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resources & energy

SHELL CANADA LIMITED

Interim Abandonment and Restoration Plan

Camp Farewell, NT

C52360500

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SHELL CANADA LIMITED
INTERIM ABANDONMENT AND RESTORATION PLAN
CAMP FAREWELL, NT

PROJECT C52360500 - INTERIM ABANDONMENT AND RESTORATION PLAN

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1. INTRODUCTION

1.1 Overview

WorleyParsons Komex was retained by Shell Canada Ltd. (Shell) to provide an updated Interim Abandonment and Restoration Plan (Plan) for Shell's Camp Farewell (the site) located at 69° 12' 30" N latitude, 135° 06' 04" W longitude, approximately 95 km northwest of Inuvik in the Northwest Territories (NWT) (Figure 1). This site is leased from the federal government. The Plan has been completed in partial fulfillment of the requirements outlined in the Northwest Territories Water Board (the Board) licence #N7L1-1762 Renewal dated November 1, 2005 (Appendix 1).

The Plan addresses the camp as a whole (Figure 2), but segregates out restoration requirements associated with the plant water systems. Restoration activities outlined in this plan include decommissioning (dismantling), remediation and reclamation.

1.2 Purpose and Scope

The purpose of this Plan is to summarize existing information pertaining to the restoration of Camp Farewell and has been prepared to:

- address the Board's reporting requirements for reclamation of the water systems (collection, distribution and discharge facilities); and
- provide Shell with an overview of the restoration requirements associated with the entire site as outlined in Lease No. 107 C/4-2-10 and Lease No. 107 C/4-1-7 (Appendix 2).

The following tasks have been undertaken to address the objectives of the Plan:

- review of the 2006 Phase II Environmental Site Assessment (ESA) (WorleyParsons Komex 2006a);
- review of the 2006 Interim Abandonment and Reclamation Plan (WorleyParsons Komex 2006b);
- respond to regulators' letters of recommendations as pertaining to their review of the Abandonment and Restoration Plan (Appendix 3);
- evaluate of subsequent land use alternatives and selection of a base case for subsequent land use;
- select remediation guidelines;
- determine reclamation objectives for the site;
- development of a plan for dismantling facilities and removing site inventory;
- develop a conceptual remedial programs to address areas of impact that exceed the assumed criteria; and
- prepare a reclamation plan for the developed area to return the land to a condition suitable for subsequent land use.



1.3 Organization of Report

The Restoration Plan is organized as follows:

- Introduction – overview, purpose and scope of project;
- Regional setting – climatic data, surface geology and land use information;
- Site history – background and general use, 1981 spill, current operations and previous environmental investigations;
- Restoration criteria – decommissioning, remediation and reclamation criteria;
- Nature and extent of impact – soil and groundwater impact associated with the site;
- Restoration plan – for the water systems, including the camp facilities; and
- Restoration plan – for the remainder of the site, including materials stored on the site, power generation and work areas, as well as the airstrip and areas of off site impact.

1.4 Water Board Restoration Requirements

The Restoration Plan satisfies Item 1 of Part G of Licence No. N7L1-1762 (Appendix 1) granted to Shell Canada by the NWT Water Board (Board) in accordance with the *Northwest Territories Waters Act*. Item 1 of Part G of the Licence states:

The Licensee shall submit to the Board for approval within one (1) year of issuance of this Licence, an updated Interim Abandonment and Restoration Plan including a complete Phase II Environmental Assessment of Camp Farewell.

The 2006 Phase II Environmental Assessment has been submitted under a separate cover (WorleyParsons Komex 2006a), but where relevant, is summarized in this report.

The “Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories” (NWTWB 1990) is the latest published literature associated with abandonment and restoration in the NWT and is therefore applied in this case. The approach, outlined in the Guidelines, has been tailored to address the unique characteristics of Camp Farewell. It is possible that Camp Farewell will continue to be used as a staging and storage area after the camp operations have been discontinued and decommissioned. For this reason, restoration of the camp facilities and storage area has been presented separately.

1.5 Scope and Requirements of Site Restoration

Requirements for restoration of the entire site provide Shell with a better understanding of final site abandonment and reclamation requirements. Where available, restoration options have been provided to allow Shell to better plan these activities. Implementation of the preferred restoration option will require review and consent by various regulatory bodies.

Lease No. 107 C/4-2-10 and Lease No. 107 C/4-1-7 (Appendix 2) outline the general requirements regarding restoration of the site and the airstrip, respectively. Both leases state in Termination – Part 11:

Upon the termination or expiration of this lease, the lessee shall deliver up possession of the land in a condition satisfactory to the Minister.

And in Restoration – Part 13:

Where the lessee fails to restore the land as required and within the time allowed by the Regulations or by the Minister, the Minister may order the restoration of all or any part of such land and any expenses thus incurred by the Minister shall be recoverable from the lessee as a debt due to Her Majesty.



2. REGIONAL SETTING

2.1 Climatic Data

Climatic data is available for Inuvik which is located approximately 95 km southeast of Camp Farewell. Over the period from 1971 to 2000, the mean daily temperature at Inuvik was -8.8°C with the maximum daily temperature exceeding 0°C on average 156 days a year. Average annual precipitation for this period is 248.4 mm, consisting of 117 mm of rainfall and 167.9 cm of snowfall (Environment Canada 2006).

Climatic data is also available for Tuktoyaktuk which is located approximately 75 km northeast of Camp Farewell and is situated on the Beaufort Sea coast. Over the period from 1971 to 2000 the mean daily temperature at Tuktoyaktuk was -10.6°C with the temperature exceeding 0°C on average 137 days a year. Average annual precipitation for this period was 167.8 mm, consisting of 75.3 mm of rainfall and 95.3 cm of snowfall (Environment Canada 2006). The ice free period on the Mackenzie River is approximately four to five months (June to October). The active layer is similarly governed by this period of time.

2.2 Surface Geology and Permafrost

Camp Farewell is located in the Mackenzie Delta on an outwash plain bordered to the west and southwest by the Mackenzie River and to the east, north, and south by shallow lakes and intermittent ponds (Figure 2). The distance from Camp Farewell's lease boundaries to these water bodies varies from 20 m (southwest to the Mackenzie River as depicted in Figure 3) to a maximum of approximately 360 m north and 660 m east to several unnamed lakes. Drainage from the lease is predominantly to the south and southwest (Figure 2).

Surficial geology (Figure 4) near the site consists of silty sand overlying sand and interbedded sand and gravel deposits associated with the Toker Member, Melloch Till, or those deposited during the Buckland Glaciation (Rampton 1987). These glaciofluvial sediments are overlain by organic deposits. The outwash plains and valley trains encountered in the Mackenzie Delta and along the Tuktoyaktuk Coastlands are generally 3 to 30 m thick and include the Cape Dalhousie Sands, North Star Outwash, Garry Island Member and, probably, Turnabout Member. Visual observation at Camp Farewell indicates that the outwash plain upon which the camp is situated is approximately 15 m thick.

The region surrounding Camp Farewell is underlain by extensive discontinuous permafrost with a low to moderate ice content ($<10\%$ to 20%) that extends to a depth of approximately 95 metres below ground surface (mbgs). The region is characterized by sparse ice wedges, no massive ground ice and sparse pingo ice (Heginbottom 1995). The depth to the active layer (i.e. the layer of soil subject to seasonal thaw) is typically less than 1.0 mbgs and can be as little as 0.28 mbgs. The active layer is typically the zone of highest groundwater flow. WorleyParsons Komex (2006a) reported groundwater above permafrost at depths ranging from 0.26 m to 0.83 mbgs (with depth increasing to the south) and generally dependent on the amount of gravel overburden. As a result of the organic rich soils, the groundwater is light brown in colour.

The area to the north and west of Camp Farewell demonstrates these ice wedges in the form of polygon-shaped depressions. These depressions provide favourable conditions for the establishment of both willow (*Salix* spp.) and alder (*Alnus*). The surrounding area is characterized by dwarf shrubs and ground cover such as mosses and lichens.

2.3 Sensitive Land Use Information

Camp Farewell is located within the Kendall Island Bird Sanctuary (KIBS), near its southern boundary. Shell is required to hold and meet the conditions set out in a permit (Permit # NWT-MBS-06-02) that allows its personnel and/or delegates to enter and conduct activities in the sanctuary. This sanctuary was established in 1961 to protect the staging and breeding grounds of over 100 species of shorebirds, songbirds and waterfowl, especially the Lesser Snow Goose (Canadian Wildlife Service 2000). This sanctuary includes over 600 km² of the Mackenzie River Delta and is bounded to the north by the Beaufort Sea. The habitat provided by the Mackenzie delta-estuary (which houses KIBS) consists of seasonal flats, wet meadows and coastal marshes. Seasonally up to 7,500 Lesser Snow Geese, 5,000 Greater White-fronted Geese, 1,000 Brant and 1,200 Tundra Swans nest, moult and stage in the sanctuary. An estimated 60,000 pairs of shorebirds nest in the outer Mackenzie Delta (Canadian Wildlife Service 2000).

KIBS is adjacent to the migration and summering area of many marine mammals. The waters north of the sanctuary (downstream of Camp Farewell) are thought to be the calving habitat for at least 2,000 beluga whales (Canadian Wildlife Service 2000). Barren-ground grizzly bears are also indigenous to the outer islands of the sanctuary.

2.4 Present and Past Land Use and Adjacent Land Use

The Mackenzie Delta is a traditional hunting and trapping area for both of the region's indigenous populations, the Gwich'in and the Inuvialuit. The area surrounding Camp Farewell is protected and managed by the Canadian Wildlife Service and has been since the establishment of the KIBS in 1961. Given the protected status of the lands surrounding Camp Farewell, there are and have been no industrial settlements within several kilometres of the site. Industrial activity in the form of seismic exploration and exploratory drilling have been ongoing, albeit intermittently, throughout the region since the 1960s.

Due to the presence of permafrost throughout the region, the inhabitants of the Mackenzie Delta draw their water from either freshwater lakes or the Mackenzie River and its tributaries. This is also the case with Camp Farewell (Komex International Ltd. [Komex] 2001).



3. SITE HISTORY

3.1 Background and General Use

The Camp Farewell site was established in the winter of 1970 and the camp housing was brought to site during the summer of 1971. The main purpose of the camp was to act as a staging and storage site for Shell's Delta Drilling Program. The camp was operated fulltime until 1978 with crew accommodations consisting of a single story building accommodating up to 60-70 people. Camp Farewell has since operated periodically until the present (primarily between 1978 and 1994). In the mid-1970s, several large capacity fuel tanks were moved onto the site including two 5,000 bbl tanks, one 3,000 bbl tank and three 2,000 bbl tanks. In the mid 1980s, the original crew accommodations (camp) were replaced with the current facility. This operational camp facility has a capacity of 32 men. Storage activities included fuel storage for up to 6.8 million litres of fuel (including aviation fuel, diesel and gasoline), material storage (including building material and drilling mats), pipe storage and drilling materials storage (including barite, caustic soda and Aqua Seal). Shell also holds a second lease with the Federal government for the adjacent airstrip.

During construction of the site, either 50 mm of polyurethane foam or polyurethane pads were laid over the tundra across the entire lease site (Komex 2001). These pads along with 450 mm of compacted gravel were used as a thermal barrier providing insulative protection for the underlying permafrost. Urethane foam has been tested as an effective impermeable liner to prevent contamination of underlying soils and groundwater (EPS 1977). During test pitting conducted in 2006 (WorleyParsons Komex 2006a), this liner was generally encountered in the central portion of the gravel pad area at depths between 0.38 mbgs and 0.62 mbgs. However, the liner was not encountered in all test pits thereby suggesting that the gravel pad was extended beyond the perimeter of the liner, possibly after the initial establishment of the facility. The pad fill material generally comprises sand and gravel at depths ranging from 0.47-0.90 mbgs (the deepest areas of gravel were encountered at the Burn Pit and Day Tank areas).

It was also noted that, during site construction, drilling mud products (bentonite) were mixed with the gravel that was used on the lease in order establish good gravel adhesion and compaction (Komex 2001).

3.2 1981 Dome/CanMar Spill

A search of the Government of the NWT Hazardous Spills Database (Komex 2001) confirmed a major spill (approximately 800,000 litres) of water contaminated diesel fuel from the tank farm in 1981. This fuel was stored at Camp Farewell by Canadian Marine Drilling (CanMar), a subsidiary of Dome Petroleum, in the two 5,000 barrel tanks in Camp Farewell's tank farm. Based on personnel interviews conducted in 2000 (Komex 2001), the spill was attributed to an act of vandalism/theft and that the tanks were likely tampered with during the winter of 1980-81 and the spill occurred in the spring. It was reported on May 24, 1981.

The spill was released into the berm, overtopped the berm and travelled through the berm onto the lease site from where it followed the site topography southwest over the steep banks to the frozen Mackenzie River. Initial spill cleanup consisted of collecting any free fuel within the berm and camp area. This fuel

was pumped into various holding tanks. Residual fuel was collected using sorbent pads. Over the four to six week clean-up effort a Sacke Portable Burner was used 24 hours/day to burn the recovered fuel. Fuel spilled onto the river was collected using sorbents or burned in situ. All collected sorbents and other spill-related debris on site were incinerated. Other than the collection of free oil, no soil/water remediation was conducted. Further details of correspondence related to the spill and clean up can be found in Komex (2001).

3.3 Current Operations

The Camp Farewell lease (Figure 3; Photos 1 and 2) is under the stewardship of Shell. Currently, the camp is used as a staging site for various activities such seismic operations, preliminary development assessment work and drilling operations. Aside from providing crew accommodations, the site is used for seismic vehicle maintenance, seasonal storage and as a fuel depot. In 1999, E. Gruben's Transport placed a temporary one-story modular accommodations building for 30 plus persons and an exterior transformer approximately 20 m to the east of the main accommodations building (Komex 2001).

The primary water-related facilities at the site include the following:

- water intake system;
- storage system – storage tank inside the crew accommodations;
- distribution system;
- water use facilities – toilets, sinks, showers and associated piping;
- gravity collection system;
- lift station tank and pump;
- primary treatment system;
- UV disinfection unit and chlorine dosing system; and
- final transport tank, pump and piping.

In addition to the camp and water facilities, the lease area includes:

- a bermed tank farm with five tanks;
- a lagoon;
- a fuel trailer;
- Storage Sheds 1, 2 and 3;
- metal storage tanks (believed to be empty);
- a number of storage racks with metal sleds and pipes;



- two stockpiles of crates containing drilling mud additives (bentonite, potash, barite, caustic soda, etc.); and
- a Burn Pit Area containing an open top metal bin for incineration of construction debris.

A more detailed audit of materials and structures at the site should be repeated prior to implementing decommissioning and dismantling activities to ensure an accurate and current inventory.

The northeast corner of the Camp lease, adjacent to the airstrip, is currently used for temporary storage of aviation fuel for regional helicopter operations.

3.4 Previous Environmental Investigations

Several environmental investigations have been conducted at the site previously and are referenced throughout this report. These include the following:

Table A Summary of Previous Environmental Programs

Environmental Program	Summary
Baseline ESA, Camp Farewell, Mackenzie Delta, NWT (Golder 2000)	Golder (2000) summarizes baseline sampling results conducted for Geco-Prakla, a division of Schlumberger Canada Limited, prior to sub-leasing a portion of the site from Shell. The area of the sub lease included the main camp accommodations, associated accommodation trailers, the lagoon area, the area south of the storage crates and racks (including Shed #1) and extended to the east of the lease (Golder 2000). It is not believed that the sub-lease area included the burn pit.
Phase I and Phase II ESA of the Shell Farewell Stockpile and Campsite (Komex 2001)	<p>A Phase I and Phase II study of the entire site was conducted in September 2000 (Komex 2001). Key issues of concern identified in this study included:</p> <ul style="list-style-type: none">• total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAHs) and selected trace metals on and down-gradient of the burn pit;• xylene and TPH in the area of and around the Tank Farm and the spill area of the historical tank release;• TPH concentrations related to surface staining throughout various areas of the gravel base pad;• total barium concentrations throughout various areas of the base pad; and• electrical conductivity (EC) and pH on the base pad in the areas where drilling mud additives had historically been stored.

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Environmental Program	Summary
Interim Abandonment and Restoration Plan (Komex 2002)	Following completion of the Phase I and II ESA (Komex 2001), an Abandonment and Restoration Plan was submitted to the NWT Water Board.
Phase II ESA, Camp Farewell, NWT (WorleyParsons Komex 2006a)	A more detailed Phase II was conducted to delineate soil and groundwater contamination at the site. Key issues of concern identified by this study are discussed in Section 5 of this report (Photos 3 to 5).



4. RESTORATION CRITERIA

4.1 Decommissioning Requirements

Decommissioning (i.e. dismantling and removal) requirements, for the purpose of site restoration, are outlined in “Guidelines for Abandonment and Restoration Planning for Mines in the Northwest Territories” (NWTWB 1990) and “Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products” (Canadian Council of Ministers of the Environment [CCME] 1994).

The Guidelines for Abandonment and Restoration include information regarding decommissioning the following on site items:

- Fuel and Chemical Storage Areas;
- Airstrips and Other Drainage Inhibitors;
- Solid waste; and
- Buildings and Other Structures.

The Environmental Code of Practice for Aboveground Storage Tank (AST) Systems includes additional requirements which will be addressed during tank decommissioning, as outlined in Sections 6.4 and 6.5 of the Code.

It is assumed that all materials and facilities will be removed from the site as part of the restoration process. In general, the facilities to be dismantled can be divided into the following generalized categories:

- facilities and components that remain operable and can be re-used directly;
- materials that can be treated and/or recycled for beneficial re-use;
- waste materials that must be managed and disposed of in accordance with NWT Regulations and Guidelines; and
- contaminated materials that must be managed, treated and/or disposed of in accordance with NWT regulations and guidelines.

4.2 Remediation Guidelines

4.2.1 Soil

For the purposes of developing this plan, remediation guidelines for soil were based on background soil conditions and the NWT Environmental Tier 1 Guidelines for Contaminated Site Remediation (NWT 2003) as outlined below.

Background Soil Chemistry

The background concentration of a substance in soil is the natural concentration of that substance in the absence of any input from anthropogenic activities or sources. In some cases the background concentration of some substances can be a significant portion of, or even exceed, (generic) guidelines (AENV 2008a). Results compiled from studies and assessments conducted locally in the Mackenzie Valley region have reported many mineral elements and organic constituents in background soils that exceed applicable regulated generic guidelines.

Background concentrations will vary with soil parent material, soil depth and hydrologic regime (AENV 2008b). As such it is necessary to take sufficient representative samples and ensure that those samples are collected from outside of the area affected by site activities. Laboratory analysis of background soil samples collected from the surface and near-surface intervals at site have shown varying levels of hydrocarbons that exceed applicable generic guidelines. Further investigation of documented olfactory evidence or visual observations of samples collected in the field did not indicate the presence of hydrocarbons. In response to this phenomenon, background soil chemistry from WorleyParsons Komex (2006a) was assessed to evaluate the effect of textural differences in the soil (i.e. organic versus mineral soil) on soil chemistry, and the influence of organic matter in the organic rich soils on measured middle-to-heavy end hydrocarbon concentrations (typically petroleum hydrocarbon fractions [PHC] F2, F3 and F4). This allowed for the comparison of results to background samples of similar textural class (organic or mineral).

A 95% confidence interval was calculated based on measured background PHC F2, PHC F3, PHC F4 results.

Table B Upper Limit of the 95% Confidence Interval, Background Organic Rich Soils

PHC F2	PHC F3	PHC F4
176 mg/kg	3127 mg/kg	2061 mg/kg

As demonstrated above, naturally occurring hydrocarbons can resemble anthropogenic hydrocarbons in laboratory data that are un-scrutinized. Natural organics interfere with petroleum hydrocarbon results on the gas chromatograph scan as atypical peaks resulting from the detection of the naturally occurring organics. These peaks are then integrated into the final results as the laboratory has no way of differentiating between anthropogenic and natural analytical responses. The end result is a false positive as outlined above in Table B.

The hydrocarbon soil chemistry of organic rich soil samples taken from locations adjacent to or beneath the gravel base pad was then compared to the calculated background hydrocarbon ranges (PHC F2-F4). Chromatograms were also used to identify particular background “signatures” in order to distinguish between naturally occurring hydrocarbons and hydrocarbons related to historical site activities. As detectable PHC F1 and benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations are not anticipated in background soils samples, these parameters were not compared to background conditions



but rather to the regulatory guidelines outlined below. Where samples were taken from soil of dominantly mineral composition, results were also only compared to the reference guidelines outlined below.

As per CCME guidelines (1993) the recommendation of selecting one control site sample per matrix was met with two local background soil samples being collected during the ESA. Furthermore, the local control sites (which are preferable to area control sites) selection met the three listed criteria for selection of control sites (CCME 1993).

Regulatory Guidelines

It is recognized that the selection and approval of appropriate remediation guidelines will need to be re-visited and formally approved at the time of actual facility restoration. More detailed site-specific (i.e. Tier 2) or risk based (i.e. Tier 3) standards may eventually be applied, in accordance with the NWT Environmental Tier 1 Guidelines for Contaminated Site Remediation (NWT 2003). If base pad material (sandy gravel) requires removal following on site remediation, it is assumed that Industrial guidelines would be applied for evaluation of this material. For the purpose of developing this plan, the following regulatory remediation guidelines for soil have been used.

Table C Applicable NWT Guidelines

Parameter	Guideline
Hydrocarbons (BTEX and PHCs)	NWT Environmental Guideline for Site Remediation (NWT 2003); Tier 1 levels for PHCs, Industrial and Residential/Parkland land use, coarse surface soils, Eco Soil contact pathway.
Salinity, metals and PAHs	NWT Environmental Guideline for Site Remediation (NWT 2003); Industrial and Residential/Parkland land use, coarse surface soils.
Barium (total and extractable)	Alberta Environment (AENV) Soil Quality Guidelines for Barite (AENV 2004).

Should a Tier 3 Risk Based approach be selected, relevant CCME guidelines will be utilized (CCME 1996a, 1996b, 1997, 2001 and 2003).

Land Use

The NWT Tier 1 guidelines are generally considered to be protective of human and environmental health for specified uses of soil at contaminated sites based on the intended future use of the land. Under NWT (2003) guidelines, current and likely future land use is classified as Industrial and Residential/Parkland, respectively.

Relevant portions of the Industrial land use definition (NWT 2003) include “land uses in which the primary activity is related to the production, manufacture or storage of materials” and “The public does not usually

have uncontrolled access to this type of land.” Although, access to the Camp Farewell site is not controlled, the relative remoteness of the site limits public access to the site.

Relevant portions of the Residential/Parkland land use definition (NWT 2003) include “the activity that is recreational in nature, and requires the natural or human designed capability of the land to sustain that activity. Residential/Parkland areas are often readily accessible to the public.” By utilizing the Residential/Parkland land use definition it is believed that traditional access and aboriginal harvesting activities are considered.

Based on current land use definitions, Industrial land use guidelines are the most applicable for the site at this time. However, eventual restoration of the site will likely require application of Residential/Parkland land use guidelines. As such, Residential/Parkland land use guidelines are the primary regulatory guidelines referred to in this Plan.

Exposure Pathways

Key exposure pathways (CCME 2001) selected as most appropriate for the Camp Farewell site are protection of groundwater for aquatic life and ecological soil contact. For coarse-grained soil in both land uses, these exposure pathways are also the most restrictive and have been used for the comparison of hydrocarbon results.

