NON-TECHNICAL ANNUAL REPORT – LICENCE #01 034 16N-M

1 Project Name

Geotechnical and Environmental Baseline Studies – Iqaluit Port Development.

2 Researcher's Name and Affiliation

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3 Project Location

Koojesse Inlet, Iqaluit, Qikiqtaaluk Region.

4 Timeframe

Summer and fall 2016. Further studies planned through to summer 2017.

5 Description of Studies

The studies were performed for the Government of Nunavut in two areas in Iqaluit. One area is near the municipal wharf (small craft harbour) for the proposed expansion. The other location is in the proposed deep water port area and supporting quarry.

6 Purpose

Geotechnical and environmental baseline studies are required to support the design and permitting of the proposed small craft harbour upgrade and the new deep water port.

7 Goals and Objectives

These studies provided data to support the engineering design and an assessment of environmental effects as Part 4 screening-level assessment, as per the *Nunavut Land Claims Agreement*, and other permitting, including Disposal at Sea (DAS) and *Fisheries Act* authorization.

8 Annual Report

Data from this study and other related studies will be included in reports to be submitted to applicable regulatory agencies and other stakeholders.

8.1 Geotechnical

Two field visits to Iqaluit were undertaken in 2016. The first visit occurred from September 17 to 20 and included a site reconnaissance of two potential quarry locations; deep water port and small craft harbour locations and quarry face rock mapping. The second field visit took place between October 14 and October 17. There were two aims for the second site visit. The first was to gain a better understanding of soil conditions in the intertidal areas at both the deep water port and small craft harbour, prior to freeze up. The second was to collect rock samples from the two potential quarry locations for testing for suitability as rock aggregates.

Initial observations of the two potential quarry locations indicate that both sites have good potential for obtaining sufficient rock to use for construction materials. Aggregate testing to assess the rock for characteristics such as strength, resistance to weathering processes and Potentially Acid Generating (PAG) will take place in 2017.

Five boreholes were drilled at the small craft harbour ranging from 6 to 10 metres below sea bed. Boreholes were advanced using air rotary drilling methods and the drilling contractor was Canadrill Limited, based out of Iqaluit. Hand dug pits were excavated at both the deep water port and small craft harbour ranging from 0.1 to 0.4 m below sea bed.

Surface and borehole grab samples indicate that the soil profile at both the deep water port and small craft harbour are variable, including coarse materials such as sands, gravels, cobbles and boulders with pockets / layers of organic to non-organic silts and clays. Laboratory testing is ongoing for standard soil and rock classification testing.

8.2 Environmental

The environmental program for Iqaluit consisted of water and sediment quality sampling, fish and fish habitat and terrestrial vegetation and habitat survey and current measurement. A summary of the studies completed to date is included in the following sections. Preliminary observations taken by field biologists are provided, however, analysis and interpretation of the results is still ongoing and will be provided in the Pond Inlet NIRB Part 4 screening document.

8.2.1 Water and Sediment Quality Sampling

Water samples were collected at six sites in Iqaluit on September 24, 2016. Two samples were collected at each site using a Niskin sampler from the surface (1 m below surface) and near-bottom (1 m above seabed). Samples were decanted into appropriate sterilized containers and preserved following laboratory guidance. Samples were transported on ice, with the recommended hold times to a qualified laboratory under Chain of Custody (COC) documentation for detailed analysis.

The following parameters were analyzed:

- pH, alkalinity, Total Suspended Solids, hardness, Total Organic Carbon (TOC), dissolved organic carbon (DOC), Bicarbonate, Carbonate, Hydroxide, Alkalinity (as CaCO3), Sulphur-Dissolved, Sulphur-Total.
- Nutrients (ammonia, Total Kjeldahl nitrogen (TKN), nitrate, nitrite, total phosphorus, orthophosphate, nitrogen).
- Total and dissolved metals (Canadian Council of Ministers of the Environment (CCME) suite, a total of 32 metals).

