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Abbreviations and Acronyms

Acronym/abbreviation	Definition
AIA	Archaeological Impact Assessment
AIS	Automatic Identification System
BMP	Best Management Practices
CCA	Canadian Construction Association
CCME	Canadian Council of Ministers of the Environment
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CWPs	Contractor Work Plans
DAS	Disposal at sea
DFO	Fisheries and Oceans Canada
DFO-FFHPP	DFO - Fish and Fish Habitat Protection Program
DFO-SCH	DFO – Small Craft Harbours
EMP	Environmental Management Plan
GN	Government of Nunavut
GN-CGS	GN Community and Government Services
GN-CH	GN Culture and Heritage
GN-DoE	GN Department of Environment
GPS	Global Positioning System
HADD	Harmful alteration, disruption, and destruction
HHWM	High High Water Mark
HTA	Ikajutit Hunters and Trappers Association
IQ	Inuit Qaujimagatuqangit
LFSP	License to fish for scientific purposes
LoO	License of Occupation
LUP	Land Use Permit
MMO	Marine Mammal Observer
NIRB	Nunavut Impact Review Board
NPC	Nunavut Planning Commission

1 Project Overview

1.1 Background and Purpose

Worley Canada Services Ltd. and Ikpiaryuk Services Ltd. in joint venture, operating as Advisian-Ikpiaryuk JV, has been retained by Public Services and Procurement Canada (PSPC) and Fisheries and Oceans Canada – Small Craft Harbours (DFO-SCH) to conduct an engineering feasibility study for the construction of small craft harbours (SCH) in four communities in Nunavut: Sanikiluaq, Coral Harbour, Naujaat, and Chesterfield Inlet (the Project) (see Figure 1-1). Sanikiluaq is located within the Qikiqtaaluk Region, while Coral Harbour, Naujaat and Chesterfield Inlet are located within the Kivalliq Region.

To inform the engineering and environmental deliverables for the Project, a field program will be required which is planned for the open-water season of 2022 (the 2022 field program). The 2022 field program will focus on environmental, geoscience, geophysics and archaeological baseline studies in each location as detailed in Table 1-1 and depicted in Figure 1-1. A future geotechnical drilling program (the drilling program) will be undertaken in each of the communities at the detailed design phase of the Project. Collectively, the field programs are referred to as the Project field programs.

This document is an Environmental Management Plan (EMP) for the Project field programs. The development of this EMP has considered the mandates of regulatory authorities (RAs) including the Nunavut Planning Commission (NPC), the Nunavut Impact Review Board (NIRB), DFO – Fish and Fish Habitat Protection Program (DFO-FFHPP), the Nunavut Water Board (NWB) and the Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC). The latter two, specifically for the drilling program. An update to the EMP will be required to support the drilling program, once site specific details of drilling are known. However, pertinent compliance requirements for land and marine based drilling are addressed.

1.2 Regulatory Compliance

Approval and compliance requirements for the Project field programs are summarized in Table 1-2.

Table 1-1 Field Program Locations

Location	Location Description	Latitude	Longitude
Sanikiluaq	Flaherty Island is the largest island of the Belcher Islands group in Hudson Bay in the Qikiqtaaluk Region of Nunavut. The Inuit community of Sanikiluaq is located on its north coast. Sanikiluaq is the southernmost community in Nunavut.	56° 32.744'N	79° 13.526'W
Coral Harbour	Coral Harbour is a small Inuit community that is located on Southampton Island in the Kivalliq Region of Nunavut. Its name is derived from the fossilized coral that can be found around the waters of the community which is situated at the head of South Bay. The name of the settlement in Inuktitut is Salliq, sometimes used to refer to all of Southampton Island. The plural Salliit, means large flat island(s) in front of the mainland.	64° 8.040'N	83° 9.728'W