4.2.2 Surface and Groundwater

At present, no specific water quality guidelines exist for the NWT. As a conservative measure, the CCME guidelines for freshwater and marine aquatic life (CCME 1999 and updates) were used for surface and groundwater for the purposes of developing this plan. The abbreviations “FWAL” and “MAL” in the text refer to Freshwater Aquatic Life and Marine Aquatic Life, respectively. Exceedances of the CCME FWAL or MAL values do not necessarily indicate a facility-related source, and may reflect natural conditions.

4.2.3 Initial Background Exceedances

During the initial sampling event a toluene concentration was reported to be above guidelines at piezometer P06-2. Subsequent sampling events are required to determine if the results were inaccurately reported due to laboratory or sampling error. If subsequent sampling events report similar toluene concentrations further investigation may be necessary.

4.3 Reclamation Guidelines

Reclamation criteria for the site will parallel those outlined in “Reclamation Guidelines for Northern Canada” (INAC 1987) and “Mine Site Reclamation Policy for the Northwest Territories” (INAC 2002). Information from these Guidelines will be supplemented with current reclamation literature and site specific information. Site-specific information will be used to restore the site to a state compatible with the original undisturbed conditions, in a manner consistent with the present Licence that is protective of human health and the environment.



5. NATURE AND EXTENT OF IMPACT

5.1 Water-Related Facilities

5.1.1 Lagoon Water and Sediments

Lagoon water is managed in accordance to Part D “Conditions Applying to Waste Disposal” of the water licence (Appendix 1). As per Part B “General Conditions”, annual reporting, including that of all discharged waste and analytical results, is required by March 31 of the following calendar year. As such, reporting related to Part B “General Conditions” will be provided under a separate cover.

Following final draining of the lagoon for abandonment, sediment sampling and lagoon sidewall sampling (and analyses) should be undertaken prior to decommissioning and backfilling. In particular, previous environmental investigations (Komex 2001), reported a toluene concentration of 0.94 mg/kg that exceeded the NWT Residential/Parkland guideline of 0.8 mg/kg. Additional sampling is recommended to confirm or refute the presence of toluene. Opportunistic delineation and re-sampling may be conducted on the lagoon sediments once the lagoon has been decanted to confirm or refute the presence of toluene. Should the presence of toluene be confirmed then, as progressive reclamation efforts proceed, delineation of the toluene source will be incorporated into such efforts.

5.2 Gravel Base Pad and Surrounding Land

5.2.1 2006 Environmental Site Assessment

A detailed Phase II ESA (WorleyParsons Komex 2006a) was conducted in August 2006 to evaluate soil, surface water and groundwater conditions at the Camp Farewell site, and to identify the nature and extent of contamination resulting from historical or current operations at the site in support Shell's asset management activities. The assessment program included: a geophysical survey (EM31 and EM38), soil sampling, surface water sampling and the installation and sampling of groundwater monitoring wells among specified Areas of Assessment (AOAs) (Figures 5A and 5B).

A summary of findings from the 2006 Phase II is provided below. Results from previous investigations are included where relevant. 2006 analytical results and piezometer details are summarized in Tables 1 to 6B. Figures 6 and 7 depict sample locations and interpreted areas exceeding reference guidelines or background baseline concentrations (see Section 5.2).

5.2.2 Burn Pit

Eight soil locations, one piezometer and two surface water locations were sampled within and down-gradient of the Burn Pit area. A summary of findings for this AOA is provided below:

- a) Facility-related hydrocarbon impact was identified within (S06-56) and down-gradient of (S06-55 and S06-62 located in a depression running to the south/southwest) of the Burn Pit. Other PHC

concentrations down-gradient of the Burn Pit were attributed to natural organic material. Elevated pH and concentrations of copper, lead and zinc within the Burn Pit, and detectable concentrations of PAHs within and down-gradient (S06-10, S06-55 and P06-3) were also reported, confirming the disposal of hydrocarbon contaminated material and scrap metal in the Burn Pit. These results are consistent with the analytical results from previous investigations (Komex 2001). The reported elevated total barium concentration may be due to the incineration of empty bags of drilling mud additives (barite) in the Burn Pit.

- b) Detectable concentrations of BTEX (ethylbenzene above CCME MAL guidelines) and PHC were identified in shallow groundwater down-gradient of the Burn Pit.
- c) No detectable hydrocarbon concentrations were measured in the two surface water bodies located down-gradient of the Burn Pit and site.
- d) Metals concentrations (cadmium, copper and iron) above CCME MAL and/or FWAL guidelines were detected in surface water bodies in the area. These exceedances likely reflect metals concentrations attributed to background surface water bodies. Based on background information acquired from local projects (WorleyParsons Komex 2008a and 2008b), copper and iron have been noted in the Mackenzie River above CCME MAL and/or FWAL guidelines. The above information along with the lack of cadmium exceedances in any of the soil samples (which would negate any cadmium sources), strongly suggest that the concentrations observed at Camp Farewell ponds (source for which is the Mackenzie River) is normal and within background conditions. Further assessment of background water sources including the Mackenzie River may be warranted.
- e) An area of hydrocarbon stained soil adjacent to the Burn Pit was sampled (S06-43) following excavation by Shell personnel. Concentrations of all hydrocarbon parameters were below reference guidelines or laboratory detection limits indicating that adequate excavation of this hydrocarbon impacted gravel has been accomplished.

5.2.3 Tank Farm/Historical Tank Spill Area

Twenty seven soil borehole and two piezometer locations were sampled in the west and southwest (down-gradient) sides of the site to assess soil conditions on and off the gravel base pad. A summary of findings for this AOA is provided below:

- a) Soil samples were taken at the location of the historical tanks to assess “worst case” conditions and along the spill path from the tank area to the base of the embankment where the spill flowed onto the frozen Mackenzie River. The “worst case” sample (S06-23) was advanced in the source area zone where the spill originated. Results suggest that impact associated with the tank farm and historical spill is characterized by hydrocarbon fractions PHC F3 and lighter, and not PHC F4 concentrations, which is typical of diesel or jet fuel composition.
- b) An area with BTEX and PHC concentrations above reference guidelines for Residential/Parkland and Industrial land uses and established background concentrations has been identified (see Figures 6 and 7). The area of impact incorporates the Tank Farm and Historical Spill area on the



gravel pad (S06-23, S06-37, S06-38, S06-39, S06-40), an area off the gravel pad extending into the adjacent tundra to the north (S06-15, S06-16, S06-44 and S06-66) and an area extending into the adjacent tundra to the west/southwest (S06-20 and P06-7). The area around locations S06-23 and S06-44 reported the highest concentrations of facility-related hydrocarbon impact. These results are consistent with the main direction of spill flow as described in Komex (2001). The area of impact does not appear to extend to P06-6.

- c) Piezometers were installed down-gradient of the Tank Farm area and along the flow path of the 1981 spill to assess, and if necessary, monitor potential migration of contamination. Detectable but below regulatory guideline concentrations of xylenes and PHC F2 were identified in one piezometer down-gradient of the historical tank spill area.

5.2.4 Gravel Pad

Ten soil locations were sampled across the gravel pad, targeting storage areas and providing general coverage across the site or EM anomalies. A summary of findings for this AOA is provided below:

- a) A liner between the natural tundra and the gravel fill was encountered in the central portion of the pad area but not at all test pit locations. This suggests that while a liner was used, the gravel pad was extended beyond the perimeter of the liner, possibly after the initial establishment of the facility.
- b) Total barium concentrations measured on the gravel pad were generally consistent with previous analytical results. However, based on the measured extractable barium concentrations and the application of regulations outlined in the Alberta Barite guidelines (AENV 2004), all samples except S06-3 reported total barium concentrations below AENV (2004) Residential/Parkland criteria (3,300 mg/kg). The elevated total barium concentration at S06-3 (5,040 mg/kg) appears to be localized and restricted to the upper 0.20 m.
- c) Hydrocarbon impact was identified in gravel fill material at one location near storage racks in the central portion of the pad area (S06-6). These results are consistent with Komex (2001) which also reported elevated TPH concentrations in this area. The extent of facility-related impact across the gravel pad appears to be limited to areas of localized drips and spills as part of refuelling and other operational activities.
- d) Slightly elevated terrain conductivity values were measured by EM31 and EM38 surveys at the center of the gravel pad, covering an area approximately 25 m by 30 m, centered at 495997 E, 7677661 N. Locations S06-63 and S06-68 were selected based on the geophysical anomaly reported to the northeast of Storage Shed #1 and intersected extremely hard concrete-like material. This material reported EC, pH and molybdenum values above Residential/Parkland guidelines, soluble salt concentrations elevated above background concentrations and a nickel concentration above Industrial guidelines.
- e) A large conductivity anomaly was measured by the EM31 and EM38 surveys, covering an area approximately 65 m by 50 m, centered at 496185 E, 7677738 N. The nature of the anomaly may be attributed to buried metals in the area. Location S06-45 was advanced to assess this EM anomaly.

Soil chemistry measured in this location was consistent with that of other locations on the pad. Although no buried metal was intersected during sampling, it is believed that buried metal is the source of this EM anomaly.

- f) Small, discrete anomalies were measured throughout the site by the EM31 and EM38 surveys. Their nature can also be attributed to the high number of buried and surface metal debris throughout the gravel pad.

5.2.5 Aboveground Fuel Storage Tanks

Ten soil locations were sampled within three identified AST areas, excluding the Tank Farm. A summary of findings for this AOA is provided below:

- a) A localized PHC F2 concentration above the Residential/Parkland guideline was measured in gravel adjacent to the Day Tank (S06-48; 0.2-0.65 mbgs). PHC F2, PHC F3 and PHC F4 concentrations in the underlying organic horizon at this sample location were below background concentrations. Surrounding test pits (S06-47, S06-49 and S06-50) reported detectable but below guideline PHC concentrations in the gravel pad and below background PHC F2, PHC F3 and PHC F4 concentrations in the underlying buried organic horizon thereby suggesting that PHC F2 impact is limited to the gravel pad at S06-48.
- b) Four samples were taken in areas of limited vegetation growth near the fuel storage tanks where drips and spills were believed to have occurred during fuelling. Two locations (S06-34 and S06-42) reported BTEX and/or PHC concentrations above Residential/Parkland and/or Industrial land use criteria thereby supporting visual indications of surface fuel spills. The remaining sample locations in this area reported detectable PHC concentrations below Residential/Parkland guidelines. The depth of impact likely extends to the base of the gravel pad.
- c) PHC F2 and/or PHC F3 concentrations above background or Residential/Parkland guidelines were reported adjacent to the Heating Oil AST. Analysis of S06-60 reported elevated PHC F3 concentrations in the gravel pad. Analyzed samples submitted from S06-61 reported elevated PHC F2 concentrations in the underlying organic layer, but not in the overlying gravel cover.

5.2.6 Perimeter of the Gravel Pad

Eight soil locations (five along the northeast perimeter and three along the east perimeter) and two piezometer locations (along the south perimeter) were sampled at the perimeter of the site. A summary of findings for this AOA is provided below:

- a) Hydrocarbon concentrations identified off the gravel pad on the northeast perimeter were generally attributed to natural organic material. Potential facility-related hydrocarbon impact was evidenced by PHC F2, F3 and F4 concentrations above background at S06-31 and S06-57. Detectable PHC F1 values in samples from S06-32 and S06-33 may suggest facility-related impact; however, measured hydrocarbon concentrations are below the established background values for organic rich soils.



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- b) Perimeter samples taken to the east and south of the site reported no concentrations of parameters exceeding reference guidelines or background concentrations.
 - c) Two piezometers (P06-4 and P06-5) were installed to the south of the site. These piezometers were dry at the initial time of sampling. A groundwater sample was collected approximately one month after installation from P06-5; however, only sufficient water for hydrocarbon analysis was obtained. P06-4 was still dry and unable to be sampled. No facility-related hydrocarbon impact was identified in groundwater to the south (down-gradient) of the Gravel Pad area.

6. RESTORATION OF WATER-RELATED FACILITIES

6.1 Overview

The restoration plan to be implemented for the water-related facilities, including the accommodation facilities, consists of the following:

- re-sampling of standing water associated with the facilities and disposal of water in accordance with Licence terms and conditions;
- decommissioning (i.e. dismantling and removal) of facilities associated with water collection, distribution, use, treatment and disposal;
- treatment (i.e. dewatering and remediation, if required) of lagoon sediments/sludge following lagoon decommissioning; and
- management of waste generated by these activities.

Reclamation of these areas is included in the scope of work for reclamation of the site as a whole.

6.2 Decommissioning and Dismantling Activities

All facilities located in the camp accommodation area, including water systems (Figure 2) will be dismantled in support of restoration. An audit of the materials and structures in the camp area will be repeated prior to implementing decommissioning and dismantling activities to ensure an accurate inventory is available at that time.

In general, efforts will be made to re-use and recycle materials where practical. At this point, it is reasonable to plan for the following program:

- a) The current camp facilities would have little salvage value given their age. It is reasonable to assume that a survey would be completed to identify any potentially hazardous materials such as mercury switches, asbestos and lead paints. Because the camp is relatively new (1985) there is low risk that any of these materials are present. These materials along with the remaining facilities in the camp accommodation area would be removed and either partially recycled or disposed at a local municipal landfill. Based on the results of the Phase I assessment (Komex 2001), no significant quantities of potentially hazardous materials are suspected to be present.
- b) Water collection, transfer and treatment facilities likely have residual value and would be sold for subsequent application elsewhere.
- c) Miscellaneous metals and piping would be segregated from the facilities and likely shipped south for recycling. It is possible that a small portion of the metals will be in sufficiently good condition for re-use.



The primary costs associated with the dismantling phase would be associated with the physical dismantling in such a remote location, as well as transportation of materials either south, or to an alternate location in the Arctic.

6.3 Remediation Activities

The lagoon will be decommissioned once it is no longer required in the sewage treatment process. If analytical data indicates, treatment of the sediment that has accumulated in the lagoon may be required to comply with remedial standards. Prior to remediation, effluent from the lagoon will be required to meet discharge criteria set out in NWT Water Board Licence # N7L1-1762 Renewal, Part D before discharging to the Mackenzie River.

Following lagoon decanting, dewatering of the sludge will be performed using natural air-drying potentially coupled with mixing of absorbents. The depth of the sludge is not expected to exceed 0.5 m and should be mixed in thin lifts to increase drying efficiency. The sludge can be dried in the lagoon and may require mechanical mixing to enhance the drying process.

Air drying is expected to require approximately three months with at least two of the three months having an average daily temperature above 0°C, which occurs from June to September. Should the estimated three months prove to be an insufficient amount of time to dewater the sludge, the dewatering will continue in thin lifts the following year and so on, until all the sludge is dewatered. Treatment of the lagoon sediment/sludge in this manner negates the need for off site transport and disposal. Air drying the digested sludge/sediments in this manner constitutes a Process to Significantly Reduce Pathogens (PSRP) as designated by the Environmental Protection Agency (EPA 1989). Treatment of lagoon sediment/sludge meets Item 6 of Part D of the Water Board Licence. The process of air drying will also serve to reduce hydrocarbon compounds that are present. As such, the dried sediments are expected to be suitable for subsequent reuse as fill following the drying and treatment process. They could also be beneficially reused as a topsoil amendment as part of site reclamation.

6.4 Reclamation Activities

Reclamation of the camp accommodation area is addressed with the remainder of the camp storage facilities. It is possible that the site will continue to be used as a material storage facility after the accommodation component has been removed.

The sewage lagoon should be reclaimed by backfilling the lagoon using the dykes and treated sediments to conform to the surrounding landscape. It may be beneficial to spread alluvial sediments (imported from external sources) over the prepared grade to approximate the surrounding topsoil conditions. At this point, the surface material would be fertilized and seeded with native species (see Section 7.6, Table E). The final reclamation plan will be chosen based on feedback from the local Government Land Use Inspector.

7. RESTORATION OF BASE PAD AND SURROUNDING LAND

7.1 Overview

It is suggested that the Restoration Plan for the site be conducted in several phases, with near term, preliminary remediation and monitoring initiated in response to areas of impact defined in Komex (2006) with a longer term plan detailing final (site end of life) restoration plans. As such this section is organized as follows:

- near-term remediation and monitoring of areas of previously identified impact;
- decommissioning (i.e. dismantling and removal) of structures and materials;
- additional treatment (e.g. remediation or disposal) of contaminated soils, if necessary;
- management of waste generated by these activities; and
- final reclamation of the area to a condition compatible with undisturbed conditions and surrounding land use.

7.2 Near Term Site Remediation and Monitoring

7.2.1 General

ESAs undertaken at the site have identified several areas requiring remediation (Figures 6 and 7). A general summary of proposed remediation strategy is as follows:

- source removal of hydrocarbon impacted soil/gravel located within the gravel base pad area;
- off site disposal or on site treatment of excavated soil;
- restoration of excavated areas;
- monitoring and management of hydrocarbon impacted natural tundra; and
- groundwater monitoring.

7.2.2 Impacted Gravel (Source) Removal – Gravel Base Pad Area

The estimated volume of hydrocarbon impacted soil requiring excavation within the gravel pad area is 2,495 m³ (excluding berm material). This soil is located in several of the identified 2006 AOAs at site:

- Tank Farm/historical fuel spill area – 2,000 m³: the gravel fill requires excavation until the intersection of the liner or the underlying organic soil, at an average depth of 0.5 mbgs;
- Fuel Storage AST – 30 m³: two additional localized areas east of the main impacted area requiring excavation of gravel fill material until the intersection of the liner or the underlying organic soil, at an approximate depth of 0.6 mbgs;



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- Fuel Tank Area – 370 m³: the gravel fill material and the underlying natural soil requires excavation, to an approximate depth of 1.2 mbgs;
 - Burn Pit – 75 m³: the gravel fill material requires excavation until the intersection of the liner or the underlying organic material, at an approximate depth of at least 0.5 mbgs; and
 - Gravel Pad – 20 m³: the gravel fill material in a localized area near the storage racks requires excavation until the intersection of the liner or the underlying organic soil, at an approximate depth of 0.65 mbgs.

Excavation would be conducted with heavy equipment transported to the site by barge (summer) or by winter road. Validation samples will be collected from the completed excavation to ensure that the remediation objectives have been met.

7.2.3 Treatment Options

Options for the management of excavated base pad gravel/soil include:

- on site ex situ treatment of hydrocarbon impacted material and reuse as backfill; and
- off site disposal – transportation of excavated soil to an appropriate landfill facility.

Given the limited supply of gravel in the Mackenzie Delta, the preferred option is to excavate, treat and replace/reuse the impacted gravel for industrial purposes, wherever and whenever gravel is removed from the site.

On Site

On site ex situ treatment will be implemented to reduce BTEX and PHC F1 through PHC F3 concentrations in the sandy gravel base pad material to less than NWT guideline levels for the pre-determined land use (Residential/Parkland or Industrial). On site treatment options include thermal desorption, chemical oxidation or bioremediation.

Ex situ biological treatment has been applied successfully at similar project locations and for similar contaminant conditions. Komex International (now WorleyParsons) has been involved in two similar projects on behalf of Amoco Canada with Canmar's former Tuk Base and with the Government of the NWT Department of Transportation at the Tuk Airport. The characteristics of the soils and contaminants at the site are very similar to those at the Tuk Airport and Canmar's Base, as is evidenced in the underlying summary of the projects.

Table D Comparison of Hydrocarbon Contamination

Parameter	Tuk Airport	Canmar Tuk Base	Camp Farewell
Contaminant	Diesel, gasoline and jet fuel	Diesel and jet fuel	Gasoline and diesel
Contaminated media	Sandy gravel	Sandy gravel	Sandy gravel
Volume of soil (m ³)	2,000	2,000	2,495
Before Treatment			
Primary carbon chain length range	C8 to C60	C10 to C20	C10 to C34
Primary hydrocarbon concentration (mg/kg)	TPH range from 2,500 to 10,000	TPH range from 3,000 to 20,000	PHC F1 - <293 PHC F2 - <4,220 PHC F3 - <3,980
After Treatment			
Primary carbon chain length range	C10 to C34+	C10 to C34	C10 to C34
Primary TPH concentration (mg/kg)	600 to 1950	300 to 2,200	NWT, 2003

It is important to note that Komex's previous experience involved sites that continued to be used for industrial purposes. The addition of nutrients and oxygen, in conjunction with moisture amendments similar to that used at the Tuk sites, will act as a more aggressive approach to meet the desired criteria. More than one field season may be required. These modifications are based on successful treatment methods applied at similar projects in northern latitudes (Ramert and Eberhardt 1996 and Reynolds et al. 1998).

Given the gravel (in general) material to be excavated, thermal desorption or chemical oxidation are considered to be the more time efficient of these options. Thermal desorption equipment or chemical oxidizer would require transport to site.

Treatment cells (with the design and number of cells dependent on the remediation method employed, volumes and time constraints) could be constructed on a portion of the storage base pad area or the adjacent air strip.

Off Site Disposal

The majority of the proposed material to be excavated appears to be impacted only with hydrocarbons, and therefore should be able to be re-used as backfill after treatment and confirmatory sampling to ensure



successful treatment. In situ volumes of base pad soils containing salts, basic materials (elevated pH) or barite above site criteria and/or Industrial land use guidelines are estimated to be localized on the order of $<150 \text{ m}^3$. In particular, material from the Burn Pit contains trace metals above reference guidelines and therefore the potential for treatment and reuse of this soil is limited and alternative remedial options will be required.

A risk assessment should be considered to evaluate potential reuse options for these materials. Alternately, these materials would be transferred to Alberta or British Columbia for disposal unless a suitable facility is constructed in the area as an alternative. Material for off site disposal will be sampled for classification prior to transportation for evaluation against the Transportation of Dangerous Goods and Landfilling Regulations. All materials would generally be classified as non-hazardous and non-dangerous in accordance with accepted transportation and disposal criteria.

7.2.4 Restoration of Excavated Areas

Completed excavations will require backfilling, either with treated soil (in the case of on site treatment) or with imported backfill material (in the case of off site disposal), to return the excavated areas to a level compatible with the remaining Gravel Pad area. Fill material will be sampled prior to backfilling to ensure that all parameter guideline concentrations are met.

7.2.5 Hydrocarbon Impacted Natural Tundra

Identified hydrocarbon impact appears to extend beyond the gravel pad in several areas as listed below:

- Tank Farm/historical fuel spill area – 700 m^3 : the area of hydrocarbon impacted soil extends beyond the gravel pad to the north and west;
- Burn Pit area – 395 m^3 : the area of hydrocarbon impacted soil extends beyond the gravel pad to the south and south-east; and
- Northeast perimeter – 60 m^3 : an area of hydrocarbon impacted soil is located off the gravel pad at the northeast perimeter.

Currently, the vegetation in these areas does not show any obvious, visual signs of being stressed by the presence of hydrocarbons (Komex 2001 and WorleyParsons Komex 2006a). A vegetation survey to assess the detailed health of the surrounding plant life has not been conducted to date. Preliminary visual inspections have reported no evidence that would suggest native flora has been adversely affected by site activities. Limited ground and vegetation disturbance is an important variable in considering remediation methods for these areas. The fragile nature of the local vegetation and difficulties associated with re-vegetation in northern climates are reasons to discourage such disturbance. In short, the extensive ground and vegetation disturbance that would result from excavation would cause excessive damage to the fragile tundra environment and the underlying permafrost. Excavation of the natural tundra is not considered to be a beneficial option.

