REPORT

Inuvialuit Water Board Water Licence N5L8-1837
Reclamation, Closure and Monitoring Plan

2020 RECLAMATION, CLOSURE AND MONITORING PLAN

Submitted to:

Inuvialuit Water Board
P.O. Box 2531
151 Mackenzie Road
Mack Travel Building, 2nd Floor
Inuvik, NT X0E 0T0

Submitted by:

Golder Associates Ltd.
9, 4905 - 48 Street Yellowknife,
X1A 3S3

+1 867 873 6319
1780495
June 26, 2020
Distribution List
E-Copy, 3 Hard Copies - Inuvialuit Water Board
E-copy - Golder Associates Ltd.
E-copy - Repsol
# Table of Contents

## 1.0 INTRODUCTION

1.1 Site Location ......................................................................................................................... 1
1.2 Issues of Concern .................................................................................................................... 1
1.3 Reclamation Objectives .......................................................................................................... 2
1.4 Site Specific Reclamation Criteria

### 1.4.1 Physical Stability ........................................................................................................... 2

### 1.4.2 Chemical Stability ......................................................................................................... 3

### 1.4.3 Ecological Stability ....................................................................................................... 3

### 1.4.4 Climate and Geographic Stability .................................................................................. 3

## 2.0 BACKGROUND

2.1 Site History .......................................................................................................................... 4
2.2 Regulatory Background ......................................................................................................... 5

## 3.0 ENVIRONMENTAL BASELINE

3.1 Physical Environment

### 3.1.1 Climate .......................................................................................................................... 6

### 3.1.2 Terrain and Topography ............................................................................................... 7

### 3.1.3 Permafrost Condition .................................................................................................. 7

### 3.1.4 Pingos .......................................................................................................................... 8

### 3.1.5 Surface Water Hydrology

#### 3.1.5.1 Standing Water ........................................................................................................ 8

#### 3.1.5.2 Watercourses ......................................................................................................... 8

### 3.1.6 Groundwater and Surface Water Quality .................................................................... 9

### 3.1.7 Groundwater Monitoring ............................................................................................. 9

3.2 Biological Environment

### 3.2.1 Vegetation .................................................................................................................... 10

### 3.2.2 Freshwater Biota and Habitat ...................................................................................... 11

### 3.2.3 Terrestrial Wildlife and Habitat ................................................................................... 12
June 26, 2020

3.2.3.1 Peary Caribou ............................................................................................................................ 13
3.2.3.2 Muskox ....................................................................................................................................... 13
3.2.3.3 Wolf ............................................................................................................................................ 13
3.2.3.4 Arctic Fox ................................................................................................................................... 14
3.2.3.5 Arctic Hare ................................................................................................................................. 14
3.2.4 Avian Wildlife and Habitat ............................................................................................................. 14
3.3 Land Use ............................................................................................................................................ 17
3.3.1 Hunting and Fishing ...................................................................................................................... 17
3.3.2 Protected Areas and Archaeology ................................................................................................ 17
3.3.3 Pre-Disturbance Site Conditions ................................................................................................... 18

4.0 RECLAMATION AND CLOSURE MEASURES ............................................................................. 18
4.1 Reclamation and Closure Approach ................................................................................................ 18
4.2 Re-contouring and Revegetation .................................................................................................... 18
4.3 Water Course Crossings ................................................................................................................... 19
4.4 Borrow Source ................................................................................................................................... 19
4.5 Soil Excavation Areas ...................................................................................................................... 20
4.6 Dismantling and Removal of Temporary Camps and Fuel Storage Area ....................................... 21
4.6.1 Temporary Camps ....................................................................................................................... 21
4.6.2 Temporary Fuel Storage Areas ..................................................................................................... 21
4.7 Dismantling and Removal of Butler Building .................................................................................. 21
4.8 Removal of Equipment ..................................................................................................................... 22
4.9 Schedule of Reclamation and Closure Activities ........................................................................... 23
4.9.1 Work Completed in 2017 .............................................................................................................. 23
4.9.2 Work Completed in 2018 .............................................................................................................. 23
4.9.3 Work Completed in 2019 .............................................................................................................. 24
4.9.4 Work to be Completed in 2021 .................................................................................................... 25
4.9.5 Work to be Completed in 2022 .................................................................................................... 25
4.9.6 Work to be Completed in 2023 .................................................................................................... 25
4.9.7 Work To be Completed in 2024 .................................................................................................... 26
5.0 MONITORING PLAN .................................................................................................................................... 26
  5.1 Monitoring During Remediation.............................................................................................................. 26
  5.2 Post-construction monitoring .................................................................................................................. 27
    5.2.1 Visual Inspections ........................................................................................................................... 27
    5.2.2 Groundwater Sampling .................................................................................................................... 27
    5.2.3 Seepage and Runoff Sampling ......................................................................................................... 28
    5.2.4 Soil Sampling .................................................................................................................................. 28
    5.2.5 Thermal Monitoring ...................................................................................................................... 29
  5.3 Contingency ......................................................................................................................................... 31
  5.4 Schedule of Monitoring Activities ........................................................................................................ 31
6.0 CLOSURE ................................................................................................................................................ 33
7.0 REFERENCES .......................................................................................................................................... 34

TABLES
Table 1: Permits and Licences .................................................................................................................................. 6
Table 2: Rare Plant Species Potentially Occurring in the Satellite Bay Area* ......................................................... 11
Table 3: Fish Species that may be found in the Project Area ................................................................................ 11
Table 4: Federally and / or Territorially Listed Species ...................................................................................... 12
Table 5: Post-construction Monitoring Activities ..................................................................................................... 31

APPENDICES
APPENDIX A
Figures
### SUMMARY OF CHANGES

The table below is a summary of changes.

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Description</th>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 25, 2020</td>
<td>Revised dates</td>
<td>Cover page and headers</td>
<td>-</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Revised dates</td>
<td>4.3</td>
<td>19</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Revised dates</td>
<td>4.4</td>
<td>19</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Revised schedule</td>
<td>4.6.1</td>
<td>21</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Revised dates</td>
<td>4.9</td>
<td>23</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Revised dates</td>
<td>4.9.2</td>
<td>23</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Revised dates</td>
<td>4.9.3</td>
<td>24</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Revised dates</td>
<td>4.9.4</td>
<td>25</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Revised dates</td>
<td>4.9.5</td>
<td>25</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Added section due to change in schedule</td>
<td>5.2</td>
<td>27</td>
</tr>
<tr>
<td>June 25, 2020</td>
<td>Revised dates</td>
<td>5.4</td>
<td>31</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION
1.1 Site Location

The Repsol Oil and Gas Canada Inc. (Repsol) Site Remediation of the Panarctic F-68 Abandoned Wellsite (Site), Satellite Bay, Prince Patrick Island, Northwest Territories (NWT; the ‘Project’) is undertaken in compliance with Inuvialuit Water Board (IWB) Type “B” Water Licence N5L8-1837 (the ‘Water Licence’) (IWB 2016). Repsol is the Licensee and Clifton Associates Ltd. is the Prime Contractor for the Project. Golder Associates Ltd. (Golder) completes the environmental sampling, is the designer of record for the Containment Structure and completed all construction and borrow activities on behalf of Repsol. Golder is also responsible for completion of the reports to the IWB for this program.

The Water Licence requires that a Reclamation, Closure and Monitoring Plan (RC&MP) be completed for the Site to outline the post-construction reclamation, closure and monitoring activities at Panarctic Site F-68, located on Prince Patrick Island, in the NWT (the Site). The Site location is shown in Figure 1 and overview is shown in Figure 2 (both in Appendix A). In addition, a temporary camp and fuel storage area will be established at Mould Bay on the south end of Prince Patrick Island using an existing air strip and adjacent apron area owned by Environment and Climate Change Canada (ECCC). Figure 3 (Appendix A) provides an overview of planned Project components at Mould Bay.

This RC&MP was developed for the Project in compliance with the Water Licence requirements to outline the remediation activities and construction of an engineered Contaminated Soil and Waste Containment Structure (hereafter referred to as the Containment Structure and the Containment Cell [the portion of the structure that is below the liner]). Wherever applicable, the RC&MP references and refers to other plans prepared for approval by the IWB. Plans referenced in the RC&MP include the following:

- Waste Management Plan;
- Spill Contingency Plan;
- Surveillance Network Program Plan;
- Remediation Action Plan; and
- Pre-construction Containment Structure Design Report

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

The 2019 Annual Report submitted to the IWB on March 30, 2020 describes the Project components that were completed in the 2019 field season and the planned tasks for subsequent years to complete the Project. Post Construction (As-Built) drawings for the Containment Structure are contained in Appendix I of the 2019 Annual Report. There will be no work undertaken at the Site in 2020.

1.2 Issues of Concern

There are several issues of concern related to the Site stemming from historic well site activities. These issues have been assessed since 2008 and were considered in developing the Project scope of work, including:

1) Soils impacted with petroleum hydrocarbons (PHC), barium, lead, nickel, chromium, tin, zinc, molybdenum, and copper at concentrations above applicable guidelines;
2) Buried waste contributing to soil and groundwater impacts;
3) Exposed waste that can create an exposure risk to ecological receptors; and
4) Degradation of permafrost that creates the following:
   a. ponded water adjacent to buried waste and impacted soils; and,
   b. general slumping throughout buried waste areas.

1.3 Reclamation Objectives
Repsol is committed to carry out all activities associated with the design, operation, closure, reclamation and
monitoring of the Project in a way that minimizes the risk of negative impacts on the environment, terrestrial,
aquatic and avian wildlife, and humans.

Based on our understanding of the issues of concern (as described in Section 1.2 above) and subsequent analyses
of management and mitigation of the concerns, the following objectives have been developed:

1) Minimize disturbance;
2) Thermally stabilize the ground to limit migration from areas of impacted soil and the containment cell;
3) Backfill ponded areas in the footprint of the Containment Structure and within a 10 m buffer to prevent direct
   contact of water with impacted soil;
4) Excavate impacted soils within the active layer outside of the containment cell footprint to permafrost;
5) Consolidate impacted soils and existing buried waste beneath an engineered thermal cover to prevent
   exposure to human, wildlife, groundwater and surface water receptors;
6) Remove all encountered waste and surface debris (including the Butler Building and contents) from the
   Site to prevent exposure to human, wildlife and water receptors, in compliance with all applicable permits,
   licences and legislation;
7) Design the thermal cover consistent with observed local landforms to minimize erosion;
8) Minimize safety risks (e.g., minimize time on Site, number of personnel required, number of flights required);
   and,
9) Comply with all applicable laws, permits and licences.

1.4 Site Specific Reclamation Criteria
1.4.1 Physical Stability
The only project components remaining at the Site after closure will be the Containment Structure, the tower
structure supporting the solar panel and power for the thermistors and the unmaintained air strip. As outlined in
the Remediation Action Plan (developed for the IWB and submitted with the 2019 Annual Report), measures have
been implemented to ensure that the Containment Structure is physically stable, does not erode, subside, or
move from its location under natural events or disruptive forces.

The edges of the embankment will be graded to an inclination of six horizontal to one vertical (6H:1V) or flatter to
promote airflow across the top of the Containment Structure and minimize snow drifting. Minimizing snow drifting
is important in order to provide long term stability, since snow insulates the ground surface and negatively impacts
June 26, 2020

a thermal closure. Snow drifts also may be an area where wildlife can den during the winter and potentially
damage the closure cap. A relatively flat side slope is also expected to be more stable and less susceptible to
erosion than steeper slopes during spring break-up when portions of the slope may be locally saturated as snow
melts and excess water drains. All fill and side slopes will be compacted thoroughly, and no frozen material will be
used during constructing the side slopes. These measures are in place to further minimize the potential for
erosion. In addition, shallower slopes are less likely to attract curious wildlife that could potentially dig or otherwise
impact the Containment Structure.

The surface of the Containment Structure will be graded so that precipitation does not pond and so that runoff
drains to the edges of the cap without causing erosion or gullying. The surface grades will be between 2% to 5%.
In addition, the surrounding ground surface will be graded so that runoff flows away.

In general, some post-construction settlement and annual heave should be anticipated as the ground freezes and
thaws. It is anticipated that the post-construction settlement will be low, especially after the core freezes during
the first winter after construction, since the fill for the thermal cap is comprised of unfrozen sand that is placed
in the summer.

1.4.2 Chemical Stability

The only project components remaining at the Site after closure are the Containment Structure, thermistor tower
and the unmaintained air strip. Measures have been implemented to ensure that the impacted soil is
stabilized through use of a geosynthetic liner and placement of a thermal cap to keep the impacted soils frozen.
This will ensure that that seepage or runoff will not endanger human, wildlife, or environmental health and safety
and therefore will not result in the inability to achieve the water or soil quality objectives in the receiving
environment. The thermal cover was constructed from local sand and the liner system (an impermeable, 40 mil,
linear low density polyethylene geomembrane combined with two layers of medium weight non-woven geotextile
as described in detail in the Remediation Action Plan) used in the Containment Structure was chosen because it
is non-reactive, designed for use in arctic environments, and will freeze in place with the impacted soil.