Legislation	Association	Regulatory Authority Details	Program	Activities	Required Authorization/ Permit/Approval	Permit Status
	PSPC	Once the land tenure is understood, PSPC may need to issue a license of occupation (LoO).	Drilling program	Geotechnical Drilling	LoO	
<i>Fisheries Act</i> https://laws-lois.justice.gc.ca/PDF/F-14.pdf	DFO	DFO-FFHPP is the RA for Section 35 of the <i>Fisheries Act</i> , which prohibits causing the harmful alteration, disruption or destruction (HADD) of fish habitat. Compliance with Section 35 (1) of the <i>Fisheries Act</i> must occur through either a compliance document from a Qualified Environmental Professional (QEP), notification to DFO for standards and codes of practice (SCOPs) as defined by DFO (DFO 2019c), or through a Request for Review application (RFR) submitted to DFO-FFHPP to confirm that the Project works as described will not result in a HADD.	Project field programs	Marine environment surveys Geotechnical drilling	Compliance document Standards and Codes of Practice (SCOPs)	No permits required. This report.
DFO license to fish for scientific purposes (LFSP)	DFO	A DFO LFSP permit is required for the collection of marine invertebrates and fish.	2022 field program	Marine environment surveys	LFSP	Submitted April 27, 2022

1.3 Study Areas

Study Areas will be developed prior to mobilization into the field to encompass the following Project components may exist:

- Small Craft Harbour;
- Haul Road and Quarry; and
- Disposal at Sea (DAS) sites.

All Study Areas will be designed to include the maximum footprint required for construction plus a 100 m buffer. Study Areas were not defined at the time of this permit application. The SCH Study Area will be developed in collaboration with the engineering team and through consultation and are generally fronting the communities. Potential quarry, haul road and DAS Study Areas will be selected through desktop study, community consultation and Inuit Qaujimajatuqangit (IQ), with existing roads used where possible. Collectively, they are referred to as the Project Study Areas.

1.4 Program Scope

1.4.1 2022 Field Program

The Scope of Work (SoW) for the 2022 field program is to collect information to understand existing conditions for the following components:

- Marine environment;
- Wildlife;
- Vegetation;
- Geotechnical (exploratory);
- Geotechnical (drilling, future [not planned for 2022]);
- Topographic and Orthographic Imagery Surveys;
- Geophysical surveys (including bathymetry); and
- Archaeology.

Field surveys are required to document existing conditions within the Project Study Areas and to support engineering design. A summary of the purpose and proposed methodology for each of the field studies is provided in Table 1-3.