In situ treatment options, such as soil vapour extraction (SVE), have also been considered. However, source removal of hydrocarbon impacted soil/sandy gravel from the base pad should eliminate any

chance of impact migration to soil and groundwater in the natural tundra surrounding the site. As such, although in situ remediation is potentially a viable option, given the apparent health of the vegetation, the limited lateral movement of contaminants over time, the physical limitations (including shallow permafrost), the presence of longer chain less treatable hydrocarbons, and the remote location of the site, in situ treatment is not considered to be the best option at this time. Following removal of the hydrocarbon impacted material from the gravel pad, the vegetation in the natural tundra surrounding the gravel pad will be monitored for signs of stress which may be related to the identified presence of hydrocarbons in the soil. Additional soil sampling will be undertaken to monitor and assess attenuation of hydrocarbons off site.

7.2.6 Groundwater Management and Monitoring Programs

Facility-related hydrocarbon impact, including detectable concentrations of BTEX and PHC, identified in soil at the Burn Pit appears to have impacted the shallow groundwater down-gradient of the Burn Pit area. Detectable but below regulatory guideline concentrations of xylenes and PHC F2 were also reported in one piezometer down-gradient of the historical tank spill area.

Continued soil, vegetation and groundwater monitoring will be undertaken to reassess conditions following completion of excavation and remediation activities. A timeline of one, two and five years after the completion of excavation and reclamation activities is suggested (this would be reassessed based on the results of each monitoring event). Monitoring will include:

- a) Groundwater monitoring at all piezometer locations to assess groundwater conditions on an annual basis (for the above mentioned timeline) after the completion of excavation and reclamation activities. Analysis of groundwater samples would include BTEX, PHC F1, and F2 and routine water chemistry parameters.
- b) Annual soil and vegetation monitoring following source removal will be undertaken in the natural tundra surrounding the gravel pad in AOAs with identified facility-related impact. Soil samples will be obtained and submitted for laboratory analyses and vegetation will be monitored for signs of stress which may be related to the identified presence of hydrocarbons in the soil.

The analytical schedule for soil samples would be consistent with contaminants identified during previous environmental assessments (Komex 2001 and WorleyParsons Komex 2006) and would consist of some or all of the following:

- BTEX;
- PHC F1, F2, F3, F4 and F4G;
- soil salinity: pH, EC, soluble anions and cations;
- total metals (CCME Metals); and
- PAHs.



Additional options for the management of soil and groundwater in the native tundra will be considered following review of annual soil, vegetation and groundwater monitoring data.

7.3 Progressive Reclamation Schedule

Shell, in accordance with their core corporate focus of sustainable development and environmental stewardship has, adopted a program of progressive reclamation at the Camp Farewell site. An interim schedule of progressive reclamation is as follows:

2009

Winter/Spring

- Mobilization of heavy equipment and materials to site via ice road or barge.

Summer

- Construction of temporary soil treatment cells.
- Excavation of source material from the gravel pad AOAs.
- Placement of impacted material in temporary treatment cells for ex situ treatment.
- Placement of non-treatable soil material in approved packaging for transport to a licensed landfill facility, as required.
- Packaging and transport off site of sea-cans and/or miscellaneous items not required on site.
- Establishment of baseline soil and water quality:
 - groundwater monitoring;
 - surface water sampling; and
 - shallow soil sampling.

2010

Summer (Year One)

- Ongoing treatment of soils within the treatment cell(s), if required.
- Dewater and backfill open excavations.
- Post Remediation Monitoring.
- Areas of focus for monitoring efforts:
 - Tank Farm (700 m³ to the north and west);
 - Burn Pit (395 m³ to the south and southeast); and
 - Perimeter of Gravel Pad (60 m³ northeast of Gravel Pad).

- Monitoring tasks:
 - groundwater monitoring;
 - surface water sampling;
 - shallow soil sampling; and
 - visual monitoring.

2011

Summer (Year Two)

- Post Remediation Monitoring:
 - groundwater monitoring;
 - surface water sampling;
 - shallow soil sampling; and
 - visual monitoring.
- Ongoing treatment, if necessary.

2012

Summer (Year Three)

- Post Remediation Monitoring (if treatment continued into 2011):
 - groundwater monitoring; and
 - shallow soil sampling.

2013

Summer (Year Four)

- Post Remediation Monitoring
 - visual monitoring.

2014

Summer (Year Five)

- Post Remediation Monitoring:
 - groundwater monitoring;
 - surface water sampling;
 - shallow soil sampling; and
 - visual monitoring.



Undetermined Date

Abandonment and Restoration Activities.

As outlined in 2006 Interim Abandonment and Restoration Plan (Sections 7.3 and 7.5).

- Reclamation Tasks:
 - selective grading to match site topography;
 - rip area to loosen compacted soil and scarify with machinery to enhance micro-topography for vegetation;
 - cover with a thin lift of natural alluvial soils to match the surrounding soil conditions; and
 - re-vegetate site with an appropriate mixture of native plant species as regulations dictate.

Abandonment of the facility is not planned for the immediate future and as such no timeline can be provided for associated abandonment activities.

It is understood that, updates to the Abandonment and Restoration Plan, including the Progressive Reclamation Schedule may be required in one or more of the following circumstances:

- the facility activities lead to expansion that hasn't been contemplated in the existing Plan;
- there is a change (or proposed change) in reclamation procedures; and/or
- there are unforeseen or significant hazards as well as operational changes identified.

As such, Abandonment and Reclamation/Closure plans may be updated where and when required, subject to regulatory review and consent.

7.4 Decommissioning and Dismantling Activities

An up-to-date audit of the materials and structures in the storage area of the site will be completed prior to implementing decommissioning activities to ensure an accurate inventory. This ensures that decommissioning is completed in a safe manner and that appropriate measures are implemented to deal with the materials that are present at that time.

In general, efforts will be made to re-use and recycle materials where practical. At this point, it is reasonable to plan for the following program:

- a) Drilling materials such as pipes that are still in operable condition would be sold for subsequent re-use in exploration or production projects being completed in the area. Worn materials or drilling materials that are no longer functional would be recycled or disposed.
- b) Fuels would be removed from their storage facilities and beneficially reused locally. Fuel storage tanks would be reused or recycled.

- c) Miscellaneous construction materials remaining on the site likely have adequate function for beneficial reuse in the local market place. It is assumed that these materials would either be recycled or disposed locally in a municipal landfill.
- d) The current camp support facilities would have little salvage value given their age and present condition. It is reasonable to assume that a survey would be completed to identify any potentially hazardous materials such as mercury switches, asbestos, and lead paints. These materials would be removed, if present. Given the age of the camp (1985), there is low risk of these materials being present. The remaining facilities would be removed and either partially recycled or disposed of at a local municipal landfill. Based on the results of the Phase I assessment, no significant quantities of potentially hazardous materials are suspected to be present.
- e) Miscellaneous metals and piping would be segregated from the facilities and recycled or disposed. It is possible that a small portion of the metals will be in sufficiently good condition for re-use in the Arctic.

The primary costs associated with the site decommissioning and dismantling phase would be associated with the physical dismantling in such a remote location, as well as transportation of materials either south, or to an alternate location in the Arctic.

7.5 Additional Remediation Activities

It is anticipated that remediation of areas of impacted soil identified by ESAs conducted to date (see Section 7.2) will have been undertaken before the final restoration of the site. However, other remediation requirements may be present which will need to be addressed at the time of final site restoration. The remediation strategy for any such requirements will be based on the type and location of contamination, and is likely to follow the same general principles as outlined in Section 7.2.

7.6 Reclamation and Re-Vegetation Activities

7.6.1 Reclamation Activities

Reclamation activities will focus on returning the site to a condition that will be compatible with that of the surrounding undisturbed land.

The Reclamation Plan involves leaving the current urethane and gravel layers of the base pad in place. Removing the liner may result in deeper penetration of contaminants into soils and groundwater due to removal of the impermeable layer and/or deepening the active zone and allowing for an increased area for contaminant migration. Complete breakdown of Urethane Foam into soluble components proceeds very slowly and therefore it is unlikely that products deleterious to the environment would be released into the soil or groundwater at significant rates (EPS 1977). Freeze-thaw cycles and exposure to the elements are probably the largest contributors to urethane degradation.

Permanent and complete removal of these layers (urethane and gravel) would expose the pre-camp natural surface, which has experienced subsidence due to static loading and melting caused by the site



base. The exposed surface and lack of an insulative vegetation layer would likely lead to ground thawing resulting in landscape subsidence and depression. The potential for landscape depression, coupled with soil compaction issues and elevated ground temperatures caused by increased solar radiation influences, give rise to the possibility of substantial site ponding. If base materials are left in place, topography of the site will remain relatively unchanged. Reclamation focus would be on re-vegetation of the site. A summary of the Reclamation Plan consists of:

- localized grading activities to match site topography;
- rip area to loosen compacted soil and scarify with machinery to enhance micro-topography for vegetation;
- cover with a thin lift of natural alluvial soils (obtained from local source such as Inuvik) to match the surrounding soil conditions; and
- re-vegetate site with an appropriate mixture of native non-invasive plant species.

The deposition of up to a 0.40 m lift of natural alluvial soils (sourced from area borrow locations) will be required to foster the initial and future floral performance by supplying a more amenable substrate for the vegetation root systems. The nutrient rich alluvial soils, in comparison to amended gravel of the site pad, are expected to be favourable to initial plant development and increase the success rate of revegetation.

Studies have been conducted at sites along the Mackenzie River and in the Mackenzie Delta regarding vegetation reclamation requirements and associated rooting depths (Bates 2006, and USDA 2008). The reclamation strategy for the Camp Farewell site would likely involve the following species:

Table E Species Used in Reclamation in the Mackenzie Delta¹

Scientific Name	Common Name	Rooting Depth ²
<i>Agropyron trachycaulum</i>	Slender wheat grass	0.40 m
<i>Agropyron violaceum</i>	Broad-glumed wheat grass	n/a
<i>Agrostis scabra</i>	Rough hair grass	0.76 m (30 inches)
<i>Alopecurus arundinacea</i>	Creeping foxtail	n/a
<i>Arctagrostis arundinacea</i>	Polar grass	n/a
<i>Calamagrostis canadensis</i>	Bluejoint	0.40 m
<i>Deschampsia beringensis</i>	Bering hair grass	0.40 m
<i>Deschampsia cespitosa</i>	Tufted hair grass	0.40 m
<i>Festuca ovina</i>	Sheep fescue	0.25 m
<i>Festuca saximontana</i>	Rocky Mountain fescue	0.25 m
<i>Poa alpina</i>	Alpine bluegrass	0.25 m

Notes: ¹ Bates 2006, ² USDA 2008, n/a not available

Given the relative scarcity of gravel materials in the region and the likelihood of requiring backfill material during the reclamation phase, partial removal of gravel from the pad may be necessary. In such an event, clean gravel fill may be removed in limited quantities from the surface of the gravel pad. The possible reduction in depth of the gravel pad would be taken into consideration to ensure that the integrity of the permafrost below is maintained. Prior to the inception of end-of-life reclamation the impact of ground/gravel cover removal on permafrost integrity will be more thoroughly investigated.

7.6.2 Re-Vegetation

A native seed mixture combined with amendments (e.g. fertilizer) is proposed for the site. The final seed mix and application rate will be developed with input from reclamation specialists and regulators including the local Government Land Use Inspector. The objectives of the seed mix are to:

- stabilize site soils;
- provide habitat equivalent to the surrounding landscape;
- allow the for natural succession of vegetation and minimize maintenance; and
- utilize a seed mixture compatible with the local vegetation.

7.6.3 Monitoring Programs

Vegetation/Reclamation Monitoring

The site will be assessed for reclamation success, on an annual basis for the first five years following remediation, restoration and abandonment activities, until vegetation is established. The progress and extent of growth of all desirable and non-desirable species will be identified and documented. Any unusual soil conditions, such as erosion, bare areas, etc., would be identified and addressed. Maintenance would be undertaken as required, until reclamation is accepted as complete and sustainable by relevant regulatory bodies.

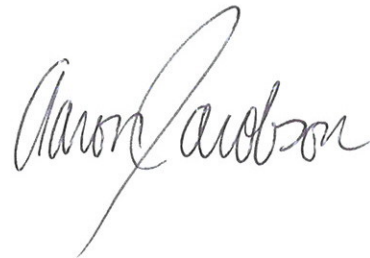
8. CLOSURE

We trust that this report satisfies your current requirements and provides suitable documentation for your records. If you have any questions or require further details, please contact the undersigned at any time.

Report Prepared by
WorleyParsons Komex



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Senior Review by



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Global Lead - Environment

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Tables

2006 Soil Analytical Results

CLIENT: Shell Canada Limited
PROJECT NO.: C52360300
PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

			Physical						Salinity / Sodicity														Sulphur		Hydrocarbons										
Sampling Location	Soil Depth (m)	Date (d-m-y)	Moisture Content				Theor. Gypsum Reqmt. (tons/ac)															Sulphur (mg/kg)	Sulphur:T (mg/kg)												
			(%)	Clay (%)	Silt (%)	Sand (%)		Texture Class (units)	EC (us/cm)	pH (units)	Sodium Adsorption Ratio (ratio)	Saturation % (%)	Soluble Ca (mg/L)	Soluble Cl (mg/L)	Soluble CO ₃ (mg/L)	Soluble HCO ₃ (mg/L)	Hydroxide (mg/L)	Soluble K (mg/L)	Soluble Mg (mg/L)	Soluble Na (mg/L)	Soluble SO ₄ (mg/L)			Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes-total (mg/kg)	PHC F ₁ (C ₆ -C ₁₀) (mg/kg)	PHC F ₂ (C ₁₁ -C ₁₆) (mg/kg)	PHC F ₃ (C ₁₇ -C ₃₄) (mg/kg)	PHC F ₄ (C ₃₅ -C ₅₀ +) (mg/kg)	F ₂ SG (Heavy HC-Silicagel) (mg/kg)	Reached baseline at C ₅₀ (Yes/No)		
NWT Industrial, Coarse surface			--	--	--	--	--	4,000	6 - 8	12	--	--	--	--	--	--	--	--	--	--	--	--	--	5	0.8	20	20	330	760	1,700	3,300	--	--		
NWT Residential/Parkland Coarse Surface			--	--	--	--	--	2,000	6 - 8	5	--	--	--	--	--	--	--	--	--	--	--	--	--	0.5	0.8	1.2	1	130	150	400	2,800	--	--		
Background Chemistry (Organic rich soils, PHCs only) - 95% Conf. Int.			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<10	176	3,127	2,061	--	--		
Background																																			
S06-1	(0.0-0.20)	03-Aug-06	66.5	7	58	34	Silt Loam	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	<10	64	1,150	585	4,900	NO		
	(0.20-0.40)	03-Aug-06	68.5	23	57	20	Silt Loam	<0.1	251	6.7	0.6	180	30	15	<10	102	--	<5	14	17	<10	--	1,100	<0.0050	<0.020	<0.010	<0.045	<10	164	2,850	1,880	12,000	NO		
S06-2	(0.0-0.20)	03-Aug-06	81.2	--	--	--	Organic	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	<10	89	1,760	975	5,300	NO		
	(0.20-0.40)	03-Aug-06	69.9	5	66	30		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	<10	91	1,580	1,020	4,700	NO		
P06-1	(0.85-1.35)	05-Aug-06	17.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	<10	<10	<10	<10	--	YES		
P06-2	(0.15-0.35)	06-Aug-06	46.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	<10	64	1,000	614	4,700	NO		
Burn Pit Area																																			
S06-9	(0.15-0.45)	04-Aug-06	14.1	--	--	--	--	<0.1	1,370	7.9	3.8	34	31	75	<10	367	<10	329	8	93	187	<200	84	<0.0050	<0.020	<0.010	<0.045	<10	<10	47	31	--	YES		
	(0.45-0.65)	04-Aug-06	17.9	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--			
S06-10	(0.15-0.45)	04-Aug-06	55.2	--	--	--	--	<0.1	1,120	6.7	1	160	87	44	<10	130	<10	177	29	41	278	--	--	<0.0050	<0.020	<0.010	<0.045	16	147	1,460	1,020	6,600	NO		
S06-11	(0.0-0.15)	04-Aug-06	64.1	--	--	--	--	<0.1	1,630	7.6	5	260	55	147	<10	576	<10	278	17	166	94	<200	1,590	<0.0050	<0.020	<0.010	<0.045	12	54	744	661	3,200	NO		
	(0.15-0.45)	04-Aug-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--			
S06-12	(0-0.15)	04-Aug-06	54.8	--	--	--	Loamy Sand	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
	(0.15-0.45)	04-Aug-06	18	5	11	84		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
S06-43	(0.2-0.9)	07-Aug-06	5.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.020	<10	29	86	32	--	YES		
S06-55	(0.2-0.6)	11-Aug-06	52.6	--	--	--	--	<0.1	459	6.6	0.7	100	37	10	<10	82	--	54	16	21	90	<200	717	<0.0050	<0.020	<0.010	<0.040	128	1,740	1,770	861	6,500	NO		
S06-56	(0.2-0.5)	11-Aug-06	6.7	--	--	--	--	<0.1	1,230	8.3	4.6	19	56	50	<10	725	--	273	9	142	158	<200	1,360	<0.0050	0.077	<0.010	0.26	293	3,460	356	88	--	YES		
S06-62	(0.15-0.63)	14-Sep-06	66	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	18	883	1520	685	6300	NO		
P06-3	(0.7-0.85)	06-Aug-06	8	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	<10	<10	<10	<10	--	YES		
Historical Tank Spill Area																																			
S06-14	(0-0.2)	04-Aug-06	33.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	<10	116	841	520	3,000	NO		
S06-15	(0.2-0.42)	04-Aug-06	44.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	0.068	0.05	0.095	16	292	3,470	2,100	12,000	NO		
S06-16	(0.20-0.44)	04-Aug-06	70.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	0.22	<0.010	<0.020	19	441	5,710	2,810	--	NO		
S06-17	(0.2-0.46)	04-Aug-06	31.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	11	170	1,820	1,380	6,100	NO		
S06-19	(0.20-0.60)	04-Aug-06	5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.020	<10	16	37	12	--	--		
S06-20	(0.2-0.6)	04-Aug-06	42.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
S06-23	(0.15-0.45)	07-Aug-06	5.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.045	59	4,220	3,980	52	--	YES		
	(0.45-0.75)	07-Aug-06	6.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	0.087	0.095	1.9	109	3,400	2,780	63	--	YES		
	(0.75-1.15)	07-Aug-06	58.1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	--	--	<0.0050	3.7	0.062	0.58	88	310	6,930	3,770	24,000	NO		
	(1.15-1.35)	07-Aug-06	57.4	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	2.6	<0.010	<0.045	27	182	3,580	1,840	13,000	NO		
S06-27	(0.2-0.5)	06-Aug-06	35.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.0050	<0.020	<0.010	<0.020	<10	26	503	394	--	YES		

2006 Soil Analytical Results

CLIENT: Shell Canada Limited
PROJECT NO.: C52360300
PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

			Physical						Salinity / Sodicity														Sulphur		Hydrocarbons										
Sampling Location	Soil Depth (m)	Date (d-m-y)	Moisture Content (%)	Clay (%)	Silt (%)	Sand (%)	Texture Class (units)	Theor. Gypsum Reqmt. (tons/ac)	EC (us/cm)	pH (units)	Sodium Adsorption Ratio (ratio)	Saturation % (%)	Soluble Ca (mg/L)	Soluble Cl (mg/L)	Soluble CO ₃ (mg/L)	Soluble HCO ₃ (mg/L)	Hydroxide (mg/L)	Soluble K (mg/L)	Soluble Mg (mg/L)	Soluble Na (mg/L)	Soluble SO ₄ (mg/L)	Sulphur (mg/kg)	Sulphur:T (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes-total (mg/kg)	PHC F ₁ (C ₆ -C ₁₀) (mg/kg)	PHC F ₂ (C ₁₁ -C ₁₆) (mg/kg)	PHC F ₃ (C ₁₇ -C ₃₄) (mg/kg)	PHC F ₄ (C ₃₅ -C ₅₀ +) (mg/kg)	F ₂ SG (Heavy HC-Silicagel) (mg/kg)	Reached baseline at C ₅₀ (Yes/No)		
NWT Industrial, Coarse surface			---	---	---	---	---	---	4,000	6 - 8	12	---	---	---	---	---	---	---	---	---	---	---	---	---	5	0.8	20	20	330	760	1,700	3,300	---	---	
NWT Residential/Parkland Coarse Surface			---	---	---	---	---	---	2,000	6 - 8	5	---	---	---	---	---	---	---	---	---	---	---	---	---	0.5	0.8	1.2	1	130	150	400	2,800	---	---	
Background Chemistry (Organic rich soils, PHCs only) - 95% Conf. Int.			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<10	176	3,127	2,061	---	---	
Historical Tank Spill Area continued																																			
S06-28	(0.2-0.7)	06-Aug-06	20.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.020	<10	15	241	183	---	YES	
S06-29	(0.2-0.7)	06-Aug-06	33.6	---	---	---	---	<0.1	491	7.1	0.8	82	70	20	<10	280	<10	<5	32	33	15	---	521	<0.0050	<0.020	<0.010	<0.045	<10	48	647	377	---	YES		
S06-30	(0.2-0.76)	06-Aug-06	48.8	---	---	---	---	<0.1	473	6.7	0.9	120	67	12	<10	171	<10	<5	30	36	48	---	736	<0.0050	<0.020	<0.010	<0.045	<10	106	1,490	935	---	NO		
S06-37	(0.5-0.7)	07-Aug-06	6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	176	112	<10	---	YES	
	(0.7-1.0)	07-Aug-06	55.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.034	9.8	<0.010	0.29	16	300	2,090	1,010	9,100	NO		
	(1.0-1.3)	07-Aug-06	21.7	5	16	80	Loamy Sand	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-38	(0-0.35)	07-Aug-06	6.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	<10	12	53	---	YES	
	(0.35-0.55)	07-Aug-06	32.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.015	5.2	0.035	0.25	<10	60	657	394	2,900	NO	
S06-39	(0.65-0.95)	07-Aug-06	44.5	13	45	42	Loam	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	3	<0.010	<0.045	<10	152	2,080	1,010	9,000	NO	
	(0.95-1.4)	07-Aug-06	14	6	7	87	Loamy Sand	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	0.1	<0.010	<0.045	<10	<10	25	99	---	YES	
S06-40	(0.15-0.5)	07-Aug-06	6.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	0.037	<0.010	<0.045	<10	92	205	45	---	YES	
	(0.5-0.7)	07-Aug-06	5.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	0.24	0.033	0.2	28	787	754	36	---	YES	
S06-41	(0.15-0.6)	07-Aug-06	3.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	<10	25	16	---	YES	
	(0.95-1.4)	07-Aug-06	17.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	0.11	<0.010	<0.045	<10	<10	83	52	---	YES	
S06-44	(0-0.15)	07-Aug-06	58.9	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	0.21	<0.010	0.59	34	1,330	6,890	3,810	23,000	NO	
	(0.15-0.5)	07-Aug-06	60.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	4.9	<0.010	<0.045	37	550	9,490	6,320	37,000	NO	
S06-52	(0.5-1.0)	09-Aug-06	10.9	---	---	---	---	<0.1	394	7.4	0.6	30	57	16	<10	247	---	6	18	22	74	---	288	<0.0050	<0.020	<0.010	<0.040	<10	12	109	54	---	YES		
S06-64	(0.0-0.15)	14-Sep-06	58.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	16	56	576	209	---	YES	
	(0.15-0.33)	14-Sep-06	62.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	<10	47	919	421	3900	NO	
S06-65	(0.15-0.39)	14-Sep-06	63.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	60	148	1820	968	6800	NO	
S06-66	(0.15-0.58)	14-Sep-06	65.3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	0.54	<0.010	<0.040	195	343	5290	2810	19,000	NO	
S06-67	(0.00-0.15)	14-Sep-06	57.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	16	173	943	231	---	YES	
	(0.15-0.47)	14-Sep-06	41.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	47	53	523	421	1900	NO	
P06-6	(0.15-0.3)	06-Aug-06	48.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.020	<10	21	323	211	---	YES	
	(0.5-1.1)	06-Aug-06	21.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	27	276	201	---	YES	
	(1.1-1.25)	06-Aug-06	14.8	7	11	82	Loamy Sand	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	<10	76	79	---	YES	
P06-7	(0.15-0.45)	07-Aug-06	54.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	0.071	0.31	2.3	14	79	1,520	986	6,200	NO	
Gravel Pad																																			
S06-3	(0.0-0.20)	03-Aug-06	6.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.20-0.40)	03-Aug-06	5.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	(0.40-0.60)	03-Aug-06	---	---	---	---	---	<0.1	286	7	1.4	17	15	22	<10	53	---	12	6	26	40	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-4	(0-0.20)	04-Aug-06	5.3	---	---	---	---	---	---	---	---	24	---	---	---	---	---	---	---	---	---	---	<200	246	---	---	---	---	---	---	---	---	---	---	---
S06-5	(0.2-0.4)	04-Aug-06	5	---	---	---	---	---	---	---	---	25	---	---	---	---	---	---	---	---	---	---	<200	397	---	---	---	---	---	---	---	---	---	---	---
S06-6	(0.2-0.40)	04-Aug-06	5.4	---	---	---	---	---	---	---	---	22	---	---	---	---	---	---	---	---	---	---	<200	645	<0.0050	<0.020	<0.010	<0.045	<10	53	660	184	---	YES	
S06-7	(0.2-0.5)	06-Aug-06	3.8	---	---	---	---	<0.1	208	7.9	<0.1	23	30	<10	<10	148	<10	9	6	<10	27	---	311	---	---	---	---	---	---	---	---	---	---	---	
S06-8	(0.2-0.5)	07-Aug-06	3.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	---	---	---	---	---	---