1.4.3 Ecological Stability

Upon completion of construction and removal of all debris, barrels and other structures from the Site, the
topography of the structure will be equivalent to the surrounding landscape.

The surrounding landscape on Prince Patrick Island is barely vegetated and is considered a region of Polar Desert
soils. It is desert-like, with low vegetation limited to the lower, wetter areas. Polar Desert soils typically have a
surface covered with closely packed pebble and cobble-sized rock fragments (Tedrow et al. 1968). This was
confirmed during previous Site visits.

1.4.4 Climate and Geographic Stability

Recent research in the Canadian Arctic is showing evidence of changing coastal zone landscapes and coastal
stability resulting from changing sea ice conditions, storm exposure, and warming permafrost. Affected regions
include the southern Beaufort Sea to the central Arctic, the Baffin coast, Foxe Basin and Hudson Bay, Nunavik
and Nunatsiavut (Bell and Forbes 2011).

Combining data on global sea level changes (from changing climate), postglacial rebound (called vertical land
motion), and the contribution to global sea-level rise from major ice-caps worldwide (called sea-level
fingerprinting), sea-level projections have been estimated for Arctic regions (GNWT 2015).

In the Canadian Arctic, vertical land motion is mainly a delayed response to the thinning and retreat of the
continental ice sheets from the last ice age. Vertical land motion affects sea level changes on a local scale and
can differ between different coastal areas in the same region. If the land is sinking, sea levels will rise locally, and if the land is rising, sea level rise will decrease. In some parts of Nunavut, the land is rising at a rapid rate of almost one centimetre (cm) per year which results in decreased sea level rise for example in Iqaluit and Arviat (Bell and Forbes 2011). Most coastal communities in the NWT are located near the periphery of the former ice sheet and vertical land motion is much slower than in Nunavut and therefore sea levels are not impacted as much by this phenomenon (GNWT 2015).

No information on projected sea level changes is available for Satellite Bay or Prince Patrick Island. However, Ulukhaktok and Sachs Harbour are the closest communities to Satellite Bay and projections on these communities are available (GNWT 2015). Along the NWT Beaufort Sea coast, vertical land motion estimates range from an uplift of the coast of about 1 millimetre (mm) per year at Ulukhaktok, to subsidence of 1 mm per year at Sachs Harbour. These estimates do not take into account subsidence resulting from compaction or thawing permafrost or tectonic activity.

In addition to vertical land motion, local sea levels are affected by the uneven redistribution of meltwater from glaciers, ice caps, and ice sheets (sea-level fingerprinting). Sea levels will fall in proximity to a body of ice that is melting and providing its meltwater to the oceans. Areas that are further away from melting glaciers will experience rising sea levels. In the Canadian Arctic, the melting ice cap in Greenland is contributing to global sea level rise. The effect on the sea level at Ulukhaktok is estimated be -0.1 mm per year (decrease) for a 1 mm per year Greenland ice cap contribution to global sea-level rise. Sea levels at Sachs Harbour are estimated to result in a slight rise at the same time.

Scenarios of global sea level change are ranging from 28 to 115 cm rise between 2010 and 2100. The projections for Ulukhaktok and Sachs Harbour show an overall sea level rise in the 21st century. Ulukhaktok may experience a slight drop in sea level at the lower end of the projection and a rise of up to 70 cm. According to these projections, Sachs Harbour could experience between 10 and 90 cm of sea level rise.

The above projections are described as changes in mean sea level. It should be noted that, in addition to these effects, for the permafrost-rich coastline of the NWT, changes in storms, sea ice, wave energy, as well as water and air temperatures may affect changes in sea level but are not considered in the described projections for the 21st century (GNWT 2015).

Given the altitude of the proposed Containment Structure at Satellite Bay between approximately 14 and 17 metres above sea level (masl), it can be assumed that expected local sea level changes in the 21st century will not affect the Containment Structure.

2.0 BACKGROUND
2.1 Site History

Panarctic Satellite F-68 (77° 17’ 30” N and 116° 54’ 27” W) is an abandoned well site located near Satellite Bay at the northern end of Prince Patrick Island, Northwest Territories (NWT). Several Site visits have been completed to delineate the environmental issues at Site and collect the data necessary to produce a detailed design.

The Site contains waste materials, including soil impacted by hydrocarbons and metals and solid wastes (e.g., used drums, scrap metal and other debris). Previous work at the Site in 2008, 2010, 2011, 2013, 2015 and 2017 through to 2019 has involved intrusive sampling programs to identify Areas of Potential Environmental Concern (APEC) and determine the nature and extent of any soil and water impacts. Hazardous and non-hazardous debris located on the Site has been organized, catalogued and quantified to the extent feasible and an Airstrip Assessment was conducted.
A detailed Phase I and Preliminary Phase II Environmental Site Assessment (ESA) report was prepared for the 2008 work and a Debris Consolidation and Phase II ESA report was prepared based on the 2010 work. An Airstrip Assessment report and a detailed Site Description and Future Assessment report (including recommendations) were developed based on the 2011 work. In addition, Summary Reports of the completed 2008, 2010 and 2011 work were prepared in 2012. To proceed with detailed planning and engineering, an additional Site reconnaissance and investigation program was completed in the summer of 2013. In 2014, an explosives disposal program was completed to safely remove abandoned explosives and decommission shot holes at the Site.

The 2015 Site Investigation and Debris Clean-up Program was designed to provide final input into the planned construction of an engineered thermal cover at the Site and in 2016, a brief site reconnaissance provided all subcontractors the opportunity to get familiarized with the Site.

2.2 Regulatory Background

A Project Description was submitted to and approved by the Environmental Impact Screening Committee pursuant to the Inuvialuit Final Agreement and a Scientific Research Licence from the Aurora Research Institute was acquired pursuant to the *Northwest Territories (NWT) Scientists Act*. A Land Use Permit and a Quarrying Permit from the Government of the Northwest Territories Department of Lands, pursuant to the Territorial Land Use Regulations established under the *Territorial Lands Act* were also obtained regulating all activities at Satellite Bay.

A Water Licence from the Inuvialuit Water Board (IWB) pursuant to the NWT Waters Regulations established under the *NWT Waters Act* was obtained and approval from Fisheries and Oceans Canada (DFO) for dewatering / backfilling of ponded areas was required. Additionally, in 2018, approval was received from Fisheries and Oceans Canada (DFO) to proceed without Authorization under the *Fisheries Act* to undertake the temporary water course crossing and dewatering / backfilling of one additional Ponded Area. A Land Use Permit from Indigenous and Northern Affairs Canada (INAC; now: Crown Indigenous Relations and Northern Affairs Canada [CIRNAC]) pursuant to the Territorial Land Use Regulations established under the *Territorial Lands Act* was obtained to use Mould Bay as a staff, supply and equipment transfer location, and to store fuel for refuelling of aircraft at a designated, bermed fuel storage area. Mould Bay, a designated Federal Reserve, is under CIRNAC’s jurisdiction; this includes the airstrip, all buildings and infrastructure, as well as surrounding land.

The 2019 work was completed in accordance with the applicable permits, licences, laws, and regulations. A Permit and Licence Tracking Plan was developed to ensure compliance and notifications were managed effectively. A summary of permitting requirements and notifications is presented in Table 1.

A summary of permitting requirements and notifications is presented in Table 1.

A Land Use Permit from Indigenous and Northern Affairs Canada (INAC) pursuant to Territorial Land Use Regulations established under the *Territorial Lands Act* was also secured to use Mould Bay as a staff, supply and equipment transfer location and store fuel for refueling of aircraft at a designated, bermed fuel storage area. Mould Bay, a designated Federal Reserve, is under INAC’s jurisdiction, that includes the airstrip, all buildings and infrastructure, as well as surrounding land.
### Table 1: Permits and Licences

<table>
<thead>
<tr>
<th>Permit / Licence</th>
<th>Regulator</th>
<th>Permit Status</th>
</tr>
</thead>
</table>
| Type B Water Licence | Inuvialuit Water Board | Issued on August 24, 2016  
Licence#: N5L8-1837  
Post-construction Report was submitted on December 5, 2019 |
| Class A Land Use Permit – Satellite Bay | GNWT – Lands Department: | Issued on October 3, 2016  
Permit # N2016U0004  
Extension of Land Use Permit to October 2, 2021 approved by Lands. |
| Class A Land Use Permit Application – Mould Bay | Crown-Indigenous Relations and Northern Development Canada (CIRNAC) | Issued on January 10, 2017 Permit # 16200, Amended to N2017J0001  
Extension approved to November 26, 2020. |
| Scientific Research Licence | Aurora Research Institute | Issued on March 5, 2019  
Licence # 16494  
Required 2019 Summary was submitted on October 31, 2019 |
| Quarrying Permit | GNWT – Lands Department: | Issued on October 3, 2016  
Permit # 2016QP0028  
Interim 2019 Quarry Report submitted October 1, 2019  
New Quarry Permit Application to be submitted in 2020 |
| Project Description | Environmental Impact Screening Committee | Approved with conditions May 2019  
File #: 04-19-07 |
| Confirmation received that no Authorization under the Fisheries Act is required | Fisheries and Oceans Canada | Confirmed in November 2018 for 2019 activities; File No.: NWT 18-HCAA-00365-a |

### 3.0 ENVIRONMENTAL BASELINE

#### 3.1 Physical Environment

##### 3.1.1 Climate

The Site is located on Prince Patrick Island, the most westerly of the Queen Elizabeth Islands, within the Sverdrup Islands Lowland Ecoregion of the terrestrial Northern Arctic Ecozone (Ecological Stratification Working Group 1996). This ecoregion covers Prince Patrick, Mackenzie King, Eilif Ringnes and Amund Ringnes islands. It is classified as having a high Arctic ecoclimate. Mean annual temperature is approximately -18 degrees Celsius (°C) with a summer mean of -1.5°C and a winter mean of -32°C. The mean annual precipitation ranges from 100 to 150 millimetres (mm; Ecological Stratification Working Group 1996). Additionally, the marine category of ecozones encompasses Prince Patrick Island on the western edge of the Arctic Archipelago Marine ecozone (Wiken et al. 1996). The Environment and Climate Change Canada Mould Bay Weather Station located on Prince Patrick Island is the only weather station on the island and is situated in a coastal location at an elevation of 12 masl, similar to the location of the Site. The Mould Bay Weather Station recorded a total mean annual snowfall (1971 to 2000) of 101.9 cm with snowfall events occurring throughout the year (Environment and Climate Change Canada [ECCC] 2013). The mean annual snow depth (1971 to 2000) at Mould Bay was 15 cm from September to June with no mean monthly snow accumulation recorded during July and August. The highest recorded snow depth in any given month was 55 cm in March 1997 (ECCC 2013).
3.1.2 Terrain and Topography

The Sverdrup Islands Lowland ecoregion is developed on generally soft, poorly consolidated and little-deformed Mesozoic rocks. Its surface is made up of rolling, scarped lowlands less than 150 m above sea level (masl), low uplands and dissected plateaus that reach 365 masl (Ecological Stratification Working Group 1996).

The terrain of the Site is generally flat, but gently sloping towards the northwest, with localized variability in slope characteristics. The elevation at the Site does not exceed 20 masl. Small draws traverse the area around the Site, and small dips are scattered throughout the landscape. These draws and dips often contain flowing and standing water, respectively.

The drainage of the Site and surrounding area is downslope to the northwest into the inlets of Satellite Bay, less than 0.5 km from the northwestern point of the airstrip.

Satellite Bay is within the geological province of the Arctic Continental Shelf. The sedimentary rock formations are Cenozoic in age (Natural Resources Canada [NRCan] 2012). No rock outcrops or distinctive geologic features were observed during previous field work. Bedrock was not encountered in the test pits that were dug across the Site during previous Site investigations.

3.1.3 Permafrost Condition

Prince Patrick Island is considered a region of Polar Desert soils. It is desert-like, with low vegetation limited to the lower, wetter areas. Polar Desert soils typically have a desert pavement (i.e., a surface covered with closely packed pebble and cobble-sized rock fragments) and poorly defined horizon sequences, high pH values (although soil testing results from 2010 work indicated low pH values), and high levels of soluble constituents (Tedrow et al. 1968). Prince Patrick Island is specifically a land of crysolic soils, which are permafrost-affected soils developed from cryogenic (low-temperature) processes such as freeze-thaw, cryoturbation (frost-churning) and ice segregation (Tarnocai 2004).

Permafrost is frozen rock and soil that remains below 0°C for at least two consecutive years. The entire ecoregion is underlain by deep, continuous permafrost with medium ice content and consisting of abundant ice wedges. The exception is the permafrost on Ellef Ringnes Island and the north-west coastline of Prince Patrick Island, which may have high ice content (Ecological Stratification Working Group 1996).