Table 1-3 Project Field Programs Components

Program	Component	Survey Purpose	Field Methodology	Equipment Required	Transportation Mode	Program Study Area
Marine	Fish Habitat - Intertidal	A survey of the foreshore including the intertidal and subtidal areas will be conducted to confirm the fish habitat quality within the footprint of the proposed SCH.	Intertidal surveys will be conducted at low tide to maximize the extent of seabed exposed. Transects will be established perpendicular to shore within and outside the SCH Study Area. Field personnel will document substrate and habitat characteristics. Information gathered will include substrate type and composition, algae species identification, and relative abundance of marine invertebrates. Transects will be established perpendicular to the shoreline at regular intervals from the high high water mark (HHWM) to the water line. Perpendicular transects facilitate the identification of transitions between habitat types, where zonation is a strong feature of intertidal communities for both rocky and sandy communities. A 0.5 m ² or 1.0 m ² quadrat will be spaced equidistantly along each transect line. The length of the transect will be determined by the number of habitat bands and the extent of intertidal.	Transect line, quadrat, iPad, clinometer	On foot	SCH
	Fish Habitat – Subtidal		A local boat operator will be subcontracted. Perpendicular and parallel to shore subtidal transects will be conducted to visually assess habitat conditions using a remotely operated vehicle (ROV). Field personnel will document substrate and habitat characteristics. Information gathered will include substrate type and composition, algae species identification, and relative abundance of marine invertebrates. Data collected from these surveys will be complimentary to the intertidal habitat surveys and allow for the creation of a habitat map.	ROV, iPad, depth sounder	Boat	SCH, DAS
	Fish and amphipod collection	Fish (sculpin, Arctic char) will be purchased from locals to transport to the University of British Columbia (UBC) for diet analysis.	Fish (sculpin or Arctic char) will be purchased from locals and frozen prior to transportation to UBC. Analysis (species identification, fatty acid/lipid analysis and genetic analysis) will be performed in a laboratory. A local boat and operator will be required. Benthic amphipods will be collected at low tide from beach areas. Specimens will either be frozen or preserved in 95% ethanol.	Tweezers, fishing equipment	Boat, on foot	SCH
	Fish Habitat – Plankton	A plankton survey will be undertaken in the subtidal areas of the SCH to confirm species diversity.	Plankton surveys will be conducted with a 200 µm, 1 m wide and 1 m long mesh net, which will be towed from a boat travelling at 1 to 1.5 knots in a straight line for five minutes. A float will be attached to the plankton net ring to ensure that the net remains at 2 m depth consistently. Field personnel will collect plankton samples and store in 95% ethanol to preserve samples for species diversity analysis.	Plankton net	Boat	SCH
	Water Quality	Water quality analysis will be conducted to confirm water characteristics at the site. Samples sent to the laboratory for chemical analysis will be analyzed for the following: <ul style="list-style-type: none"> Nutrients (ammonia, nitrate, nitrite, phosphate, total organic carbon); Physical parameters (pH, total suspended solids); Total metals; Dissolved metals; and Physicochemical parameters will include temperature, salinity, pH, turbidity and conductivity. 	Water quality sample locations will be selected within and outside of the relevant Study Area(s). Each location will consist of a shallow (1 m below surface) and a deep (1 m above seabed) sample. Samples for chemical analysis will be collected using a 1.5 L Niskin bottle deployed from a boat. A Niskin sampler will be lowered over the side of the boat, the messenger deployed and the Niskin hauled back into the boat. Once at the surface, the water sample will be decanted into specific containers, supplied by an accredited laboratory. Sample containers will be labelled and immediately stored in coolers. Samples will be retained in coolers until they can be shipped to the south for laboratory processing. A YSI monitoring meter will be used to measure physicochemical parameter at each location. If scheduling allows, multiple casts will be conducted at each location to determine variations in parameters during tidal exchange.	YSI, Niskin sampler, depth sounder, iPad	Boat	SCH, DAS

2 Potential Environmental Effects

Project field program activities with the potential to have environmental effects are described in Table 2-1. Potential environmental effects relating to Project field program activities are described in Table 2-2.

Project field programs are not expected to result in negative effects to the environment (including HADD to fish or fish habitat). All effects are considered mitigatable with mitigation and monitoring measures described in Section 3.3.

Table 2-1 Potential Environmental Effects

2022 Field Program	Drilling Program
Water quality degradation (marine environmental surveys)	Water quality degradation
Disturbance or injury to fish or marine mammals due to underwater sound	Contact of equipment with the seabed (drill head, drill casing)
Program vessel traffic and marine equipment	Program vessel traffic and marine equipment
Risk of harm and disruption to wildlife due to unintended interactions	Fuel storage and refuelling, including spills
Modification of fish habitat and effects to fish health due to changes in water quality, substrate changes or sedimentation	Waste production

3 Environmental Management

3.1 Guidelines and Best Management Practices

The following guidelines and best management practices (BMPs) are relevant to the Project field programs.

- DFO: Fish and Fish Habitat Protection Policy statement (DFO 2019a);
- DFO: Measures to Protect Fish and Fish Habitat (DFO 2019d);
- DFO: Interim code of practice: End-of-pip fish protection screens for small water intakes in freshwater (DFO 2020);
- Canadian Construction Association (CCA): CCA 81 – 2001: A Best Practices Guide to Solid Waste Reduction (Canadian Construction Association 2001);
- Government of Nunavut Department of Environment: Environmental Guideline for the General Management of Hazard Waste (Government of Nunavut 1999); and
- Spill Planning and Reporting Guide (Government of Nunavut 2003).