2006 Soil Analytical Results

CLIENT: Shell Canada Limited
PROJECT NO.: C52360300
PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

			Physical					Salinity / Sodicity														Sulphur		Hydrocarbons											
Sampling Location	Soil Depth (m)	Date (d-m-y)	Moisture Content (%)	Clay (%)	Silt (%)	Sand (%)	Texture Class (units)	Theor. Gypsum Reqmt. (tons/ac)	EC (us/cm)	pH (units)	Sodium Adsorption Ratio (ratio)	Saturation % (%)	Soluble Ca (mg/L)	Soluble Cl (mg/L)	Soluble CO ₃ (mg/L)	Soluble HCO ₃ (mg/L)	Hydroxide (mg/L)	Soluble K (mg/L)	Soluble Mg (mg/L)	Soluble Na (mg/L)	Soluble SO ₄ (mg/L)	Sulphur (mg/kg)	Sulphur:T (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes-total (mg/kg)	PHC F ₁ (C ₆ -C ₁₀) (mg/kg)	PHC F ₂ (C ₁₁ -C ₁₆) (mg/kg)	PHC F ₃ (C ₁₇ -C ₃₄) (mg/kg)	PHC F ₄ (C ₃₅ -C ₅₀ +) (mg/kg)	F ₂ SG (Heavy HC-Silicagel) (mg/kg)	Reached baseline at C ₅₀ (Yes/No)		
NWT Industrial, Coarse surface			---	---	---	---	---	---	4,000	6 - 8	12	---	---	---	---	---	---	---	---	---	---	---	---	---	---	5	0.8	20	20	330	760	1,700	3,300	---	---
NWT Residential/Parkland Coarse Surface			---	---	---	---	---	---	2,000	6 - 8	5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.5	0.8	1.2	1	130	150	400	2,800	---	---
Background Chemistry (Organic rich soils, PHCs only) - 95% Conf. Int.			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<10	176	3,127	2,061	---	---
Gravel Pad continued																																			
S06-45	(0.6-0.95)	09-Aug-06	47.1	---	---	---	---	<0.1	394	6.4	<0.1	180	22	14	<10	29	---	57	8	<10	109	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.9-1.4)	09-Aug-06	---	---	---	---	---	<0.1	382	7.6	0.7	27	65	20	<10	1,370	---	51	14	23	23	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(1.4-1.8)	09-Aug-06	13.3	---	---	---	---	<0.1	457	7.5	0.7	23	67	33	<10	907	---	41	15	25	21	---	---	<0.0050	<0.020	<0.010	<0.040	<10	<10	<10	<10	---	YES		
S06-46	(0.2-0.6)	09-Aug-06	---	---	---	---	---	<0.1	261	7.4	1.3	16	13	28	<10	75	---	<5	7	24	30	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-63	(0.1-0.2)	14-Sep-06	---	---	---	---	---	<0.1	570	8.76	2.1	29.5	19	<5	<2	487	<2	141	4	39	51	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.2-0.3)	14-Sep-06	6.7	---	---	---	---	<0.1	4,890	12.3	2	42.1	333	913	434	<2	9	592	<1	131	16	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-68	(0.2-1.0)	14-Sep-06	6.7	---	---	---	---	<0.1	650	8.6	1.5	22.5	60	18	97	283	<10	67	9	45	178	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Fuel Storage Tank Area (South of Tank Farm)																																			
S06-34	(0.2-0.5)	07-Aug-06	4.4	---	---	---	---	<0.1	219	7.2	0.9	17	20	<10	<10	137	<10	7	10	20	24	---	155	0.23	33	5.6	180	697	812	522	38	---	YES		
S06-35	(0.2-0.5)	07-Aug-06	4.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	0.027	<0.010	<0.045	<10	<10	21	15	---	YES	
S06-36	(0-0.2)	07-Aug-06	7.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	48	142	39	---	YES	
S06-42	(0-0.2)	07-Aug-06	12.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	78	743	130	---	YES	
Day Tank Area																																			
S06-47	(0.6-0.75)	09-Aug-06	49.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	<10	60	777	424	1,400	NO	
S06-48	(0.2-0.65)	09-Aug-06	5.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	19	682	306	20	---	YES	
	(0.65-1.0)	09-Aug-06	34.3	---	---	---	---	---	---	---	---	150	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	<10	129	708	415	1,600	NO	
S06-49	(0.85-1.05)	09-Aug-06	6.8	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	<10	71	813	508	3,100	NO	
S06-50	(03-0.85)	09-Aug-06	3.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	<10	13	<10	<10	---	YES	
	(0.85-1.05)	09-Aug-06	36.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	<10	62	889	603	1,900	NO	
Heating Oil AST / Fuel Trailer																																			
S06-60	(0.35-0.65)	11-Aug-06	62.6	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	0.54	<0.010	<0.040	<10	92	986	610	---	YES	
S06-61	(0.2-0.7)	11-Aug-06	11.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	<10	11	36	44	---	YES	
	(0.7-1.2)	11-Aug-06	34.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	0.093	30	594	1,920	1,120	7,500	NO	
NE Perimeter of Gravel Pad																																			
S06-31	(0-0.2)	07-Aug-06	54	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	250	3,540	2,840	16,000	NO	
S06-32	(0.2-0.5)	07-Aug-06	27.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	32	138	2,120	1,520	9,100	NO	
S06-33	(0.2-0.5)	07-Aug-06	59.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	13	92	1,740	1,150	7,200	NO	
S06-57	(0.0-0.15)	14-Sep-06	66.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	11	110	1,500	666	---	YES	
	(0.15-0.56)	14-Sep-06	72.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	6.3	<0.010	<0.040	<10	237	5,630	2440	21,000	NO	
S06-58	(0.2-0.35)	11-Aug-06	36.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	<10	135	1,580	874	6,100	NO	
East Perimeter of Gravel Pad																																			
S06-53	(0-0.2)	09-Aug-06	7.2	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.040	<10	13	120	41	---	YES	
S06-54	(0.2-0.4)	09-Aug-06	7.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	0.033	0.2	111	90	87	27	---	YES	
South Perimeter of Gravel Pad																																			
P06-4	(0.65-0.85)	06-Aug-06	41.7	---	---	---	---	<0.1	524	7.1	0.7	140	68	14	<10	---	---	<5	32	27	89	---	909	---	---	---	---	---	---	---	---	---	---	---	---
	(1.6-2.0)	06-Aug-06	19.1	---	---	---	---	<0.1	711	7.3	0.7	28	81	84	<10	---	---	7	31	28	48	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	<10	<10	<10	---	YES	
P06-5	(0-0.15)	06-Aug-06	22.1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	11	341	74	---	YES	
	(0.5-1.0)	06-Aug-06	18.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<0.0050	<0.020	<0.010	<0.045	<10	<10	<10	<10	---	YES	

NOTES:

- in guideline row(s) denotes no criteria for that parameter.
- in detail data row(s) denotes parameter not analyzed.
- Denotes values exceeding NWT Industrial coarse surface guidelines. For BTEX and PHC F1 parameters (all soils) and PHCs F2-F4 fractions (mineral soil only, see note 5), the most conservative of the eco soil contact or protection of groundwater for aquatic life pathways have been used.
- Denotes values exceeding NWT Residential/Parkland coarse surface guidelines. For BTEX and PHC F1 parameters (all soils) and PHCs F2-F4 fractions (mineral soil only, see note 5), the most conservative of the eco soil contact or protection of groundwater for aquatic life pathways have been used.
- For organic rich soils only, denotes PHCs F2 - F4 values exceeding the upper limit of the 95% confidence interval of established background hydrocarbon ranges
* Barium and extractable barium concentrations have been compared to AENV (2004) Natural Area and / or Industrial soil quality guidelines for Barite

2006 Soil Analytical Results

CLIENT: Shell Canada Limited
PROJECT NO.: C52360300
PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

			Metals																																
Sampling Location	Soil Depth (m)	Date (d-m-y)	Aluminum (mg/kg)	Antimony (mg/kg)	Arsenic (mg/kg)	Barium* (mg/kg)	Barium:E* (mg/kg)	Beryllium (mg/kg)	Bismuth (mg/kg)	Hot Water Soluble Boron (mg/kg)	Bromide (mg/kg)	Cadmium (mg/kg)	Calcium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Fluoride (mg/kg)	Hex Chromium (mg/kg)	Iron (mg/kg)	Magnesium (mg/kg)	Lead (mg/kg)	Potassium (mg/kg)	Lithium:D (mg/kg)	Manganese (mg/kg)	Sodium (mg/kg)	Mercury (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Phosphorus (mg/kg)	Phosphorus:D (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Strontium (mg/kg)		
NWT Industrial, Coarse surface			---	40	12	41,000	440	8	---	---	---	22	---	87	300	91	---	1.4	---	---	600	---	---	---	---	---	50	40	50	---	---	---	3.9	40	---
NWT Residential/Parkland Coarse Surface			---	20	12	3,300	260	4	---	---	---	10	---	64	50	63	---	0.4	---	---	140	---	---	---	---	---	6.6	10	50	---	---	1	20	---	
Background Chemistry (Organic rich soils, PHCs only) - 95% Conf. Int.			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Background																																			
S06-1	(0.0-0.20)	03-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	(0.20-0.40)	03-Aug-06	4,030	<2	4	206	63	0.3	<10	0.6	---	0.5	11,600	7	6.1	6	---	<0.3	13,000	1,640	<10	184	2.4	75.8	68	0.12	<0.5	18	---	365	1.6	<1	35.5		
S06-2	(0.0-0.20)	03-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	(0.20-0.40)	03-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
P06-1	(0.85-1.35)	05-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
P06-2	(0.15-0.35)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Burn Pit Area																																			
S06-9	(0.15-0.45)	04-Aug-06	---	---	3	84.3	35	<0.1	---	<0.1	---	<0.2	---	5	0.7	<2	167	<0.3	---	---	<10	---	---	---	---	---	<0.05	<0.5	<4	---	---	<0.5	---	---	
	(0.45-0.65)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-10	(0.15-0.45)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-11	(0.0-0.15)	04-Aug-06	---	---	2	361	30	0.2	---	1.3	---	<0.2	---	5	0.7	6	131	<0.3	---	---	<10	---	---	---	---	---	<0.05	1.1	8	---	---	0.7	---	---	
	(0.15-0.45)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-12	(0-0.15)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	(0.15-0.45)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-43	(0.2-0.9)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-55	(0.2-0.6)	11-Aug-06	3,500	<2	4	206	42	0.2	<10	0.8	<10	0.3	4,410	7	4.4	6	120	<0.3	5,320	1,330	<10	732	4.8	227	58	0.06	<0.5	15	---	385	<0.5	<1	16.6		
S06-56	(0.2-0.5)	11-Aug-06	4,280	<2	5	5,380	98	0.2	<10	2.2	<10	1.4	8,290	18	2.5	83	196	<0.3	14,500	1,090	336	1,970	2.7	473	935	<0.05	1.8	11	---	444	<0.5	<1	138		
S06-62	(0.15-0.63)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
P06-3	(0.7-0.85)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
Historical Tank Spill Area																																			
S06-14	(0-0.2)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-15	(0.2-0.42)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-16	(0.20-0.44)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-17	(0.2-0.46)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-19	(0.20-0.60)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-20	(0.2-0.6)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-23	(0.15-0.45)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	(0.45-0.75)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	(0.75-1.15)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
	(1.15-1.35)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	
S06-27	(0.2-0.5)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	

2006 Soil Analytical Results

PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

[illegible]

2006 Soil Analytical Results

PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

			Metals																														
Sampling Location	Soil Depth (m)	Date (d-m-y)																															
			Aluminum	Antimony	Arsenic	Barium*	Barium:E*	Beryllium	Bismuth	Hot Water Soluble Boron	Bromide	Cadmium	Calcium	Chromium	Cobalt	Copper	Fluoride	Hex Chromium	Iron	Magnesium	Lead	Potassium	Lithium:D	Manganese	Sodium	Mercury	Molybdenum	Nickel	Phosphorus	Phosphorus:D	Selenium	Silver	Strontium
			(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
NWT Industrial, Coarse surface			---	40	12	41,000	440	8	---	---	---	22	---	87	300	91	---	1.4	---	---	600	---	---	---	---	50	40	50	---	---	3.9	40	---
NWT Residential/Parkland Coarse Surface			---	20	12	3,300	260	4	---	---	---	10	---	64	50	63	---	0.4	---	---	140	---	---	---	---	6.6	10	50	---	---	1	20	---
Background Chemistry (Organic rich soils, PHCs only) - 95% Conf. Int.			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Gravel Pad continued																																	
S06-45	(0.6-0.95)	09-Aug-06	3460	<1	4	240	---	<0.4	---	0.5	---	0.2	7060	31	3	<5	---	<0.2	6360	1390	6	938	---	73	52	---	<0.4	9	343	---	0.7	<1	19
	(0.9-1.4)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(1.4-1.8)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-46	(0.2-0.6)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-63	(0.1-0.2)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.2-0.3)	14-Sep-06	5100	<1	7	627	---	<0.4	---	6	---	0.4	56,900	93	5	7	---	<0.2	7710	3690	8	1,040	<10	192	152	---	15.9	85	264	---	<0.5	<1	24
S06-68	(0.2-1.0)	14-Sep-06	2270	<1	7	749	---	<0.4	---	<2	---	0.2	9,550	57	6	5	---	<0.2	7920	847	8	692	<10	615	75	---	8.1	49	291	---	<0.5	<1	27
Fuel Storage Tank Area (South of Tank Farm)																																	
S06-34	(0.2-0.5)	07-Aug-06	1,480	<2	4	416	22	0.2	<10	0.1	---	<0.2	692	5	0.8	5	---	<0.3	4,300	455	<10	172	1.5	118	20	<0.05	<0.5	4	---	197	<0.5	<1	16.9
S06-35	(0.2-0.5)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-36	(0-0.2)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-42	(0-0.2)	07-Aug-06	2,000	<2	5	3,880	---	0.2	<10	0.1	---	<0.2	1,530	5	1.6	6	---	<0.3	5,790	622	<10	229	2.2	169	31	0.06	<0.5	7	---	300	<0.5	<1	35.8
Day Tank Area																																	
S06-47	(0.6-0.75)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-48	(0.2-0.65)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.65-1.0)	09-Aug-06	4,410	<2	4	303	---	0.3	<10	1.3	---	<0.2	10,600	8	4.9	7	---	<0.3	10,800	2,450	<10	318	6	134	60	<0.05	0.6	17	---	639	<0.5	<1	26.6
S06-49	(0.85-1.05)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-50	(03-0.85)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.85-1.05)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Heating Oil AST / Fuel Trailer																																	
S06-60	(0.35-0.65)	11-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-61	(0.2-0.7)	11-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.7-1.2)	11-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
NE Perimeter of Gravel Pad																																	
S06-31	(0-0.2)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-32	(0.2-0.5)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-33	(0.2-0.5)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-57	(0.0-0.15)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.15-0.56)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-58	(0.2-0.35)	11-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
East Perimeter of Gravel Pad																																	
S06-53	(0-0.2)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-54	(0.2-0.4)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
South Perimeter of Gravel Pad																																	
P06-4	(0.65-0.85)	06-Aug-06	3,210	<2	4	225	18	0.2	<10	0.2	---	<0.2	14,500	6	4.2	6	---	<0.3	8,820	3,540	<10	301	4.5	120	109	<0.05	0.6	14	596	---	0.6	<1	29.3
	(1.6-2.0)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P06-5	(0-0.15)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.5-1.0)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
 2. --- in detail data row(s) denotes parameter not analyzed.
 3. Denotes values exceeding NWT Industrial coarse surface guidelines. For BTEX and PHC F1 parameters (all soils) and PHCs F2-F4 fractions (mineral soil only, see note 5), the most conservative of the eco soil contact or protection of groundwater for aquatic life pathways have been used.
 4. Denotes values exceeding NWT Residential/Parkland coarse surface guidelines. For BTEX and PHC F1 parameters (all soils) and PHCs F2-F4 fractions (mineral soil only, see note 5), the most conservative of the eco soil contact or protection of groundwater for aquatic life pathways have been used.
 5. For organic rich soils only, denotes PHCs F2 - F4 values exceeding the upper limit of the 95% confidence interval of established background hydrocarbon ranges
- * Barium and extractable barium concentrations have been compared to AENV (2004) Natural Area and / or Industrial soil quality guidelines for Barite

2006 Soil Analytical Results

CLIENT: Shell Canada Limited
PROJECT NO.: C52360300
PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

			Metals (Cont.)							PAHs																	
Sampling Location	Soil Depth (m)	Date (d-m-y)	Thallium (mg/kg)	Tin (mg/kg)	Titanium (mg/kg)	Uranium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)	Zirconium (mg/kg)	2-Methylnaphthalene (mg/kg)	Acenaphthene (mg/kg)	Acenaphthylene (mg/kg)	Anthracene (mg/kg)	Benzo(a)-anthracene (mg/kg)	Benzo(a)-pyrene (mg/kg)	Benzo(b,k)fluoranthene (mg/kg)	Benzo(g,h,i)-perylene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Chrysene (mg/kg)	Dibenzo(a,h)-anthracene (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)	
NWT Industrial, Coarse surface			1	300	---	---	130	360	---	---	---	---	---	10	---	---	---	---	10	---	---	---	---	10	22	50	100
NWT Residential/Parkland Coarse Surface			1	50	---	---	130	200	---	---	---	---	---	1	---	---	---	---	1	---	---	---	---	1	0.6	5	10
Background Chemistry (Organic rich soils, PHCs only) - 95% Conf. Int.			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Background			---	---	---	---	---	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
S06-1	(0.0-0.20)	03-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.20-0.40)	03-Aug-06	<1	<2	24.9	0.5	14	13	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-2	(0.0-0.20)	03-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.20-0.40)	03-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P06-1	(0.85-1.35)	05-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P06-2	(0.15-0.35)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Burn Pit Area			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-9	(0.15-0.45)	04-Aug-06	<1	---	---	---	11	11	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
	(0.45-0.65)	04-Aug-06	---	---	---	---	---	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
S06-10	(0.15-0.45)	04-Aug-06	---	---	---	---	---	---	---	0.55	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1.1	<0.05	<0.05
S06-11	(0.0-0.15)	04-Aug-06	<1	---	---	---	9	28	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
	(0.15-0.45)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-12	(0-0.15)	04-Aug-06	---	---	---	---	---	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
	(0.15-0.45)	04-Aug-06	---	---	---	---	---	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
S06-43	(0.2-0.9)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-55	(0.2-0.6)	11-Aug-06	<1	<2	43	0.7	14	25	<1	3.9	0.11	<0.05	<0.05	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.13	0.05
S06-56	(0.2-0.5)	11-Aug-06	<1	<2	71	0.4	15	218	1	<0.05	0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1	0.05
S06-62	(0.15-0.63)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P06-3	(0.7-0.85)	06-Aug-06	---	---	---	---	---	---	---	0.46	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.13	0.25	<0.05
Historical Tank Spill Area			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-14	(0-0.2)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-15	(0.2-0.42)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-16	(0.20-0.44)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-17	(0.2-0.46)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-19	(0.20-0.60)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-20	(0.2-0.6)	04-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-23	(0.15-0.45)	07-Aug-06	---	---	---	---	---	---	---	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.49	<0.05	<0.05	<0.05	1	
	(0.45-0.75)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.75-1.15)	07-Aug-06	---	---	---	---	---	---	---	1.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.32	<0.05	0.08	
	(1.15-1.35)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-27	(0.2-0.5)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Table 1

2006 Soil Analytical Results

CLIENT: Shell Canada Limited
PROJECT NO.: C52360300
PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

			Metals (Cont.)							PAHs																
Sampling Location	Soil Depth	Date	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)-anthracene	Benzo(a)-pyrene	Benzo(b&f)fluoranthene	Benzo(g,h,i)-perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)-anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
	(m)	(d-m-y)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
NWT Industrial, Coarse surface			1	300	---	---	130	360	---	---	---	---	---	10	---	---	---	10	---	---	---	---	10	22	50	100
NWT Residential/Parkland Coarse Surface			1	50	---	---	130	200	---	---	---	---	---	1	---	---	---	1	---	---	---	---	1	0.6	5	10
Background Chemistry (Organic rich soils, PHCs only) - 95% Conf. Int.			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Historical Tank Spill Area continued																										
S06-28	(0.2-0.7)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-29	(0.2-0.7)	06-Aug-06	<1	<2	30.4	0.4	13	18	<1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
S06-30	(0.2-0.76)	06-Aug-06	<1	<2	38.3	0.4	14	22	<1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	
S06-37	(0.5-0.7)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.7-1.0)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(1.0-1.3)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-38	(0-0.35)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.35-0.55)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-39	(0.65-0.95)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.95-1.4)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-40	(0.15-0.5)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.5-0.7)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-41	(0.15-0.6)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.95-1.4)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-44	(0-0.15)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.15-0.5)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-52	(0.5-1.0)	09-Aug-06	<1	<2	29.1	0.5	12	30	<1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-64	(0.0-0.15)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.15-0.33)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-65	(0.15-0.39)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-66	(0.15-0.58)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-67	(0.00-0.15)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.15-0.47)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P06-6	(0.15-0.3)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.5-1.1)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(1.1-1.25)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
P06-7	(0.15-0.45)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Gravel Pad																										
S06-3	(0.0-0.20)	03-Aug-06	<1	<2	25.8	0.5	16	54	<1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.20-0.40)	03-Aug-06	<1	<2	23	0.4	15	23	<1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.40-0.60)	03-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-4	(0-0.20)	04-Aug-06	<1	---	---	---	14	19	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-5	(0.2-0.4)	04-Aug-06	<1	---	---	---	15	28	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-6	(0.2-0.40)	04-Aug-06	<1	---	---	---	15	29	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-7	(0.2-0.5)	06-Aug-06	<1	<2	18.8	0.3	10	14	<1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-8	(0.2-0.5)	07-Aug-06	<1	<2	9.6	0.4	9	15	<1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

