REPORT

Tuk Base Dock Repair and Removal Monitoring Plan

Submitted to:

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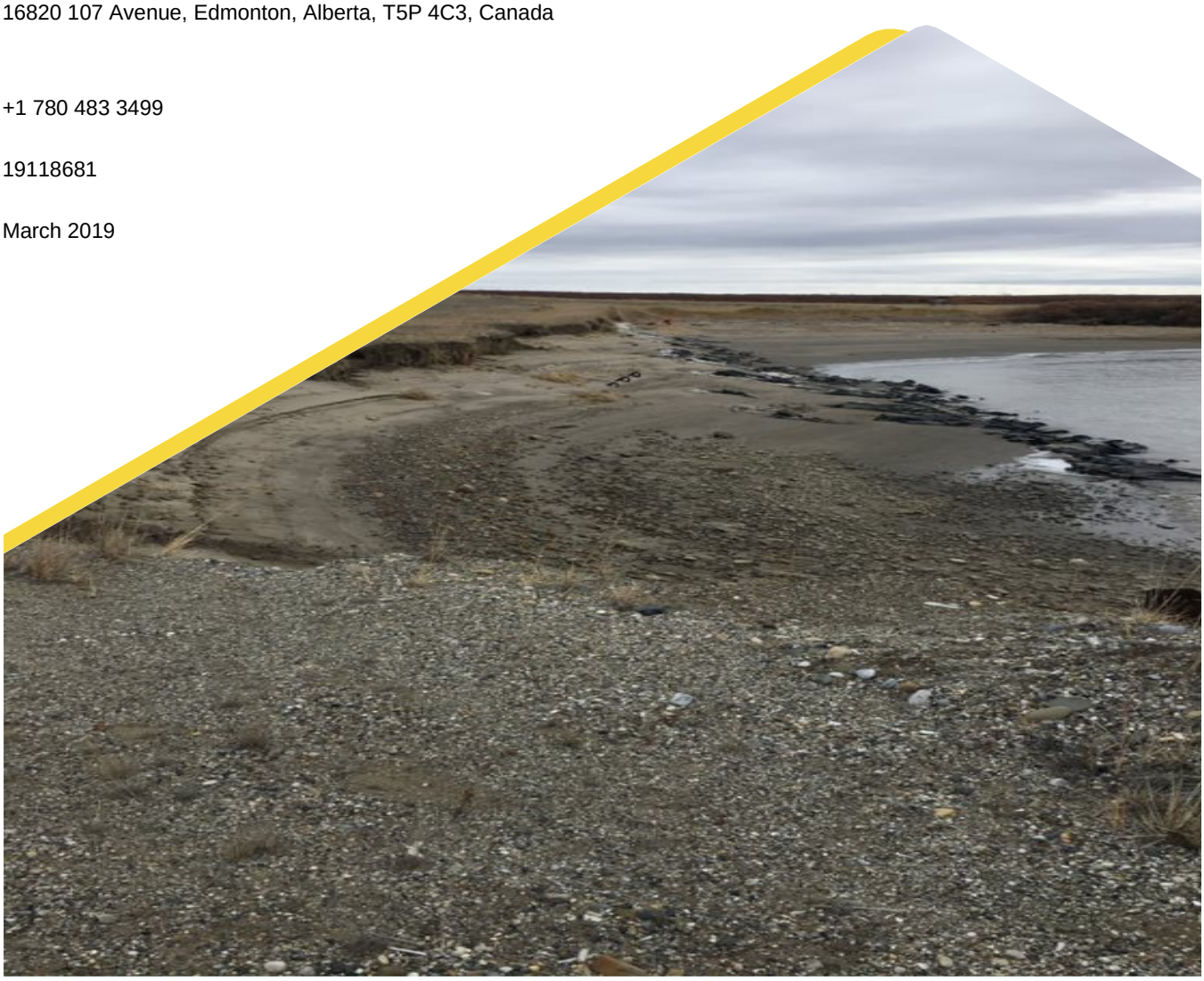

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1.0 INTRODUCTION

The Tuktoyaktuk Exploration Logistics Base Camp (Tuk Base) located within Tuktoyaktuk Harbour, 1.5 km southeast from Tuktoyaktuk, Northwest Territories (NT) is being remediated by Imperial Oil Environmental & Property Solutions (Imperial) based on details in the Remedial Action Plan (RAP) prepared by Advisian in 2018 and subsequently approved by the Inuvialuit land Administration (ILA). The RAP was revised in March 2019 to fulfill the NT Archaeological Sites Regulations requirements. It outlines how environmental contamination attributed to past Imperial operations will be remediated during the Tuk Base Remediation (the Project).