3.2 Roles and Responsibilities

All work shall be overseen by the field lead. In addition, wildlife monitors will accompany discipline leads during surveys. A marine mammal observer (MMO) will be present at the SCH for geotechnical drilling and will mainly be responsible for monitoring for the presence and behaviour of seals, and to document their proximity to the drill rig. This role will be conducted by local support in each community.

A Spill Response Plan (SRP) will be developed, and the field lead will maintain compliance with all regulatory conditions and confirm all measures are followed by site personnel.

3.3 Mitigation Measures

General practices will be put in place to avoid environmental incidents. Mitigation measures that will be implemented to reduce the likelihood of environmental incidents are described in Sections 3.3.1 through 3.3.8. Additional measures that are required by RAs through permits or compliance best practices pertinent to the Project field programs must also be followed.

Contractor Work Plans (CWPs) may be developed for the drilling program to further support regulatory compliance measures (such as spill response and waste management plans), however the details provided in this section are sufficient for the Project field programs to be carried out in compliance with permits and approvals.

3.3.1 General

- G1. Works shall comply with requirements of applicable laws, legislations, and BMPs.
- G2. Adherence to “Best Management Practices” for working in the marine environment (see Section 3.1).

- G3. If HADD to marine mammals or fish is observed, the event will be immediately reported to DFO at 1-867-979-8000.
- G4. Suspend all Project field program activities should any dead fish or wildlife, or any injured wildlife be observed during any works or activities in and around the marine waters.
- G5. Copies of all permits shall be on site and readily available.
- G6. Personnel shall be adequately trained.
- G7. Routine inspections of the worksite, equipment, as required to ensure regulatory compliance.
- G8. General housekeeping rules will be used to minimize clutter and keep work areas tidy.
- G9. The field lead will conduct a 'tail-gate' meeting prior to the start of Project field programs to confirm that all field personnel are aware of regulatory compliance requirements and understand their responsibilities (e.g. during spill response).
- G10. The field lead will report all non-compliances and incident reporting as indicated in Sections 3.6.2 and 3.6.3.
- G11. The field lead will complete all RA communications as summarized in Section 3.5.1.

3.3.2 Fish and Fish Habitat (Including Marine Mammals)

- FFH1. Implement measures designed to minimize disturbance to seabed sediments and benthic communities and marine wildlife when carrying out Project field program activities within the marine environment.
- FFH2. All aquatic works will cease in the event of fish kill/injury or stress to aquatic wildlife is observed near the site until a QEP can provide guidance for the continuation of works.
- FFH3. Water intakes for drilling in marine and fresh-water environments will be of an appropriate mesh size to not impinge fish on the screen and for the quarry (freshwater) will be in compliance with DFO's SCOPs for end-of-pipe fish screens (DFO 2019b).
- FFH4. Marine-based activities will be ceased if there is a risk of physical harm to any marine mammals from direct contact. Activities will only resume once there is no longer risk of injury to marine mammals from direct contact.
- FFH5. An MMO will be onsite at all times during geotechnical drilling at the SCH to confirm the presence of marine mammals and document any behavioural interferences due to geotechnical drilling.
- FFH6. The MMO will maintain records of the seal observations and document the species, behaviour and distance from the geotechnical drilling.
- FFH7. Prior to the geophysical refraction survey, field personnel will create mechanical disturbance in the water (e.g. splashing) to deter sedentary fish species from the area.

3.3.3 Wildlife Management

- WL1. A wildlife monitor will be present during all Project field programs.
- WL2. All project personnel will participate in wildlife safety training, including bear safety training. This will be carried out during the site orientation.
- WL3. Waste material bins to prevent scavenging by wildlife and feral animals, as well as to control odour.
- WL4. All site personnel will be instructed that the feeding of terrestrial or marine wildlife is prohibited.