2006 Soil Analytical Results

CLIENT: Shell Canada Limited
PROJECT NO.: C52360300
PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

			Metals (Cont.)							PAHs																
Sampling Location	Soil Depth	Date	Thallium	Tin	Titanium	Uranium	Vanadium	Zinc	Zirconium	2-Methylnaphthalene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)-anthracene	Benzo(a)-pyrene	Benzo(b&f)fluoranthene	Benzo(g,h,i)-perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)-anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	Naphthalene	Phenanthrene	Pyrene
(m)	(d-m-y)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
NWT Industrial, Coarse surface			1	300	---	---	130	360	---	---	---	---	---	10	---	---	---	10	---	---	---	---	10	22	50	100
NWT Residential/Parkland Coarse Surface			1	50	---	---	130	200	---	---	---	---	---	1	---	---	---	1	---	---	---	---	1	0.6	5	10
Background Chemistry (Organic rich soils, PHCs only) - 95% Conf. Int.			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Gravel Pad continued																										
S06-45	(0.6-0.95)	09-Aug-06	<0.3	<1	---	<1	16	14	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.9-1.4)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(1.4-1.8)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-46	(0.2-0.6)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-63	(0.1-0.2)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.2-0.3)	14-Sep-06	<0.3	<1	---	<1	25	35	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-68	(0.2-1.0)	14-Sep-06	<0.3	<1	---	<1	14	26	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Fuel Storage Tank Area (South of Tank Farm)																										
S06-34	(0.2-0.5)	07-Aug-06	<1	<2	11.2	0.3	10	13	<1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-35	(0.2-0.5)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-36	(0-0.2)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-42	(0-0.2)	07-Aug-06	<1	<2	17.9	0.3	10	22	<1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Day Tank Area																										
S06-47	(0.6-0.75)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-48	(0.2-0.65)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.65-1.0)	09-Aug-06	<1	<2	24.5	0.5	17	26	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-49	(0.85-1.05)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-50	(03-0.85)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.85-1.05)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Heating Oil AST / Fuel Trailer																										
S06-60	(0.35-0.65)	11-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-61	(0.2-0.7)	11-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.7-1.2)	11-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
NE Perimeter of Gravel Pad																										
S06-31	(0-0.2)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-32	(0.2-0.5)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-33	(0.2-0.5)	07-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-57	(0.0-0.15)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(0.15-0.56)	14-Sep-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-58	(0.2-0.35)	11-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
East Perimeter of Gravel Pad																										
S06-53	(0-0.2)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S06-54	(0.2-0.4)	09-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
South Perimeter of Gravel Pad																										
P06-4	(0.65-0.85)	06-Aug-06	<1	<2	32.2	0.5	13	46	1	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	(1.6-2.0)	06-Aug-06	---	---	---	---	---	---	---	---	---	---	---	---	---											

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
2. --- in detail data row(s) denotes parameter not analyzed.
3. Denotes values exceeding NWT Industrial coarse surface guidelines. For BTEX and PHC F1 parameters (all soils) and PHCs F2-F4 fractions (mineral soil only, see note 5), the most conservative of the eco soil contact or protection of groundwater for aquatic life pathways have been used.
4. Denotes values exceeding NWT Residential/Parkland coarse surface guidelines. For BTEX and PHC F1 parameters (all soils) and PHCs F2-F4 fractions (mineral soil only, see note 5), the most conservative of the eco soil contact or protection of groundwater for aquatic life pathways have been used.
5. For organic rich soils only, denotes PHCs F2 - F4 values exceeding the upper limit of the 95% confidence interval of established background hydrocarbon ranges
- * Barium and extractable barium concentrations have been compared to AENV (2004) Natural Area and / or Industrial soil quality guidelines for Barite



Piezometer Installation Details, Datum/Groundwater Surface Elevations And Hydraulic Conductivities

CLIENT: Shell Canada

PROJECT NO.: C52360300

PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

Monitoring Station	Ground Elevation (masl)	Datum Elevation (Top of PVC) (masl)	Stickup (PVC) (m)	Total Depth of Piezometer (mbgs)	Depth Interval of Screen (mbgs)	Date Measured (d-m-y)	Depth To Groundwater (mbtoc)	Depth To Groundwater (mbgs)	Depth To Permafrost (mbgs)	Groundwater Surface Elevation (masl)	Hydraulic Conductivity (m/s)	Lithology
C52360300 - Water - Year 2006												
P06-1	13.57	14.35	0.78	1.01	0.56 - 0.15	9-Aug-06	1.04	0.26	0.40	13.31	N/M	Silt Loam
P06-2	12.56	13.36	0.80	1.10	0.65 - 0.24	9-Aug-06	1.14	0.34	0.35	12.22	N/M	Silt Loam and Organic
P06-3	10.21	11.01	0.80	1.30	0.80 - 0.39	9-Aug-06	1.57	0.77	0.70	9.44	N/M	Sandy Loam and Organic
P06-4	10.45	11.25	0.80	1.80	1.8 - 1.07	9-Aug-06	Dry	Dry	2.00	Dry	N/M	Loamy Sand
P06-5	9.63	10.43	0.80	1.05	0.7 - 0.29	9-Aug-06	1.53	0.73	0.60	8.90	N/M	Loamy Sand and Organic
P06-6	13.52	14.32	0.80	1.50	0.93 - 0.2	9-Aug-06	1.63	0.83	1.10	12.69	N/M	Loamy Sand and Organic
P06-7	13.93	14.73	0.80	0.77	0.56 - 0.15	9-Aug-06	1.17	0.37	0.50	13.56	N/M	Organic

NOTES:

1. Data may be entered to the nearest mm, but are reported above to the nearest cm.
Apparent rounding errors may occasionally occur in calculated fields (e.g., Groundwater Surface Elevation).
2. N/M - Denotes not measured.
3. masl - Denotes Metres Above Sea Level.
4. mbgs - Denotes metres below ground surface.
5. mbtoc - Denotes metres below top of PVC casing.
6. Piezometer survey elevation data taken on September 14, 2006 by Klohn Crippen Berger personnel



Water Quality: Field Measured Parameters

CLIENT: Shell Canada

PROJECT NO.: C52360300

PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

Monitoring Station	Date (d-m-y)	Temperature (°C)	Electrical Conductivity (at 25°C) (µS/cm)	pH (units)	Comments
C52360300 - Water - Year 2006					
<u>Surface Water</u>					
WS06-1	3-Aug-06	20.9	315	9.6	Surface water
WS06-2	3-Aug-06	22.2	869	7.65	Surface water
<u>Piezometers</u>					
P06-1	9-Aug-06	9.4	615	6.97	Purged dry
P06-2	9-Aug-06	9.2	849	7.09	Purged dry
P06-3	9-Aug-06	9.8	2260	7.21	Purged dry
P06-4	9-Aug-06	---	---	---	Dry
	14-Sep-06	---	---	---	Dry
P06-5	9-Aug-06	---	---	---	Dry
	14-Sep-06	---	---	---	Insufficient sample for field parameters
P06-6	9-Aug-06	10.0	1149	6.87	Purged, did not go dry
Duplicate	9-Aug-06	9.8	1084	7.01	
P06-7	9-Aug-06	9.8	980	6.9	Purged dry

NOTES:

1. Electrical conductivity values standardized to 25°C.
2. --- Denotes parameter not measured.



Water Quality Analytical Results: Indicators, Ions, Physical, Organic, and Nitrogen

CLIENT: Shell Canada Limited

PROJECT NO.: C52360300

PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

		PHYSICAL					INDICATORS				CATIONS, ANIONS & ION BALANCE									NITROGEN PARAMETERS			
Monitoring Station	Date (d-m-y)	EC (us/cm)	pH (units)	Tot Hard as CaCO ₃ (mg/L)	Tot Alk as CaCO ₃ (mg/L)	PP Alk. as CaCO ₃ (mg/L)	Chloride:D (mg/L)	Sulphate:D (mg/L)	Iron:D (mg/L)	Manganese:D (mg/L)	Calcium:D (mg/L)	Magnesium:D (mg/L)	Potassium:D (mg/L)	Sodium:D (mg/L)	Bicarbonate (mg/L)	Carbonate (mg/L)	Hydroxide (mg/L)	Fluoride:D (mg/L)	Ion Balance (balance)	NO ₂ as N (mg/L)	NO ₃ as N (mg/L)	NO ₂ +NO ₃ as N (mg/L)	
CCME Freshwater Aquatic Life, 1999 and updates		---	6.5 - 9	---	---	---	---	---	0.3	---	---	---	---	---	---	---	---	---	---	---	0.06	13	---
CCME Marine Life, 1999 and updates		---	7 - 8.7	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	16	---
C52360300 - Water - Year 2006																							
WS06-1	03-Aug-06	295	8.7	140	92	3	11	43	0.081	0.003	34.6	13.9	0.6	9.85	104	4	<1	0.1	1.09	<0.06	<0.2	<0.2	
WS06-2	03-Aug-06	776	8.1	340	353	<1	50	<1	0.628 ¹	0.003	74.8	38.1	9.9	45.5	430	<1	<1	0.1	1.08	<0.06	<0.2	<0.2	
P06-1	09-Aug-06	540	7.8	310	261	<1	16	4	2.39 ¹	1.51	74.4	30.3	5	23.3	318	<1	<1	0.2	1.29	<0.06	<0.2	<0.2	
P06-2	09-Aug-06	809	7.8	520	441	<1	17	2	4.54 ¹	0.352	116	54.9	3.2	19.7	538	<1	<1	0.2	1.22	<0.06	<0.2	<0.2	
P06-3	09-Aug-06	2,560	8.1	450	669	<1	395	26	4.71 ¹	0.824	115	38.6	358	164	816	<1	<1	0.1	1.01	<0.06	<0.2	<0.2	
P06-6	09-Aug-06	1,210	7.8	730	707	<1	18	2	0.314 ¹	2.01	175	71.5	2.1	19.1	862	<1	<1	0.1	1.06	<0.06	<0.2	<0.2	
Duplicate	09-Aug-06	241	8.1	720	78	<1	16	2	0.09	1.82	171	72.1	1.4	18.5	95	<1	<1	0.1	7.46	<0.06	<0.2	<0.2	
P06-7	09-Aug-06	945	7.8	550	520	<1	17	6	9.34 ¹	1.29	130	55.9	3.6	25.5	634	<1	<1	0.2	1.15	<0.06	<0.2	<0.2	
Trip Blank	09-Aug-06	1	5.8 ^{1,2}	<0.5	<1	<1	<1	<1	<0.006	<0.001	<0.05	<0.05	<0.2	<0.05	<1	<1	<1	<0.1	---	<0.06	<0.2	<0.2	

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
2. --- in detail data row(s) denotes parameter not analyzed.
3. Superscript ¹ denotes values exceeding CCME Freshwater Aquatic Life, 1999 and updates
4. Superscript ² denotes values exceeding CCME Marine Life, 99
4. CCME Aquatic Life (Marine or Freshwater) refers to
CCME Canadian Environmental Quality Guidelines, 1999 and updates.



Water Quality Analytical Results: Dissolved Hydrocarbon

CLIENT: Shell Canada Limited

PROJECT NO.: C52360300

PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

		BTEX				SELECT HYDROCARBONS		
Monitoring Station	Date (d-m-y)	Benzene	Toluene	Ethylbenzene	Xylenes-total	PHC F ₁ (C ₆ -C ₁₀)	PHC F ₁ (C ₆ -C ₁₀)-BTEX	PHC F ₂ (C _{>10} -C ₁₆)
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
CCME Freshwater Aquatic Life, 1999 and updates		0.37	0.002	0.09	---	---	---	---
CCME Marine Aquatic Life, 1999 and updates		0.11	0.215	0.025	---	---	---	---
C52360300 - Water - Year 2006								
WS06-1	03-Aug-06	<0.0005	<0.0005	<0.0005	<0.001	<0.1	<0.1	<0.1
WS06-2	03-Aug-06	<0.0005	<0.0005	<0.0005	<0.001	<0.1	<0.1	<0.1
P06-1	09-Aug-06	<0.0005	<0.0005	<0.0005	<0.001	<0.1	<0.1	<0.1
P06-2	09-Aug-06	<0.0005	0.0099 ¹	<0.0005	<0.001	<0.1	<0.1	<0.1
P06-3	09-Aug-06	0.0691	<0.0005	0.045 ²	0.149	0.959	0.695	1.9
	14-Sep-06	0.0829	0.0007	0.102 ^{1,2}	0.195	1.12	0.735	1.7
P06-5	14-Sep-06	<0.0004	<0.0004	<0.0004	<0.008	<0.1	<0.1	Insufficient Sample
P06-6	09-Aug-06	<0.0005	<0.0005	<0.0005	<0.001	<0.1	<0.1	<0.1
(Duplicate)	09-Aug-06	<0.0005	<0.0005	<0.0005	<0.001	<0.1	<0.1	<0.1
P06-7	09-Aug-06	<0.0005	<0.0005	<0.0005	0.008	<0.1	<0.1	0.4
Trip Blank	09-Aug-06	<0.0005	<0.0005	<0.0005	<0.001	<0.1	<0.1	<0.1

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
2. Superscript ¹ denotes values exceeding CCME Freshwater Aquatic Life
3. Superscript ² denotes values exceeding CCME Marine Aquatic Life
4. CCME Aquatic Life (Marine or Freshwater) refers to CCME Canadian Environmental Quality Guidelines, 1999 and updates.



Water Quality Analytical Results: Dissolved Metals

CLIENT: Shell Canada

PROJECT NO.: C52360300

PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT

		DISSOLVED METALS AND TRACE ELEMENTS																	SULPHUR	
Monitoring Station	Date (d-m-y)	Barium:D	Beryllium:D	Bismuth:D	Boron:D	Chromium:D	Cobalt:D	Lithium:D	Mercury:D	Molybdenum:D	Nickel:D	Phosphorus:D	Silicon:D	Strontium:D	Tin:D	Titanium:D	Vanadium:D	Zinc:D	Zirconium:D	Sulphur:D (mg/L)
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	
CCME Freshwater Aquatic Life, 1999 and updates		---	---	---	---	---	---	---	---	0.073	0.15	---	---	---	---	---	---	0.03	---	---
CCME Marine Life, 1999 and updates		---	---	---	---	57.5	---	---	---	---	---	---	---	---	---	---	---	---	---	---
C52360300 - Water - Year 2006																				
WS06-1	03-Aug-06	---	---	---	---	---	---	<0.02	---	---	---	---	---	---	---	---	---	---	---	---
WS06-2	03-Aug-06	---	---	---	---	---	---	<0.02	---	---	---	---	---	---	---	---	---	---	---	---
P06-1	09-Aug-06	0.281	<0.001	<0.2	<0.05	<0.007	0.008	<0.02	<0.00005	<0.006	0.031	0.2	3.18	0.25	<0.04	0.01	<0.05	0.02	<0.005	3
P06-2	09-Aug-06	0.259	<0.001	<0.2	<0.05	<0.007	<0.005	<0.02	0.00006	<0.006	0.016	0.1	2.95	0.32	<0.04	0.007	<0.05	0.008	<0.005	3
P06-3	09-Aug-06	0.232	<0.001	<0.2	<0.05	<0.007	<0.005	0.03	<0.00005	<0.006	0.013	<0.1	5.03	0.66	<0.04	<0.006	<0.05	0.008	<0.005	10.8
P06-6	09-Aug-06	0.509	<0.001	<0.2	<0.05	<0.007	0.006	<0.02	0.00006	<0.006	0.048	<0.1	2.12	0.5	<0.04	0.008	<0.05	0.007	<0.005	2
Duplicate	09-Aug-06	0.485	<0.001	<0.2	<0.05	<0.007	<0.005	<0.02	0.00008	<0.006	0.047	0.1	1.78	0.48	<0.04	<0.006	<0.05	<0.005	<0.005	1.9
P06-7	09-Aug-06	0.256	<0.001	<0.2	<0.05	<0.007	0.007	<0.02	0.00006	<0.006	0.02	0.2	4.64	0.42	<0.04	<0.006	<0.05	<0.005	<0.005	4.4
Trip Blank	09-Aug-06	<0.003	<0.001	<0.2	<0.05	<0.007	<0.005	<0.02	<0.00005	<0.006	<0.008	<0.1	<0.05	<0.01	<0.04	<0.006	<0.05	<0.005	<0.005	<0.2

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
2. --- in detail data row(s) denotes parameter not analyzed.
3. Highlighting indicates parameters above applied guideline/criteria
4. Superscript ¹ denotes values exceeding CCME Freshwater Aquatic Life, 2005
(Canadian Environmental Quality Guidelines for the Protection of Aquatic Life (CCME, 1999 and updates))
5. Superscript ² denotes values exceeding CCME Marine Life, 99
(Canadian Environmental Quality Guidelines for Marine Aquatic Life (CCME, 1999 and updates))

Nickel:D

0.025 mg/L Hardness(CaCO₃) = 0-60 mg/L
0.065 mg/L Hardness(CaCO₃) = 60-120 mg/L
0.110 mg/L Hardness(CaCO₃) = 120-180 mg/L
0.150 mg/L Hardness(CaCO₃) = >180 mg/L

Water Quality Analytical Results: Total Metals

CLIENT: Shell Canada Limited

PROJECT NO.: C52360300

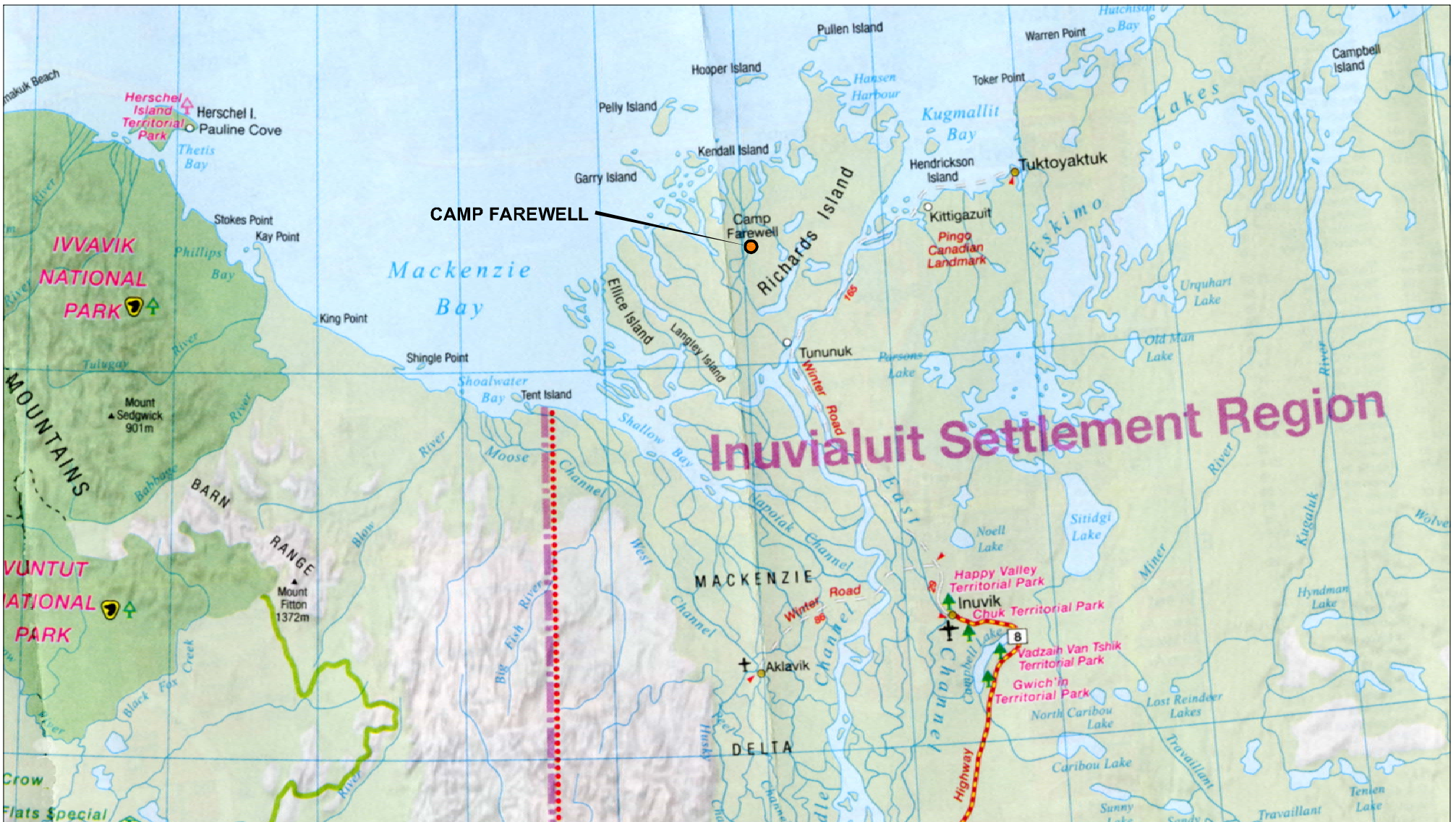
PROJECT NAME: Abandonment and Restoration Plan, Camp Farewell, NT


		TOTAL METALS AND TRACE ELEMENTS																																
Monitoring Station	Date (d-m-y)	Aluminum:T	Antimony:T	Arsenic:T	Barium:T	Beryllium:T	Bismuth:T	Boron:T	Cadmium:T	Calcium:T	Chromium:T	Cobalt:T	Copper:T	Iron:T	Lead:T	Magnesium:T	Manganese:T	Mercury:T	Molybdenum:T	Nickel:T	Phosphorus:T	Potassium:T	Selenium:T	Silicon:T	Silver:T	Sodium:T	Strontium:T	Thallium:T	Tin:T	Titanium:T	Uranium:T	Vanadium:T	Zinc:T	Zirconium:T
		(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
CCME Freshwater Aquatic Life, 1999 and updates		0.1	--	0.005	--	--	--	--	0.000017	--	--	--	0.002 - 0.004	0.3	0.001 - 0.007	--	--	--	0.073	0.025 - 0.15	--	--	0.001	--	0.0001	--	--	0.0008	--	--	--	--	0.03	--
CCME Marine Life, 1999 and updates		--	--	0.0125	--	--	--	--	0.00012	--	57.5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
C52360300 - Water - Year 2006																																		
WS06-1	03-Aug-06	0.042	<0.001	<0.005	0.091	<0.001	<0.2	<0.05	0.00005 ¹	34.6	<0.007	<0.005	0.007 ¹	0.197	<0.001	12.8	0.012	<0.00005	<0.006	<0.008	<0.1	0.6	<0.001	0.75	<0.0001	10.9	0.23	<0.0008	<0.04	<0.006	<0.001	<0.05	<0.005	<0.005
WS06-2	03-Aug-06	<0.005	<0.001	<0.005	0.332	<0.001	<0.2	<0.05	0.00012 ¹	70.2	<0.007	<0.005	0.002	1.29 ¹	<0.001	35.9	0.078	<0.00005	<0.006	<0.008	0.1	10.7	<0.001	0.42	<0.0001	47.2	0.27	<0.0008	<0.04	<0.006	<0.001	<0.05	<0.005	<0.005