There are two docks associated with Tuk Base. The North Dock has experienced erosion on its south side (upstream) which requires repair. Pending further discussions with the ILA, the repaired North Dock will either be transferred to the ILA and remain in place or be removed as part of the Project. The South Dock (Photo A) will be removed as part of the Project.

Instream work associated with repairs to the North Dock and removal of the South Dock pose a risk of mobilization of sediment that may cause harm to fish or their habitat. As such, monitoring during instream work is proposed to document such events and allow for mitigations to be applied.

This document is designed to fulfill the requirement of an Aquatic Effects Monitoring Plan (AEMP). AEMPs are developed and implemented to monitor project-related effects on aquatic ecosystems, including effects to water quality and/or quantity, aquatic habitats and aquatic life in the receiving environment. Since predictions of project-related effects on receiving aquatic environment carry a certain element of uncertainty, aquatic effects monitoring is as a direct measure of the type and extent of project-related effects during the work.

Concurrent with the submission to the Inuvialuit Water Board (IWB), this document is also provided to Fisheries and Oceans Canada (DFO). All input and additional requirements received through that process will be implemented into revisions of this plan.

This document summarizes the nature of the fish community in Tuktoyaktuk Harbour and addresses specifically how the South Dock removal will be monitored to ensure that water quality and thereby aquatic productivity are maintained. The dock consists of a sheet pile perimeter on three sides filled with earth (Photo A). The general plan for removal will involve excavation inside the sheet piling with subsequent removal of the piling itself. As outlined in the RAP, previous sampling of soil inside the piling found no hydrocarbon contamination

Photo A: View of south dock with deteriorated condition evident

2.0 ENVIRONMENTAL SETTING

At least 20 species of fish are known to use the estuarine habitat in the general Tuktoyaktuk Harbour area and are listed in Table A. Species found include freshwater, anadromous, and marine forms. Salinity in Tuktoyaktuk Harbour varies both seasonally and spatially. Under ice cover, freshwater from the Mackenzie River blocks the influx of saltwater into the harbour. By late-spring, a freshwater layer up to 6 metres (m) deep overlies saline water at depth. During summer, winds mix the waters creating a more brackish environment (Bond 1982). Given these variable conditions, species distribution varies seasonally and spatially, with freshwater species more predominant in the nearshore (fresher) habitat, and marine species in the offshore habitat. Sampling by Bond (1982) and Hopky and Ratynski (1983) indicated that nearshore habitat such as adjacent to the Tuk Base docks was used predominately by least cisco, Arctic cisco, lake whitefish, followed by broad whitefish, rainbow smelt, Arctic flounder, and fourhead sculpin. Other species were present less frequently. Of the species listed in Table A, blackline prickleback is listed as a species of “special concern” under the *Species at Risk Act* (SARA; 2019), and as “data deficient” by the Committee on Status of Endangered Species in Canada (COSEWIC). This species is suspected to spawn in fall in nearshore habitat, although specific details are unknown (SARA 2019). The Species at Risk NWT Act designated neither of these two species (Government of the Northwest Territories [GNWT] 2018).

The intent of the *Species at Risk Act*, and the *Species at Risk (NWT) Act* is to protect species at risk from becoming extirpated or extinct as a result of human activity (GNWT 2018). While the former was enacted by the Government of Canada, the latter was enacted by the Government of the GNWT and applies only to wild animals and plants managed by the GNWT. For the purposes of this document, species may be of concern as a result of either their national, territorial or Committee on Status of Endangered Wildlife in Canada (COSEWIC) status. As the Species at Risk (NWT) Act is implemented, it is expected that the NWT Species at Risk Committee (NWT SARC) will make further assessments, and the Conference of Management Authorities will prepare the List of Species at Risk, providing legal protection for these species. This could mean changes to the Project's species of concern.