At each water quality sampling location a vertical profile of physio-chemical parameters was taken using a Seabird Electronics Inc. SBE19, which included:

- Temperature
- Salinity (conductivity)
- Turbidity
- Dissolved oxygen (DO)

Sediment samples were collected at 18 sites in Iqaluit from September 22nd to 24th. All samples were collected using a standard Ponar grab, which sampled a 23 cm^2 area to a depth of approximately 8 cm. Samples were described by substrate type, colour/odour, presence of organic debris (i.e. sticks), and presence of biological material (i.e. invertebrates). Sediment was homogenized in a stainless steel bowl before being placed into glass jars for laboratory analysis.

Samples were collected in laboratory-supplied sample containers and transferred on ice to a qualified laboratory (Maxxam Analytics), under COC documentation, for detailed analysis.

Sample analysis included:

- pH
- Phosphorus
- Total organic carbon
- Total metals (CCME suite)
- Nutrients (nitrogen, ammonia, nitrate, nitrite, phosphorous – a total of 31 metals)
- Polycyclic aromatic hydrocarbons (PAHs)
- Polychlorinated biphenyls (PCBs)
- Particle size distribution

Sediment samples varied in texture from smooth to coarse, and were grey brown, and black in texture with occasional terrestrial debris (e.g. sticks) and shell hash observed.

8.2.2 Fish and Fish Habitat

The Fish and Fish Habitat program consisted of an assessment of; intertidal habitat, subtidal habitat, and the infaunal soft sediment community. This information will be used to develop a habitat map which will be superimposed on the project engineering design to determine potential effects (if any) to fish and fish habitat. The intertidal habitat assessment is not described as it was conducted during the 2015 program.

8.2.2.1 Subtidal Habitat Assessment

The subtidal habitat assessment consisted of a series of parallel and perpendicular to shore transects utilizing a georeferenced towed camera. The video was analyzed subsequent to the field program where the following information was documented; estimations of substrate type and composition, algae species identification and estimated percent cover, and the relative abundance of marine invertebrates and fish. In total 20 transects were conducted over a two day period (September 22 to 23, 2016).

Habitat and substrate types observed included; boulder and cobble, sand and gravel, and sparse boulders with filamentous algae and rockweed (*Fucus* sp).

8.2.2.2 Infaunal Benthic Community Assessment

Benthic community sampling was conducted in conjunction with the Sediment Quality Program. Each sample was sieved using a 1 mm stainless steel mesh, transferred to individual 500 ml plastic sampling jars and preserved with 10 % buffered formalin solution. Samples are transport to an accredited laboratory for analysis.

8.2.3 Oceanography

Surface current data (i.e. speed and direction data) was collected between September 22 and 24, 2016 using surface drogues to support characterization of surface current patterns at the Project site. This data will be used to calibrate the hydrodynamic numerical model which will be used to drive the DAS dispersion model. The drogues were deployed in multiple locations near the Project site and DAS site during flood tide and ebb tide cycles. The position and speed of each drogue was recorded using a data logger fixed to the mast of the drogue. Surface currents speeds were found to vary approximately between 0.1 knots and 1 knots. Currents were generally stronger near the project sites in comparison to the DAS site depending on state of the tide and location.

8.2.4 Migratory and Marine Birds

Information on suitable habitat for migratory and marine birds was collected as part of vegetation surveys in September 2016. Due to the timing of field studies, no targeted migratory and marine bird survey was undertaken in 2016.

8.2.5 Terrestrial Vegetation and Rare Plants

An ecosystem mapping and partial rare plant survey was conducted in September 2016. Methods used included the meander search approach typically followed for reconnaissance surveys in complex terrain. This involved walking 'randomly' throughout the study area noting each new species until no new species are observed. The survey focused on areas where rare plant species are more likely to occur. Plot data such as total percent cover was also collected to determine ecosystem mapping classes.

No rare plant species were identified at the Iqaluit site. The area surveyed consisted of predominately exposed bedrock with pockets of grasses and dwarf shrubs. The bedrock had extensive and diverse lichen cover throughout the area. Small seepage areas were found throughout the vegetation study area in breaks in the bedrock where water pooled. Although infrequent and small in size, these seepage areas were comparably rich in vegetation species diversity compared to the drier vegetation communities.