The primary factors that control permafrost and soil temperature regimes include type and extent of vegetation cover, thickness of surface organic layer, moisture content and topographic location. Specifically, dense vegetation cover, thick surface organic matter, high moisture content, and depressional topography have a negative effect on soil temperature. Snow cover can also have an insulating effect (Tarnocai 1984). Once seasonal thawing has occurred, sensitivity of any site to disturbance may vary depending on the ice content of the soil, soil type, drainage and vegetative cover.

Based on field observations, the soils at the Site are predominantly sands containing variable amounts of pebbles, gravel and cobbles with some layers / pockets of clay, and the surface was typically covered with a layer of larger pebbles and gravel. The soils were typically dry at the surface (to several cm depth) and then became wetter with depth, often to saturation. During the investigations, groundwater was often found at the bottom of the active layer at an average depth of approximately 0.63 m and the average permafrost depth was approximately 0.8 m. The depths to water and permafrost will vary depending on location, soil type and current climatic conditions.

In several test pits that were dug in the central area of the Site, a layer of moss (that grows on the soil surface) was found buried at variable depths, typically around 50 cm. This observation indicates that the entire working area within the Site may have been covered with layer(s) of fill material during past work at the Site, presumably
to flatten out the terrain. The overlying fill material appears to be native in nature and was likely extracted from nearby areas.

During the 2015 field program, a data logging thermistor was installed in one of the boreholes at the location of the planned Containment Structure, which allowed remote temperature monitoring in several depth categories at the Site.

The Containment Structure was commenced in 2017 and was completed in 2019. In 2020, final trimming of the buffer area 10 metres beyond the toe and, as necessary, portions of the outside of the thermal soil cover layer, will be completed. The temperature monitoring system was installed concurrently with construction of the Containment Structure in 2017 and completed in 2019, as described in Section 5.2.5.

3.1.4 Pingos

A series of pingos are located in the south-central portion of Prince Patrick Island (Mackay and Black 1973). Pingos are hills with a core of ice that can reach a height of 70 m and a diameter of 1,000 m. These hills originate from lakes that do not have permafrost located beneath them. As the lake gradually fills with sediment, invading permafrost isolates the remaining water in the lake sediment. Inward and downward freezing creates enough pressure to push the core water upward, which then freezes to form the ice core at the centre of the developing pingo. Young pingos can grow at a rate of 1.5 m in height per year (Pidwirney 2006).

3.1.5 Surface Water Hydrology

The terrain of the Site is generally flat, but gently sloping towards the northwest, with localized variability in slope characteristics. The elevation at the Site does not exceed 20 masl. Small draws traverse the area around the Site, and small dips are scattered throughout the landscape. These draws and dips often contain flowing and standing water. The drainage of the Site and surrounding area is towards the northwest, into the inlets of Satellite Bay (Arctic Ocean), less than 500 m from the northwest end of the airstrip.

Hydrological features are variable across the Site, ranging from puddles with standing water and ponded areas to flowing watercourses. There were a number of standing water bodies in and around the Site noted during the various Site investigations, ranging in size from small puddles to larger ponded areas, as well as a number of creeks, including the unofficially named South River and North River (Appendix A, Figures 2 and 4).

3.1.5.1 Standing Water

Several depressions with standing water were noted at the Site (Appendix A, Figures 2, 5 and 6). These ponds and puddles varied in diameter and depth and typically had sandy substrates with variable quantities of aquatic vegetation. While fish were never observed, various organisms were noted in the water, including amphipods, aquatic worms and/or insect larvae and aquatic insects. These water bodies did not have any surface inflow or outflow channels.

Water bodies at the Site were generally shallow (estimated to be less than 1 m deep). Ponded areas in and around the Site may have been created by the gradual formation of depressions in the ground. It is likely that some of the ponds and puddles found throughout the Site are the result of ground subsidence that has occurred since the Site was actively worked on during the 1970s.

3.1.5.2 Watercourses

Two freshwater creeks, flowing to the northwest, are located to the northeast (referred to as North River) and southwest (referred to as South River) of the Site. Additionally, smaller watercourses flow west out of the Project area (Appendix A, Figure 2).
The South River at a crossing point between the airstrip and the Site (Appendix A, Figure 2), was assessed for the planned watercourse crossing (described in Section 4.3) during previous Site visits. The bank-full width was 20 m at its widest point and water depth was 0.2 to 0.4 m while the flow rate was estimated as 1 to 2 m/second (s). The substrate was comprised of sand and gravel and no vegetation was observed in the drainage except for some lichen along the banks.

### 3.1.6 Groundwater and Surface Water Quality

Surface water quality in and around the Site appears to be variable. Based on investigations in 2010, 2011 and 2015, surface water in the various water bodies on and around the Site was not affected by hydrocarbons. Metals exceedances were found at some locations. Given the distribution of metals concentrations in surface water on-site, it is possible that the metal concentrations are related to natural sources. There are no previous water quality studies for the Site (or similar sites) available to verify naturally exceeding metal levels in surface waters. However, it is possible that the existence of metal rich mineral soils and / or the existence of desert soils with low pH values could contribute to elevated surface water metal levels. Prince Patrick Island soils are permafrost-affected soils developed from cryogenic processes such as freeze-thaw, frost-churning and ice segregation.

Groundwater was encountered in some locations where test pits and temporary groundwater sampling points were installed across the Site. During initial investigations groundwater was often encountered at the bottom of the active layer at an average depth of 0.63 m. Based on the results of previous investigations, it is believed that groundwater quality at previous sample locations has been affected by metals and hydrocarbons. These effects are likely related to past activities related to the former Site operations. Some of the metal concentrations may also be related to natural sources as described above.

### 3.1.7 Groundwater Monitoring

In 2019, four groundwater monitoring wells were constructed in the area immediately surrounding the Containment Structure and water levels were obtained on August 31, 2019. Two of the four wells were dry and water levels measured in the two wet wells were 0.68 and 0.86 m below grade, consistent with observations during earlier excavation activities.

### 3.2 Biological Environment

Several of the species observed in the project area are listed by the Government of Canada's *Species at Risk Act* (SARA; 2019). SARA designates a national classification for species that have been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). These include species designations as ‘special concern’ (may become ‘threatened’ or ‘endangered’ from a combination of biological characteristics and identified threats), ‘threatened’ (may become ‘endangered’ if not protected from factors leading to extirpation or extinction), ‘endangered’ (facing extirpation or extinction), ‘extirpated’ (no longer existing in Canada but does elsewhere in the world), and ‘extinct’ (no longer existing anywhere; Government of Canada 2019). If a species becomes listed as ‘extirpated’, ‘endangered’ or ‘threatened’, it is legally prohibited to kill, harm, harass, or capture individuals of the species, or to damage or destroy their habitat. In addition, species can be listed under three schedules. Species listed under Schedule 1 of SARA include those species officially listed under SARA. Species that had been listed by COSEWIC prior to October 1999, but have not yet been officially protected under SARA, are listed under Schedule 2 and Schedule 3. The species listed under Schedule 2 and Schedule 3 are required to be assessed by COSEWIC within a certain timeframe.

In addition to federal legislation, the GNWT has established an assessment program for NWT species used as a tool for conservation management. It is called the General Status Ranks of Wild Species (Working Group on General Status of NWT Species 2016). Under this program, species’ ranks must be reviewed every five years and
made available for review in the NWT Species Monitoring Infobase. Species may be ranked as ‘at risk’ (have been assessed in detail or ranked by COSEWIC as ‘threatened’ or ‘endangered’), ‘may be at risk’ (may be at risk of extinction or extirpation; the highest rank for species under GNWT General Status Ranking system), ‘sensitive’ (may require protection to keep from becoming at risk), ‘secure’ (not at risk or sensitive), ‘undetermined’ (insufficient information to determine status), ‘not assessed’ (not assessed 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 2016).

To assess the biological status of species that may be at risk in the NWT, the Species at Risk Committee (SARC) was established under the Species at Risk (NWT) Act and assesses whether a species should be included in the NWT List of Species at Risk (Northwest Territories Species at Risk Committee, 2019).

The following sections summarize species potentially occurring in the Project area that are listed territorially and / or federally.

3.2.1 Vegetation

Vegetation communities in the Arctic are generally simple and dominated by a few species that are well adapted to the harsh climate and poor soil conditions due to the presence of permafrost. Mosses, lichen, and cold-resistant vascular plants such as sedges (*Carex spp.*) and cotton grass (*Eriophorum spp.*) are the dominant vegetation. Arctic willow (*Salix spp.*) and aven (*Dryas spp.*) occur infrequently (Ecological Stratification Working Group 1996).

As observed during 2008, 2010, 2011, 2013, 2014, 2015 and 2016 Site visits, vegetation was largely absent from the Project area. The scattered vegetation that was observed was concentrated around the lower, wetter areas and was comprised of mosses, lichens, sedges and other low-growing forbs.

Throughout the Site, the developed / impacted areas and the surrounding higher areas were generally devoid of vegetation or had small, isolated patches of mosses, lichen and forbs, such as the relatively abundant arctic poppy (Papaver radicatum). There are currently no species of vascular plants, lichen, or mosses occurring in the NWT that are listed on Schedule 1 of the federal Species at Risk Act (SARA; 2019). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists the hairy braya (Braya Pilosa) as ‘endangered’ (Working Group on General Status of NWT Species 2016). However, this species occurs well south of the Project area.

The General Status Ranking Program of Wild Species in the NWT as represented in the NWT Species Monitoring Infobase (Infobase; Working Group on General Status of NWT Species 2016) lists species for the Northern Arctic Ecozone which contains Prince Patrick Island. The Infobase lists currently 20 ‘sensitive’ lichen or mosses in the Project area and two lichen species that are assessed as ‘may be at risk’:

- Sandy foam lichen (*Stereocaulon arenarium*); and
- Peppered brownette lichen (*Vestergrenopsis isidada*).

There are currently 12 listed ‘sensitive’ vascular plant species included in the Infobase that may occur in the Project area, and 5 listed species that ‘may be at risk’ for Prince Patrick Island:

- Dane’s gentian (*Comastoma tenellum*);
- Moss heather (*Harrimanella hypnoides*);
- Bank Island alkali grass (*Puccinella banksiensis*);
- Cushion saxifrage (Saxifraga eschscholtzii); and
- White mountain saxifrage (Saxifraga paniculata; Working Group on General Status of NWT Species 2016).

A list of rare plants of the NWT, compiled by McJannet et al. (1995), identifies approximately 206 rare species. Of the 206 rare species listed by McJannet et al. (1995), only two species may occur in the Satellite Bay area (Table 2).

**Table 2: Rare Plant Species Potentially Occurring in the Satellite Bay Area**

<table>
<thead>
<tr>
<th>Scientific Name</th>
<th>Common Name</th>
<th>Habitat</th>
<th>Species Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dryas integrifolia</td>
<td>Mountain aven</td>
<td>Arctic; gravely or rocky places on river flats and less commonly, tundra.</td>
<td>Rare in Canadian Arctic</td>
</tr>
<tr>
<td>Saxifraga eschscholtzii</td>
<td>Cushion saxifrage</td>
<td>Arctic; calcareous gravelly slopes</td>
<td>Rare</td>
</tr>
</tbody>
</table>


### 3.2.2 Freshwater Biota and Habitat

Although many fish species occur within the freshwater and marine environments of the High Arctic, there is little available information specific to the Site. It is assumed, based on observations made during the 2008, 2010, 2011, 2013, 2014, 2015 and 2016 work and the 2017 through 2019 construction programs in and around the Site, that the small water bodies in the Project area are not fish-bearing, but this has not been confirmed. Some of the waterbodies were observed to be seasonally dry. The rivers at the Site could potentially be fish bearing.

A list of fish species that may occur in the general Project area is provided in Table 3. The fish listed as being in the Victoria Island region are included (Community of Ulukhaktok et al. 2008), as well as fish listed by the GNWT, ENR Infobase as occurring in the Northern Arctic Ecozone (Working Group on General Status of NWT Species 2016). It should be noted that, as verified through previous consultations with the local Hunters and Trappers Committees (HTCs) and DFO, there are no commercial, recreational or Aboriginal fisheries carried out at the Site or on the island.