NOTES:

1. --- in guideline row(s) denotes no criteria for that parameter.
2. Superscript ¹ denotes values exceeding CCME Freshwater Aquatic Life, 1999 and updates
3. Superscript ² denotes values exceeding CCME Marine Life, 1999 and updates
4. CCME Aquatic Life (Marine or Freshwater) refers to
CCME Canadian Environmental Quaility Guidelines, 1999 and updates.
- Aluminum:T
0.005 mg/L pH<6.5; [Ca2+]<4.0 mg/L; DOC<2.0 mg/L.
0.1 mg/L pH>6.5; [Ca2+]>4.0 mg/L; DOC>2.0 mg/L.
- Cadmium:T
10 {0.86[log(hardness)]-3.2}.
- Copper:T
0.002 mg/L Hardness(CaCO3) = 0-120 mg/L
0.003 mg/L Hardness(CaCO3) = 120-180 mg/L
0.004 mg/L Hardness(CaCO3) = >180 mg/L
- Lead:T
0.007 mg/L Hardness(CaCO3) = >180 mg/L
0.001 mg/L Hardness(CaCO3) = 0-60 mg/L
0.004 mg/L Hardness(CaCO3) = 120-180 mg/L
0.002 mg/L Hardness(CaCO3) = 60-120 mg/L
- Nickel:T
0.025 mg/L Hardness(CaCO3) = 0-60 mg/L
0.065 mg/L Hardness(CaCO3) = 60-120 mg/L
0.110 mg/L Hardness(CaCO3) = 120-180 mg/L
0.150 mg/L Hardness(CaCO3) = >180 mg/L

Figures



Environment & Water Resources					 WorleyParsons Komex resources & energy	
SHELL CANADA LIMITED ABANDONMENT AND RESTORATION PLAN AT CAMP FAREWELL, NWT SITE LOCATION MAP						
25-OCT-06	date	MJC	edited by	OTHERS	drawn by	app by
<small>PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS KOMEX HAS NOT ENTERED INTO A CONTRACT.</small>						PROJECT NUMBER: C52360300
						FIGURE: 1



LEGEND

5.0m INDEX CONTOUR

1.0m INDEX CONTOUR

SITE DIGITIZED FROM FAREWELL STOCK SITE & ACCESS ROAD DATA APRIL 09, 1973

BUILDING

ROAD

GRAVEL PAD

TANK

050100150200250m

SCALE 1 : 5,000

Projection: UTM ZONE 08
Datum: North American Datum 1983 (NAD83)

SOURCES:
1. SHELL CANADA LTD.; MAP SHOWING ORTHOPHOTO CAMP FAREWELL; MACKENZIE DELTA NT; JUNE 12, 2006; ACAD NO 35014
2. ORTHOPHOTOGRAPHY: PRODUCED BY CHALLENGER GEOMATICS LTD. FROM 1:30,000 PHOTO FLOWN AUGUST 04,2005 0.5M PIXEL
3. AERIAL PHOTOGRAPH; © 2005. GOVERNMENT OF CANADA WITH PERMISSION FROM INDIAN AND NORTHERN AFFAIRS CANADA

Environment & Water Resources

WorleyParsons Komex
resources & energy

SHELL CANADA LIMITED

ABANDONMENT AND RESTORATION PLAN AT CAMP FAREWELL, NWT

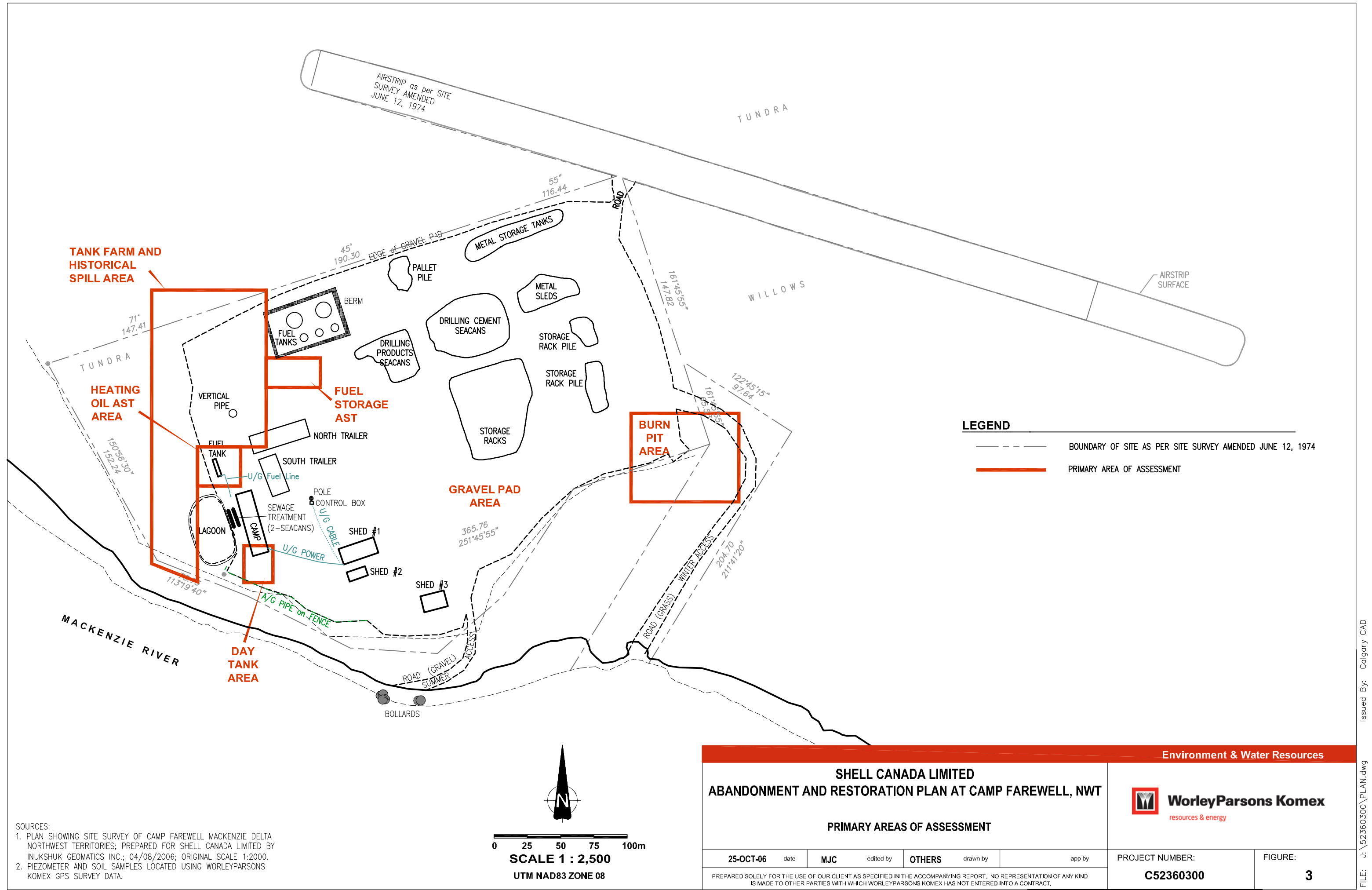
AERIAL PHOTOGRAPH

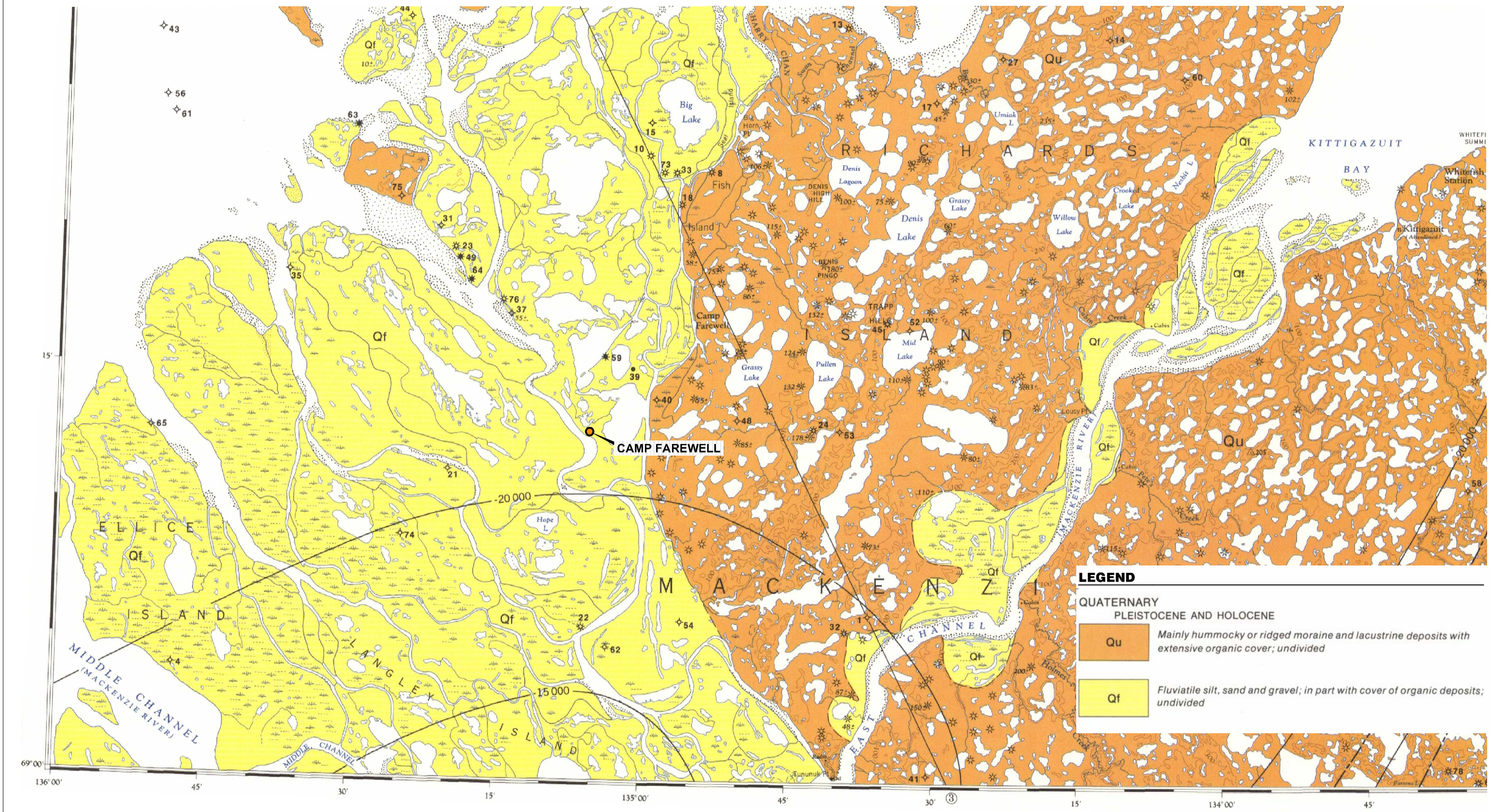
25-OCT-06	date	MJC	edited by	OTHERS	drawn by	app by
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PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS KOMEX HAS NOT ENTERED INTO A CONTRACT.

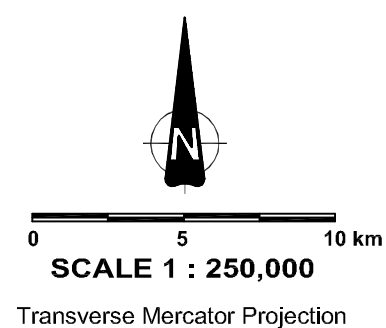
PROJECT NUMBER:
C52360300

FIGURE:
2





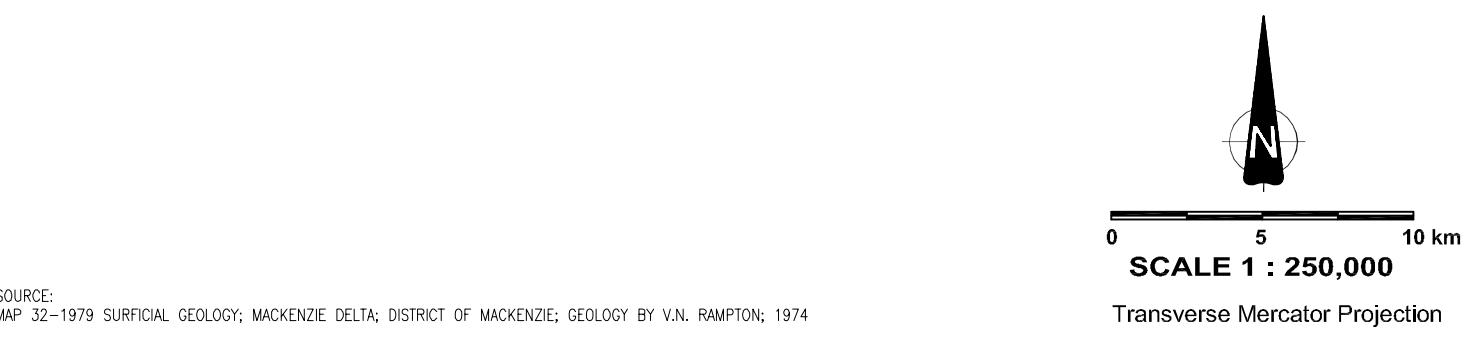
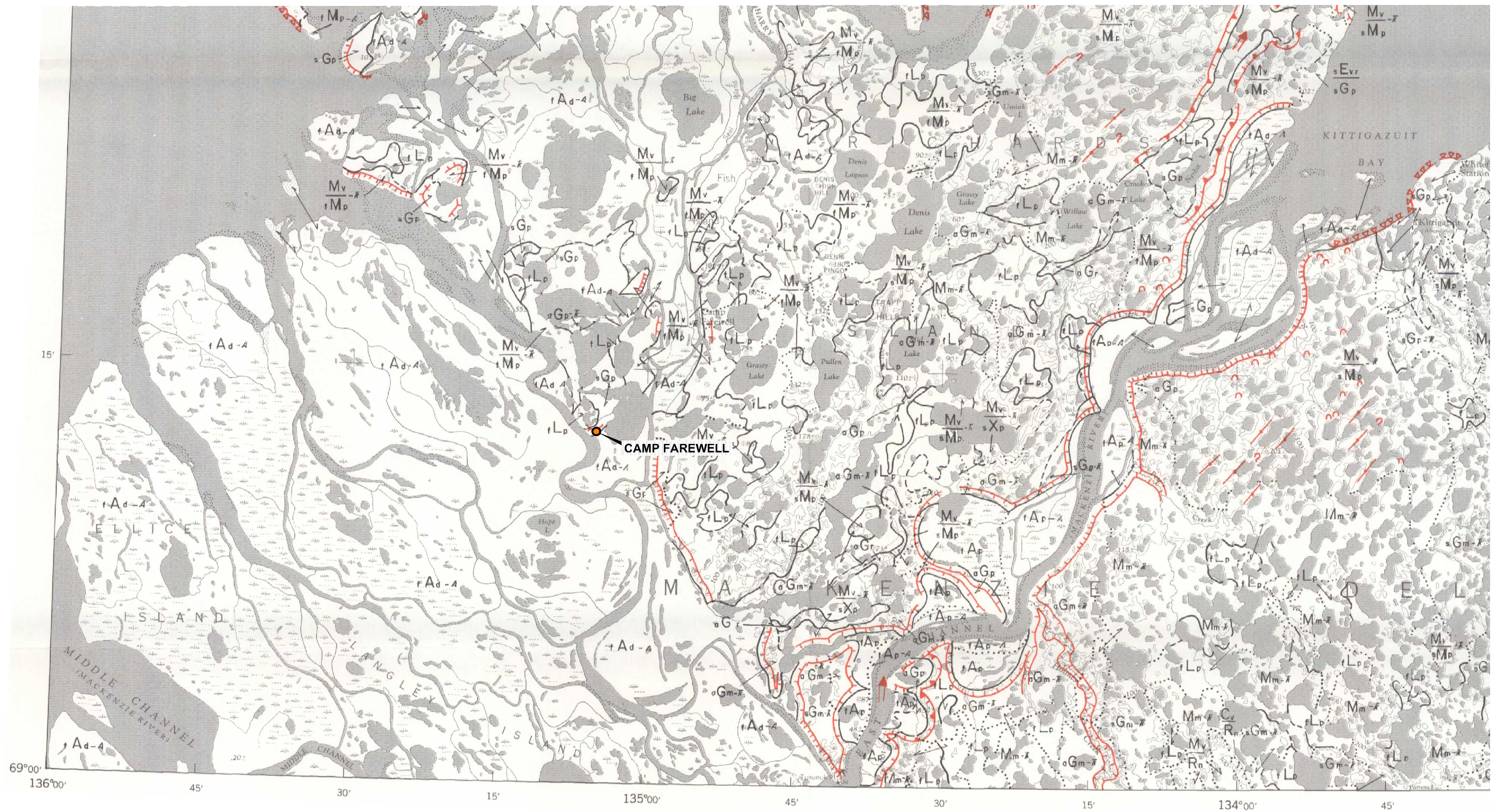
SOURCE:
MAP 1515A GEOLOGY;MACKENZIE DELTA; DISTRICT OF MACKENZIE; GEOLOGY BY D.K. NORRIS; 1975



Environment & Water Resources					
SHELL CANADA LIMITED ABANDONMENT AND RESTORATION PLAN AT CAMP FAREWELL, NWT					
GEOLOGY					
25-OCT-06	date	MJC	edited by	OTHERS	drawn by
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS KOMEX HAS NOT ENTERED INTO A CONTRACT.					app by
PROJECT NUMBER: C52360300					FIGURE: 4



Issued By: Calgary CAD
FILE: J:\52360300\Geology.dwg



SOURCE:
MAP 32-1979 SURFICIAL GEOLOGY; MACKENZIE DELTA; DISTRICT OF MACKENZIE; GEOLOGY BY V.N. RAMPTON; 1974

Environment & Water Resources				
SHELL CANADA LIMITED ABANDONMENT AND RESTORATION PLAN AT CAMP FAREWELL, NWT				
SURFICIAL GEOLOGY				
25-OCT-06	date	MJC	edited by	OTHERS
			drawn by	
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS KOMEX HAS NOT ENTERED INTO A CONTRACT.				
PROJECT NUMBER: C52360300			FIGURE: 5A	

