



REPORT

Reclamation, Closure and Monitoring Plan

*Soil Remediation at Former Wellsite Unipkat I-22, Inuvialuit Settlement Region,
Northwest Territories*

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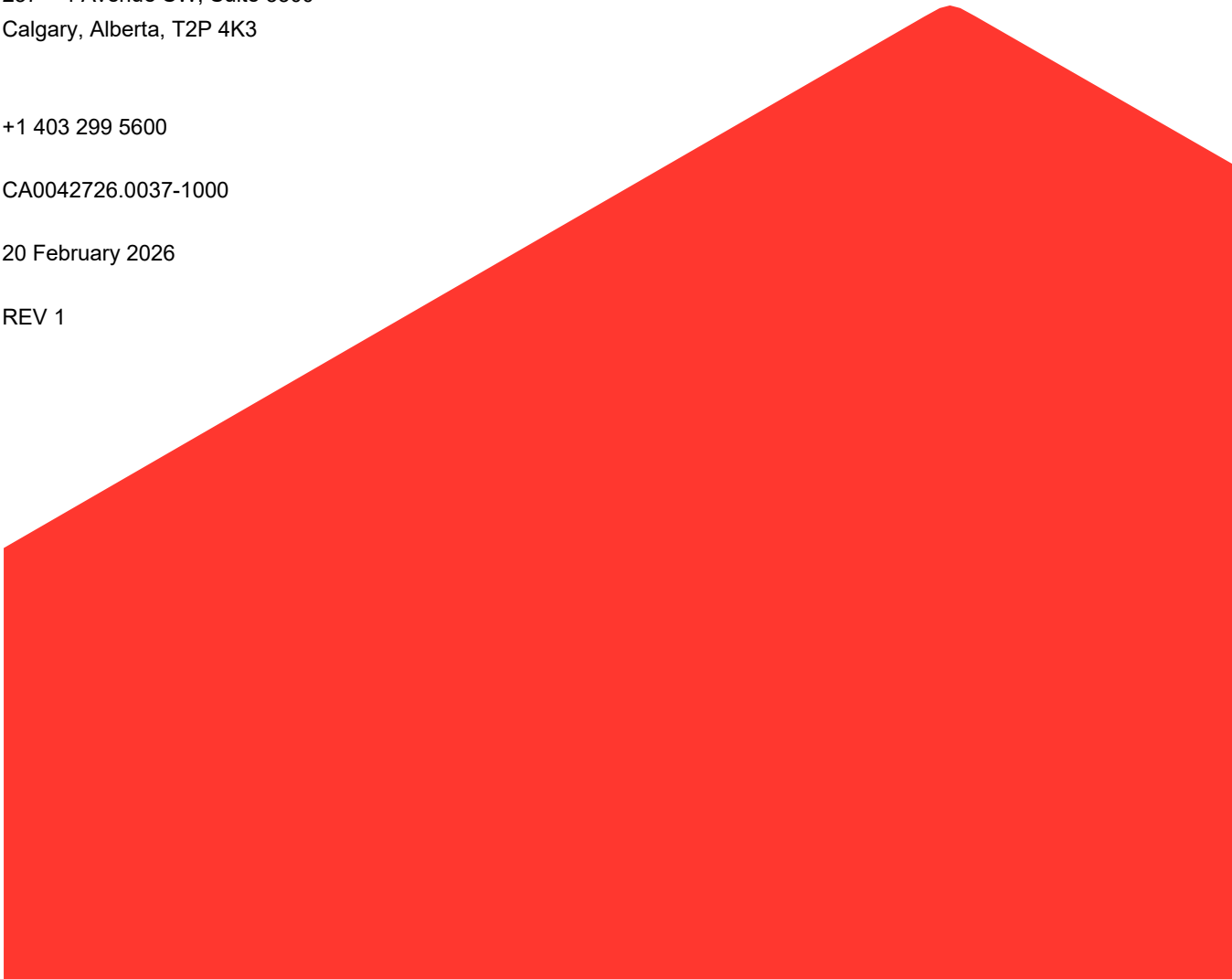
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1.0 INTRODUCTION

1.1 Background

WSP Canada Inc. (WSP) has prepared this Reclamation, Closure and Monitoring Plan (the Plan) on behalf of Shell Canada Limited (Shell) to support the soil remediation at the former well site Unipkat I-22 (the Site) in the Inuvialuit Settlement Region (ISR), Northwest Territories (NWT) (the Project). The purpose of this Plan is to describe the planned reclamation of the Site, including soil remediation, backfilling, grading, re-contouring, and re-vegetation. It also outlines the monitoring activities to be conducted during and following remediation.

The Plan will be effective upon its approval and will be implemented during the Project. Paper copies of this Plan will be available on the Site (through the Site Supervisor) and will be posted at several accessible locations. All personnel will have access to paper and digital copies of the Plan.

1.2 Location and Description

The Site is approximately 115 kilometres (km) northwest of Inuvik, in the ISR in the Mackenzie Delta, NWT at latitude 69°11'36.07" N and longitude 135°20'33.88" W. The site location is presented in Figure A1 (Appendix A).

Access to the Site in winter will be via ice road extension from the Inuvik to Aklavik public ice road and snowpack ramp, as presented in Figure A2 (Appendix A). The ice road extension to the Site will pass through Inuvialuit 7(1)(A) Private Lands and will follow the Mackenzie River East Channel and Arvoknar Channel (Figure A2, Appendix A). Access to the Site in summer will be via barge, boat or helicopter.

Shell developed the Site as an exploratory natural gas well site in 1972 and 1973 and re-entered in 1996 for additional well abandonment activities. Historically, the Site consisted of a camp sump, a well centre (e.g., a historical well marker), a drilling waste sump, a drilling flare pit and wood pilings used to support surface infrastructure above the ground.

1.3 Project Summary

The updated scope of work for the Project consists of the following activities for the winter 2026:

- Construction of an approximately 110 km long ice road extension from a junction approximately 30 km north of the Government of Northwest Territories (GNWT) Inuvik to Aklavik public ice road. This will allow for site access for equipment as well as the off-site transport and disposal of waste materials. The ice road extension will cross Inuvialuit 7(1)(A) Private Lands and will follow the Mackenzie River East Channel and Arvoknar Channel (Figure A2, Appendix A). Ice road reconnaissance and profiling began in January 2026 and it is expected that construction will be completed in February 2026. A snowpack ramp will be constructed at the Site to allow access for equipment and crew.
- Mobilization of equipment (office trailer, including heated portable toilets, skid steers, loaders, excavators, fuel trucks and fuel tanks, and other miscellaneous equipment) to the Site via the ice road for the duration of the winter 2026 season.
- Accommodations will be off-site at a temporary self-contained camp established on the gravel pad at Camp Farewell.
- Excavation and off-site disposal of soil containing barite (i.e., true total barium) at concentrations above the proposed soil quality objectives (SQOs), at an approved disposal facility.

- Removal of wood pilings from the future remediation operational area using the previously employed perimeter drilling method (EISC Registry File [10/22-01]).
- Borehole drilling and pre-remedial thermistor installation.
- Destabilization of the top 10 metres (m) of grout fill above the well stub through a combination of excavation and drilling.
- Fuel storage at the Site will be in appropriate fuel trucks and slip tanks for refueling of the equipment; fuel storage and refueling areas will be bermed. Drip trays and secondary containment will be used at fuel storage and refueling areas.
- Personnel and equipment demobilization by ice road in April 2026, before break-up.

Summer 2026 activities may include the following tasks:

- Personnel and equipment will be mobilized by boat or helicopter from off-site accommodations in Inuvik or at Camp Farewell.
- Limited Site reconnaissance activities in preparation for the planned winter 2027 remediation activities.
- Mobilization of barge camp (if using) and select petroleum hydrocarbon (PHC) soil remediation equipment for planned winter 2027 activities. The barge camp and equipment will not be used during the summer 2026 activities.

Winter 2027 remediation activities may include the following tasks:

- Soil PHC remediation and remaining wood pile removal and soil barite remediation (if needed).

1.4 Reclamation Objectives

PHCs and barite (true total barium) have been detected in soil at the Site at concentrations above proposed SQOs. To mitigate these risks, the Site will be subject to remedial action, beginning in winter 2026. The site remediation (the Project) is described in the Remedial Action Plan (RAP) (provided in Appendix B of the Project Description) and summarized in Section 1.3. The Inuvialuit Water Board (IWB) requires that a Reclamation, Closure and Monitoring Plan (RC&MP) be completed to outline the post-construction reclamation, closure and monitoring activities at the Site. As such, the RC&MP follows the guidance outlined by the IWB's Outline for Remedial Action Plan (RAP) and Reclamation, Closure and Monitoring Plan (RC&MP). The site location is shown in Figure A1, and a site overview is shown in Figure A2 (Appendix A).

Shell is committed to carrying out all activities associated with the design, operation, closure, reclamation and monitoring of the Project in a way that minimizes the risk of adverse effects on the aquatic and terrestrial environment. Objectives have been developed to minimize disturbance in compliance with applicable laws, permits and licenses.

This RC&MP will be reviewed regularly and revised if necessary to reflect changes in site conditions, operations or technology. All revisions or modifications will be submitted for approval to the IWB.

1.5 Site-Specific Reclamation Objectives

1.5.1 Physical Stability

As outlined in the Project-specific RAP, soil containing PHCs at concentrations above the proposed SQOs will be treated using ex situ ETC, a mobile, fully enclosed thermal desorption process wherein a heated airstream (typically 300 to 450 °C) is transmitted through the soil to increase the volatility of organic constituents (i.e., PHCs, polycyclic aromatic hydrocarbons [PAHs] and volatile organic compounds [VOCs]) for recovery in the vapour phase. As the CoCs volatilize, they are captured and removed via vacuum through a thermal oxidizer for destruction via controlled combustion. The thermal oxidizer will be operated within defined parameters and monitored to ensure the efficient and complete destruction of PHC vapours.