**Table 3: Fish Species that may be found in the Project Area**

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wolffish (Anarhichadidae)</td>
<td>Northern Wolfish</td>
<td><em>Anarhichas denticulatus</em></td>
</tr>
<tr>
<td>Capelin (Osmeridae)</td>
<td>Capelin</td>
<td><em>Mallotus villosus</em></td>
</tr>
<tr>
<td>Cod (Gadidae)</td>
<td>Arctic cod</td>
<td><em>Boreogadus saida</em></td>
</tr>
<tr>
<td></td>
<td>Greenland cod</td>
<td><em>Gadus ogac</em></td>
</tr>
<tr>
<td></td>
<td>Saffron cod</td>
<td><em>Elegiums navaga</em></td>
</tr>
<tr>
<td></td>
<td>Tom cod</td>
<td><em>Microgadus proximus</em></td>
</tr>
<tr>
<td>Esocid (Esocidae)</td>
<td>Northern pike</td>
<td><em>Esox lucius</em></td>
</tr>
<tr>
<td>Flounder (Pleuronectidae)</td>
<td>Starry flounder</td>
<td><em>Platichthys stellatus</em></td>
</tr>
<tr>
<td>Herring (Clupeidae)</td>
<td>Blue herring</td>
<td><em>Clupea pallas</em></td>
</tr>
<tr>
<td>Ling (Lotidae)</td>
<td>Burbot</td>
<td><em>Lota lota</em></td>
</tr>
<tr>
<td>Sand Lance (Ammodytidae)</td>
<td>Sand eel</td>
<td><em>Amodys spp.</em></td>
</tr>
<tr>
<td>Sculpin (Cottidae)</td>
<td>Fourhorn sculpin</td>
<td><em>Myxocephalus quadricornis</em></td>
</tr>
<tr>
<td></td>
<td>Deepwater sculpin</td>
<td><em>Myxocephalus thompsonii</em></td>
</tr>
<tr>
<td>Stickleback (Gasterosteidae)</td>
<td>Ninespine stickleback</td>
<td><em>Pungitius pungitius</em></td>
</tr>
<tr>
<td></td>
<td>Threespine stickleback</td>
<td><em>Gasterosteus aculeatus</em></td>
</tr>
</tbody>
</table>
Table 3: Fish Species that may be found in the Project Area

<table>
<thead>
<tr>
<th>Family</th>
<th>Common Name</th>
<th>Scientific Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trout (Salmonidae)</td>
<td>Arctic char^1</td>
<td>Salvelinus alpinus</td>
</tr>
<tr>
<td></td>
<td>Arctic cisco^1,6</td>
<td>Coregonus autumnalis</td>
</tr>
<tr>
<td></td>
<td>Arctic grayling^4</td>
<td>Thymallus arcticus</td>
</tr>
<tr>
<td></td>
<td>Broad whitefish^1</td>
<td>Coregonus nasus</td>
</tr>
<tr>
<td></td>
<td>Lake trout^1</td>
<td>Salvelinus namaycush</td>
</tr>
<tr>
<td></td>
<td>Lake whitefish^1</td>
<td>Coregonus clupeaformis</td>
</tr>
<tr>
<td></td>
<td>Least cisco^1,3</td>
<td>Coregonus sardinella</td>
</tr>
<tr>
<td></td>
<td>Round whitefish^4</td>
<td>Prosopium cylindraceum</td>
</tr>
</tbody>
</table>

1 Species identified in the OCCP as being in the Victoria Island region (Community of Ulukhaktok et al. 2008).
2 Marine / brackish water species.
3 Anadromous (live in ocean but spawn in freshwater) and freshwater populations.
4 Species listed on the Infobase (Working Group on General Status of NWT Species 2016) in addition to those identified by the Community of Ulukhaktok et al. 2008.
5 Species listed as ‘at risk’ in Species at Risk in the NWT (NWT Species at Risk Committee 2019) and as ‘threatened’ by COSEWIC.
6 species listed as ‘sensitive’ in the Infobase (Working Group on General Status of NWT Species 2016).

Of the fish species listed in Table 3, the Working Group on General Status of NWT Species (2016) lists the Arctic cisco as ‘sensitive’. This species is not listed under SARA (2019) or COSEWIC. The northern wolfish is not listed under SARA (2018), listed as ‘threatened’ by COSEWIC and as a ‘at risk’ in the NWT (Working Group on General Status of NWT Species 2016).

3.2.3 Terrestrial Wildlife and Habitat

Wildlife species are important to the communities for subsistence harvesting and for their spiritual and cultural values. Potential adverse effects on these species and their habitats are listed as being of concern in the Olokhatomiut Community Conservation Plan (Community of Ulukhaktok et al. 2008) and the Sachs Harbour Community Conservation Plan (SCCP; Community of Sachs Harbour et al. 2008).

The primary terrestrial mammals potentially occurring in the general Project area include Peary caribou (Rangifer tarandus pearyi), muskox (Ovibos moschatus), wolf (Canis lupus), Arctic fox (Vulpes lagopus), and Arctic hare (Lepus arcticus; Community of Ulukhaktok et al. 2008). These species are described in the following subsections.

Species observed (or potentially occurring) at Mould Bay and Satellite Bay and are listed either federally or territorially are listed in Table 4.

Table 4: Federally and / or Territorially Listed Species

<table>
<thead>
<tr>
<th>Species</th>
<th>SARA Status</th>
<th>COSEWIC Status</th>
<th>GNWT Status</th>
<th>GNWT SARC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peary caribou (Rangifer tarandus pearyi)</td>
<td>Schedule 2 – Endangered (High Arctic population)</td>
<td>Threatened</td>
<td>At Risk</td>
<td>Threatened</td>
</tr>
<tr>
<td>Polar bear (Ursus maritimus)</td>
<td>Schedule 1 – Special Concern</td>
<td>Special Concern</td>
<td>Sensitive</td>
<td>Special Concern</td>
</tr>
<tr>
<td>Wolverine (Gulo gulo)</td>
<td>Schedule 1 – Special Concern</td>
<td>Special Concern</td>
<td>Sensitive</td>
<td>Special Concern</td>
</tr>
</tbody>
</table>

It should be noted that in May 2004 the three Peary caribou population designations were de-activated by COSEWIC, and the Peary caribou, Rangifer tarandus pearyi, includes now both the former High Arctic and Low Arctic populations and is assessed separately from the Dolphin and Union Caribou, Rangifer tarandus. The Peary
caribou is assessed as ‘threatened’ by COSEWIC. SARA still assesses the three populations separately and the caribou on Prince Patrick Island belong to the High Arctic population for the purpose of that assessment and are listed as ‘endangered’.

### 3.2.3.1 Peary Caribou

Peary caribou inhabit the Arctic Cordillera and Northern Arctic ecozones. Their diet includes more mosses than that of other types of caribou. Fecal studies on nearby Melville and Axel Heiberg islands showed that willow is the predominant food item in summer, and forbs, grasses, and that some sedges were consumed in the winter (COSEWIC 2004a). All Peary caribou populations on Melville, Prince Patrick, Banks, and north-west Victoria belong to the High Arctic population (Nagy 1999).

There are two populations of Peary caribou in the Inuvialuit Settlement Region (ISR): the Banks Island population (on Banks Island and northwestern Victoria Island) and the High Arctic population (on the Queen Elizabeth Islands). It is estimated that there are approximately 7,250 Peary caribou in the NWT (and those are in the ISR), which have suffered severe declines of up to 80% over the past five decades (SARA 2018).

High Arctic Peary caribou migrate annually and seasonally between Prince Patrick, Eglinton and Melville islands. Many caribou that overwinter on Prince Patrick Island move in spring to Eglinton, Emerald, Melville, and Byam Martin islands for the summer (COSEWIC 2004a). Although the majority of inter-island movements occur on sea ice, some caribou are believed to swim during the open water period. Peary caribou are especially sensitive during the fall, winter, and early spring due to inter-island movements for which they depend on the sea ice. It is believed that the availability of winter forage under deep snow and ice is the main limiting factor for Peary caribou across their range. In addition, hunting, predation and disturbance due to human activities are considered as contributing factors to their decline (SARA 2018). Inuvialuit also believe that the caribou are affected by competition for food with the growing muskox population (Community of Sachs Harbour et al. 2008).

The High Arctic population of Peary caribou is listed because of an ongoing decline. The GNWT Infobase lists them as ‘at risk’ due to low numbers and high level of threats in the form of climate change, predation, and human development (Working Group on General Status of NWT Species 2016).

### 3.2.3.2 Muskox

Muskox are found year-round throughout Prince Patrick Island; however, they are typically concentrated in the southern portion of the island (Bird Studies Canada 2012). A 1997 aerial survey resulted in a population estimate of approximately 100 animals on Prince Patrick Island (Gunn and Dragon 2002). Previous studies of Prince Patrick Island, dating back to 1961, have shown extreme fluctuation in muskox abundance. Periodic harsh winter conditions may have led to lack of forage, which can cause die-offs and may limit reproductive success (Gunn and Dragon 2002). Muskox reportedly disappeared completely from Prince Patrick Island between 1952 and 1961 but re-colonized the island by 1972 (Thomas et al. 1981).

During the summer, muskox move to areas of higher vegetation concentration along the small rivers and creeks, feeding on willow leaves, sedges and grasses. In the fall, from late August to early September, they move toward the coast before going back inland for the winter (Community of Ulukhaktok et al. 2008). Muskox browse on willows in the summer and sedges through the winter (Urquhart 1982). Muskox are not listed by SARA (2018) nor by COSEWIC. The GWNT Infobase lists them as ‘secure’ (Working Group on General Status of NWT Species 2016).

### 3.2.3.3 Wolf

The wolf subspecies that inhabits Prince Patrick Island is the Arctic wolf (Canis lupus arctos). These animals are light coloured, and their diet includes species such as caribou, muskox, Arctic hare, lemming, seal, ptarmigan, and
bird eggs (Riewe 1975; Morrison 2007). A 1995 study of wolves throughout the Arctic Archipelago found that pack sizes ranged from 2 to 15 wolves with a mean pack size of 5 (Miller and Reintjes 1995). The frequency of wolf sightings is reported to fluctuate with the populations of Peary caribou and muskox. Wolf harvest reports from Sachs Harbour and Ulukhaktok on neighbouring Banks and Victoria Islands indicate that wolf numbers increased throughout the 1990s on these islands (Larter and Nagy 2001).

In High Arctic locations, wolves have pups in May and they are known to reuse the den site or at least same area for denning (Feldhamer et al. 2003). The Arctic wolf is not listed by SARA (2018), is listed as ‘data deficient’ by COSEWIC, and as ‘secure’ by the GNWT Species Monitoring Infobase (Working Group on General Status of NWT Species 2016).

### 3.2.3.4 Arctic Fox

The Arctic fox population of the NWT is estimated to be in excess of 10,000 (Mammals Committee 1999). The population numbers fluctuate in a four-year cycle, following fluctuations of its main prey - lemmings. Arctic fox also prey on Arctic hares, birds, fish, insects, and have been known to prey on weak caribou calves and ringed seal (Phoca hispida) pups. Their diet also includes bird eggs, berries, and carrion (Feldhamer et al. 2003).

Arctic foxes mate in March, den in April, and pups are active in May although they may stay near the den until October (Community of Ulukhaktok et al. 2008). Fox den construction occurs in sites with sandy soils with good exposure to spring sun and reduced accumulation of winter snow. Dens are often on mounds or ridges where the soils are more thawed (Feldhamer et al. 2003). Neither COSEWIC nor SARA (2018) list the Arctic fox and the GNWT Infobase lists them as ‘secure’ (Working Group on General Status of NWT Species 2016).

### 3.2.3.5 Arctic Hare

Arctic hare have been found throughout the Queen Elizabeth Islands (Feldhamer et al. 2003). Their winter diet consists mainly of willow with lesser amounts of legumes. Their summer diet includes mainly legumes with lesser amounts of forbes such as mountain aven (*Dryas integrifolia*), sedges (*Carex aquatilis*), cotton grass (*Eriophorum scheuchzeri*), and tundra grass (*Dupontia fisheri*).

The Arctic hare population on neighbouring Victoria Island is recognized as following a seven-year cycle, with populations rising, then drastically decreasing within that time frame (Community of Ulukhaktok et al. 2008). The population of neighbouring Banks Island has reportedly increased substantially since the 1980’s (Community of Sachs Harbour et al. 2008). Neither COSEWIC nor SARA (2018) list the Arctic hare and the GNWT Infobase lists them as ‘secure’ (Working Group on General Status of NWT Species 2016).

### 3.2.4 Avian Wildlife and Habitat

The Arctic is important as a spring and fall staging and moulting area for migrating waterfowl, and a variety of different shorebirds breed in the Arctic Archipelago. Most waterfowl species and shorebirds arrive in the area by mid-June and leave by late September, depending on weather conditions (Aurora Research Institute 2002). Ducks, geese and swans are an important subsistence resource in spring and fall and the communities wish to see the identification and protection of important habitats from disruptive land uses (Community of Ulukhaktok et al. 2008).

The area around Satellite Bay has no specifically identified important habitat for birds. On the east coast of Prince Patrick Island (approximately 40 km south of the Project area) is an area designated as an Important Bird Area (IBA) by Birdlife International (Bird Studies Canada 2012). This Eastern Prince Patrick Island Coast (NT044) site was designated due to its significant breeding population of Western High Arctic black brant (*Branta bernicla nigricans*). This area is south of Intrepid Inlet along the cliffs and includes tundra habitat. Some of the brant are
believed to nest there, the majority come there to moult and the birds are believed to leave southern Prince Patrick Island around mid-August (Bird Studies Canada 2012).

Further north in the Satellite Bay area, without cliffs and almost bare of vegetation, there are no known nesting, moulting or staging areas. However, individual birds may pass through the area.

The following species may occur in the Project area:

**Black brant** (*Branta bernicla*) - The brant on Prince Patrick Island are considered part of the western high Arctic brant population and are thought by some ornithologists to be a separate subspecies (CWS Waterfowl Committee 2011). The entire population winters in Puget Sound in Washington, USA. A winter count in Washington in 2004 found 7,695 western High Arctic brant. The same survey in 2003 found 4,880 western High Arctic brant.