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DESCRIPTION OF TERRAIN UNITS					
SYMBOL	NAME	MATERIALS AND THICKNESS	PERMAFROST DISTRIBUTION ¹ AND ICE CONTENTS	GEOMORPHOLOGY ² AND DRAINAGE	ORIGIN AND AGE
$\frac{sC_v}{R_n}$	Sandy colluvium over bedrock	Sand; possibly contains few interbeds of silt clay and gravel; 0.5-4 m thick. Swales contain peat up to 3 m thick.	Continuous permafrost; variable ice contents.	Moderate to steep escarpments; moderately well to well drained. Undisturbed slopes are stable.	Scarps probably result from glacial and stream erosion along edge of Caribou Hills (underlain by poorly consolidated Tertiary rocks at their northern end).
$\frac{sE_{vr}}{sG_p}$	Sand dune on glaciofluvial plain	Fine to medium sand, in places silty, isolated peaty layers. Local veneer of silt and few patches of thin peat present on surface. Windblown sand up to 4 m thick, generally 1.5-3 m thick; glaciofluvial sand, 3-10 m thick.	Continuous permafrost. Sand generally has low ice contents. Silt and peat have medium to high ice contents due to abundance of ice lenses.	Broad linear sand dunes range from 1.5-3 m in height; variable drainage with small thaw pools common on extensive flat areas. Blowouts common along banks of streams and lakes.	Dunes formed subsequent to outwash deposition during early Wisconsin(?) glaciation. Dunes presently stable, except where blowouts form.
tA_p	Alluvial plain	Silt, fine sand, and clayey silt, commonly organic; generally more than 6 m thick. Thin local accumulations of peat present.	Irregular distribution of permafrost; medium ice contents in frozen sediment due to presence of ice lenses.	Flat floodplains and low terraces near sea or stream level; thaw pools, lakes, and marshy areas common; low surfaces occasionally inundated.	Alluvium deposited by streams in recent past.
$tA_p - A$	Alluvial plain; actively forming	Silt, fine sand, and clayey silt, commonly organic; coarse sand and gravel possibly underlie fine alluvium in some areas. Fine alluvium is 2 to more than 6 m thick.	Isolated islands of permafrost within unit; medium ice contents in frozen sediments due to presence of ice lenses.	Flat floodplain with many marshy areas on poorly drained surface; inundated annually.	Floodplain alluvium presently being deposited.
$tA_d - A$	Alluvial delta; actively forming	Silt, fine sand, and clayey silt, commonly organic; 10 to more than 30 m thick.	Permafrost present under part of unit; many irregularly shaped taliks; low to medium ice contents in frozen sediments; ice contents decrease with depth.	Flat surface marked by numerous distributaries, islands, lakes, and marshes. Poorly drained and subject to flooding by sea or river water. Some lakes expanding due to thermokarst.	Alluvium deposited primarily by Mackenzie River with minor silt and clay being deposited following storm tides at outer edge of delta. Delta formed during Holocene and graded to present sea level.
$tM_p - A$	Tidal flats	Interbedded silt, clayey silt, and sand; 1-8 m thick.	Irregular distribution of permafrost; ice lenses in frozen sediments.	Flat; poorly drained and marshy surface; frequently inundated by sea water.	Deposition continuing at present. Most of underlying marine sediment deposited during last 5000 years.
$\frac{tM_v}{tL_p} - A$	Intertidal lagoons	Interbedded silt, clayey silt, and sand; predominantly sand on northeastern part of Richards Island. Marine veneer generally 1-3 m thick.	Irregularly shaped taliks present within permafrost; ice contents probably low in sandy sediments, medium to high in fine sediments.	Flat basins; poorly drained and marshy; frequently inundated by sea water.	Lagoons are lake basins whose seaward edges have been breached during the postglacial rise in sea level; deposition has continued subsequently, mainly during last 5000 years.
$\frac{sM_r - A}{oM_r - A}$	Beaches, spits and bars	Sand (sM) or gravel and sand (aM), 0.5-3 m thick; mainly sand features along northern edge of Tuktoyaktuk Peninsula.	Irregular distribution of thin permafrost; low ice contents in frozen sediment.	Low broad ridges rising up to 3 m a.s.l.	Ridges formed and continuously modified by wave action.
tL_p	Lacustrine plain and pond	Interbedded silt, clayey silt, and silty sand with peaty layers; predominantly silty sand and sand in areas of outwash and till-veneered sandy deposits; sediment 1.5-8 m thick.	Rare isolated taliks present within continuous permafrost; ice contents generally low to medium in sandy sediments and medium to high in silty and clayey sediments due to presence of ice lenses; massive ice under pingos and domes.	Flat to gently sloping; in places benches are separated by small scarps. Surface commonly marshy with many thaw pools. Pingos and small domes, both inactive and presently forming, within unit.	Lake basins formed by thermokarst development mainly during last 10 000 years and subsequently infilled and drained through normal stream development. Pingos and domes have formed during aggradation of permafrost in drained lake basins. Lacustrine plain lying below mapped strandline in Eskimo Lakes basin formed during blockage of outlet to Liverpool Bay by late Wisconsin glaciofluvial deposition along Kugaluk River estuary.
$tL_m - \bar{x}$	Rolling lacustrine plain; modified by thermokarst	Interbedded clayey silt and clay; generally 3-10 m thick. Surface patches of peat 1.5-3 m thick.	Isolated taliks present within continuous permafrost; ice contents medium to high due to presence of ice lenses; massive ice at base of unit and in underlying sediments at depths of 7-70 m.	Rolling surface with local relief to 30 m; summits of hills are generally accordant. Slopes moderately well drained; flat hill tops and depressions imperfectly drained.	Sediment deposited in glacially fed basin of probable early Wisconsin age.
$\frac{t/sG_p}{sG_p}{oG_p}$	Outwash plain	Silty sand over sand (t/sG), sand (sG), and interbedded sand and gravel (aG), local veneer of fine sand and silt and surface patches of thin peat. Outwash generally 3-10 m thick.	Continuous permafrost; ice contents of sand and gravel generally low, but silt has high ice content; massive ice may be present in underlying sediments at depths of 7-70 m.	Flat plain with some relief due to terracing, inset channels, and thermokarst basins; drainage moderately good to good, but imperfect to poor in channel traces and on extensive broad flat areas where ice-thaw pools are common.	Outwash plain making up major part of Tuktoyaktuk Peninsula formed when early Wisconsin(?) glacier stood at its maximum extent; remainder of outwash on Tuktoyaktuk Peninsula, Richards Island, and adjacent areas deposited during deglaciation. Outwash in Eskimo Lakes basin deposited during late Wisconsin time.
$\frac{sG_p - \bar{x}}{oG_p - \bar{x}}$	Outwash plain; modified by thermokarst	Sand with few pebbly beds and channels of gravel (sG) and interbedded sand and gravel (aG); generally 10-20 m thick. Local veneer of fine sand and silt and patches of thin peat on surface. Depressions contain 2-5 m of sandy and gravelly lacustrine sediment and peat.	Rare taliks in depressions within continuous permafrost; ice contents in near-surface outwash low, but massive ice may be present at depths of 7-70 m.	Rolling to hummocky surface with local relief to 50 m; summits of hills are generally flat and accordant; well drained.	Outwash plains formed during early Wisconsin(?) glaciation, except in Eskimo Lakes basin where outwash plains are late Wisconsin in age. Most ground ice formed concurrent with deglaciation; relief results from thermokarst during last 10 000 years.
$\frac{sG_m - \bar{x}}{oG_m - \bar{x}}$	Hummocky thermokarst-modified outwash	Sand (sG) or interbedded sand and gravel (aG); extensive unmapped areas of morainal deposits may be present in unit. Outwash generally 10-30 m thick; depressions contain 2-5 m of lacustrine sediment and peat.	Rare taliks in depressions within continuous permafrost; ice contents in near surface low, but morainal deposits have higher ice contents, and massive ice may be present at depths of 7-70 m, especially under hills and ridges.	Hummocky with local relief to 50 m; well drained, but depressions imperfectly to moderately well drained.	Outwash deposited during early Wisconsin(?) glaciation. Most ground ice formed concurrent with deglaciation; thermokarst, modifying unit morphology, occurred mainly during last 10 000 years.
$\frac{sG_r}{oG_r}$	Esker	Gravel with sandy interbeds (gG) or interbedded sand and gravel (aG); generally 5-30 m thick.	Continuous permafrost; ice contents in near surface low, but massive ice may be present at depths of 7-70 m.	Linear features 60-600 m wide; locally multiple ridges and hummocky topography; well drained.	Eskers formed during retreat of early Wisconsin(?) glacier.
$M_m - \bar{x}$	Rolling and hummocky moraine; modified by thermokarst	Clayey diamicton containing pockets of sorted silty and clayey material; diamicton is 4-12 m thick; depressions contain 2-8 m of lacustrine sediment and peat; isolated areas of unmapped outwash within unit.	Rare taliks in depressions within continuous permafrost; ice contents of diamicton low to medium due to presence of ice lenses (generally having reticulate pattern); massive ice common at base of till and at depths of 7-70 m especially under hills and ridges	Hummocky to rolling with local relief between 30 and 50 m. Many hills around Tuktoyaktuk show an "involute" pattern of ridges with 1-4 m relief. Slopes moderately well drained; hill crests imperfectly to moderately well drained; depressions poorly drained. Inactive and active retrogressive thaw flow slides along hill slopes.	Till deposited during maximum extent of Laurentide glaciers during early Wisconsin(?) time. Most ground ice formed concurrent with deglaciation; thermokarst, modifying unit morphology, mainly during last 10 000 years.
$\frac{M_v}{sM_p} - \bar{x}$ $\frac{M_v}{sA_p} - \bar{x}$ $\frac{M_v}{sX_p} - \bar{x}$	Hummocky till-veneered sand; modified by thermokarst	Clayey diamicton or poorly sorted gravel over fine grained marine sand (sM), medium grained fluvial (glaciofluvial?) sand (sA), or interbedded marine and fluvial sand (sX). Diamicton extremely variable in thickness, generally 1-5 m but thin or absent in areas between Kittigazuit and Pete's Creek, and between Cabin Creek and Pullen Island, where sand is commonly capped by thin poorly sorted gravel; sands generally 10-20 m thick. Depressions contain 2-8 m of lacustrine sediment and peat. Isolated unmapped outwash in unit.	Rare taliks in depressions within continuous permafrost; ice contents of diamicton low to medium due to presence of ice lenses; near-surface sands have low to medium ice contents, but massive ice may be present at depths of 7-70 m, especially at the base of till and in sediments under hills and ridges.	Hummocky to rolling with local relief between 30 and 70 m; hills and slopes moderately well drained, depressions imperfectly drained. Stabilized retrogressive thaw flow slides on slopes where till is thick, active slides on recently steepened slopes. Cliff-top dunes and blowouts common along eroding coast lines where till is thin.	Deposition of thick marine sands in deltaic foresets appears to have been preceded and followed by the deposition of fluvial sand, apparently in proglacial outwash plains. The upper outwash sands possibly correlate with units formed on Tuktoyaktuk Peninsula during early Wisconsin(?) time. Till deposited during maximum extent of Laurentide glaciers during early Wisconsin(?) time. Most ground ice formed concurrent with deglaciation; thermokarst, modifying unit morphology, mainly during last 10 000 years.
$\frac{M_v}{tM_p} - \bar{x}$	Hummocky till-veneered silt and clay; modified by thermokarst	Clayey diamicton over marine clay, silt, and fine sand. Diamicton generally varies from 0.5-2.5 m thick, rarely to 6 m. Depressions contain 1.5-8 m of lacustrine deposits and peat.	Rare isolated taliks present under depressions within continuous permafrost. Ice contents variable in diamicton; massive ice present in places near base of diamicton. Marine sediments have low to high ice contents; ice lenses commonly form reticulate network; isolated layers of massive ice.	Rolling topography with 10-30 m of local relief; hills and slopes moderately well drained; depressions imperfectly to poorly drained and marshy. Stabilized retrogressive thaw flow slides on slopes where till is thick, active slides on recently steepened slopes.	Till deposited during maximum extent of Laurentide glaciers during early Wisconsin(?). Most ground ice formed concurrent with deglaciation. Thermokarst, modifying unit morphology, mainly during last 10 000 years.
$\frac{M_v}{c,sX_p} - \bar{x}$	Hummocky till-veneered clay and sand; modified by thermokarst	Clayey diamicton or poorly sorted gravel over marine clay (c) and marine and fluvial sand (s). Diamicton generally less than 5 m thick. Depressions contain 2-8 m of lacustrine sediment and peat.	Rare taliks in depressions within continuous permafrost; ice content of diamicton low to medium due to presence of ice lenses; near-surface sands commonly have low to medium ice contents; clay has low to high ice content with ice lenses commonly forming a reticulate network; massive ice may be present at depths of 7-70 m.	Hummocky with local relief between 30 and 70 m. Hills and slopes moderately well drained; depressions imperfectly drained.	Deposition of marine clay and sand and fluvial (glaciofluvial?) sand preceded the early Wisconsin(?) glaciation that deposited the till. Most ground ice formed concurrent with deglaciation; thermokarst, modifying unit morphology, mainly during last 10 000 years.
$\frac{M_v}{R_n}$	Till veneer on bedrock	Clayey diamicton over poorly consolidated Tertiary rocks; diamicton up to 5 m thick. Low areas may contain 2-8 m of lacustrine sediment and peat.	Rare isolated taliks present under depressions within continuous permafrost; ice contents variable in diamicton; massive ice present in places near base of diamicton.	Rolling broad hills with 10-30 m of local relief; hills and slopes moderately well drained; depressions imperfectly drained. Few stabilized retrogressive thaw flow slides on slopes where till is thick.	Till deposited during maximum extent of Laurentide glaciers during early Wisconsin(?). Most ground ice formed concurrent with deglaciation. Thermokarst, modifying unit morphology, occurred mainly during last 10 000 years.

Environment & Water Resources								
SHELL CANADA LIMITED ABANDONMENT AND RESTORATION PLAN AT CAMP FAREWELL, NWT								
SURFICIAL GEOLOGY LEGEND								
25-OCT-06	date	MJC	edited by	OTHERS	drawn by	app by	PROJECT NUMBER:	FIGURE:
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS KOMEX HAS NOT ENTERED INTO A CONTRACT.							C52360300	5B

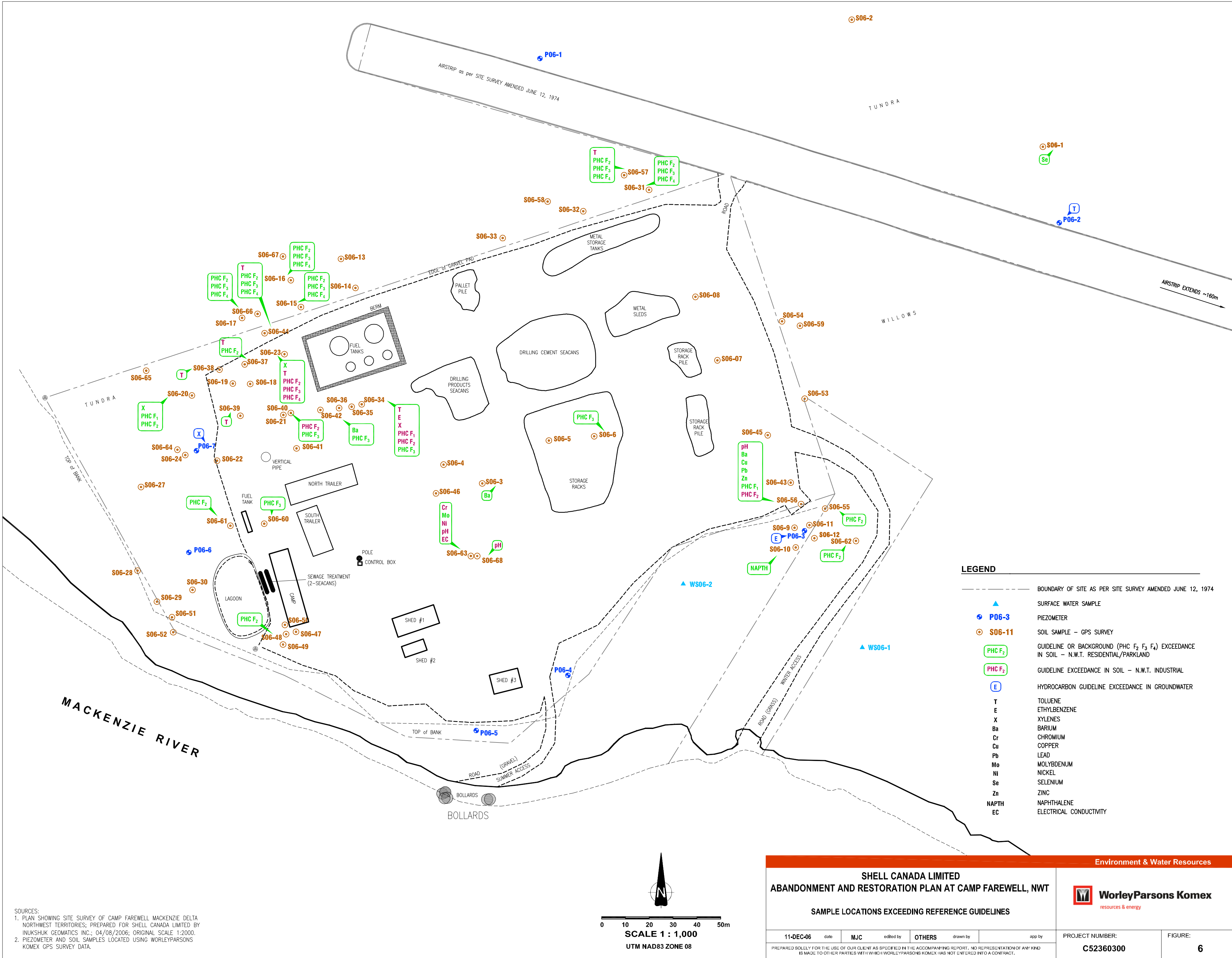
resources & energy

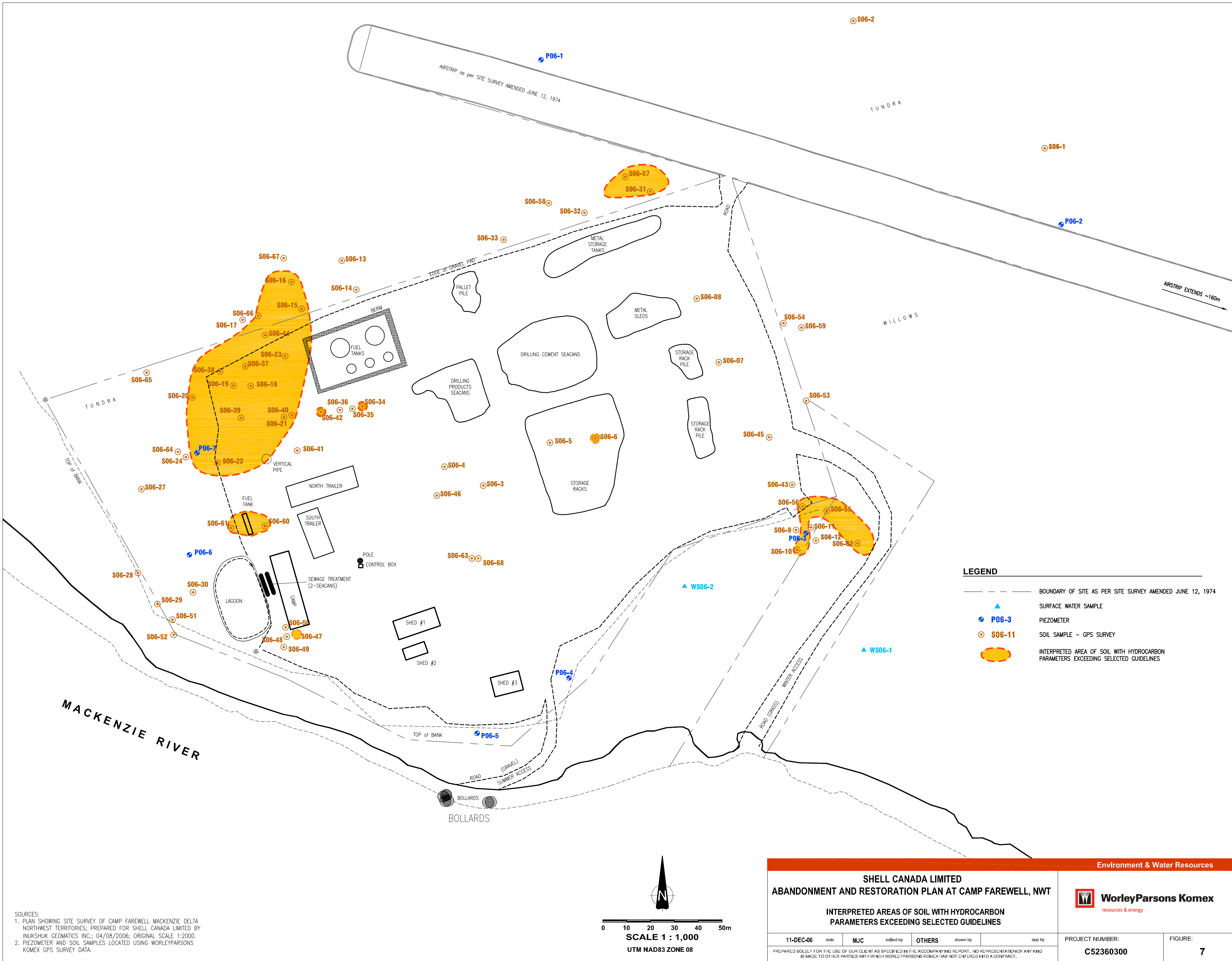
SOURCE:
MAP 32-1979 SURFICIAL GEOLOGY; MACKENZIE DELTA;
DISTRICT OF MACKENZIE; GEOLOGY BY V.N. RAMPTON;
1974

FILE: J:\52360300\Geology.dwg


Issued By: Calgary CAD

SOURCE:
MAP 32-1979 SURFICIAL GEOLOGY; MACKENZIE DELTA;
DISTRICT OF MACKENZIE; GEOLOGY BY V.N. RAMPTON;
1974





SOURCES:
1. PLAN SHOWING SITE SURVEY OF CAMP FAREWELL, MACKENZIE DELTA, NORTHWEST TERRITORIES; PREPARED FOR SHELL CANADA LIMITED BY INUKSHUK GEOMATICS INC.; 04/08/2006; ORIGINAL SCALE 1:2000.
2. PIEZOMETER AND SOIL SAMPLES LOCATED USING WORLEYPARSONS KOMEX GPS SURVEY DATA.

SHELL CANADA LIMITED						Environment & Water Resources	
ABANDONMENT AND RESTORATION PLAN AT CAMP FAREWELL, NWT							
INTERPRETED AREAS OF SOIL WITH HYDROCARBON PARAMETERS EXCEEDING SELECTED GUIDELINES							
11-DEC-06	date	MJC	edited by	OTHERS	drawn by	app by	PROJECT NUMBER: C52360300
PREPARED SOLELY FOR THE USE OF OUR CLIENT AS SPECIFIED IN THE ACCOMPANYING REPORT. NO REPRESENTATION OF ANY KIND IS MADE TO OTHER PARTIES WITH WHICH WORLEYPARSONS KOMEX HAS NOT ENTERED INTO A CONTRACT.							FIGURE: 7