Soils containing concentrations of PHCs above the proposed SQOs will be excavated from the areas designated in the RAP and treated via ETC, with thermocouple probes placed throughout the soil to monitor treatment temperature. Soil may be treated in various configurations, either by placed in long rows enclosed by Quonset huts or stacked in vertical containment units, both of which are capable of satisfying treatment objectives (i.e., the principal thermal conduction process remains the same but may be implemented with different infrastructure in variable batch sizes). Each structure (referred to as a treatment cell) will treat up to 400 m³ over an approximately 10 to 15 day period. Although the structures are temporary, measures will be implemented to ensure the cells are physically stable, do not erode, subside or move from their location under natural events or disruptive forces.

Treated soils that meet the proposed SQOs for PHCs (confirmatory testing as outlined in the RAP Section 7.0 Appendix B of the Project Description) will be used as backfill (once cooled or hydrated and quenched [summer only]) in the excavation and graded at surface to blend into the surrounding landscape, promote drainage, and facilitate natural revegetation.

Soils containing barite (measured as true total barium) at concentrations above the proposed SQO at the Site (depths less than 1.5 metres below ground surface [mbgs]) will be excavated for off-site disposal at an approved facility outside of NWT. This approach is designed specifically for this Site, which is subject to active erosion. It may not be the preferred approach at other sites with similar CoCs in the region. Given the low volume of soil exceeding the proposed SQO for barite, no backfill is expected to be required and the excavated areas will be recontoured using balanced grading.

1.5.2 Chemical Stability

Throughout the remediation activities, measures will be implemented to minimize seepage and/or runoff of CoCs at concentrations which may pose a potential risk to terrestrial, aquatic and avian wildlife, and humans (as outlined in Section 9 of the RAP, Appendix B of the Project Description).

1.5.3 Ecological Stability

During remediation, ecological stability will be promoted through the implementation of permafrost protection measures outlined in the Permafrost Protection Plan (Appendix H of the Project Description). Following remediation activities, all equipment will be removed. Topsoil is not expected to be present at the Site. Treated soils that meet the proposed SQOs (confirmation as outlined in the RAP Section 7.0 Appendix B of the Project Description) will be used as backfill (once cooled and hydrated) in the excavation and graded at surface to blend into the surrounding landscape, promote drainage, and facilitate natural revegetation. Additional revegetation measures (e.g., reseeding with a native seed mixture) may be implemented.

1.5.4 Climate and Geographic Stability

Recent research in the Canadian Arctic notes evidence of increased flooding due to changes in precipitation patterns within the Beaufort Delta region. The combination of increasing sea levels together with the loss of ice cover has resulted in the production of destructive wave patterns known as storm surges. The storm surges have resulted in the damage or destruction of a substantial portion of the shore protection, and flooding within communities located in the Mackenzie Delta (GNWT 2021).

At approximately 2 to 3 metres above sea level (masl), the Site is at risk of flooding and/or erosion. Since 2007, the southern boundary of the Site has experienced between approximately 20 and 65 metres (m) of shoreline erosion with the most erosion associated with the former remedial excavation areas (average rate of erosion between 1.2 and 3.8 metres per year [m/yr]) (Figure A3, Appendix A). It is expected that erosion may continue at the Site, though the rate is uncertain, and in some cases sedimentation may occur.

2.0 REGULATORY BACKGROUND

Shell, through WSP, is submitting this RC&MP to the EISC as part of the Project Description. Pursuant to the terms established under the Inuvialuit Final Agreement of 1984, Shell understands that EISC approval is required for the proposed Project.

A summary of permitting requirements and relevant legislation is listed in Table A below. Note that all applications are either approved, currently ongoing or requirements for approvals being determined.

Table A: Approvals Required for the Proposed Project

Agency and Contact Person	Relevant Legislation / Required Approval
Patricia Sung Environmental Impact Screening Coordinator Environmental Impact Screening Committee P.O. Box 2120 Inuvik, NT, X0E 0T0 Telephone: (867) 777-2828 Fax: (867) 777-2610 Email: eisc@jointsec.nt.ca	Inuvialuit Final Agreement <i>Western Arctic (Inuvialuit) Claims Settlement Act</i> Approval of Project Description
Bijaya Adhikari Science and Regulatory Coordinator Inuvialuit Water Board P.O. Box 2531 Inuvik, NT X0E 0T0 Telephone: (867) 678-8610 Fax: (867) 678-2943 Email: adhikarib@inuvwb.ca	<i>Waters Act</i> and Waters Regulations Type B Water Licence
Donald Arey Regional Superintendent Department of Environment and Climate Change Land and Water Beaufort-Delta Region 86 Duck Lake Road Bag Service #1 Inuvik, NT X0E 0T0 Telephone: (867) 678-8090 Email: Donald_Arey@gov.nt.ca	<i>Northwest Territories Lands Act</i> and Land Use Regulations Class A Land Use Permit

Agency and Contact Person	Relevant Legislation / Required Approval
Fish and Fish Habitat Protection Program Fisheries and Oceans Canada 867 Lakeshore Rd Burlington ON L7S 1A1 Telephone: 1-855-852-8320 Email: FisheriesProtection@dfo-mpo.gc.ca	<i>Fisheries Act and Species at Risk Act</i> Request for Review of Project
Navigation Protection Program Transport Canada, Prairie and Northern Group 1100 9700 Jasper Avenue Edmonton, Alberta, T5J 4E6 Telephone: (844) 425-7787 Email: NPPPNR-PPNRPN@tc.gc.ca	<i>Canadian Navigable Waters Act</i> No Interference with Navigation Notification of Work
Prince of Wales Northern Heritage Centre Department of Education, Culture and Employment Government of the Northwest Territories 4750 48th Street, P.O. Box 1320 Yellowknife, NT X1A 2L9 Telephone: (867) 767-9347 ext. 71472 Fax: (867) 873-0205	<i>Archaeological Sites Act and Access to Information and Protection of Privacy Act</i> Archaeological Site Data Access Request
Scientific Services Office Department of Education, Culture and Employment Government of the Northwest Territories P.O. Box 2884 Inuvik, NT X0E 0T0 Telephone: (867) 777-3298 Email: ResearchLicensing@gov.nt.ca	<i>NWT Scientists Act</i> Scientific Research Licence
Department of Infrastructure Beaufort Delta Region 106 Veterans Way, Bag Service #1 Inuvik, NT X0E 0T0 Telephone: (867) 777-7146 Fax: (867) 777-3463	<i>Public Highways Act</i> Public Highway Access Permit
Department of Infrastructure Beaufort Delta Region 106 Veterans Way, Bag Service #1 Inuvik, NT X0E 0T0 Telephone: (867) 777-7146 Fax: (867) 777-3463	<i>Public Highways Act</i> Public Highway Sign Permit

In October 2023, information about previously recorded heritage resources in the vicinity of the Site was provided by the Prince of Wales Northern Heritage Centre (PWNHC), Yellowknife, NWT (Smethurst 2023, pers. comm.). The closest known archaeological site is approximately 11 km northeast of the Site. This archaeological site is classified as prehistoric and comprises scatter (lithic). Given the distance and location of this archaeological site, no interactions with any proposed Project activities are expected.

Between October 2023 and May 2024, WSP consulted with the Scientific Services Office, GNWT Education, Culture and Employment to determine if a Scientific Research Licence was required for a similar remediation

project at West Channel (EISC Registry File [11/23-03]), and it was determined that there is no licensing required for this type of project and is thus not required for the proposed Project.

It was determined that an application under Transport Canada's Navigation Protection Program (NPP) will not be required for the winter ice road construction and maintenance and remediation component of the Project due to the nature of the work (barge at anchor, temporary pump through ice surface). No notification is required for the summer works as all summer remediation activities will be a minimum of 10 m away from the ordinary high-water mark of any channel and no part of the channel will be obstructed during the Project (Chamberlain 2025, pers. comm.).

3.0 ENVIRONMENTAL BASELINE

3.1 Physical Environment

3.1.1 Climate

The region where the Project is located is classified as having a high subarctic ecoclimate (ESWG 1996).

In general, the region experiences very cold winters and cool summers. Daylight hours vary from near total darkness during December to January, to 24 hours of daylight from approximately mid-May to mid-July. Based on the Inuvik Airport weather station, the mean annual daily temperature is -7.0 degrees Celsius (°C), and daily average temperatures range from -24.9°C in January to 14.2°C in July (ENR 2024, internet site). The Inuvik area receives an average 240.6 millimetres (mm) of precipitation a year, approximately 50% of which falls as snow (GOC ENR 2024, internet site).

3.1.2 Physiography

The Site is within the Mackenzie Delta physiographic region, in the Mackenzie Delta Low Arctic north (LAN) Ecoregion, which includes the northernmost part of the Mackenzie Delta, and is within the Tundra Plains LAN Southern Arctic Ecoregion (Ecosystem Classification Group [ECG] 2012). The Mackenzie Delta LAN Ecoregion is characterized by nearly level floodplains with low and wet alluvial deposits with many shallow ponds and channels of the Mackenzie River (ECG 2012). The region is influenced by active fluvial processes (flooding, sediment deposition and reworking of the sediments by storm surges along the coastline) and calcium-rich soils that are saline in areas influenced by storm surges and tides. Tall willow shrublands are dominant in slightly elevated areas, whereas shorter willows, sedges, cotton-grasses, reed bent-grass and horsetails are common in the lower areas (ECG 2012).

3.1.3 Topography and Drainage

The Mackenzie Delta LAN Ecoregion has surface elevations ranging from sea level to 25 masl (ECG 2012). The entire delta is subject to flooding: near the head of the delta flooding occurs during spring breakup, particularly when ice jams occur, and near the coast flooding occurs because of storm surges (Rampton 1988).

