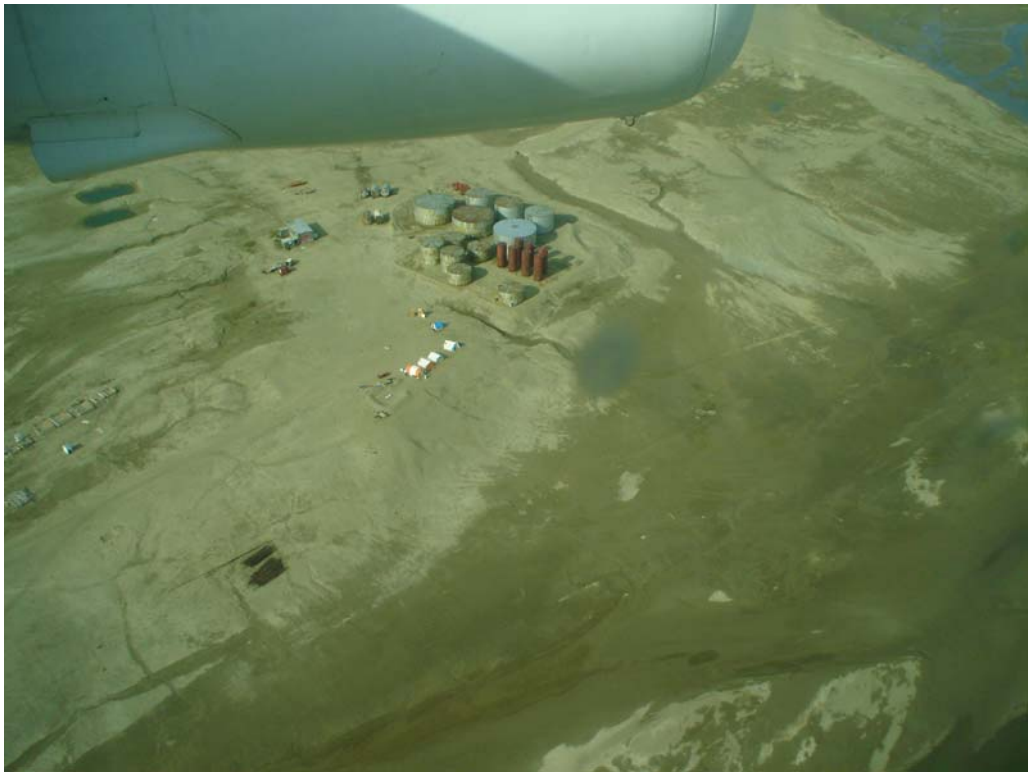
The RPD values calculated for the duplicate analyses are presented in Table D-1 for the sediment media and Table D-2 for the water media.

All three sediment samples submitted for petroleum hydrocarbon analyses had RPD values of greater than 30%. However, concentrations are generally within the same order of magnitude. With respect to inorganic elements, RPD values exceeded 20% for a number of parameters, but the difference was generally less than 10 times the Method Detection Limit, with the exception of sample STR-3. It is noted that RPD values are not as reliable for soil matrices due to the inherent heterogeneous nature of soils.

In general, calculated RPD values were less than the 20% and 30% targets for inorganic and organic analyses respectively. Two exceptions were aluminum and zinc. For both parameters, the differences were less than three times the method detection limit and results are considered acceptable.