3.3.4 Water Quality Management

- WQM1. No deleterious substances will be deposited into any aquatic environment (freshwater or marine) waterbodies. Should such activities occur, appropriate measures for response and reporting must be stipulated in the SRP.
- WQM2. Do not use any water nor construct or disturb any stream, lakebed or the banks of any definable water course unless otherwise authorized by the NWB or DFO-FFHPP.
- WQM3. During geotechnical drilling, drill muds, additives, and other products shall not be used in connection with holes drilled through marine ice unless they are re-circulated or contained such that they do not enter the water, or are demonstrated to be non-toxic.
- WQM4. During geotechnical drilling, if drilling additives are used for on-ice drilling they must be re-circulated in a way that they do not enter the marine environment or be demonstrated as non-toxic.

3.3.5 Air Quality

- AQ1. There will be no unnecessary idling of equipment or vehicles.
- AQ2. Machinery and equipment will be maintained in good working order to minimize emissions.

3.3.6 Fueling and Chemical Storage

Near or over water re-fuelling is required due to the nature of the drilling program and because it is standard practice for marine-based programs. Measures are in place to minimize negative effects to the marine environment. These measures have been developed using BMPs and industry standard measures to minimize or prevent spills to the marine environment.

- FCS1. Fuelling of equipment that will be over and near water; the plan will outline the use of secondary containment, drip trays, fuel line check valves, and spill kits.
- FCS2. All stationary petroleum products storage facilities shall be marked with flags, posts or similar devices so that they are at all times plainly visible.
- FCS3. All fuel storage containers examined for leaks a minimum of once every day and all leaks repaired immediately. Further they will be covered to keep out rainwater and snow.

- Determine if external support, such as local authorities, should be called to assist;
- Determine if the spill is reportable by consult per the Reportable Threshold Table (<http://www.enr.gov.nt.ca/programs/hazardous-materials-spills/reporting-spills>);
- Divert potential runoff away from the spill area, if possible;
- Store and/or dispose of contaminated materials resulting from the spill appropriately;
- Determine the extent of the spill, volume, area affected, and equipment required to conduct remediation works;
- Plan and implement remediation works; and
- Complete an incident report.

3.3.9 Reclamation

Reclamation is not required given the location that Project field programs are being undertaken. However the SCH and quarry locations will be left in the same condition they were in prior to the field program.

- R1. After Project field programs are complete, the area will be cleaned and restored. This includes the removal of all equipment and waste clean-up.
- R2. All equipment used to conduct the studies will be removed and transported offsite.
- R3. Any spills will be cleaned-up and the area remediated and restored prior to completion of Project field programs.
- R4. Drill holes will be appropriately filled and capped.
- R5. Drill cuttings shall be discharged to their marine or terrestrial origin within a small footprint.

3.4 Adaptive Management

During Project field programs, it may be necessary to modify methodology and address site conditions not initially foreseen. Should adaptation to field conditions need to be addressed, the field lead in conjunction with all field disciplines, will develop the update to the methodology and mitigation measures will be updated.

3.5 Communication

3.5.1 Regulatory Authority Communication

During the drilling program, it is expected that CIRNAC and NWB, and potentially DFO-FFHPP, will require notifications. This EMP will be revised at a future time to address specific RA notification requirements.

A spill of any kind to any environment (aquatic or terrestrial) is reportable to the GN-DoE 24-hour spill report line (1-867-920-8130) and through their fillable form (Available at: <https://www.gov.nu.ca/environment/documents/nt-nu-spill-report-form-pdf>).

3.6.3.2 Fisheries and Oceans Canada

Any activities or spills that have the potential to or have caused HADD to fish or fish habitat will be reported to DFO-FFHPP (1-855-852-8320).

Nunavut Water Regulations. SOR/2013-69. Available at: <http://laws-lois.justice.gc.ca/PDF/SOR-2013-69.pdf> Enabling Acts: *Nunavut Land Claims Agreement Act, Nunavut Waters and Nunavut Surface Rights Tribunal Act.*

Nunavut Waters and Water Surface Rights Tribunal Act. S.C. 2002, c. 10 <http://laws-lois.justice.gc.ca/PDF/N-28.8.pdf> Last Ammended June 16 2016.