3.1.3.1 Bank Erosion

The Site is in a topographically low-lying area of in the Mackenzie Delta (Figure A1, Appendix A) adjacent to the Arvoknar Channel of the Mackenzie River with ground surface elevations of less than 3 masl. The southern boundary of the Site has been eroded by the Arvoknar Channel and a bank, followed by a gently sloping, shallow beach, is present along the entire southern boundary. Portions of the former operating areas on the Site are fully submerged by the Arvoknar Channel, including the former flare pit, camp sump and part of the drilling waste sump (WSP 2024). Since 2007, the southern boundary of the Site has experienced between approximately 20 and 65 m

of shoreline erosion with the most erosion associated with the former remedial excavation areas (average rate of erosion between 1.2 and 3.8 metres per year [m/yr]) (Figure A3, Appendix A). It is expected that erosion may continue at the Site, though the rate is uncertain, and in some cases sedimentation may occur. Currently, drainage is generally south towards the Arvoknar Channel and to the north towards low-lying areas on the Site.

While site-specific bathymetry data have not been collected, real-time hydrometric data are collected from a sensor operated by the Government of Canada (GoC) approximately 14.5 km southeast (upstream) of the Site (GoC ENR 2023, internet site). Five-year daily-mean water levels measured at the sensor typically range from approximately 9.5 m (in winter months) to 11.4 m (in May, during freshet).

At the time when aerial imagery (obtained in 2024) used in Figure A3 (Appendix A) was taken, the mean-daily water level was recorded as being approximately 9.7 m at the upstream sensor. As shown in Figure A3 (Appendix A), the water level is well below the top of the riverbank at the Site and generally follows the shallow, sloped toe of the bank. According to Light Detection and Ranging (LiDAR) data collected in 2023 and 2024, as well as on-site observations, the elevation gain between the toe and top of the riverbank is approximately 1.5 m to 2 m, demonstrating that the current erosional effects are predominantly confined to soils at depths of less than 3 mbgs on the Site; and erosion is likely the highest during periods of above-average water levels in the channel (i.e., spring freshet).

Given seasonal water levels, aerial photography and on-site observations, it is expected that erosion will continue laterally across the Site and in the near-surface soils.

3.1.4 Bedrock Geology

The Mackenzie Delta is about 200 km long and 65 km wide, extending to the north-northeast (Rampton 1988). The region is characterized by Mesozoic and Cenozoic rocks that were deposited in the Beaufort-Mackenzie Basin and underlay unlithified floodplain and delta deposits (Rampton 1987).

The rivers in the area drain a range of bedrock terrain. On the west side of the Mackenzie Delta is the Yukon Coastal Plain, which consists of folded and faulted Mesozoic rocks. On the east side of the Mackenzie Delta is an unlithified coastal plain that is underlain by Proterozoic and lower Palaeozoic clastics and carbonates which are in turn overlain by Cretaceous clastic sediments (Solomon 2003).

3.1.5 Surficial Deposits

The Mackenzie Delta surface is marked by a complex network of lakes and anastomosing channels (i.e., the channels are separated by semi-permanent islands). Lakes cover between 15% and 30% of the delta. Thermokarst lakes with thick permafrost are most common in the upper delta. The lakes usually contain sediments discharged from the channels (Rampton 1988).

Surficial soils in the region consist of alluvial floodplain and delta deposits comprising silt, clay, fine sand, minor gravel, coarse sand and organic sediments. Surficial soils in the region may be more than 20 m thick (Rampton 1987).

Dominant soils of the Mackenzie Delta LAn Ecoregion are characterized by calcareous fine-loamy and fine-silty alluvium and include Regosolic Static Cryosols, Gleyed Cumulic Regosols and Gleysolic Static Cryosols (ECG 2012).

Results from the winter 2024 field program indicate that the dominant soil grain size is fine-grained, where 94% or more of soil particles were less than 75 micrometres. The soil types were identified as clayey silt and silty clay, with some occurrences of silt and sand from the surface extending to 7.5 mbgs (WSP 2024).

3.1.6 Permafrost

The Mackenzie Delta LAn Ecoregion is characterized by continuous permafrost with scattered permafrost features such as drained lakes, low-centre polygons and pingos (ECG 2012). In the Mackenzie Delta, permafrost thickness is generally less than 90 m thick, and contains deep unfrozen zones (taliks), which may extend to the base of the permafrost. The depth of the active layer generally ranges from 0.3 to 1.0 mbgs but is largely a function of ground surface insulation, vegetation cover, level of ground disturbance and winter snow cover (Heginbottom 1998).

Records collected between 2007 and 2010 from three historical thermistors, prior to Site remediation in 2011, indicated that the permafrost depths were approximately 2.0, 1.6 and 1.5 mbgs on the south edge of the drilling waste sump, centre of drilling waste sump and north of the drilling waste sump, respectively (IEG 2007, 209, 2012a, 2012b).

The approximate depth to the base of the active layer (i.e., depth to permafrost) was also noted on available borehole logs completed during historical site investigations dating back to 2007 (i.e., September 2007, August 2010, April 2011, and August 2022). The approximate depth to permafrost ranged from 0.7 to 5.2 mbgs in boreholes advanced during the 2022 ESA activities, with the deepest observed from a borehole directly adjacent to the Arvoknar Channel in an area subject to significant erosion. The approximate depth to permafrost at other borehole locations advanced in 2022 to the west, where less erosion is visible along the shoreline of the channel, ranged from 1.7 to 2.5 mbgs. The approximate depth to permafrost ranged from 0.7 to 2.2 mbgs at boreholes advanced within areas of historical site activities (WSP 2023).

3.1.7 Site Hydrology/Hydrogeology

The Mackenzie Delta is a dynamic complex of lakes, islands, braided and anastomosing channels and oxbows. Ice covers the waters of the delta for approximately eight months of the year and can reach thicknesses of up to 2.5 m. Ice breakup typically occurs in late April to early May, and ice movement occurs prior to the peak water levels in the spring. Water levels recede in late summer and fall. The spring breakup is the major hydrological event of the year (Mackenzie River Basin Committee [MRBC] 1981). The Site is bordered to the south by the Arvoknar Channel of the Mackenzie River, and to the north, east and west by small surface ponds.

During the September 2007 groundwater monitoring event, the shallow groundwater levels across the Site generally varied between 1.32 and 4.13 metres below top of casing (mbtoc) (IEG 2009). More recently, the shallow groundwater depths within the previously disturbed area of the Site ranged from 0.81 to 1.31 mbgs (WSP 2023). Based on topography and historical groundwater monitoring events, the anticipated groundwater flow direction is inferred to be to the southwest although the potential for groundwater wells to heave from frost reduces the reliability of water level measurement data. In addition, given the intermittent presence of groundwater, it is likely that groundwater flow is limited and only present for portions of the summer months.

3.1.8 Groundwater and Surface Water Quality

Groundwater quality data at the Site is available from 2007, prior to remedial activities that took place, as well as from 2011, and in 2013 and 2022, following the remedial activities. Six monitoring wells, including one background monitoring well, were sampled at the Site in September 2007 and analyzed for routine chemistry parameters, benzene, toluene, ethylbenzene, xylenes (BTEX) and PHC Fractions F1 and F2, and total and dissolved metals.

Toluene in one groundwater sample and iron concentrations in two groundwater samples were greater than the generic guidelines applied at the time. Total and/or dissolved concentrations of aluminum, arsenic, cadmium, chromium, copper, iron, lead, nickel, selenium, silver, thallium and/or zinc were greater than the generic guidelines applied at the time from the four monitoring wells from which groundwater samples were analyzed. The background sample was not analyzed for total and dissolved metals (IEG 2009). One monitoring well was sampled in 2013 and analyzed for BTEX and PHC Fractions F1 and F4, PAHs, total and dissolved metals and routine chemistry parameters. Total and/or dissolved concentrations of chloride, aluminum, cadmium, copper, iron, selenium, silver and zinc were greater than the generic guidelines applied at the time but may be representative of natural background conditions (IEG 2013). In 2022, groundwater samples collected from the drilling waste sump area contained concentrations of PHCs and dissolved metal parameters greater than the generic guidelines applied at the time and/or background ranges (WSP 2023).

While there have been multiple groundwater monitoring and sampling activities at the Site, groundwater was intermittently detected in the wells, as they were dry. Where sufficient groundwater was available to be sampled, the analysis of contaminants of potential concern (CoPCs) generally identified low or non-detectable concentrations. In samples where concentrations of CoPCs were identified, they were either singular detections (e.g., detected in one sampling event or in one well), below generic guidelines in the most recent groundwater monitoring and sampling event, or in concentrations consistent with background conditions. Based on these factors, remedial efforts for the Site are targeted towards contaminants identified in soil, and groundwater is not a target of the RAP.

Surface water quality data for the Site was obtained in 2004 and 2007, prior to remediation, during the remedial program in 2011, as well as in 2022 and 2024. A background sample and a sample from the pond east of the drill sump were analyzed in 2004 for routine chemistry and had turbidity values greater than the applied guideline (Komex 2005). Three surface water samples (two from the pond to the east of the drill sump and one from the Arvoknar Channel [background]) were analyzed in 2007 for PHCs, routine chemistry parameters and metals. One of the pond samples and the background sample exhibited concentrations of total aluminum and total iron greater than the guidelines applied at the time but were considered reflective of background conditions. Concentrations of dissolved selenium greater than the applied guidelines were also detected in the two samples from the pond (IEG 2009). During the 2011 remediation, one surface water sample from the Arvoknar Channel (background) was analyzed for PHCs, PAHs, routine chemistry parameters and total metals. The concentration of total zinc in the background sample was greater than the guidelines applied at the time (IEG 2012). Concentrations of PHCs, PAHs, routine chemistry parameters and/or total metals in surface water samples collected in 2022 and 2024 were below the guidelines applied at the time and/or background ranges (WSP2023; 2024).