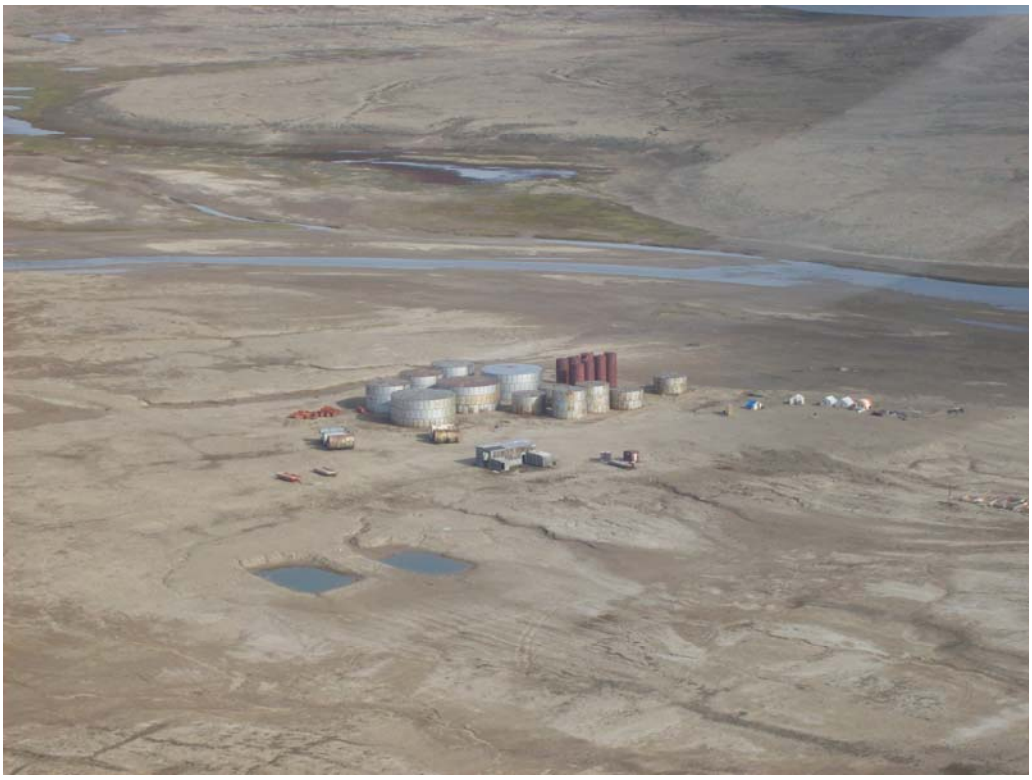
ANNEX E

SITE PHOTOGRAPHS



Photograph 1: Aerial View of Johnson Point 2007

Photograph 2: Aerial View of Site from Tank Farm towards Apron – Apron Pond to right - Johnson Point 2007



Photograph 3: Aerial View of Tank Farm – Johnson Point 2007.

Photograph 4: View from Shoreline – towards site, Johnson Point 2007.

Photograph 5: View along access road towards apron – Johnson Point, 2007

Photograph 6: View from Apron Pond towards Apron – Johnson Point 2007

Photograph 7: View from Apron pond towards tank farm – Johnson Point 2007

Photograph 8: View Upstream from SED-STR-1 – Johnson Point 2007

Photograph 9: View downstream from SED-STR-1 – Johnson Point 2007

Photograph 10: View east of SED-STR-1 and airstrip – Johnson Point 2007

Photograph 11: View of sediment from SED-STR-5 – Johnson Point 2007

Photograph 12: View of flood plain – Unnamed River - Johnson Point 2007

Photograph 13: View of Sediment Collection Apron Pond - Johnson Point 2007

Photograph 14: View upstream in Unnamed River towards potable water sampling location, POT2 – Johnson Point 2007

Photograph 15: Nodwells at Beach – Johnson Point 2007

Photograph 16: Orange Nodwell Paint Sample No. 2– Johnson Point 2007

Photograph 17: Paint/Substrate Sample 3 – Johnson Point 2007

Photograph 18: Paint/Substrate Sample 4, from interior blue paint – Nodwells – Johnson Point 2007

Photograph 19: Paint/Substrate Sample 6 – Orange on Nodwell – Johnson Point 2007

Photograph 20: Paint/Substrate Sample No. 7 White paint in Nodwell – Johnson Point 2007

Photograph 21: Paint/Substrate Sample 8, white interior paint trailers – Johnson Point 2007

Photograph 22: Paint Substrate Samples 9 and 10, Blue and exterior white paint on trailers. – Johnson Point 2007

Photograph 23: Paint/Substrate Sample 11 – Green Paint on wood, 4 sheds, weathered paint – Johnson Point 2007

Photograph 24: Paint Sample – silver tanks – Johnson Point 2007

Photograph 25: Paint/Substrate Sample 15 – Orange Tanks – Johnson Point 2007

Photograph 26: Paint/Substrate Sample 17 – Shop Type Building - Johnson Point 2007

Photograph 27: Paint/Substrate Sample 18 – Johnson Point 2007

Photograph 28: Paint/Substrate Sample 19 – White on Shed near Airstrip - Johnson Point 2007

Photograph 29: Paint/Substrate Sample 21 Red on wood shed near airstrip - Johnson Point 2007

Photograph 30: Paint/Substrate Sample 22 – metal siding from nodwells at airstrip - Johnson Point 2007

Photograph 31: Paint/Substrate Sample 25 White Tanks - Johnson Point 2007