This species is not listed by SARA (2018) or COSEWIC, but the GNWT Infobase lists it as ‘sensitive’ due to its small, highly fluctuating population size and restricted wintering range (Working Group on General Status of NWT Species 2016).

**King eider** (*Somateria spectabilis*) / **common eider** (*Somateria mollissima*) - There is an eastern and a western population of king eider (Cornell 2013). Both populations may be found breeding on Prince Patrick Island. Studies in the western Canadian Arctic in the early 1990’s arrived at a population estimate of 200,000 to 260,000 king eiders (CWS Waterfowl Committee 2011). The Pacific population of common eider has an estimated population of 37,000 breeding birds in the central Arctic (Working Group on General Status of NWT Species 2016). In nesting areas, both common eider and king eider feed on aquatic vegetation such as sedges, buttercups (*Ranunculus spp.*), bur reeds (*Sparganium spp.*), and their diet also includes crustaceans, and aquatic insect larvae (Cornell 2013; GNWT, ENR 2012).

The NWT populations of king and common eider have both been in decline since the 1970’s (Working Group on General Status of NWT Species 2016). Neither king nor common eider is listed by SARA (2018) or COSEWIC. The GNWT lists both species as ‘sensitive’ due to limited occurrence in the NWT and the decline in population respectively (Working Group on General Status of NWT Species 2016).

**Long-tailed duck** (*Clangula hyemalis*) - The Atlantic Coast Sea Duck survey indicates that the population of long-tailed duck (formerly known as oldsquaw) has increased from 1991 to 2002 (CWS Waterfowl Committee 2011). They nest at a density of about one pair per square kilometre (km²; Cornell 2013). Long-tailed ducks nest from late-June to early-September (Community of Ulukhaktok et al. 2008). They feed on larval and adult aquatic insects, crustaceans (amphipods, fairy shrimp, cladocerans), fish roe, and vegetable matter (Cornell 2013). Population studies on the Arctic Coastal Plain and on Devon Island (the two populations closest to Prince Patrick Island for which studies are available) showed no discernable population trends up to the late 1990’s (Cornell 2013).

The number of long-tailed duck in the NWT is estimated at 115,000 (Working Group on General Status of NWT Species 2016). Long-tailed ducks are not listed by SARA (2018) or COSEWIC; the GNWT Infobase lists this species as ‘sensitive’ because of its limited population and distribution (Working Group on General Status of NWT Species 2016).

**Ivory gull** (*Pagophila eburnea*) - Ivory gulls remain in the Canadian Arctic year-round, but their breeding range is not well known; they are assumed to breed in the High Arctic. Nesting occurs on granite, limestone or gravel, near openings in the ice. Outside of the breeding season, ivory gulls are found along the edge of the pack ice (Working Group on General Status of NWT Species 2016).
Their breeding population is estimated to be 500 to 700 and shrinking (GNWT, ENR 2012). Ivory gulls are ranked as 'endangered' by SARA (2018) and as 'special concern' by COSEWIC. The NWT SARC (2018) also lists ivory gulls as 'endangered' and mentions they are an uncommon migrant in the Beaufort Sea, while the GNWT Infobase lists them as 'at risk' (Working Group on General Status of NWT Species 2016).

**Ruddy turnstone** (*Arenaria interpres*) - Ruddy turnstones nest throughout Arctic coastal North America and most of the Queen Elizabeth Islands, including Prince Patrick Island (Cornell 2013). Their diet when breeding consists mainly of insects and spiders, and some vegetation such as berries early in season.

The NWT population size is approximately 36,000 birds (Working Group on General Status of NWT Species 2016). Ruddy turnstones reach their breeding grounds in late-May or early-June. They nest in dry, open tundra flats and slopes near ponds, lakes, and creeks and depart their breeding ground between mid-August and mid-September. Ruddy turnstone is not listed by SARA (2018) or COSEWIC; the GNWT lists this species as ‘sensitive’ because of population decline in the NWT (Working Group on General Status of NWT Species 2016).

**Sanderling** (*Calidris alba*) - Sanderling nest throughout the Canadian Arctic Archipelago, including on Prince Patrick Island (Cornell 2013). Their estimated NWT population is 60,000 birds (Working Group on General Status of NWT Species 2016). They arrive at the nesting grounds between late-May and early-June and leave between July and October (Cornell 2013). During the breeding season, they feed at damp tundra sites or at edges of creeks, ponds, lakes, and sandy beaches on insects, spiders and crustaceans (e.g., burrowing amphipod *Pseudalibrotus litoralis*). When insects are scarce, sanderling may feed on plant material, including buds and shoots.

Sanderling are not listed by SARA (2018) or COSEWIC; the GNWT lists this species as ‘sensitive’ because of the small population in the NWT (Working Group on General Status of NWT Species 2016).

**Red knot** (*Calidris canutus*) - There are two subspecies of red knot, one of which (*C. c. islandica*) nests on the Queen Elizabeth Islands. The other, *C. c. rufa* nests to the south on Victoria Island and is not expected to occur in the Project area (Working Group on General Status of NWT Species 2016). There are estimated to be approximately 30,000 breeding individuals in the NWT. Individuals feed on insects and marine invertebrates where available and early in the breeding season feed on grass shoots, seeds, and other vegetable matter. Nests are built on dry, sunny, elevated tundra, on windswept ridges and slopes dominated by stunted willow and avens (Cornell 2013).

The red knot *islandica* subspecies is listed by SARA (2018) and COSEWIC as ‘special concern’. The subspecies are listed as such because of an estimated 70% decline in the past 15 years possibly due to depletions of its food sources (e.g., shellfish) in its wintering grounds in north-west Europe. The GNWT Infobase lists both subspecies as ‘at risk’ in the NWT (GNWT, ENR 2012).

**Buff-breasted sandpiper** (*Tryngites subruficollis*) - The buff-breasted sandpiper is a shorebird that may occur in the Project area. They arrive in the NWT as early as mid-May to breed and leave from July to early-September for their wintering grounds in South America. Nesting habitat is in grassy meadows on the tundra near streams (GNWT, ENR 2012).

The buff-breasted sandpiper is listed by SARA (2018) and COSEWIC as ‘special concern’. The GNWT Infobase lists this species as ‘sensitive’ due to potential threat of breeding habitat degradation due to industrial development and climate change (Working Group on General Status of NWT Species 2016).

**Additional species** - Other bird species that may occur in the Project area during the breeding season include glaucous gull (*Larus hyperboreus*), Baird’s Sandpiper (*Calidris bairdii*), white-rumped sandpiper (*Calidris
fuscicollis), pectoral sandpiper (Calidris melanotos), purple sandpiper (Calidris maritima), red throated loon (Gavia stellata), long-tailed jaeger (Stercorarius longicaudus), rough legged hawk (Buteo lagopus), snow bunting (Plectrophenax nivalis), common raven (Corvus corax) and Lapland longspur (Calcarius lapponicus) (Cornell 2013; American Ornithologists' Union [AOU] 2013).

A complete list of 2018 wildlife observations and encounters is provided in the 2017 Annual Report submitted to the IWB on March 31, 2019.

3.3 Land Use

The proposed Project falls within the Olokhaktomiut Community Conservation Planning Area identified in the Olokhaktomiut Community Conservation Plan (Community of Ulukhaktok et al. 2008).

The Community of Ulukhaktok (formerly known as Holman) has identified a special designated area that encompasses portions of the southern end (including Mould Bay) of Prince Patrick Island (Management Zone 505E) as Key Migratory Bird Terrestrial Habitat (Community of Ulukhaktok et al. 2008). The area is approximately 100 km south of the Satellite Bay Project area but includes a portion of the Mould Bay coast beginning approximately 2 km north of the Mould Bay airstrip. The area belongs to Management Category “E” which is considered to have lands and waters with cultural or renewable resources of extreme significance and sensitivity. In these areas no development is allowed, and the lands and waters are managed to eliminate potential damage and disruption. It recommends the highest degree of protection (Community of Ulukhaktok et al. 2008). The Hamlet of Ulukhaktok was included in consultations on planned Site activities since 2008. After each field season, summary reports were sent to the HTC for distribution and discussion. With each new proposed field season, the HTC was provided with proposed plans and encouraged to provide comments and concerns. To date, only positive feedback was received from Ulukhaktok and the HTC provided their approval for the planned 2017 Remediation Program.

Management Zone 505E is home to nesting and moulting waterfowl, particularly the black brant. The wetland habitat in the area is recognized as being sensitive year-round and the area is important as polar bear habitat and for subsistence harvesting (Community of Ulukhaktok et al. 2008).

The Sachs Harbour Community Conservation Plan does not include Prince Patrick Island (Community of Sachs Harbour et al. 2008).

3.3.1 Hunting and Fishing

There are no communities on Prince Patrick Island. The closest communities are Sachs Harbour, located approximately 650 kilometres (km) south-west of the Site on Banks Island, and Ulukhaktok, located approximately 730 km south on Victoria Island. The Community of Ulukhaktok includes Prince Patrick Island in their Community Conservation Plan area (Community of Ulukhaktok et al. 2008).

3.3.2 Protected Areas and Archaeology

There are no protected areas in proximity of the Site. As described above, on the east coast of Prince Patrick Island (approximately 40 km south of the Project area) is an area designated as an Important Bird Area by Birdlife International and the Eastern Prince Patrick Island Coast (NT044) site was designated due to its significant breeding population of Western High Arctic black brant. Also described above, north of Mould Bay is an area classified as Management Category “E” land in the Ulukhaktok Community Conservation Plan.

No previously documented cultural and heritage resource sites occur within the proposed Project area. A search of the database maintained by the Prince of Wales Northern Heritage Centre (PWNHC) was conducted in 2012.
for the proposed Project area and it was determined that no known archaeological sites are located within the Project area plus a 150 m buffer. However, Repsol acknowledges the fact that not all archaeological sites are reported, and vast areas of land have remained unexplored. In the event of a discovery of a potential archaeological site during field operations, work will cease at that location and the PWNHC will be contacted for further instructions.

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 1970’s the conditions were very similar to those of the surrounding area which is described in the sections above.

4.0 RECLAMATION AND CLOSURE MEASURES

4.1 Reclamation and Closure Approach

The ongoing Site Remediation Program constitutes the reclamation and closure of a historic, abandoned wellsite. The purpose of the Project is primarily to remove impacted soil and waste from direct contact with water bodies and terrestrial ecological receptors and place this material into an engineered containment cell. A total of approximately 3,000 m³ of soil was originally estimated to exceed the Canadian Council of the Ministers for Environment (CCME) Agricultural Land Use Criteria for BTEX, PHCs and metals. Of the initial estimate of 3,000 m³ of impacted soils, an estimated 2,150 m³ were to be covered in place as they are located at the base of the Cell. Following the completion of all delineation investigations and excavations, a total of 2,050 m³ of impacted soil was excavated from the active layer in 2017 and 2019 and relocated directly on top of the in-place impacts (Appendix A, Figure 5). A cap liner was placed over the impacted soil. The liner system consists of a linear low density polyethylene (LLDPE) geomembrane and two layers of medium weight non-woven geotextile. The details of this approach are provided in the Pre-construction design report developed for the IWB. Following completion of the Containment Structure, the total volume of impacted soils was 4,200 m³.

As described in the updated Remediation Action Plan and the 2018 Annual Report (both submitted to the IWB on February 26, 2019), additional impacted soil was identified in 2017 and 2019, which was accommodated through changes to the Containment Structure design, as approved in 2017. Drawings depicting the final As-Built Containment Structure are provided in Appendix I of the 2019 Annual Report and in the Post-Construction Report submitted to the IWB in December 2019. This design was also provided to the IWB as part of the 2017 Annual Report (as Appendix H).

An over-arching principle that was applied to all aspects of the design was to minimize the requirements for maintenance and long-term monitoring. Continuous thermal monitoring (see Section 5.2.5), intermittent soil sampling (see Section 5.2.4) as well as intermittent groundwater and surface water monitoring (see Sections 5.2.2 and 5.2.3, respectively) are included in the design to confirm performance of the Containment Structure.

4.2 Re-contouring and Revegetation

In ongoing correspondence with regulators, revegetation of the Site has been considered. Specifically, discussions with the GNWT Lands Department regarding Repsol’s LUP #N2016U0004 (GNWT, Lands 2016) concluded that given the poor soil, the complete lack of an organic layer, naturally bare vegetation (predominantly mosses and lichen with scattered herbaceous plants), revegetation will not be likely. By removing debris and contamination from the Site, regrading excavation and borrow areas and sloping the sides of the Containment Structure, will facilitate natural revegetation over time and have been typically accepted in lieu of reseeding. Re-contouring and grading of specific Project components are discussed in the following sections.
4.3 Water Course Crossings

As in 2019, it will be again necessary in 2021 to establish a temporary water course crossing across the South River between the airstrip/camp area and the construction area (Appendix A, Figures 2 and 4). Based on previous assessments and a survey of the proposed water course crossing location, it is planned to construct a crossing by stacking, clean, untreated, 15 centimetre high prefabricated wooden mats. A series of up to 20 wooden mats will be placed to create a 4.3 metre wide crossing. The mats will be connected using straps or chains and tethered to shore to establish a stable, ground supported crossing. Some minor grading work will be required at each end of the structure (above high-water line) to provide a compact and level foundation to access the mats. Additional timber cribbing may be required at intermediate points to provide a reasonably level surface; however, no excavation or regrading of the stream bed will be required.