3.2 Biological Environment

The Government of Canada's *Species at Risk Act* (SARA; 2002) was enacted to prevent Canadian indigenous species, subspecies and distinct populations of wildlife from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and to encourage the management of other species to prevent them from becoming at risk. The enactment established the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as an independent body of experts responsible for assessing and identifying species-at-risk (SAR). It provided that COSEWIC's assessments were to be reported to the Minister of the Environment and to the Canadian Endangered Species Conservation Council and it authorized the Governor in Council to establish the official list of SAR based on that process. It required that the best available knowledge be used to define long and short-term objectives in a recovery strategy for endangered and threatened species and it provides for action

plans to identify specific actions. The SARA (2002) created prohibitions to protect listed threatened and endangered species and their critical habitat. Species can be listed under three schedules. Schedule 1 is the official list of species that are classified as extirpated, endangered, threatened and of special concern. Species listed in Schedule 2 are species that had been designated as endangered or threatened and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1. Species listed in Schedule 3 are species that had been designated as special concern and have yet to be re-assessed by COSEWIC using revised criteria. Once these species have been re-assessed, they may be considered for inclusion in Schedule 1 (SARA 2024, internet site).

In addition to federal legislation, the GNWT established the NWT Species General Status Ranking Program which produces the General Status Ranks of Wild Species in the NWT (Working Group on General Status of NWT Species 2021). Under this program, species' ranks are reviewed and published every five years. The 2021 report presents the general status ranks for 8,228 species known or expected to be present in the NWT.

Species may be ranked as 'at risk' (have been assessed in detail and ranked by the NWT Species at Risk Committee [SARC] or COSEWIC as 'threatened' or 'endangered'), 'may be at risk' (may be at risk of extinction or extirpation and candidates for detailed risk assessments), 'sensitive' (may require protection to keep from becoming at risk), 'secure' (not at risk or sensitive), 'undetermined' (insufficient information to determine status), 'not ranked' (not ranked under program), 'alien' (introduced through human activities), 'extirpated / extinct' (no longer found in the NWT / world), 'vagrant' (infrequent and/or unpredictable occurrences outside normal distribution range) and 'presence expected' (species not yet recorded but expected to occur in the NWT) (Working Group on General Status of NWT Species 2021).

The NWT Species General Status Ranking Program provides species ranks to the NWT SARC, which was established under the SARA (NWT) to assesses the biological status of species that may be at risk in the NWT, to identify threats and positive influences on species and their habitats, and to recommend whether a species should be added to the NWT list of SAR (NWT SARC 2024, internet site).

The following sections include summaries of species potentially occurring in the Project area that are currently listed territorially and/or federally.

3.2.1 Vegetation

Vegetation in the Mackenzie Delta LAn Ecoregion predominantly consists of relatively tall willow (*Salix spp.*) shrubland on elevated areas (1 or 2 m above the water table), with shorter willows, sedges (*Carex spp.*), cotton-grass (*Eriophorum angustifolium*), reed bent-grass (*Deyeuxia quadriseta*) and horsetail (*Equisetum arvense*) on areas where the water table is near surface, and sedge, cotton-grass, horsetail marshes with scattered willows where the water table is at or above the surface (ECG 2012).

The only vascular plant species currently listed by the NWT SARC is present in the ISR – the hairy braya (*Braya pilosa*). It is listed territorially as 'threatened', and as 'endangered' under the federal SARA and COSEWIC. However, this species is endemic to Cape Bathurst (Conference of Management Authorities 2024, internet site), over 300 km northeast of the Site.

Based on site observations, the vegetation within the Project area is dominated by willows and brush; however, the Site itself is mostly free of vegetation.

3.2.2 Avian Wildlife and Habitat

The vast majority of birds that are found in and around the Mackenzie Delta are migratory waterfowl and shorebirds that are present from May to October. The delta provides important nesting, breeding and staging grounds for avian wildlife, in addition to key subsistence harvesting for Inuvialuit hunters.

Based on the Aklavik, Inuvik and Tuktoyaktuk Community Conservation Plans (AICCP 2016; ICCP 2016; TCCP 2016), the Site is within or near the following Special Designated Lands recognized for avian species, their habitat, and/or subsistence harvesting (Figure A4a and A4b; Appendix A).

- Spring Goose Harvesting Areas (304C): considered a key area for subsistence hunting of geese in the spring.
- Fall Goose Harvesting Areas (312C): considered a key area for subsistence harvesting of waterfowl during the fall.
- Kendall Island Bird Sanctuary (706E): valuable waterfowl breeding and staging grounds within the outer Mackenzie Delta. The islands of the outer delta are important staging grounds from late August to late September for several species of shorebirds. Shallow Bay area is an important staging area for greater white-fronted geese (*Anser albifrons*), Canada geese (*Branta canadensis*), cackling geese (*Branta hutchinsii*) and lesser snow geese (*Anser caerulescens*). Black brants (*Branta bernicla*) also migrate west through the outer Mackenzie Delta. Large numbers of shorebirds migrate through the delta area. Small islands south of Kendall Island support a colony of lesser snow geese. Tundra swans (*Cygnus columbianus*), greater white-fronted geese, sandhill cranes (*Grus canadensis*), black brant, ducks and shorebirds, nest and moult throughout this area. This area is considered a sensitive harvesting area.
- Mackenzie River Delta Key Migratory Bird Habitat (715C): considered an important nesting and breeding habitat for migratory birds from May to September.

At least 125 bird species may be found in the Mackenzie Delta region (AICCP 2016; ICCP 2016; TCCP 2016). Several of these species are listed federally and/or territorially. Table B below provides a summary of these listed species.

Table B: Avian Species of Conservation Concern Potentially Occurring at the Site

Common Name	Scientific Name	NWT SAR ¹	COSEWIC ²	SARA ³
Bank swallow	<i>Riparia riparia</i>	n/a	Threatened	Threatened
Barn swallow	<i>Hirundo rustica</i>	n/a	Special concern	Threatened
Eskimo curlew	<i>Numenius borealis</i>	n/a	Endangered	Endangered
Harris's sparrow	<i>Zonotrichia querula</i>	n/a	Special concern	Special concern
Horned grebe (western population)	<i>Podiceps auritus</i>	n/a	Special concern	Special concern
Hudsonian godwit	<i>Limosa haemastica</i>	n/a	Threatened	Under consideration
Lesser yellowlegs	<i>Tringa flavipes</i>	n/a	Threatened	Under consideration
Red-necked phalarope	<i>Phalaropus lobatus</i>	n/a	Special concern	Special concern

Common Name	Scientific Name	NWT SAR ¹	COSEWIC ²	SARA ³
Rusty blackbird	<i>Euphagus carolinus</i>	No status	Special concern	Special concern
Short-eared owl	<i>Asio flammeus</i>	No status	Threatened	Special concern

Notes:

¹ Conference of Management Authorities. 2024. NWT List of Species at Risk. Species listed under the Species at Risk (NWT) Act.

² Species recommended by the COSEWIC for listing under Schedule 1 of the federal SARA.

³ Species listed under Schedule 1 of the federal SARA.

n/a – not applicable

Both subspecies of the red knot (*Calidris canutus islandica* and *Calidris canutus rufa*) breed on the central and high arctic islands of the ISR hundreds of km northwest of the Site. They may cross through the general area of the Site during migration. The *islandica* subspecies is listed as ‘not at risk’ by COSEWIC and as ‘special concern’ under SARA while the *rufa* subspecies is listed as ‘endangered’ through both COSEWIC and SARA. NWT SAR lists the status of both subspecies as ‘not applicable’.

Most of the birds found in and around the Mackenzie Delta are migratory. They will be wintering in southerly locations during the winter months and may be using the Site and surrounding area for nesting, breeding, and staging habitat during the summer months.

3.2.3 Mammals and Habitat

Terrestrial wildlife in the vicinity of the Site may include moose (*Alces alces*), barren-ground caribou (*Rangifer tarandus groenlandicus*), muskox (*Ovibos moschatus*), grizzly bear (*Ursus arctos*), wolverine (*Gulo gulo*), grey wolf (*Canis lupus*), arctic fox (*Vulpes lagopus*), red fox (*Vulpes vulpes*), lynx (*Lynx canadensis*), mink (*Neovision vison*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), snowshoe hare (*Lepus americanus*) and small mammals.

Polar bears (*Ursus maritimus*) may be encountered in the vicinity of the Site. Typically, they are restricted to high arctic areas with sea ice in summer and, in winter, they may be found in coastal onshore areas with maternity dens along the Yukon North Slope, Herschel Island, Kay Point, eastern Mackenzie Delta coastal and offshore areas (as defined by the Mainland Coastal Polar Bear Denning Areas [323C]; TCCP 2016).

Based on the Aklavik, Inuvik and Tuktoyaktuk Community Conservation Plans (AICCP 2016; ICCP 2016; TCCP 2016), the Site is within or near to the following Special Designated Lands recognized for terrestrial and marine mammals and their habitat (Figures A4a and A4b; Appendix A).

- Winter Wolverine Harvesting Areas (314C): key area for subsistence harvesting of wolverine during the winter.
- Critical Grizzly Bear Denning Areas (322C): considered important for denning grizzly bears from October to May.
- Mainland Coastal Polar Bear Denning Areas (323C): considered important for polar bear denning from October to March.
- Kendall Island Bird Sanctuary (706E): important area for polar bears and caribou. This area is considered a sensitive harvesting area.

- Mackenzie River Delta Key Migratory Bird Habitat (715C): important denning habitat for grizzly bears from October to May and polar bears from November to April.

At least 39 mammal species may be found in the Mackenzie Delta region (AICCP 2016; ICCP 2016; TCCP 2016). Several of these species are listed federally and/or territorially. Table C below provides a summary of these listed species.