The Site is located on Tuktoyaktuk Inuvialuit 7.1(a) Private Lands and the Tuktoyaktuk Community Conservation Plan (TCCP 2016) classifies the Site as Category C Lands “where cultural or renewable resources are of particular significance and sensitivity during specific times of the year. These lands and waters shall be managed so as to eliminate, to the greatest extent possible, potential damage and disruption”. Tuk Base is located on the following Special Designated Lands that consider aquatic and marine resources (TCCP 2016):

- spring fish harvesting (Site 305C) - Key area for subsistence fishing during the spring
- summer fish harvesting (Site 307C) - Key area for subsistence fishing during the summer
- fall fish harvesting (Site 310C) - Key area for subsistence fishing during the summer
- fall seal harvesting (Site 311C) - Key area for subsistence fishing during the fall
- site 712C Beluga Management Zone 2 - All Mackenzie Shelf waters shallower than 20 m; major beluga travel corridor to move into, out of, and amongst bays of the Mackenzie estuary
- site 704C Fish Lakes and Rivers - Important fish habitat and important historic and present subsistence harvest area for people of Inuvik and Tuktoyaktuk

Table A: Common fish species present in Tuktoyaktuk Harbour and Listed Status (SARA and COSEWIC), and species form

Common Name (Inuvialuktun Name)	Latin Name	Listed	Species Form
Starry Flounder	*Platychthys stellatus*	No	marine
Arctic Flounder	*Liopsetta glacialis*	No	marine
Pacific Herring* (Piqquaqtitaq)	*Clupea harengus*	No	marine
Rainbow Smelt	*Osmerus mordaz*	No	anadromous
Arctic Cod*	*Boreogradus saida*	No	marine
Saffron Cod	*Eleginus gracilis*	No	marine
Burbot* (Tiktaaliq)	*Lota lota*	No	freshwater
Fourhorn Sculpin	*Myoxocephalus quadricornis*	Freshwater variant - Special Concern (SARA), Saltwater variant – none.	marine
Arctic Cisco*	*Coregonus autumnalis*	No	anadromous
Least Cisco* (Iqalusaaq)	*C. sardinella*	No	anadromous
Lake Whitefish* (Pikuktuuq)	*C. clupeaformis*	No	anadromous
Broad Whitefish* (Aanaakliq)	*C. nasus*	No	anadromous
Inconnu* (Siigaq)	*Stenodus leucichthys*	No	anadromous
Eelpout or Shulupaoluk	*Lycodes jugoricus*	No	marine
Slender Eelblenny	*Lumpenus fabricii*	No	marine
Blackline Prickleback	*Acantholumpenus mackayi*	Special Concern (SARA), Data Deficient (COSEWIC)	marine
Northen Pike* (Siulik)	*Esox lucius*	No	freshwater
Longnose Sucker	*Catostomus catostomus*	No	freshwater
Pond Smelt	*Hypomesus olidus*	No	freshwater
Ninespine Stickleback	*Pungitius pungitius*	No	

*Listed as important food resource in the Tuktoyaktuk Community Conservation Plan (TCCP 2016)

Given that Tuktoyaktuk Harbour is an estuarine environment, it will experience semidiurnal tidal fluctuations in water level (average of 0.4 m) and flow reversal. As such, placement of sampling stations must consider that the location of background conditions unaffected by instream works may change depending on direction of flow during a sampling event.

3.0 MONITORING PLAN

3.1 Selection of Variables

The monitoring plan proposed to be conducted during removal of the South Dock and repairs to the North Dock takes into consideration Contaminants of Potential/Proven Concern (COPC). Sampling of fill in the North and South Docks in 2018 included metals and petroleum hydrocarbons (as outlined in the RAP). In all cases there were no exceedances above guidelines that would lead to characterization of COPCs associated with these products. As such, monitoring for hydrocarbons in water samples during instream works is not deemed to be necessary. This also is corroborated by monitoring conducted during the removal of the dock at Bar-C under similar conditions. While testing for total petroleum hydrocarbons (TPH), all measurements were below the detection limit and well below regulatory guidelines (Advisian 2017).