Once installed, the mat crossing will allow water to flow below, through each crib mat, between adjoining mats and during sporadic peak flows over the anchored mats. Given the spacing of the mats it is anticipated that the crossing will have a negligible effect on streamflow and will not impede potential movement of aquatic organisms. At completion of the Project, the untreated wooden mats will be systematically removed, and burned. Ash will be collected and transported off site for disposal. Abutment areas will be contoured back to pre-existing conditions.

The following mitigation measures will be implemented during the installation and removal processes:

- Installation of erosion control measures will be to the satisfaction of the Lead Environmental Engineer;
- Access mats will be positioned to make use of high points of ground and mats will be supported using untreated wood timbers to minimize flow restriction;
- Access mats will extend on shore at least one metre, to protect the bank;
- Any required grading of the approaches will be conducted in such a way as to not decrease the cross-sectional area of the creek;
- Temporary silt fencing will be installed as required, to protect the banks at the approaches;
- Mats and timbers will be pinned to the ground to minimize movement from traffic;
- The crossing will be inspected daily in order to identify deficiencies in a timely fashion;
- Any observed deficiency will be corrected the same day or early the next day;
- Only new, clean wooden access mats and timbers will be placed below the normal high-water mark;
- All wood used will be un-treated;
- All proposed building materials will be inspected prior to installation to ensure compliance;
- Significant streambank modifications will not be required for construction of a safe crossing, with the exception of grading of the approaches (see above); and
- Any minor contouring required in areas adjacent to the stream banks will be restored to pre-existing conditions during crossing removal.

4.4 Borrow Source

Construction of the Containment Structure and associated activities were essentially completed in 2019. Should minor grading in 2021 require borrow material, this will be sourced from the licenced borrow area. The location of
the borrow area is shown on Figure 2 (Appendix A). The exact location and extent of the area was laid out by a legal land surveyor under guidance of a registered Canada Lands Surveyor prior to opening the quarry and was surveyed at the end of the 2019 construction season.

Due to the relatively brief window of thawed surface soils each summer, the intent is to develop the borrow source soon after arrival. A loader will be used to push up available material down to a prescribed maximum depth in order to minimize permafrost degradation. Borrow areas will be mined in a series of horizontal lifts as the ground thaws. The excavations will be designed and managed to maintain positive drainage, avoid the creation of water collection points to minimize permafrost degradation. The thawed, sandy material will be pushed into windrows to promote draining and facilitate truck loading. Haul trucks will be used to haul sandy material on existing access trails. To minimize impacts on groundwater quality, only clean equipment will be used, and equipment will be inspected daily.

The borrow area was graded and re-contoured at the end of the 2019 construction season. If additional material is required in 2021, after all required borrow materials have been extracted, the aggregate borrow area will be graded and re-contoured to minimize the impact to local permafrost and ponding. Once the excavation is completed, the area will be final graded to minimize any direct water flow paths between excavations and natural waterways. Localized impacts to permafrost will be mitigated by confining excavation to areas with a thicker active layer and not allowing water to pool on the Borrow Site floors, as recommended by the Northern Land Use Guidelines – Pits and Quarries (GNWT 2015). Following the completion of excavation, the borrow site will be graded and re-contoured to blend into the general landscape of the Site. The side slopes will be contoured at to blend with surrounding grades.

The following mitigation measures will be implemented during borrow source development and upon completion of quarrying activities:

- The Northern Land Use Guidelines – Pits and Quarries (GNWT 2015) will be followed;
- 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 excavation base will be shaped/graded to direct and contain surface runoff;
- As needed, temporary ditching and berms will be constructed up-slope to divert surface water away from the borrow area;
- Any surface water accumulated contained within the limits of the borrow area will be contained until discharge is approved (depending on analytical results as detailed in the Surveillance Network Program Plan); and
- Final backfilling, grading and regrading (if required) will be carried out to blend in with the surrounding landscape.

4.5 Soil Excavation Areas

All areas outside of the Containment Cell where soil above the permafrost was identified above the CCME standards were excavated, loaded into haul trucks and placed within the Cell in 2017 and 2019. Relocated soils were dumped within the prescribed limits of the Cell and subsequently spread in lifts, graded and compacted. All excavation areas are shown on Figure 5 of Appendix A.
As described in detail in the updated Remediation Action Plan and the 2017 through 2019 Annual Reports submitted to the IWB, some of the excavation areas revealed that the impacted soil below grade extended further than initially determined through previous investigations. Additional delineation samples were collected and analyzed to delineate these areas in 2018 and 2019. These areas included the additional excavation required in Areas A through O in addition to the Butler Building footprint (Area P) and the background thermistor trench (Area Q). This additional impacted soil was excavated and relocated within the limits of the Cell in 2019.

The following mitigation measures were implemented during soil excavation and upon completion of the excavations:

- The excavation progressed in wide shallow cuts to remove the impacted active layer soils;
- Excavations did not daylight into downslope areas;
- Silt fencing was not required in 2017 or 2019;
- Identified areas of impacted soil were delineated and marked in the field prior to commencing excavations; and
- All excavation areas were contoured by grading or backfilling with clean borrow material to blend in with the surrounding landscape.

### 4.6 Dismantling and Removal of Temporary Camps and Fuel Storage Area

#### 4.6.1 Temporary Camps

Two camps will again be required to carry out the Project in 2021 and 2022: one at Satellite Bay (Appendix A, Figure 2) and one at Mould Bay (Appendix A, Figure 3). Camps will be required from late June to late August, and possibly into September. Due to concurrent activities at Mould Bay and Satellite Bay during the mobilization and demobilization phases, two complete camps will be constructed and in place during the entire Project duration.

Once the 2022 Project activities have been completed, demobilization will commence. This will include removal of all remaining waste at Satellite Bay, all site personnel, and the majority of site supplies. A reduced camp will be left at Satellite Bay to support the heavy-lift demobilization of the larger construction equipment (see Section 4.8). The rest of the camp and supplies will be transported through Mould bay to Yellowknife.

Once all heavy equipment has left Satellite Bay in 2023, the remaining camp, supplies and materials will be packaged and transported to Mould Bay and from there to Yellowknife (see Section 4.8). Once the last Hercules flight has left Mould Bay with oversized equipment (see Section 4.8), the Mould Bay camp, materials, supplies and all crew will be transported to Yellowknife.

#### 4.6.2 Temporary Fuel Storage Areas

Bulk JET-A fuel storage at Mould Bay will comprise three Arctic King Fuel bladders manufactured by SEI Industries and holding a total volume of approximately 50,000 Litres (L). The location of the temporary fuel storage area is shown on Figure 3 (Appendix A). The three fuel bladders will be housed each in an aluminum-framed secondary containment berm. The berm is built to military and ULC S668 specifications which meets Canadian regulatory requirements for secondary containment. In 2019, weatherhaven tents were erected over the bladders, in an effort to reduce precipitation within the containment berm. Three approximately 13,000 L bladders will be filled with bulk JET-A fuel flights of the ATR72, which will be configured with two 5,000 L Bulk Aircraft Transport Tanks (BATT) manufactured by SEI Industries. As outlined in the INAC Land Use Permit (#N2017J0001) and determined in subsequent discussions with INAC, the bladder system will be monitored for
potential leaks daily. Any observed concerns will be addressed immediately. Drummed fuel (diesel, Jet-A and gasoline), lubricants, hydraulic oils and coolants required at Mould Bay will also be stored in the containment berm and housed within a weatherhaven tent.

A similar framed containment berm will be constructed at Satellite Bay to support the camp, construction and limited aviation (helicopter) operations. Only drummed fuel, lubricants, hydraulic oils, coolants and waste liquids will be stored in this bermed storage area at the Satellite Bay camp (Figure 2, Appendix A). A smaller second fuel storage area will be located close to the construction site (Figure 2, Appendix A) and will be used for refuelling of equipment during the day.

As per the Water License, the bermed fuel storage areas, lined with an impermeable barrier, will be located a minimum of 100 m away from any water body (excluding ponded areas). An area adjacent to each fuel berm will be designated for refuelling of all site equipment and aircraft. All refuelling will be conducted as outlined in the Spill Contingency Plan. Drip pans will be used to capture potential spills during the refuelling process. Spill response equipment (i.e., absorbent pads and spill kits) and drip trays will be readily available at the fuel storage location / refuelling area and personnel will be trained in its use. Any inadvertent spills or leaks will be contained, cleaned up immediately, and reported as required pursuant to applicable legislation, the Spill Contingency Plan, and Repsol requirements.

The temporary fuel storage areas in Satellite Bay (for equipment and camp fuel) and in Mould Bay (for aviation and camp fuel) will be dismantled and removed during demobilization of each camp as outlined in the Spill Contingency Plan developed for this Project and provided to the IWB. Any remaining fuel will be transferred to fuel drums and transported off-site.

4.7 Dismantling and Removal of Butler Building

As visible on the site plan (Appendix A, Figure 2), there was a metal shed (the Butler Building) adjacent to the airstrip at Satellite Bay. The building and contents were removed and disposed off-site in 2017. Details on this process are provided in the 2017 Annual Report provided to the IWB on March 31, 2018.

4.8 Removal of Equipment

The primary demobilization will be facilitated by Twin Otter aircraft which will be loaded at Satellite Bay and shuttle loads to Mould Bay. At Mould Bay equipment and materials will be transferred to larger aircraft for transport back to Inuvik or Yellowknife. The camp equipment will be transferred from Satellite Bay to Mould Bay to allow for the camp provider to mobilize their gear back to Yellowknife using a Dash-7 aircraft.

As the demobilization is being completed, oversized equipment and supplies will be prepared for heavy-lift transfer from Satellite Bay to Mould Bay. At that time, a heavy-lift helicopter will be mobilized to Satellite Bay. A reduced ground crew will remain at Satellite Bay to assist with rigging the loads while a second ground crew will be positioned at Mould Bay to receive the loads.

Once the heavy-lift helicopter equipment lifts have been completed, the heavy-lift helicopter will demobilize. It is anticipated that this will be after two or three days of work on the island.

A Hercules aircraft will then mobilize to Inuvik and from there to Mould Bay to remove the oversized equipment from Mould Bay to Inuvik. Once the equipment is delivered to Inuvik, the land transport to Edmonton will commence. The overland travel will cover some 3,200 km and take three to four days from Inuvik to Edmonton.
4.9 Schedule of Reclamation and Closure Activities

The Reclamation and Closure Activities are part of the 2017 to 2024 Site Remediation Program outlined in the Remediation Action Plan provided to the IWB. The overall activities and schedule are described in the following paragraphs.

Overland mobilization of equipment and supplies from Edmonton to Inuvik and staging at the Inuvik Mike Zubko Airport was completed in the first half of June 2017. After some delay due to unfavourable runway conditions at Mould Bay (determined through reconnaissance flights), a small crew of staff mobilized to Mould Bay to set up a temporary camp at Mould Bay in support of transfer of equipment and supplies. Once that camp was set up and conditions at Satellite Bay were favourable, a second ground crew, mobilized to Satellite Bay in early July 2017 to establish the temporary camp there and receive the loads transported by the helicopter. The 2017 mobilization phase experienced a total of four weeks in delays. This caused further delays in the construction phase and ultimately the deferral of parts of the construction to 2018. Due to weather delays and conditions affecting the runway conditions at Mould Bay, the 2018 construction phase was deferred to 2019. The Containment Structure was completed in 2019. Remaining work onsite includes trimming the outer layer of the thermal cover and surrounding buffer area, and to confirm that the grading and contouring of the borrow area is satisfactory.

4.9.1 Work Completed in 2017

In summary, the following tasks were completed during the shortened 2017 field season:

- Two temporary camps and associated structures were established;
- Continuous wildlife monitoring, Surveillance Network Program (SNP) sampling, environmental sampling and regulatory reporting took place throughout the entire 2017 Project;
- Barrels at the site were tested, contents consolidated, removed and disposed off-site;
- Debris and waste was removed from the site and disposed off-site;
- The Butler Building was dismantled, removed and disposed off-site. Asbestos containing materials from that building were abated, removed and disposed of off-site (following all required approvals);
- The borrow area was surveyed by a legal Land Surveyor and material for construction activities was quarried in accordance with the Quarry Operations Plan and all relevant permits;
- The delineated areas of impacted soil were excavated and samples analyzed by a certified laboratory;
- The Containment Structure was partially completed including the placement of all originally expected impacted soils, installation of base and background thermistor equipment and associated tower;
- Nine ponded areas were dewatered, backfilled with clean borrow material and compacted;
- The liner was partially completed and covered with a protective layer of soil. The remaining area of the Containment Structure was graded to the approved design slope and compacted; and
- In early September of 2017, crews winterized the temporary camps and equipment and demobilized from site.