Table C: Mammal Species of Conservation Concern Potentially Occurring at the Site

Common Name	Scientific Name	NWT SAR ¹	COSEWIC ²	SARA ³
Barren-ground caribou	<i>Rangifer tarrandus groenlandicus</i>	Threatened	Threatened	Under consideration
Polar bear	<i>Ursus maritimus</i>	Special concern	Special concern	Special concern
Grizzly bear (western population)	<i>Ursus arctos</i>	No status	Special concern	Special concern
Wolverine	<i>Gulo gulo</i>	No status	Special concern	Special concern

Notes:

¹ Conference of Management Authorities. 2024. NWT List of Species at Risk. Species listed under the Species at Risk (NWT) Act.

² Species recommended by the COSEWIC for listing under Schedule 1 of the federal SARA.

³ Species listed under Schedule 1 of the federal SARA.

Of the species listed in Table C, grizzly bears will be hibernating during the winter months and may be encountered at the Site during the summer months of the Project. Polar bears are restricted to areas with sea ice during summer months; however, polar bears may be using the general area around the Site and female polar bears may be denning in maternity dens during the winter months in on- and off-shore areas along the coast north and west of the Site. The Cape Bathurst Herd of barren-ground caribou may be wintering near the Site, and the Tuktoyaktuk Peninsula Herd of barren-ground caribou may be wintering to the northeast of the Site and wolverine may be encountered year-round (Conference of Management Authorities 2024, internet site). More details on some of these species are provided in Section 14.5 of the Project Description.

3.2.4 Freshwater Fish and Habitat

The Mackenzie Delta provides important feeding, spawning, and overwintering habitat for anadromous and freshwater fish species, in addition to providing a major conduit for fish migration from spawning areas in the delta/upstream of the delta to overwintering areas in the delta or the nearshore Beaufort Sea.

Common species that may be found and/or harvested within the vicinity of the Sites include Arctic cisco (*Coregonus autumnalis*), Arctic grayling (*Thymallus arcticus*), broad whitefish (*Coregonus nasus*), inconnu (*Stenodus leucichthys*), Dolly Varden (*Salvelinus malma*), lake trout (*Salvelinus namaycush*), lake whitefish (*Coregonus clupeaformis*), least cisco (*Coregonus sardinella*), burbot (*Lota lota*) and northern pike (*Esox lucius*).

Based on the Aklavik, Inuvik and Tuktoyaktuk Community Conservation Plans (AICCP 2016; ICCP 2016; TCCP 2016), the Site is within or near the following Special Designated Lands recognized for fish, fish habitat and/or subsistence harvest (Figure A4a, Appendix A).

- Central Mackenzie Estuary (718D): used extensively by feeding anadromous whitefish and as overwintering and nursery areas for a variety of fish.

At least 28 freshwater fish species may be found in the Mackenzie Delta region (AICCP 2016; ICCP 2016; TCCP 2016). Table D below provides the only species that is listed federally and/or territorially in the general area of the Sites.

Table D: Freshwater Fish Species of Conservation Concern Potentially Occurring at the Site

Common Name	Scientific Name	NWT SAR ¹	COSEWIC ²	SARA ³
Dolly Varden	<i>Salvelinus malma</i>	n/a	Special concern	Special concern

Notes:

¹ Conference of Management Authorities. 2024. NWT List of Species at Risk. Species listed under the Species at Risk (NWT) Act.

² Species recommended by the COSEWIC for listing under Schedule 1 of the federal SARA.

³ Species listed under Schedule 1 of the federal SARA.

Many of the fish species that occur within the vicinity of the Sites may be encountered in the Mackenzie River and its channels during the proposed Project activities.

3.2.5 Insects and Habitat

Numerous insect species are found in and around the Mackenzie Delta. Table E provides a summary of insect species that are listed federally and/or territorially that may potentially occur in the general Project area.

Table E: Insect Species of Conservation Concern Potentially Occurring at the Site

Common Name	Scientific Name	NWT SAR ¹	COSEWIC ²	SARA ³
Suckley's cuckoo bumble bee	<i>Bombus suckleyi</i>	No status	Threatened	Under consideration
Transverse lady beetle	<i>Coccinella transversoguttata</i>	No status	Special concern	Special concern

Notes:

¹ Conference of Management Authorities. 2024. NWT List of Species at Risk. Species listed under the Species at Risk (NWT) Act.

² Species recommended by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) for listing under Schedule 1 of the federal Species at Risk Act (SARA).

³ Species listed under Schedule 1 of the federal SARA.

Insects will be dormant during the winter months and may be using the Sites and surrounding area during the summer months.

3.3 Land Use

3.3.1 Hunting and Fishing

The Aklavik, Inuvik and Tuktoyaktuk Community Conservation Plan (AICCP 2026; ICCP 2026; TCCP 2016) classify the general area of the Site as Management Category C, D and E Lands:

- Category C: 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.
- Category D: where cultural or renewable resources are of particular significance and sensitivity throughout the year. As with Category C, these lands and waters shall be managed so as to eliminate, to the greatest extent possible, potential damage and disruption.

- Category E: where cultural or renewable resources are of extreme significance and sensitivity. There shall be no development on these areas. These lands and waters shall be managed to eliminate, to the greatest extent possible, potential damage and disruption.

The Project is on or near the following Special Designated Lands that consider land, aquatic and marine resources important to the Inuvialuit (AICCP, ICCP and TCCP 2016; Figure A4a and A4b, Appendix A):

- Spring Goose Harvesting Areas (304C): considered a key area for subsistence hunting of geese in the spring.
- Fall Goose Harvesting Areas (312C): considered a key area for subsistence harvesting of waterfowl during the fall.
- Winter Wolverine Harvesting Areas (314C): key area for subsistence harvesting of wolverine during the winter.
- Kendall Island Bird Sanctuary (706E): valuable waterfowl breeding and staging grounds within the outer Mackenzie Delta. The islands of the outer delta are important staging grounds from late August to late September for several species of shorebirds. Shallow Bay area is an important staging area for greater white-fronted geese (*Anser albifrons*), Canada geese (*Branta canadensis*), cackling geese (*Branta hutchinsii*) and lesser snow geese (*Anser caerulescens*). Black brants (*Branta bernicla*) also migrate west through the outer Mackenzie Delta. Large numbers of shorebirds migrate through the delta area. Small islands south of Kendall Island support a colony of lesser snow geese. Tundra swans (*Cygnus columbianus*), greater white-fronted geese, sandhill cranes (*Grus canadensis*), black brant, ducks and shorebirds, nest and moult throughout this area. This area is considered a sensitive harvesting area.
- Mackenzie River Delta Key Migratory Bird Habitat (715C): considered an important nesting and breeding habitat for migratory birds from May to September.

3.3.2 Protected Areas and Archaeology

In October 2023, information about previously recorded heritage resources in the vicinity of the Site was provided by the PWNHC in Yellowknife, NWT (Smethurst 2023). The closest known archaeological site is approximately 11 km northeast of the Site. This archaeological site is classified as prehistoric and comprises scatter (lithic). Given the distance and location of this archaeological site, no interactions with any proposed Project activities are expected.

3.3.3 Pre-Disturbance Site Conditions

No studies exist describing the pre-disturbance conditions at the Site. It can be assumed that prior to oil and gas activities in the 1970s the conditions were consistent with the surrounding terrain.

4.0 RECLAMATION AND CLOSURE MEASURES

4.1 Reclamation and Closure Approach

Soil remediation will be completed at the Site, as described in the RAP. The purpose of the Project is to excavate soil with PHC concentrations above the proposed SQOs and treat on site an area of approximately 1,700 m², corresponding to an approximate soil treatment volume of 3,800 m³ using ETC. It is expected that multiple treatment cells will each treat up to 400 m³ of soil over an approximate 10 to 15 day period. The work will be staged such that while the four to five batches of soil are undergoing treatment, excavation and stockpiling will continue outside the treatment cells (See Photographs 1 and 2).



Photograph 1. ETC cell construction (West Channel Site).



Photograph 2. Winter operations of five treatment cell (West Channel Site).

The permafrost at the base of the excavation will be insulated, as necessary, to limit deterioration if exposed (during the summer). At a minimum, extruded polystyrene insulation (or soil) will be temporarily placed at the base of the excavation and topped with soil fill. Additional protection measures may be implemented as required. If after the first treatment pass, the soil CoC concentrations remain above the proposed site-specific SQOs as outlined in the RAP, the soil will undergo further ETC treatment, with the treatment temperature and duration (or both) adjusted. Following subsequent treatment, additional soil samples will be collected to verify CoC concentrations. Soil that does not meet proposed SQOs following subsequent treatment will be stockpiled for offsite disposal at an approved facility (e.g., Secure Energy's Fox Creek facility in Alberta or a similar facility in British Columbia).

Soil containing barite (measured as true total barium) at concentrations above the proposed SQOs at the Site (depths less than 1.5 mbgs) will be excavated for off-site disposal at an approved facility outside the NWT. This approach is designed specifically for this Site, which is subject to active erosion. It may not be the preferred approach at other sites with similar CoCs in the region. Given the low volume of soil exceeding the proposed SQOs for barite, no backfill is expected to be required and the excavated areas will be recontoured using balanced grading.

4.2 Recontouring and Revegetation

Following excavation, ETC treatment and confirmatory sampling, soils with concentrations of CoCs below the proposed SQO will be used to backfill the excavations and the disturbed area will be re-contoured with slopes equivalent to the surrounding landscape. The soil will be aerated or hydrated as necessary, both to reduce the temperature of the soil following ETC treatment and to prepare it for revegetation. Once treatment and backfilling

has been completed, the surface will be contoured to allow for eventual settlement to match surrounding elevations and sloped to promote overland drainage in a manner that does not further exacerbate surface erosion/scouring. Recontouring the disturbed areas as part of reclamation activities is expected to promote drainage and facilitate natural revegetation; additional re-vegetation measures (i.e., reseeded with a native seed mixture) may be implemented if natural revegetation is insufficient, or if requested by the communities or regulators.