Instream work in the estuarine environment associated with removal of the pilings and fill material does pose an issue of mobilization of sediment (fill material and bed material). Suspended sediment can pose a risk to aquatic organisms and can have both lethal and sublethal effects by causing abrasion to gills, smothering eggs, impeding light penetration and limiting visibility to name a few. These can result in immediate death, increased risk of predation, changes in water quality (temperature), and reduced productivity. As such, suspended sediment is identified as a deleterious substance under the *Fisheries Act* (DFO 2000). Suspended sediment is identified as a potential risk to the aquatic environment based on activities proposed.

3.2 Proposed Guidelines

Guidelines for total suspended solids (TSS) to be applied during the monitoring program are proposed to be those that were dictated for the Bar-C dock removal program under IWB amended Water License N7L1-1836 (Part E, Section 8). The- guideline has both an instantaneous and weekly average threshold for TSS. Instantaneous TSS concentration cannot exceed 100 mg/L above background concentration, while weekly average concentration cannot exceed 50 mg/L above background.

3.3 Turbidity to TSS Relationship

Concentration of total suspended solids is the physical weight of solids within a known volume of water, which requires that samples be collected and submitted to an analytical laboratory for measurement. In the field, TSS concentrations can be approximated by turbidity, which depends on the optical properties of liquid substances and on the concentration of particles such as sediment. Turbidity is measured in Nephelometric Turbidity Units (NTU) as the amount of light that is scattered or absorbed rather than transmitted in straight lines through a liquid. Turbidity is a useful proxy for TSS concentration which more accurately quantifies sediment input. Water quality monitoring programs take advantage of turbidity to quickly identify changes in suspended sediment concentration during construction programs, based on a site-specific empirical relationship between TSS concentration and turbidity. In order to establish this relationship, sediment that may be suspended during instream works will need to be sampled from the site. There are two potential sediment sources: the natural bed material adjacent to the dock, and the fill material within the dock structure.

Samples from both these sources will be collected ahead of instream works and used to create respective turbidity to TSS relationships. Water samples over a range of turbidities will be obtained by mixing variable amounts of sediment with water. These samples of known turbidity will be sent to a laboratory for determination of TSS concentration. This analysis will be completed for each sediment source: channel sediment and dock fill with 15 water samples for each substrate type. To account for the likelihood that both components may contribute to TSS that may be released during instream works, data from both sediment sources will be grouped and a relationship developed from this. This relationship will be prepared before instream works begin so that site-based measurements of turbidity can be converted to TSS immediately and applied to established guidelines. If a relationship between turbidity and TSS cannot be established, regulators will be consulted.

3.4 Monitoring Methodology

Based on bathymetric mapping of the area, water depth around the South Dock will range from 1to 4 m (Advisian 2018b). Sampling points will be established at five locations surrounding the South dock at a distance of 50 m from the dock (Figure A). This will provide sufficient spatial coverage to identify possible plumes of suspended sediment being mobilized from works at the dock. Baseline measurements will be collected from all sample points before any instream works begin to establish baseline conditions. Given the possible tidal influence on flow direction, during instream works, background sample points will be determined based on the direction of tidal flow at the time of sampling. Water samples will be collected from a boat and tested for turbidity using an Orbeco TB-200 handheld turbidimeter. Where depth is less than 2 m, a single water sample will be collected from just below the water surface. At sites with greater depth, a sample will be collected from just below the surface and from 1 m above the bed of the channel. Turbidity measurements will be entered into a digital spreadsheet where the turbidity to TSS relationship will be applied automatically to the established guideline. Measurements will be collected approximately four times daily during times when instream work is underway. Prior to this work starting, measurements will be taken each day to establish a baseline.

If an exceedance occurs, the appropriate regulatory agencies will be notified immediately. Where a measurement exceeds the instantaneous guideline, works will be halted until TSS concentration returns to below the threshold. Additionally, the activity will be assessed to determine whether any mitigations can be applied to reduce the risk of recurrence. Examples include application of sediment containment controls, reducing speed of excavation, or timing of a specific activity to coordinate with tidal flow. A surface containment boom will be set up around the work area in the harbour with silt fencing installed on land.

For repair and the potential removal of the North Dock, the same procedure outlined above will be implemented with sampling points distributed as shown in Figure A. Exact sample point placement will depend on position of any structures in the harbour (e.g. point TSS6).

Figure A: Proposed water quality monitoring stations around the North and South docks

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