4.9.2 Work Completed in 2018

The 2018 field program was conducted from July 18, 2018 through August 28, 2018. Due to weather delays and conditions affecting the runway conditions at Mould Bay, the proposed scope of work as set out in the 2018
Remediation Action Plan (submitted to the IWB on March 31, 2018) was not completed and the scope of the 2018 field program was adjusted. The IWB (as well as all regulators and Inuvialuit communities) were informed of the redesigned 2018 field program, the deferral of the 2018 construction work to 2019 and the deferral of the final construction to 2021/2022.

The following tasks were completed during the 2018 field season.

- Two temporary camps were re-established and improved at Mould Bay and Satellite Bay;
- Mould Bay airstrip testing, repair and maintenance;
- Continuous wildlife monitoring, Surveillance Network Program (SNP) sampling, environmental sampling and regulatory reporting took place throughout the entire 2018 Project;
- Surveys were completed at Satellite Bay using a Trimble R10 integrated GNSS System to lay out sample locations and to delineate Excavation Areas in preparation for the 2019 construction season; and
- Additional sampling and delineation of impacted soil was completed for Excavation Area P in preparation for the 2019 field program.

4.9.3 Work Completed in 2019

The 2019 field program, designed to finalize the Satellite Bay Remediation Program (the Project), was conducted from 25 June 2019 through 6 September 2019. Mobilization to Mould Bay took place starting 25 June 2019. The Satellite Bay camp was re-established starting on 12 July 2019 and was winterized on 4 September 2019.

The planned 2019 construction phase was completed in 2019, with the minor exception of final trimming and grading around the toe of the Containment Structure. The following tasks were completed during the 2019 field season.

- Temporary camps and associated structures were established at Mould Bay and Satellite Bay;
- Continuous wildlife monitoring, Surveillance Network Program (SNP) sampling, environmental sampling and regulatory reporting took place throughout the entire 2019 Project;
- The borrow area was surveyed by a legal Land Surveyor and material for construction activities was quarried in accordance with the Quarry Operations Plan and all relevant permits;
- The remaining delineated areas of impacted soil were excavated and samples analyzed by a certified laboratory;
- The containment cell was completed including the expansion of the cell to the east (as outlined in the approved design drawings) placement of all originally expected impacted soils, installation of the remaining thermistor equipment and backfilling around the associated tower and installation of the geosynthetic liner system including the key trench;
- The thermal cover was completed using sandy soil from the borrow area compacted in lifts and graded to a thickness of at least 2.4 m above the containment cell liner;
- Final grading of the bottom of the Containment Structure slopes and buffer area (10 metres beyond the cell toe) could not be completed as a result of winter conditions in late August;
- Pond P was partially backfilled with clean borrow material adjacent to the buffer area;
In late August and early September 2019, crews winterized the temporary camps and equipment and demobilized from the Site.

4.9.4 Work to be Completed in 2021

Work to be completed in 2021 includes:

- Mobilization of crew and supplies;
- Opening of both winterized temporary camps at Mould Bay and Satellite Bay;
- Maintenance of the airstrips (if required);
- Inspection of the containment structure (in accordance with the Water Licence);
- Implementation of additional grading and repairs (if required);
- Environmental sampling (in accordance with the Water Licence);
- Winterization of equipment and camps; and
- Demobilization of crew and supplies.

4.9.5 Work to be Completed in 2022

Work to be completed in 2022 includes:

- Mobilization of crew and supplies;
- Opening of both winterized temporary camps at Mould Bay and Satellite Bay;
- Maintenance of the airstrips (if required);
- Inspection of the containment structure (in accordance with the Water Licence);
- Implementation of additional grading and repairs (if required);
- Environmental sampling (in accordance with the Water Licence);
- Tear down and packaging of the temporary camp at Satellite Bay, with the exception of a few tents for emergency use in 2023;
- Winterization of equipment stored at Satellite Bay and temporary camp at Mould Bay; and
- Demobilization of crew and supplies.

4.9.6 Work to be Completed in 2023

Work to be completed in 2023 includes:

- Mobilization of crew and supplies;
- Opening of winterized temporary camp at Mould Bay and small emergency camp at Satellite Bay;
- Maintenance of the airstrips (if required);
- Inspection of the containment structure (in accordance with the Water Licence);
- Implementation of grading and repairs (if required);
Environmental sampling (in accordance with the Water Licence);
Preparing heavy equipment temporarily stored at Satellite Bay for transport;
Heavy equipment demobilization from Satellite Bay to Mould Bay via heavy lift helicopter;
Completion of Satellite Bay camp demobilization;
Winterization of temporary camp at Mould Bay; and
Demobilization of crew and supplies.

4.9.7 Work To be Completed in 2024

Work to be completed in 2024 includes:

- Mobilization of crew and supplies;
- Opening of winterized temporary camp at Mould Bay;
- Maintenance of airstrip (if required);
- Demobilization of all equipment and temporary camp from Mould Bay;
- Removal of the Mould Bay airstrip improvement tiles; and
- Demobilization of crew and supplies.

The above tasks will be carried out in accordance with all permits, licences and authorizations issued for this project and its extension, including detailed annual reporting. Repsol is in frequent direct contact with the regulators and will apply for permit extensions and new permits sufficiently prior to their expiry.

At the beginning of each field season, Repsol will provide a detailed schedule of activities planned to be completed during the upcoming season; at end of each field season, Repsol will provide a summary of accomplished tasks as part of the annual reporting requirements. Repsol will evaluate the project status after each field season and may adjust the project schedule based on progress, weather and site conditions.

5.0 MONITORING PLAN

5.1 Monitoring During Remediation

A Surveillance Network Program Plan was developed and submitted to the IWB. The Surveillance Network Program Plan outlines surface water, groundwater and discharge water monitoring during the Project (i.e., during remediation activities). The following monitoring and sampling will be carried out as needed during Project work (as described in detail in the Surveillance Network Program Plan):

- Potential seepage and runoff sampling from the Containment Structure will be analyzed for: Total Suspended Solids (TSS), oil and grease (O&G), benzene, toluene, ethylbenzene, xylenes (BTEX), hardness and total lead prior to discharge;
- Surface runoff sampling from borrow sources for TSS, Total Petroleum Hydrocarbons (TPH) and pH prior to discharge;
- Camp greywater sampling for TSS, pH, total residual chlorine and visual inspection for the presence of O&G prior to discharge; and
Creek water sampling, 50 m upstream and 100 m downstream of the watercourse crossing for TSS.

Regular bacteriologic sampling of raw and treated potable water will be carried out as required. Upon commissioning of each camp water treatment system and monthly thereafter, water samples will be collected and analyzed for water quality parameters (fecal and total coliforms, total metals, and routine water quality analyses). It is anticipated that these samples will be sent off-site for analysis during the regular supply/crew flights, but options for on-site testing will be evaluated and adopted if effective. In 2018, bottled water was provided to both camps; in 2019 an on-site filtration system was used to produce potable water. This system will be used in future years.

5.2 Post-construction monitoring

Post-construction monitoring will occur once during the summer of 2021 (one year following construction), once during the summer of 2026 (six years following construction) and once during the summer of 2036 (sixteen years following construction) to ensure that mitigation, facilitation of natural revegetation, erosion control and restoration efforts have been successful. The results of each Site monitoring visit will be provided in a report submitted to the IWB. The monitoring activities are described in the following sections.

5.2.1 Visual Inspections

Visual inspections carried out as part of the post-construction monitoring will include a walk-through of the entire Site. Overall site conditions will be recorded and photographs will be taken using a high quality digital camera to document the observations. In addition to taking soil and water samples (see Sections 5.2.2 through 5.2.4), special emphasis will be placed on examining the following components:

- Inspection and photographing of the Containment Structure to assess changes including integrity of cover, geotechnical stability of slopes, sloughing, slumping, runoff/seepage/pooling of water, etc. The locations and dimensions of any features on the cell and surrounding buffer area should be compared to the baseline condition and a summary of changes and recommended actions reported by a qualified engineer;
- Inspection and photographing of the previous borrow area and soil excavation areas to assess changes in the area including slumping, erosion, pooling of water, etc.;
- Inspection of previously disturbed areas (temporary camp, fuel storage and staging sites; location of former butler building);
- Inspection of the thermistor tower instrumentation and carrying out maintenance as required;
- Inspection and photographing of monitoring wells (including water levels and casing condition inspection and surrounding setting (within approximately 10 m of the well). Carry out maintenance and repair as required); and
- Collection of soil and groundwater samples as per the sampling plan and QA/QC requirements for the project and package for shipment to a certified analytical laboratory.

5.2.2 Groundwater Sampling

The IWB Water Licence mandated the installation of at least four monitoring wells around the perimeter of the Containment Structure, which was completed in 2019. These wells will be used to monitor water quality within the active zone. It is anticipated that groundwater flow in the active zone will follow the topography in the area. The elevation of the surrounding area is greatest in the southeast and gently decreases towards the northwest. It is likely that the North River and the South River, northeast and southwest of the Containment Structure (Appendix A, Figure 2) will influence the shallow groundwater flow in the active layer. The installation of
four monitoring wells, one on each of the four sides of the Containment Structure, result in one monitoring well located upgradient (southeast) and three wells located down/cross gradient (northwest, northeast and southwest). As described in the 2019 Annual Report and in its Appendix I submitted to the IWB in March 2020, also provided to the IWB as part of the 2018 Annual Report submitted on February 26, 2019, the Containment Structure was expanded to the east. The monitoring well locations accommodate this change. The new locations were submitted to the IWB, GPS coordinates collected, and locations identified on Figure 3 in the 2019 Annual Report.

The wells were installed in boreholes drilled to a depth of approximately two metres. The wells are installed in 152 mm (six-inch) diameter boreholes advanced to the target depth with a powered auger mounted on a skid steer. They consist of 52 mm diameter stainless steel casing and slotted screens, with sand in the annular space between the screened part of the well and the borehole. The screens are set in the upper metre to collect groundwater from the transition zone; a solid casing “sump” extending below this was grouted in place using bentonite within the permafrost to anchor the well. An annular bentonite seal is installed near grade. A larger diameter protective steel casing is installed to a shallow depth (maximum 300 mm) over the well casing; both the protective casing and well extend a height of approximately 0.5 m above grade. Soil was mounded slightly above grade to limit surface water from pooling in the area of the well.

Development of two of the wells was undertaken following the installation; the remaining two wells were dry and no water level measurement or water sample could be collected. When completed, sampling was conducted using low flow methods. Flow rates were recorded and when possible, well yields were recorded to inform subsequent sampling events. Conductivity, pH, turbidity, temperature and drawdown were also recorded during purging of the monitoring wells. At MW19-01 samples were collected following the stabilization of these values in accordance with standard protocols. At MW19-04 the well had limited water and was pumped dry prior to sampling. During low flow purging, 1 L of water was collected. A stabilized water sample was not possible due to poor recovery. The 1 L of water collected during purging was submitted to the laboratory for analysis.

Single use sampling materials for each sampling location were used. If logistical constraints prevent this approach in future sampling events, multi-use sampling equipment may be used if the equipment is adequately decontaminated (outside and inside surfaces) between each sampling event. Samples were clearly labeled with the monitoring well location and were not filtered prior to lab submittal. Groundwater samples were transported as outlined in the Surveillance Network Program Plan. The samples were analyzed for TSS, O&G, Benzene, Toluene, Ethylbenzene and Xylenes (BTEX), hardness and total lead. Results of the analyses will be provided in the future monitoring report.

5.2.3 Seepage and Runoff Sampling
If any water originating as seepage or runoff at the Containment Structure should be encountered during a post-construction monitoring Site visit, water samples will be collected following all steps outlined in the Surveillance Network Program Plan. Locations of the samples will be recorded, and water samples will be analyzed for TSS, O&G, BTEX, hardness and total lead. Results of the analyses will be provided in the monitoring report.

5.2.4 Soil Sampling
Soil sampling will be completed in the vicinity of each of the four monitoring wells (described in Section 5.2.2) and located within an approximately two to four metre radius from these wells. Initial soil samples were collected at these locations in 2019, following completion of the construction and well installation and will be collected in each subsequent year that the inspection occurs. The exact location of the soil samples will be adjusted for each sampling round, within the specified radius; documentation of the locations and soil characteristics will be completed for each round, including analytical, text and photographic descriptions. As described in detail in the
Remediation Action Plan, at each sampling location, two soil samples will be collected: (i) a shallow sample at an interval of between 0 and 15 cm and (ii) a deep sample at an interval of between 40 and 50 cm, which is anticipated to be approximately 20 cm above the typical permafrost depth. Additional samples will be collected for distinct lithological or pedological strata as well as areas where any signs of impacts are observed. If the target sampling depths cannot be reached (typically due to frozen ground), the reason for refusal will be noted and a sample collected from the refusal depth. If non-permafrost obstructions are encountered at depth, a second sample location will be attempted within a similar radius of the well. The soil samples will be collected using industry standard protocols and in compliance with this document, including decontamination of the sampling shovel with soap and water, methyl hydrate and rinsing with distilled water before each use. Soil samples will be collected by staff wearing single-use disposable nitrile gloves and placed by hand in clean 125 mL soil sample jars, or directly sampled using TerraCore™ samplers provided by the laboratory. The sample jars will be labelled with the sample date, location ID and depth. The samples will be shipped to a certified laboratory under chain-of-custody protocols and analyzed for BTEX, PHC fractions F1 to F4 and CCME Tier 1 metals with additional analyses for specific chemicals of concern to be added as required.