4.3 Water Course Crossings

The proposed ice road extension from the GNWT Inuvik to Aklavik public ice road will follow the Mackenzie River East Channel and Arvoknar Channel with a snowpack ramp to access the Site. No watercourse crossing will be required for the Project.

4.4 Borrow Sources

Based on the remedial technology selected for the Site, no borrow sources are planned.

Based on the results of the technology screening and WSP's successful experience with the ETC technology at Shell's West Channel site (EISC Registry File [11/23-03]) with similar soil and CoCs, the technology is assumed to be effective at the Site (bench-scale testing using Site soil scheduled for summer 2025). As such, excavations will be filled with treated soils. Excavations will be levelled through balanced grading at the Site and recontoured to facilitate natural revegetation. In the unlikely event that bench-scale testing determines that the soil is not suitable for ETC treatment, soils exceeding the proposed SQOs for PHC will instead be excavated for appropriate out-of-territory disposal (e.g., Secure Energy's Fox Creek facility in Alberta or a similar facility in British Columbia). In this instance, an evaluation will be completed to determine if the excavations can be levelled through balanced grading or if a borrow source may be required.

4.5 Soil Excavation Site

Figure A3 (Appendix A) shows the areas of soil excavations anticipated for on-site ETC treatment (i.e., areas of soils exceeding the proposed SQOs for PHCs) and off-site disposal (i.e., the localized areas of soils exceeding the proposed SQOs for barite).

The Project-specific Erosion and Sediment Control Plan and Permafrost Protection Plan (Appendices G and H of the Project Description, respectively) will be followed during all Project activities. Details on potential effects and proposed mitigation measures are provided in the Section 14 of the Project Description. The following mitigation measures will be implemented during soil excavation and upon completion of the excavations:

- The excavation will progress in wide shallow cuts with ongoing contouring to reduce the occurrence of steep slopes/sharp edges and to facilitate non-channelized drainage.
- The excavations will be designed and managed to maintain positive drainage, minimize areas of standing water, and with an overall geometry that facilitates grading and recontouring as part of reclamation. The base of the excavation will be sloped away from the sidewalls to direct accumulated water for ease of dewatering, as necessary.
- Temporary silt fencing or other erosion control measures will be installed on steeper slopes between excavation areas and any nearby surface water.

- Temporary silt fencing or other erosion control measures will be inspected daily to ensure they are functioning adequately, and any deficiencies will be corrected immediately.
- Excavations will not daylight into downslope areas, unless required for the removal of soils exceeding the proposed SQOs. Previously identified areas of soils exceeding the proposed SQOs will be delineated and marked in the field prior to commencing excavations.
- Following the backfill of the excavated areas, the area will be re-contoured comparable to the Site's original topographical state, matching the surrounding landscape to facilitate natural revegetation.

4.6 Dismantling and Removal of Temporary Treatment Facilities and Equipment

If remedial activities are completed during the winter of 2026, then the office trailer, soil treatment equipment, skid steers, loaders, excavators, fuel trucks and fuel tanks and the potential winter camp may be demobilized from the Site via ice road prior to breakup. Some equipment may be secured on the barge camp (potentially anchored at the Site) to be demobilized from the Site following 2026 spring breakup. Fuel tanks will be emptied prior to demobilization of Project staff. Any hazardous or non-hazardous waste will be collected and transported to Inuvik for appropriate disposal.

If remedial field execution extends into the spring/summer of 2026, select equipment (including the barge, if using) may be left at the Site (or on the barge, potentially anchored at the Site) during the spring thaw. Precautions such as the removal of mobile equipment and fuel, as well as securement of any remaining structures will be implemented to guard against potential damage from flooding and high-water levels in the Arvoknar Channel during freshet. The barge camp (potentially anchored at the Site) may be demobilized after breakup or left to remain for summer activities. Re-mobilization of equipment (including a barge camp if a winter camp was used during the winter program) and personnel and final demobilization would then occur by barge and boat during the summer/fall of 2026.

4.7 Wood Piling Removal

The remaining wood pilings at the Site will be removed during a 2027/2028 winter field program, so that they do not become a navigation hazard through the natural erosion of the Site by the Arvoknar Channel. Ice road construction, accommodations (winter camp) and mobilization will follow that described in Sections 6.3.1 to 6.3.3 of the Project Description.

Using existing wood piling information, the pilings will be located and marked by a surveyor. The pilings are reported to have been installed to a depth of 6.0 mbgs or greater and are proposed to be removed using the previously employed perimeter drilling method (EISC Registry File [10/22-01]). A dozer will first be used to clear snow at and around the pilings. The pilings on land are assumed to be fully frozen in place, and the pilings area will be flooded, if needed, to provide the drill rig access and set-up. Water use will be less than 99 m³ of water per day and the water requirement will be for a duration of approximately eight weeks. The field crew will maintain a water withdrawal log that will include, at a minimum, the day, time, water body and location, name of contractor/employee and volume of water withdrawn. A drilling rig will then be used to drill a series of close-proximity boreholes around the perimeter of the targeted wood piling (e.g., a daisy pattern) with a target depth of between 3 and 5 mbgs. The pilings will then be extracted using either a logger choker attached to the piling and pulled out by excavator or using the drilling rig winch line to pull out the pilings. The holes will be backfilled and compacted with the drill cuttings created by the perimeter drilling process.

Based on previous laboratory results of collected piling samples, the wood pilings will be temporarily stockpiled securely on site during the winter program prior to transportation for offsite disposal at an approved facility (e.g., Secure Energy's Fox Creek facility in Alberta or a similar facility in British Columbia). No additional soil sampling is expected to be completed during these activities.

4.8 Schedule of Reclamation and Closure Activities

The proposed Project schedule is presented in Table F below.

Table F: Proposed Project Schedule

Project Activity	Estimated Time Frame ¹
Engagement and consultation	Ongoing
Regulatory permitting	January to December 2025
Logistics planning	November to December 2025
Field program – Ice Road Reconnaissance and Construction	December 2025 to February 2026
Field program – Soil Barite Remediation (winter), removal of select wood pilings, borehole drilling and thermistor installation, destabilization of top 10 m of grout fill above the well stub	February to April 2026
Field program – Limited Site Reconnaissance	Summer 2026
Mobilization of barge camp (if using) and select PHC remediation equipment for planned winter 2027 activities	Summer 2026
Field program – Ice Road Reconnaissance and Construction	December 2026 to February 2027
Field program – Soil PHC Remediation (winter)	February to April 2027
Field program – Soil Remediation (summer/fall; if required) and Reclamation	July to August 2027
Post-Remedial Groundwater Monitoring Well Installation and Thermistor Installation (if needed), and Monitoring	July 2027 to August 2027
Post-Remedial and Monitoring	July to August 2028
Final Wood Pilings Removal (anticipated)	December 2028 to April 2029
Contingency (in case of unforeseen delays)	May 2029 to April 2030

Note: Final demobilization may occur via ice road or barge depending on the progress of the soil treatment.

¹In the event that permitting or other unforeseen project delays affect the proposed schedule, the estimated timeframes may extend by one to two years, depending on the nature of the delay.

5.0 MONITORING PLAN

5.1 Monitoring During Remediation

5.1.1 Confirmatory Sampling

Confirmatory sampling will be conducted to verify that proposed soil SQOs have been met. The following sections describe the sampling programs for these purposes as part of the remediation program.

5.1.2 Confirmatory Sampling – Excavation Extents

The approximate extent of excavation will be staked prior to beginning work. Once the proposed limits (vertical and lateral) of the excavation have been approached, discrete soil samples will be collected on an approximate 10 m by 10 m grid, within a 0.2 m perpendicular distance (i.e., inward) of the excavation surface, as recommended in Canadian Council of Ministers of the Environment (CCME) guidance (2016). Note that, where appropriate, (e.g., where there are sufficient historical soil analytical data from recent [i.e., within the last two years] borehole drilling investigations), that data will be relied upon for confirmation of excavation extents, pending the results of field screening at the aforementioned sampling frequency during remediation.

Soil samples may also be collected at denser spacing in areas of visible anomalies (e.g., thin layers of coarse soil expected to exacerbate potential PHC migration). A portion of each sample will be placed in a plastic bag with approximately 50% air space for field screening of combustible and volatile hydrocarbons (after 20 minutes or reaching ambient temperature) using a calibrated organic vapour analyzer set to methane elimination mode. If significant headspace vapours (>500 parts per million by volume [ppm_v]), to be adjusted in the field as needed) or PHC odours/staining are detected at its estimated pre-construction limits, the excavation will be extended and another sample will be collected for field screening and possible laboratory analysis.

If a collected soil sample presents no obvious signs of PHCs (i.e., odour, staining not present, low headspace vapour concentration), a portion of the sample will be placed in laboratory supplied containers specific to the analyses to be conducted, and placed on ice in a cooler pending shipment to the laboratory. Backfilling of the excavation with treated soils may occur while awaiting final laboratory results to confirm excavation extents. If PHC concentrations exceed proposed SQOs, additional soil will be excavated, and the sampling process repeated until acceptable results are obtained.

5.1.3 Confirmatory Sampling – Effectiveness of PHC Treatment

For confirmation of successful treatment, soil samples will be collected from treated soils in general accordance with British Columbia Ministry of Environment and Parks (formerly Environment and Climate Change Strategy) Technical Guidance 1 (BC ENV 2023a) and Protocol 19 (BC ENV 2023b), as endorsed by CCME (2016), and submitted for laboratory analysis. The guidance recommends that for non-waste soils, at least three samples be collected and analyzed for the first 130 m³, with at least one additional soil sample collected and analyzed for each 130 m³ of stockpiled soil (i.e., a minimum of five samples for a stockpile of 300 to 400 m³). Each treatment stockpile will be divided into a minimum of four segments lengthwise, such that each segment will be comprised of approximately 75 to 100 m³ of treated soil. A minimum of three soil samples will be collected from each segment, from depths centred around the lateral heat conduction piping of approximately 0.3, 0.9, and 1.5 mbgs, depending on stockpile geometry (12 samples, total). Test pits will be excavated for retrieval of each sample, staggered laterally in each segment. This sampling methodology allows for greater confidence in the consistency of treatment across the stockpile and allows for segregation of discrete volumes of soil in the event that the PHC concentrations exceeds its proposed SQO (i.e., the soil would be extracted from midpoint to midpoint both laterally and vertically between the soil not meeting the proposed SQOs and the next closest points that do). Additional samples will be collected for quality assurance and quality control purposes as described further in Section 7.3 of the RAP.

Soil samples will be collected pre-quenching, once the soil has slightly cooled. Given the expected temperature of the treated soil, samples cannot be transferred directly from the stockpile into laboratory-supplied jars given the potential for damage (i.e., melting lids). As such, the samples will be transferred temporarily to stainless steel

bowls and covered to eliminate headspace to the extent practicable. Once the sample is cooled to a reasonable handling temperature, the samples will be transferred to glassware for shipment to the laboratory for analysis.

Once efficacy of the ETC process has been verified through soil analysis, the excavated segments will be backfilled with the treated and cooled soil, in nominally compacted lifts. Cooling of the soil is expected to occur through incidental aeration through handling and stockpiling or hydrated and quenched (summer only) after treatment while waiting for analytical results before backfilling.

5.1.4 Thermal Monitoring

Thermistors will be installed at the Site prior to remediation activities to allow for assessment of baseline and post-remediation permafrost conditions within and immediately outside the area in which the ETC treatment units will be situated, and in a location away from historical site activities (i.e., a background location). The locations of the proposed new thermistors are presented in Figure A3 (Appendix A). They will be used to both monitor potential permafrost degradation beneath the proposed thermal break (e.g., rig mats) underlying the treatment area thus allowing for process adjustments, as needed, during remediation and allow for monitoring of permafrost conditions post-remediation.

5.2 Post Remedial Monitoring

A post-remedial monitoring program will consist of visual inspections, groundwater sampling, and permafrost monitoring in scheduled intervals, with the flexibility to re-evaluate the program frequency over time. A description of each element of the monitoring is provided below and are subject to change based on post-remediation conditions and regulatory requirements (e.g., through the future IWB Water Licence).

5.2.1 Visual Inspection

Visual inspections are to be carried out throughout the duration of remedial activities and as part of the post-remedial monitoring and will consist of walkthroughs of the entire Site. Site conditions will be recorded, with digital, georeferenced photographs taken to document conditions and provide a visual backup of the field notes. Examination of the following components will be emphasized during the visual inspections:

- areas disturbed during remedial activities – assess any soil slumping, areas of standing water, and the progress of vegetative growth
- thermistors and monitoring wells – assess condition of each and carry out maintenance or repairs (or note the need for replacement, as necessary)
- Arvoknar Channel riparian zone – continue to observe signs of natural erosion/scour due to high water or ice.

5.2.2 Groundwater Sampling

While no new monitoring well installations are expected prior to the onset of remedial activities, and there has been an absence of PHCs in groundwater at the Site, it is anticipated that post-remedial monitoring of suprapermafrost groundwater quality will be required as part of permit conditions. If required, the post-remedial monitoring wells will be installed into 150 mm diameter boreholes drilled using solid stem augers mounted on a track-mounted drill rig. Monitoring wells may also be installed manually using drive-points or hand augered, as ground conditions allow. Upon installation, monitoring well locations will be surveyed and the RC&MP updated. The locations of the proposed monitoring well installations are presented in Figure A3 (Appendix A).

The monitoring wells will be developed following installation, after which the first sampling event will occur. Existing monitoring wells will also be evaluated to determine if redevelopment is required. The preferred sampling method (if sufficient groundwater quantities are available) is the low flow/minimal drawdown method (ASTM 2006; EPA 1996 and updates). In accordance with this method, groundwater samples will be collected after stability is observed in electrical conductivity, pH, turbidity, dissolved oxygen, oxidation-reduction potential and temperature during purging. If groundwater volumes are not sufficient for adherence to this method (as has been found to be the case at the Site from time to time), grab samples will be collected using a bailer. Groundwater samples will be submitted for laboratory analyzes for the established CoCs at the Site.

Existing monitoring wells (presented in Figure 4, Appendix A of the RAP) may be monitored and sampled as part of the post-remedial activities. However, a number of these wells will be removed during remediation, as they are within the remedial footprint or near the boundary/in areas where mobile equipment will be operating. Only any such monitoring wells deemed critical for post remediation monitoring would be replaced. Any of the monitoring wells removed from areas that will not be excavated will be properly decommissioned by over-drilling and removal of the PVC casing, and backfilling with bentonite.

Consistent with historical monitoring events at the Site, development and purge water will be disposed of at an approved facility off site.

Based on the intermittent presence and absence of established CoCs in groundwater at the Site, it is proposed that post-remedial groundwater monitoring will cease once either of the following conditions are triggered.

- Results of laboratory analysis from two groundwater monitoring and sampling events for established CoCs at the Site are below the applicable guidelines for receptors and exposure pathways as defined in the RAP.
- If after two monitoring and sampling events groundwater monitoring wells are shown to be dry or contain insufficient water volumes for sampling and laboratory analysis.

Upon closure of the future IWB Water Licence, the monitoring well network will be fully decommissioned, as described above.

5.2.3 Permafrost Monitoring

Following remediation, post-remedial (additional) thermistors are planned to be installed within the backfilled excavations. Thermistors will monitor permafrost in the remedial footprint in comparison with the data collected from the pre-remedial thermistors as well as thermal data collected during the remedial activities. This information will be used as a comparison for post-remedial thermistor data, to confirm that the permafrost is returning towards baseline conditions, accounting for any potential natural degradation due to the proximity to the Arvoknar Channel. The locations of the proposed post-remedial thermistors are presented on Figure A3 (Appendix A).

The thermistors will be installed to projected depths ranging from approximately 8 to 15 mbgs, with up to 20 sensors installed in each, depending on actual borehole depths as dictated by drill rig capabilities in the permafrost.

Thermistor system data downloads, repairs, maintenance or replacement activities are proposed to coincide with scheduled post-remediation groundwater monitoring events (Section 5.4).

Upon closure of the future IWB Water Licence, the thermistors will be decommissioned by over-drilling and removal of the PVC casing and thermistor components, followed by backfilling with bentonite.

5.3 Contingency

The regulators will be informed if, during any of the monitoring, it becomes evident that:

- there are water quality issues;
- there are failure or erosion concerns within the areas of soil replacement;
- there are revegetation concerns;
- there are permafrost concerns; or
- any other issues are noted at the Site.

In the event of identified issues, a revised monitoring program will be developed for approval by the IWB and the new plan will take effect upon IWB approval. Modifications may include changes to monitoring activities, to monitoring parameters or to the monitoring schedule.

5.4 Schedule of Post-Remedial Monitoring Activities

The Project area will be monitored according to the proposed schedule in Table G to confirm that mitigation, natural vegetation, erosion control and reclamation efforts have been successful. The results of the monitoring, including analytical results and photographs, will be reported as required (e.g., in the annual reports submitted to the IWB).

Table G: Post-Remedial Monitoring Schedule

Year Post-Remediation	Activities
0 (summer/fall 2027)	Visual Site inspection, thermal monitoring (i.e., download thermistors), groundwater monitoring and sampling)
1 (summer/fall 2028)	Visual Site inspection, thermal monitoring (i.e., download thermistors), groundwater monitoring and sampling)

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Chamberlain, G. 2025. Officer, Navigation Protection Program, Prairie and Northern Region Transport Canada / Government of Canada. E-mail: Gordon.Chamberlain@tc.gc.ca. 25 February 2025

7.0 STATEMENT OF LIMITATIONS

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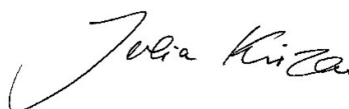
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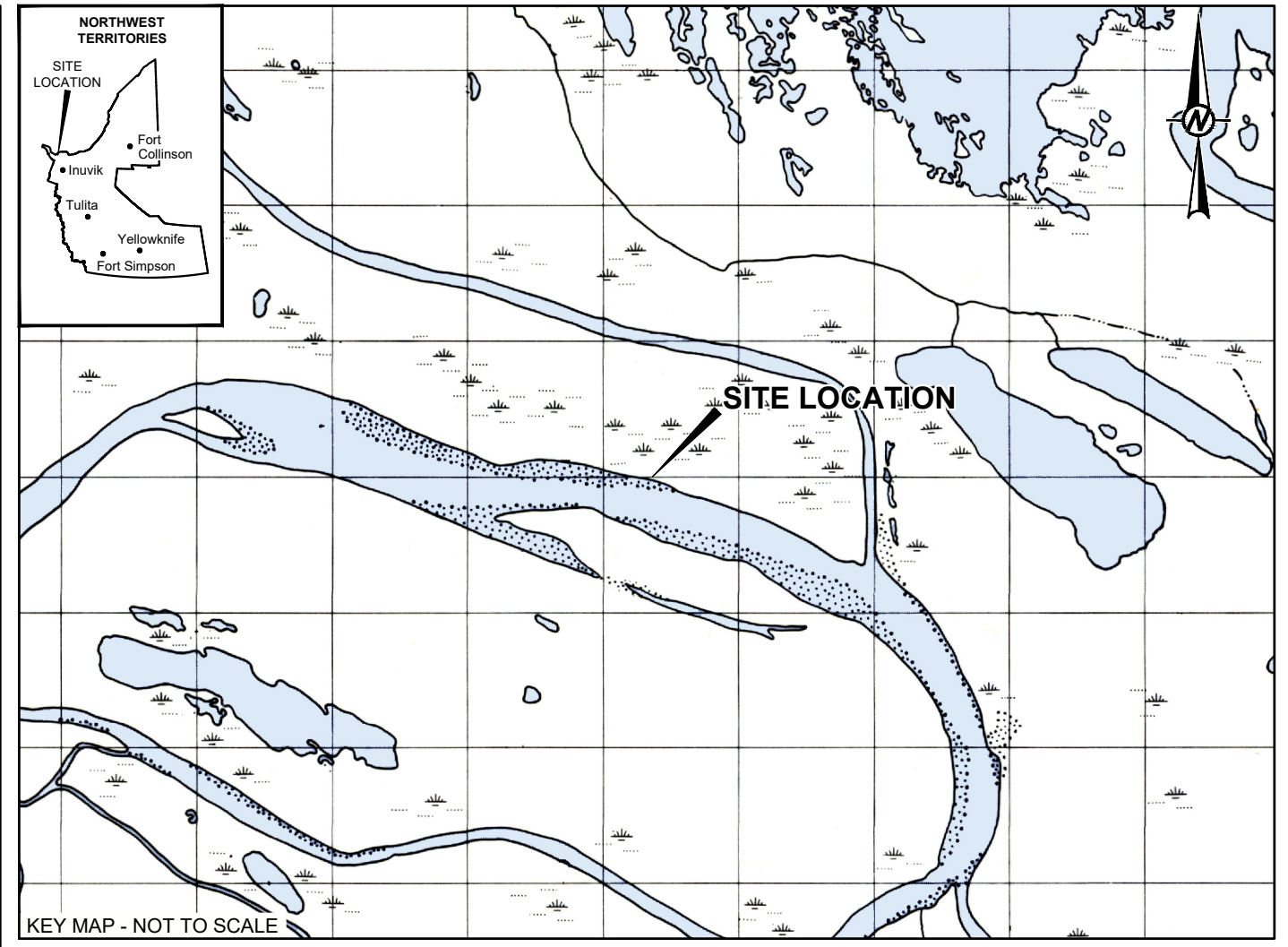
APPENDIX A