5.2.5 Thermal Monitoring

During the 2015 field program, a Digital Temperature Cable (DTC; also referred to as a “thermistor”) was installed in one of the boreholes at the location of the planned Containment Structure, which allowed remote temperature monitoring. This information was used to assess the typical thermal trends at the Site during that period and was removed in 2017.

Thermal subsurface ground temperature monitoring equipment was installed in the summer of 2017 in the Containment Structure and in a background area. The subsurface ground temperature monitoring (referred to hereafter as temperature monitoring) equipment was installed per the design of the Containment Structure. The design requires a temperature monitoring system that could collect and record ground temperature data to assess the performance of the design relative to freezing of the waste within the containment cell. The temperature monitoring system was partially constructed in 2017 and was completed in 2019.

The monitoring system is composed of four main components, which are discussed below:

- Thermistor strings;
- Instrumentation tower;
- Data collection system; and
- Communications system.

**Thermistor Strings**

Five thermistor strings protected by cross-linked polyethylene (PEX) tubing were installed to measure ground temperatures. The strings were manufactured by Hoskins Scientific Ltd. and are composed of individual thermistors inside a rugged sheathing. Four strings were installed in the containment cell, two strings are north of the east–west centerline and two are south of the east–west centerline. The fifth string is located at the background station. Three of the five strings are connected to a data logger, and two are backups.

The lower 2-node string was installed at the original ground surface, prior to the placement of impacted soil. It was placed horizontally approximately 5 m north and south of the east–west centerline.

The upper 4-node string was installed and placed horizontally approximately 5 m north of the east–west centerline. The first node is located above the west anchor trench; the second node is located in the clean fill...
directly above the 2-node string installed at the original ground surface. The remaining two nodes were installed in 2019.

**Instrumentation Tower**

An instrumentation tower manufactured by Baird Mounting Systems was installed on the west end of the Containment Structure in 2017. The tower is composed of a buried base, a mast, and a ladder rack. When construction is complete the base of the tower will be below final grade and the mast will rise approximately 3.8 m above final grade. The tower holds the data logger, solar panel, air temperature sensor, and satellite antenna.

**Data Collection System**

All three of the active thermistor strings are directly connected to a Campbell Scientific, Inc. model CR1000 data logger located at the west side of the cell. The strings run underground to the instrumentation tower. Power for the logger is supplied by a 12-volt direct current (DC) battery that is located in a buried box at the base of the tower.

The battery is recharged by a solar panel at the top of the tower. In addition to subsurface ground temperatures, the system also collects the following data:

- ambient air temperature;
- battery box temperature;
- logger temperature; and
- power supply voltage.

**Communications System**

The communications system is comprised of an Iridium satellite modem, antenna, and data visualization software. The data sent from the satellite modem are received by an email server and uploaded to the data visualization platform provided by Neve LLC. The customized platform can be accessed by a desktop computer and compatible mobile devices.

The thermal monitoring points buried within the thermal cover are intended to demonstrate how the engineered cover freezes back after construction, as well as to show that ground temperatures within the thermal cover stabilize and remain below 0ºC. The two points outside the toe of the lined area are near the edge of the thermal cover, where the deepest seasonal thawing would normally occur. Air temperatures will be monitored in order to provide site-specific data that can be used to verify design assumptions if required by Regulators.

As suggested in the IWB guidance document “Protocol for the Monitoring of Drilling-Waste Disposal Sumps”, a background location has been installed to monitor background temperatures outside of the footprint of the Containment Structure. The 6-node string was installed at the background station in a borehole constructed at a depth of two to three metres advanced with a powered auger mounted on a skid steer. This background location is approximately 70 m southwest of the structure. This string is placed vertically and can acquire the temperature profile of the relatively undisturbed ground.

Upon closure of the Water Licence, the system will be decommissioned or assumed by the IWB at their discretion.

Work completed in 2019 as part of the thermal monitoring is described in detail in the 2019 Annual Report submitted to the IWB in March 2020.
5.3 Contingency

The IWB will be informed if, during any of the scheduled monitoring Site visits, it becomes evident that:

- there are soil or water quality issues;
- the Containment Structure shows signs of failure or erosion; or
- any other issues are noted at the Site.

In the event of an identified issue, a revised monitoring schedule will be developed for approval by the IWB and that 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 Monitoring Activities

Based on the IWB Water Licence requirements, Table 5 provides an overview of the anticipated schedule of monitoring activities.

**Table 5: Post-construction Monitoring Activities**

<table>
<thead>
<tr>
<th>Year</th>
<th>Activities</th>
<th>Components / Parameters</th>
<th>Reporting</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021 (one year after construction)</td>
<td>Visual Inspection</td>
<td>Overall site conditions; Containment Structure; borrow area; excavation areas; temporary camp, staging and fuel storage sites</td>
<td>Summary of monitoring activities carried out during site visit</td>
</tr>
<tr>
<td></td>
<td>Groundwater Sampling</td>
<td>TSS, O&amp;G, BTEX, hardness and total lead</td>
<td>Description of Site conditions</td>
</tr>
<tr>
<td></td>
<td>Seepage and Runoff Sampling from Containment Structure</td>
<td>TSS, O&amp;G, BTEX, hardness and total lead</td>
<td>Inspection of the performance of the Containment Structure based on comparison to baseline</td>
</tr>
<tr>
<td></td>
<td>Soil Sampling</td>
<td>BTEX, PHC fractions F1 to F4 and CCME Tier 1 metals</td>
<td>Inspection of the borrow area</td>
</tr>
<tr>
<td>2026 (six years after construction)</td>
<td>As in 2021*</td>
<td>As in 2021*</td>
<td>Description of all visual inspections using location, dimensions, geotechnical stability</td>
</tr>
<tr>
<td></td>
<td>As in 2021*</td>
<td>As in 2021*</td>
<td>Description of all modifications while at the Site (if any)</td>
</tr>
<tr>
<td>2036 (16 years after construction)</td>
<td>As in 2021*</td>
<td>As in 2021*</td>
<td>Description of activities planned for the next scheduled site visit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Description of any modifications required for future site visits (if any)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Site photographs</td>
</tr>
</tbody>
</table>

* Assuming no revisions need to be implemented.

The thermal monitoring will be completed through the use of a solar powered data logger, configured to allow for near-real time telemetry using a satellite uplink. As the thermal monitoring will be continuously recorded remotely, collection of this data is not included in the Site visits (Table 5).
6.0 CLOSURE

We trust the above information is satisfactory and meets your present requirements. If you have any questions or require additional details, please do not hesitate to contact the undersigned.

Yours Truly,

Golder Associates Ltd.

Kevin Ratray, PEng
Environmental Engineer

Paul Dewaele, PEng
Geo-Environmental Engineer, Principal

KR/PJD/rd

Golder and the G logo are trademarks of Golder Associates Corporation


PERMIT NUMBER: P 049
NT/NU Association of Professional Engineers and Geoscientists
7.0 REFERENCES


GNWT Lands Department. 2016. Land Use Permit #N2016U0004. Issued on October 3, 2016


APPENDIX A

Figures
NOTES

1. Dimensional elevations and bearings are shown unless noted otherwise.
2. Existing site roads and trails to be utilized during construction activities as practicable.
3. Borrow area to be set back 31 metres from waterbodies.
4. Depth of excavation within the borrow area shall be typically 0.5 m below original grade. At the completion of the excavation, the borrow area will be left in place as a surface depression.
5. Site-wide surface water and erosion control measures have been designed as determined by site engineers prior to and throughout construction activities. The location of erosion control measures will be verified, placed and maintained during construction. The erosion control measures will be inspected daily and after precipitation events during construction.

REFERENCES

1. Existing topographic features compiled using LIDAR and ground survey including bathymetry performed by Golder Associates Ltd., 2015.
2. Coordinates reference UTM Zone 11 N.W.G.84.
6. Main access trail coordinates reference UTM Zone 11 WGS84.

PROJECT: SATELLITE F-68 NWT
CONSULTING SERVICES AND REMEDIATION WORK CONTRACT
SATELLITE BAY, PRINCE PATRICK ISLAND, NWT

PROJECT SITE OVERVIEW

CONSULTANT: REP SOL OIL & GAS CANADA INC.

PRESENTED: LPH
REVIEWS: JPR
APPROVED: P.D.

REV.
FIGURE

VYY-MM-DD
2018-09-13

PROJECT CONTROL NO.
1780495
0011

MAP SCALE
1:5,000

SATELLITE BAY, PRINCE PATRICK ISLAND, NWT

SATELLITE F-68 NWT

BURNING BAY, PRINCE PATRICK ISLAND, NWT

CONSULTING SERVICES AND REMEDIATION WORK CONTRACT

SATELLITE BAY, PRINCE PATRICK ISLAND, NWT

GOLDER ASSOCIATES, INC. NOVEMBER 25, 2015, TECHNICAL MEMORANDUM "DESIGN CRITERIA GUIDANCE FOR ACSCS SATELLITE F-68", PROJECT NO. 1531921.

GOLDER ASSOCIATES, INC. JANUARY 2016, TECHNICAL MEMORANDUM "THERMAL ANALYSIS OF WASTE CONTAINMENT STRUCTURE ON PRINCE PATRICK ISLAND FOR ACSCS SATELLITE F-68", PROJECT NO. 1531921.

GOLDER ASSOCIATES, INC. OCTOBER 2015, TECHNICAL MEMORANDUM "2015 GEOTECHNICAL FIELD INVESTIGATION TALISMAN ENERGY PANARCTIC SATELLITE F-68 WELLSITE", PROJECT NO. 1531921.

GOLDER ASSOCIATES, INC. JANUARY 2016, TECHNICAL MEMORANDUM "THERMAL ANALYSIS OF WASTE CONTAINMENT STRUCTURE ON PRINCE PATRICK ISLAND FOR ACSCS SATELLITE F-68", PROJECT NO. 1531921.
Air Strip
Apron
Fuel Storage / Refuelling Area
Temporary Camp Area
Air Strip
Apron
Fuel Storage / Refuelling Area
Temporary Camp Area

NOTES:
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1780495
2. SITE IMAGERY ACQUISITION PERFORMED BY GOLDER ASSOCIATES LTD. USING AN UNMANNED AERIAL VEHICLE, 2015.
3. HORIZONTAL DATUM: WGS84 PROJECTION: UTM ZONE 11N
   ELEVATIONS REFERENCED TO ORTHOMETRIC PROJECTION
   CGVD 28 VERTICAL DATUM, HT 2.0 GEOID

LEGEND
ACCESS TRAILS
WATER BODIES
DIRECTION OF STREAM FLOW

REPSOL OIL & GAS CANADA INC.

CONSULTING SERVICES AND REMEDIATION WORK CONTRACT,
SATELLITE BAY, PRINCE PATRICK ISLAND, NT

MOULD BAY SITE PLAN

CONSULTANT

PROJECT
SATELLITE BAY F-68 NWT
CONSULTING SERVICES AND REMEDIATION WORK CONTRACT,
SATELLITE BAY, PRINCE PATRICK ISLAND, NT

MOULD BAY SITE PLAN

shown on website
REFERENCES

1. EXISTING TOPOGRAPHY COMPILED USING UAV AND GROUND SURVEY INCLUDING BATHYMETRY PERFORMED BY GOLDER ASSOCIATES LTD., 2015.

2. ELEVATIONS ORIGAMING PROJECTED CURVE GENERATION USING THE CURVE.

3. DRAW ALL PONDED AREAS WITHIN 10 m BUFFER ZONE PRIOR TO BACKFILLING AND CONTRACTING. ALL WORKS WITHIN THE 10 m BUFFER ZONE SHALL BE COMPACTED AND GRADED TO DRAW AWAY FROM THE CONTAINMENT STRUCTURE TYPING TO EXISTING GRADES.

4. TOE OF CONTAINMENT STRUCTURE CAP MATCH TO EXISTING GRADE. ADDITIONAL GRADING FOR POSITIVE DRAINAGE NOT SHOWN.

NOTES

DIMENSIONS AND STATIONS ARE IN METRES UNLESS NOTED OTHERWISE.

BUFFER ZONE

GRADE TOE FROM 10 m BUFFER ZONE

TOP OF CONTAINMENT STRUCTURE CAP

TOE OF CONTAINMENT STRUCTURE CAP

1:600