Figures

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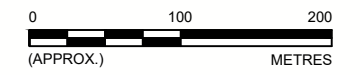


LEGEND

--- 2024 SHORELINE

REFERENCE

IMAGE OBTAINED FROM GOOGLE EARTH © 2024 GOOGLE INC. USED WITH PERMISSION. GOOGLE AND GOOGLE LOGO ARE REGISTERED TRADEMARKS OF GOOGLE INC. IMAGERY DATE: 4 JUNE 2019. GOOGLE EARTH IMAGE IS NOT TO SCALE. DATUM: NAD83, PROJECTION: UTM ZONE 8.
 TOPOGRAPHIC MAP 107C/04 OBTAINED FROM Canmatrix. © 1958 THE ARMY SURVEY ESTABLISHMENT, R.C.E. PROJECTION: TRANSVERSE MERCATOR; DATUM: NAD27; COORDINATE SYSTEM: UTM ZONE 8. TOPOGRAPHIC MAP HAS BEEN SHIFTED FROM NAD27 TO NAD83 FOR MAPPING PURPOSES.



CLIENT
SHELL CANADA LIMITED

CONSULTANT	YYYY-MM-DD	2026-02-05
	DESIGNED	SVilleneuve
	PREPARED	SSun
	REVIEWED	JKrizan
	APPROVED	BVervoort



PROJECT
SOIL REMEDIATION
FORMER UNIPKAT I-22 WELLSITE
INUVALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES

TITLE
SITE LOCATION PLAN

PROJECT NO.	PHASE-TASK	REV.	FIGURE
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LEGEND

- ★ SITE LOCATION
- CONSTRUCTED UNIPKAT I-22 ICE ROAD
- - - AKLAVIK ICE ROAD
- ▭ SETTLEMENT REGION BOUNDARY
- ▨ KENDALL ISLAND BIRD SANCTUARY

INUVALUIT PRIVATE LANDS

- ▭ SURFACE TITLE
- ▭ SURFACE AND SUBSURFACE TITLE

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE

1. CONTAINS INFORMATION LICENSED UNDER THE OPEN GOVERNMENT LICENSE - CANADA
2. BASE MAP: EARTHSTAR GEOGRAPHICS
3. COORDINATE SYSTEM: NAD 1983 CSRS UTM ZONE 8N



CLIENT
SHELL CANADA LIMITED

PROJECT
SOIL REMEDIATION
FORMER UNIPKAT I-22 WELLSITE
INUVALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES

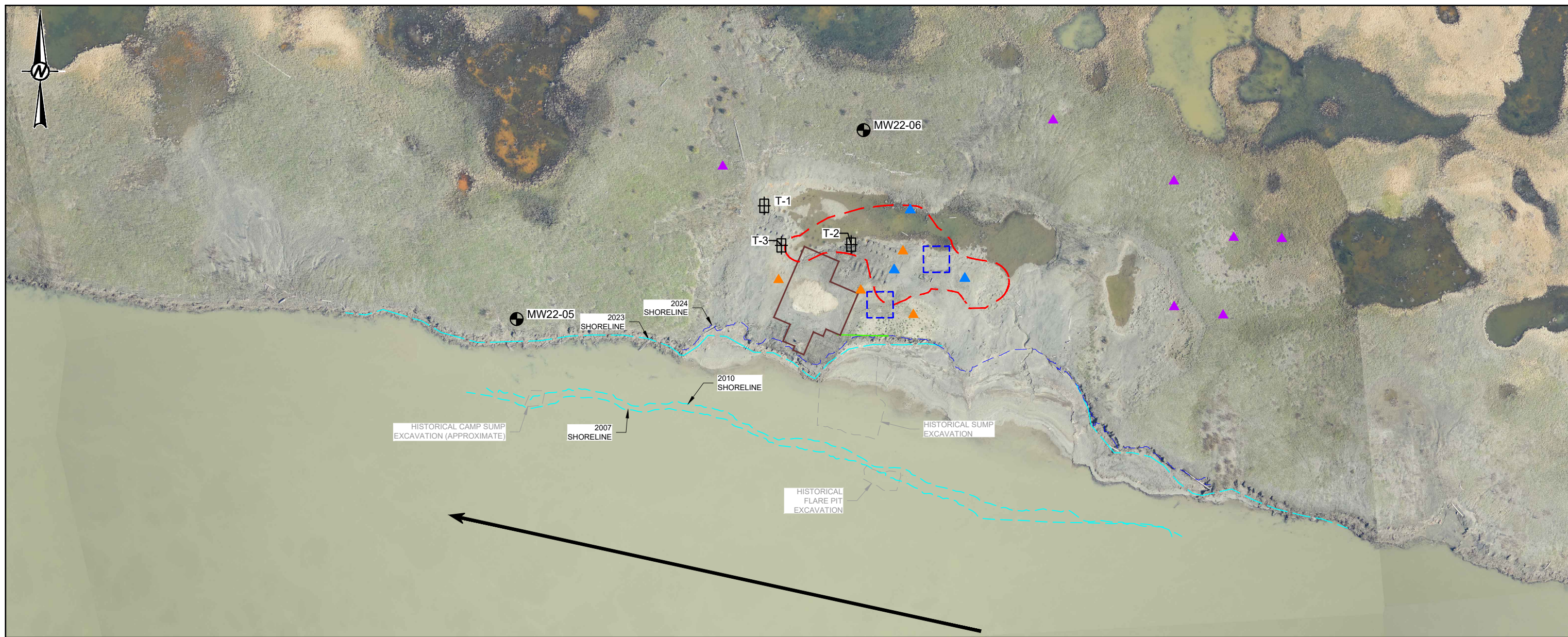
TITLE
SITE LOCATION WITH PROPOSED ICE ROAD

CONSULTANT	WSP	YYYY-MM-DD	2026-02-05
DESIGNED		SVilleneuve	
PREPARED		SSun	
REVIEWED		JKrizan	
APPROVED		BVervoort	

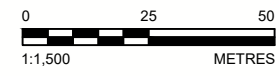
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LEGEND	
	AREA OF REMAINING WOOD PILES
	EXCAVATION LIMITS (FORMER)
	SHORELINE
	OVERALL EXCAVATION EXTENTS FOR SOIL WITH PHC CONCENTRATIONS EXCEEDING SQOs FROM SURFACE TO 3.0 mbgs
	OVERALL EXCAVATION EXTENTS FOR SOIL WITH PHC CONCENTRATIONS EXCEEDING SQOs FROM SURFACE TO 1.5 mbgs
	MONITORING WELL (EXISTING)
	THERMISTOR LOCATION
	POST-REMEDIAL GROUNDWATER MONITORING WELL
	PRE-REMEDIAL THERMISTOR
	PRE AND POST-REMEDIAL THERMISTOR
	DIRECTION OF WATER CHANNEL FLOW



- NOTES**
- ALL LOCATIONS ARE APPROXIMATE AND SUBJECT TO CHANGE BASED ON ACTUAL FIELD CONDITIONS.
 - GPS COORDINATES PROJECTION: TRANSVERSE MERCATOR; DATUM: UTM83; COORDINATE SYSTEM: UTM ZONE 8.

REFERENCE
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 ADDITIONAL INFORMATION OBTAINED FROM IEG CONSULTANTS LTD.; PROJECT No.: A04025A02; SCALE: 1:750; DATE: SEPTEMBER 20, 2011.

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SHELL CANADA LIMITED

CONSULTANT	
YYYY-MM-DD	2026-02-05
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REVIEWED	JKrizan
APPROVED	BVervoort



PROJECT		
SOIL REMEDIATION		
FORMER UNIKAT I-22 WELLSITE		
INUVIALUIT SETTLEMENT REGION, NORTHWEST TERRITORIES		
TITLE		
REMEDIAL EXTENTS FOR TYPE B PETROLEUM HYDROCARBONS AND BARITE (TRUE TOTAL BARIUM)		
PROJECT NO.	PHASE-TASK	REV.
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FIGURE	A3	

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