Photographs



PHOTO 1: Camp Farewell and local topography

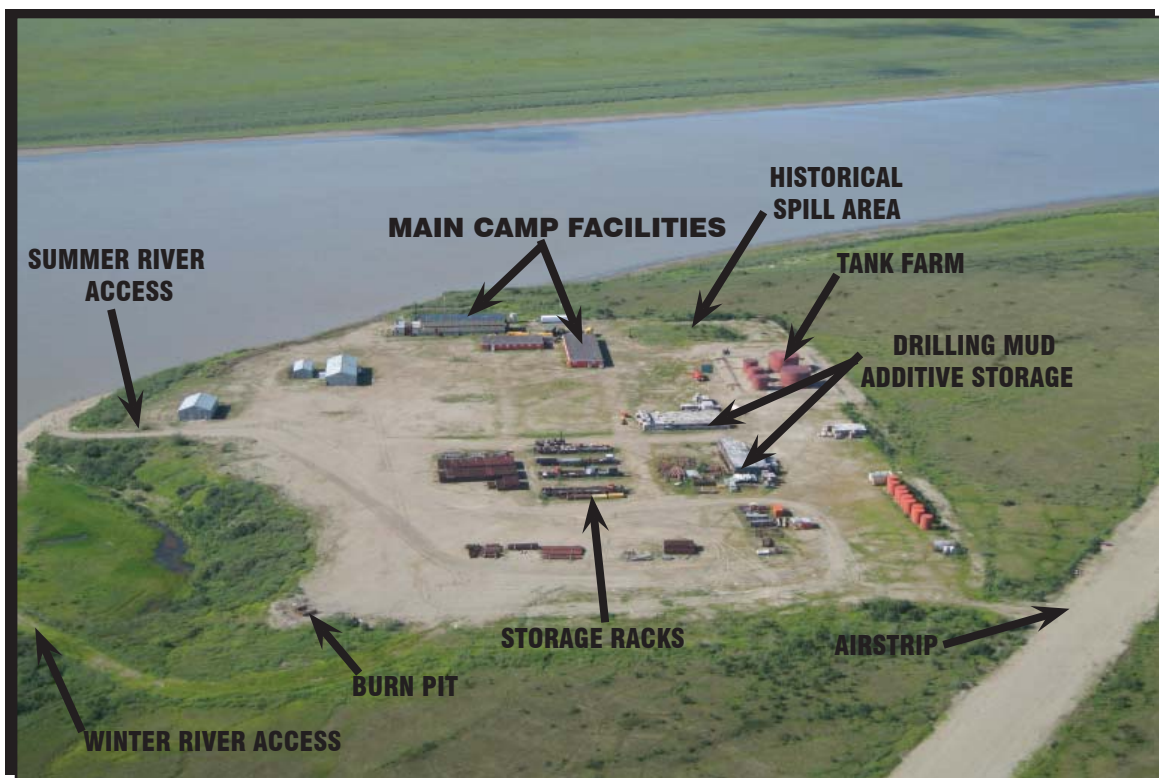
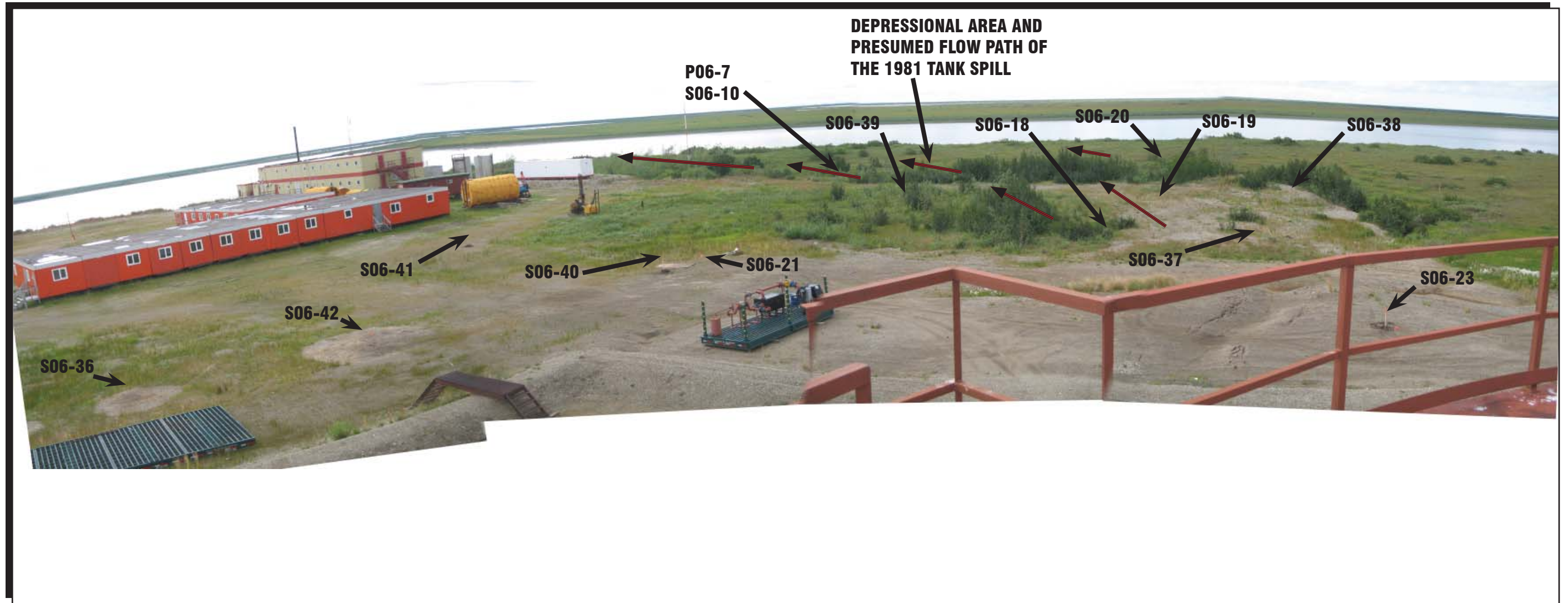
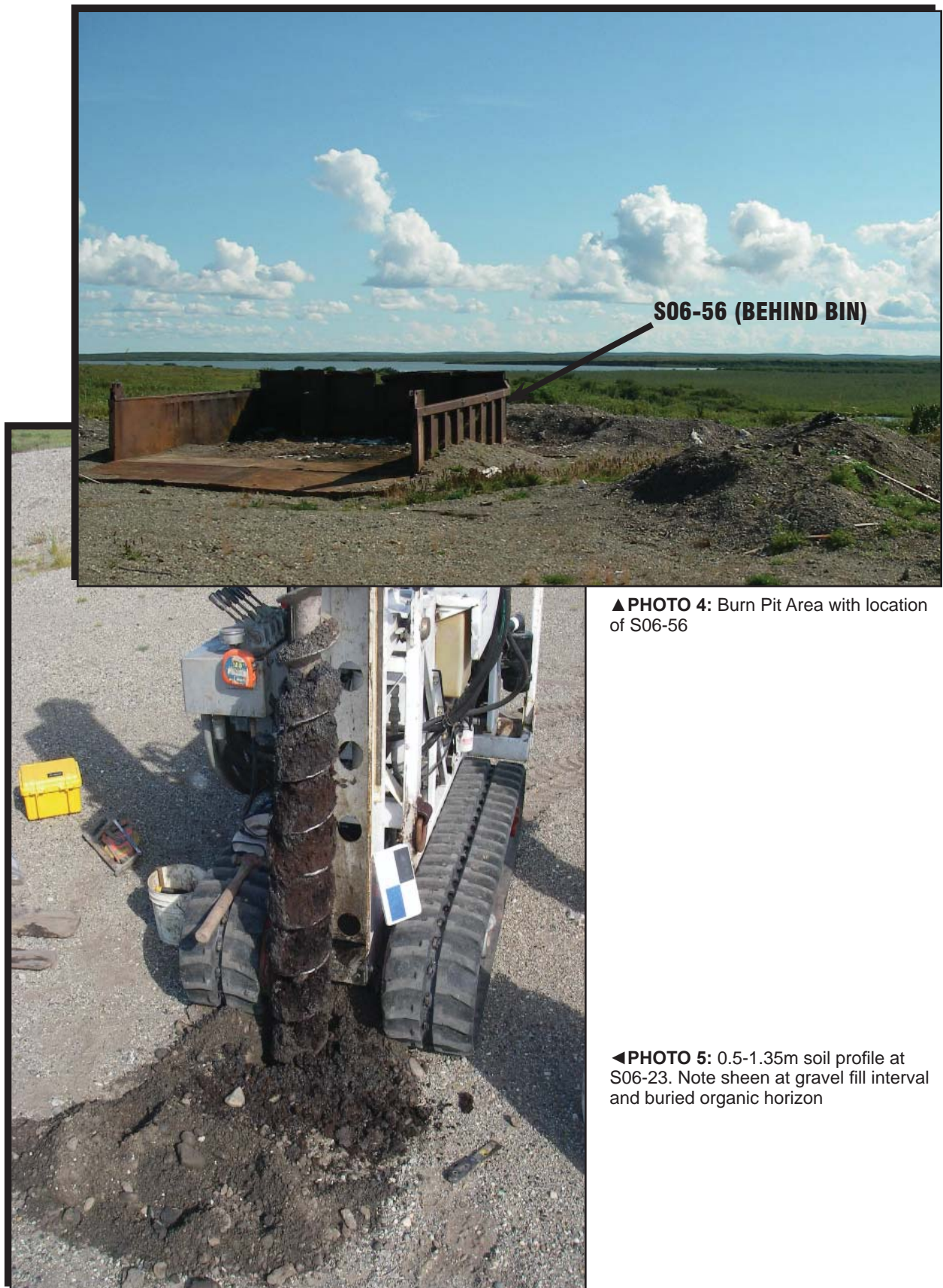


PHOTO 2: Camp Farewell with key operational areas



▲ **PHOTO 3:** Panorama view of Tank Farm and Historical Spill Area (View South to North)



▲ **PHOTO 4:** Burn Pit Area with location of S06-56

◀ **PHOTO 5:** 0.5-1.35m soil profile at S06-23. Note sheen at gravel fill interval and buried organic horizon

Appendices

Appendix 1 Water Licence – N7L1-1762 Renewal

NORTHWEST TERRITORIES WATER BOARD

Pursuant to the *Northwest Territories Waters Act* and Regulations the Northwest Territories Water Board, hereinafter referred to as the Board, hereby grants to

(Licensee) SHELL CANADA LIMITED
400 - 4 Avenue S.W.
P.O. Box 100, Station M
of CALGARY, ALBERTA T2P 0J4
(Mailing Address)

hereinafter called the Licensee, the right to alter, divert or otherwise use water subject to the restrictions and conditions contained in the *Northwest Territories Waters Act* and Regulations made thereunder and subject to and in accordance with the conditions specified in this Licence.

Licence Number N7L1-1762 RENEWAL

Licence Type "B"

Water Management Area NORTHWEST TERRITORIES 07

Location "Camp Farewell"
Latitude 69°12'30" North
Longitude 135°06'04" West
MACKENZIE RIVER DELTA, N.W.T.

Purpose TO USE WATER AND DISPOSE OF
WASTE FOR MUNICIPAL
UNDERTAKINGS AND ASSOCIATED
USES

Description OIL AND GAS EXPLORATION

Quantity of Water Not to be Exceeded 150 CUBIC METRES DAILY

Effective Date of Licence NOVEMBER 1, 2005

Expiry Date of Licence OCTOBER 31, 2010

This Licence issued and recorded at Yellowknife includes and is subject to the annexed conditions.

NORTHWEST TERRITORIES WATER BOARD


Witness


Chairman

PART A: SCOPE AND DEFINITIONS**1. Scope**

- a) This Licence entitles Shell Canada Limited to use Water and dispose of Waste for municipal undertakings associated with oil and gas exploration and development in the Mackenzie Delta at Farewell Camp and Stockpile Site (Camp Farewell) located at Latitude 69°12'30" North, and Longitude 135°06'04" West, Northwest Territories;
- b) This Licence is issued subject to the conditions contained herein with respect to the taking of Water and the depositing of Waste of any type in any Waters or in any place under any conditions where such Waste or any other Waste that results from the deposits of such Waste may enter any Waters. Whenever new Regulations are made or existing Regulations are amended by the Governor in Council under the *Northwest Territories Waters Act*, or other statutes imposing more stringent conditions relating to the quantity or type of Waste that may be so deposited or under which any such Waste may be so deposited this Licence shall be deemed, upon promulgation of such Regulations, to be automatically amended to conform with such Regulations; and
- c) Compliance with the terms and conditions of this Licence does not absolve the Licensee from responsibility for compliance with the requirements of all applicable Federal, Territorial and Municipal legislation.

2. Definitions

In this Licence: N7L1-1762

"Act" means the *Northwest Territories Waters Act*;

"Analyst" means an Analyst designated by the Minister under Section 35(1) of the *Northwest Territories Waters Act*;

"Average Concentration For Faecal Coliform" means the geometric mean of any four consecutive analytical results submitted to the Board in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program";

"Board" means the Northwest Territories Water Board established under Section 10 of the *Northwest Territories Waters Act*;

"Freeboard" means the vertical distance between water line and crest on a dam or dyke's upstream slope;

"Geotechnical Engineer" means a professional engineer registered with the Association of Professional Engineers, Geologists, and Geophysicists of the Northwest Territories and whose experience is the design and construction of earthworks in a permafrost environment;

"Greywater" means all liquid Wastes from showers, baths, sinks, kitchens and domestic washing facilities, but does not include toilet Wastes;

"Inspector" means an Inspector designated by the Minister under Section 35(1) of the *Northwest Territories Waters Act*;

"Licensee" means the holder of this Licence;

"Maximum Average Concentration" means the running average of any four (4) consecutive analytical results, or if less than four analytical results collected, and submitted to the Inspector in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program";

"Minister" means the Minister of Indian Affairs and Northern Development;

"Modification" means an alteration to a physical work that introduces a new structure or eliminates an existing structure and does not alter the purpose or function of the work, but does include an expansion;

"Permeability" means the capacity to transmit water through a medium;

"Sewage" means all toilet Waste and greywater;

"Toilet Wastes" mean all human excreta and associated products, but does not include greywater;

"Regulations" mean Regulations proclaimed pursuant to Section 33 of the *Northwest Territories Waters Act*;

"Sewage Treatment Facilities" comprises the area and engineered structures designed to contain sewage as identified in the Project Description and also includes a Sump constructed of impervious material and/or with an impervious liner;

"Sump" means an excavation for the purpose of catching or storing Water and/or Waste;

"Waste" means Waste as defined by Section 2 of the *Northwest Territories Waters Act*; and

"Waters" mean Waters as defined by Section 2 of the *Northwest Territories Waters Act*.

PART B: GENERAL CONDITIONS

1. The Licensee shall file an Annual Report with the Board not later than March 31st of the year following the calendar year reported which shall contain the following information:
 - a) the total quantity in cubic metres of fresh Water obtained from all sources;
 - b) the total quantities in cubic metres of each and all Waste discharged;
 - c) the location and direction of flow of all Waste discharged to the Water;
 - d) the results of sampling carried out under the Surveillance Network Program;
 - e) a summary of any modifications carried out on the Water supply and Sewage Treatment Facilities, including all associated structures;
 - f) a list of spills and unauthorized discharges;
 - g) details on the restoration of any sumps;
 - h) any revisions to the approved Contingency Plan; and,
 - i) any other details on Water use or Waste disposal requested by the Board within forty-five (45) days before the annual report is due.
2. The Licensee shall comply with the "Surveillance Network Program" annexed to this Licence, and any amendment to the said "Surveillance Network Program" as may be made from time to time, pursuant to the conditions of this Licence.
3. The "Surveillance Network Program" and compliance dates specified in the Licence may be modified at the discretion of the Board.

4. The Licensee shall, within thirty (30) days of the issuance of the Licence, post the necessary signs to identify the stations of the "Surveillance Network Program". All postings shall be located and maintained to the satisfaction of an Inspector.
5. Meters, devices or other such methods used for measuring the volumes of Water used and Waste discharged shall be installed, operated and maintained by the Licensee to the satisfaction of an Inspector.
6. All monitoring data shall be submitted in printed form and electronically in spreadsheet format on a diskette or other electronic forms acceptable to the Board.
7. All reports shall be submitted to the Board in printed format accompanied by an electronic copy in a common word processing format on diskette or other electronic forms acceptable to the Board.
8. Within thirty (30) days of issuance of this Licence, pursuant to Section 17(1) of the Act and Section 12 of the Regulations, the Licensee shall have posted and shall maintain a security deposit of Two Million (\$2,000,000.00) Dollars in a form suitable to the Minister.
9. The Licensee shall ensure a copy of this Licence is maintained at the site of operation at all times.

PART C: CONDITIONS APPLYING TO WATER USE

1. The Licensee shall obtain Water from the Middle Channel of the Mackenzie River in winter or the unnamed lake north of the camp in summer as described in the project description, or as otherwise approved by an Inspector.
2. For lakes used as a Water source, a representative dissolved oxygen/temperature profile must be obtained prior to the initial Water withdrawal and prior to demobilization of the project for the year.

3. The Licensee is not permitted to remove more than five (5%) percent of the available underice Water volume per lake as calculated using a maximum expected ice thickness of two (2) meters during a single winter season.
4. The daily quantity of Water used for all purposes shall not exceed 150 cubic metres.
5. The Water intake hose used on the Water pumps shall be equipped with a screen with a mesh size sufficient to ensure no entrainment of fish (2.54 mm).

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall within thirty (30) days of the issuance of this Licence, submit to the Board for approval an updated Operation and Maintenance Plan for the Sewage and Solid Waste Treatment Facilities. This Plan shall include but not necessarily be limited to details on the design, operational capacity, management and maintenance, and disposal of sludges.
2. All Sewage shall be directed to the onsite Sewage Treatment Facilities as approved by an Inspector.
3. The Sewage Treatment Facilities shall be maintained and operated in such a manner as to prevent structural failure to the satisfaction of the Inspector.
4. All Waste discharged from the onsite Sewage Treatment Facilities shall be directed to the channel of the Mackenzie River at a location approved by an Inspector.
5. There shall be no discharge of floating solids, garbage, grease, free oil or foam.

6. All Sewage effluent discharged by the Licensee from the Sewage Treatment Facilities at "Surveillance Network Program" Station Number 1762-1 shall meet the following effluent quality requirements:

Sample Parameter	Maximum Average Concentration
Biological Oxygen Demand (BOD ₅)	70.0 mg/L
Total Suspended Solids (TSS)	70.0 mg/L
Faecal Coliforms	10E4 CFU/dL
Oil and Grease	5.0 mg/L
Total Residual Chlorine (TRC)	0.1 mg/L

The Waste discharged shall have a pH between 6 and 9.

7. Introduction of Water to Waste for the purpose of achieving effluent quality requirements in Part D, Item 5 is prohibited.
8. The Licensee shall dispose of all solid Wastes in a manner acceptable to the Inspector.
9. A freeboard limit of 1.0 metre shall be maintained at all times in the Sump, part of the Sewage Treatment Facilities, or as recommended by a Geotechnical Engineer and or as approved by the Board.
10. The Licensee may commence decanting upon receipt of an Inspector's approval.
11. All analyses shall be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater" or by such other methods as may be approved by an Analyst.

PART E: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may, without written approval from the Board, carry out Modifications to the planned undertakings provided that such Modifications are consistent with the terms of this Licence and the following requirements are met:
 - a) the Licensee has notified an Inspector in writing of such proposed Modifications at least five (5) days prior to beginning the Modifications;
 - b) such Modifications do not place the Licensee in contravention of either this Licence or the Act;
 - c) an Inspector has not, during the five (5) days following notification of the proposed Modifications, informed the Licensee that review of the proposal will require more than five (5) days; and
 - d) an Inspector has not rejected the proposed Modifications.
2. Modifications for which all of the conditions referred to in Part E, Item 1 have not been met may be carried out only with written approval from an Inspector.
3. The Licensee shall provide to the Board as-built plans and drawings of the Modifications referred to in this Licence within ninety (90) days of completion of the Modifications.

PART F: CONDITIONS APPLYING TO CONTINGENCY PLANNING

1. The Licensee shall submit to the Board for approval within thirty (30) days of the issuance of this Licence an updated Emergency Response & Spill Contingency Plan.
2. The Licensee will maintain a copy of the approved Emergency Response & Spill Contingency Plan onsite in a readily available location, to the satisfaction of an Inspector.

3. The Licensee shall ensure that petroleum products, hazardous material and other Wastes associated with the project do not enter any Waters.
4. The Licensee shall ensure that all containment berms are constructed of an impermeable material, to the satisfaction of an Inspector.
5. The Licensee shall ensure that fuel stored in each tank within the tank farm be no greater than 85% of the tank's capacity to allow for expansion and avoid overflows.
6. If, during the period of this Licence, an unauthorized discharge of Waste occurs, or if such a discharge is foreseeable, the Licensee shall:
 - a) report the incident immediately via the 24 Hour Spill Reporting Line (867) 920-8130; and
 - b) submit to an Inspector a detailed report on each occurrence not later than thirty (30) days after initially reporting the event.

PART G: CONDITIONS APPLYING TO ABANDONMENT AND RESTORATION

1. The Licensee shall submit to the Board for approval within one (1) year of issuance of this Licence, an updated Interim Abandonment and Restoration Plan including a complete Phase II Environmental Assessment of Camp Farewell. This assessment will include the full delineation of contamination (soil and Water) associated with Camp Farewell operations, located both on and off the gravel base pad. The Licensee shall implement this Plan as and when approved by the Board.
2. The Licensee shall review the Interim Abandonment and Restoration Plan every two (2) years and shall modify the Plan as necessary to reflect changes in operations and technology. All proposed modifications to the Plan shall be submitted to the Board for approval.

NORTHWEST TERRITORIES WATER BOARD


Witness


Chairman

NORTHWEST TERRITORIES WATER BOARD

LICENSEE: Shell Canada Limited
LICENCE NUMBER: N7L1-1762
EFFECTIVE DATE OF LICENCE: November 1, 2005
EFFECTIVE DATE OF
SURVEILLANCE NETWORK PROGRAM: November 1, 2005

SURVEILLANCE NETWORK PROGRAM

A. Location of Sampling Stations

<u>Station Number</u>	<u>Description</u>
1762-1	Treated Sewage at the Point of Discharge

B. Sampling and Analysis Requirements

1. Water at Station Number 1762-1, shall be sampled every two weeks, and analyzed for the following parameters:

BOD₅
Oil and Grease
Ammonia
Phosphorous

Method 4500

Total Suspended Solids
Faecal Coliforms
pH - Method 4500
Total Residual Chlorine

Method 4500-Cl

2. More frequent sample collection maybe required at the request of an Inspector.

3. All sampling, sample preservation, and analyses shall be conducted in accordance with methods prescribed in the current edition of "Standard Methods for the Examination of Water and Wastewater", or by such other methods approved by an Analyst.
4. All analyses shall be performed in a laboratory approved by an Analyst.
5. The Licensee shall, by December 31st, 2005, submit to an Analyst for approval a Quality Assurance/Quality Control Plan.
6. The Plan referred to in Part B, Item 5 shall be implemented as approved by an Analyst.

C. Reports

1. The Licensee shall, within thirty (30) days following the month being reported, submit to the Board all data and information required by the "Surveillance Network Program" including the results of the approved Quality Assurance Plan.

NORTHWEST TERRITORIES WATER BOARD

Witness

Chairman

Appendix 2 Lease 107 C/4-2-10 and 107 C/4-1-7

Schedule "A"



Indian and Northern Affairs Canada
Affaires Indiennes et du Nord Canada

DUPLICATE

EXP. 105
DEC 31/2008

SF: 2726-02

Replacement of
Lease No.: 107 C/4-2-9
Lease No.: 107 C/4-2-10
File No.: 107 C/4-2

THIS LEASE made this 26th day of APRIL, 1999

BETWEEN

Her Majesty the Queen in right of Canada, hereinafter called "Her Majesty"

OF THE FIRST PART

AND

SHELL CANADA LIMITED, a body corporate, incorporated under the Laws of Canada, having a registered office in the City of Calgary, in the Province of Alberta,

hereinafter called "the lessee"

OF THE SECOND PART

WITNESSETH that in consideration of the rents, covenants and agreements herein reserved and contained on the part of the lessee to be paid, observed and performed, and subject to the Territorial Lands Act and the Territorial Lands Regulations, Her Majesty demises and leases unto the lessee all that certain parcel or tract of land situate, lying and being composed of all those parcels of land designated as "A", "B" and "C", at Farewell, located at approximately on 69°12'30" North Latitude and 135°06'04" West Longitude, in QUAD 107 C/4, in the Northwest Territories, as shown outlined in red on the sketch plan annexed hereto and forming part of this description,

hereinafter called "the land", SUBJECT TO the following reservations:

Initial

Canada

DUPLICATE

Lease No.: 107 C/4-2-10

- 2 -

- (a) all mines and minerals whether solid, liquid or gaseous which may be found to exist within, upon, or under the land together with the full powers to work the same and for that purpose to enter upon, use and occupy the land or so much thereof and to such an extent as may be necessary for the effectual working and extracting of the said minerals;
- (b) the rights of the recorded holders of mineral claims and any other claims or permits affecting the land;
- (c) all timber that may be on the land;
- (d) the right to enter upon, work and remove any rock outcrop required for public purposes;
- (e) such right or rights of way and of entry as may be required under regulations in force in connection with the construction, maintenance and use of works for the conveyance of water for use in mining operations; and
- (f) the right to enter upon the land for the purpose of installing and maintaining any public utility.

THE PARTIES COVENANT AND AGREE AS FOLLOWS:

DEFINITIONS:

1. In this lease:

- (a) "Minister" means the Minister of Indian Affairs and Northern Development and any person authorized by him in writing to act on his behalf;
- (b) "Facilities" means all physical structures or appurtenances placed in or upon the land;
- (c) "construction" means all manner of disturbance of the natural state of the surface of the land, including the sub-surface and sub-strata;
- (d) "Surveyor General" means the Surveyor General as defined in the Canada Lands Surveys Act;
- (e) "body of water" means any lake, river, stream, swamp, marsh, channel, gully, coulee or draw that continuously or intermittently contains water;

TERM:

2. The term of this lease shall be for a period of Ten (10) years commencing on the 1st day of January, A.D. 1999 and terminating on the 31st day of December A.D. 2008.

RENT AND TAXES:

3. Subject to Clause 4, the lessee shall pay to the lessor yearly and every year in advance the rental of Three hundred and sixty (\$360.00) dollars. *Power -> JENAY Cholwasi*

Initial

DUPLICATE

Lease No.: 107 C/4-2-10

- 3 -

4. The Minister may, not less than three (3) months before the expiration of the first five (5) year period of the said term, notify the lessee in writing of an amended rental payment for the following five (5) year period, the said amended rental to be based upon the fair appraised value of the land at the time of such notification, but without taking into account the value of any improvements placed thereon by and at the expense of the lessee.
5. The lessee shall during the term of this lease, pay all taxes, rates and assessments charged upon the land or upon the lessee in respect thereof.

USE:

6. The lessee shall use the land for STAGING AREA, FUEL STORAGE, EQUIPMENT AND MATERIAL STORAGE AND BASE CAMP purposes only.

SUBLETTING OR ASSIGNMENTS:

7. The lessee shall not sublet the land or assign or transfer this lease or any portion thereof without the consent of the Minister in writing, which consent shall not be unreasonably withheld. Such consent shall not be required in the event of the lessee mortgaging or pledging the rights and privileges granted herein to secure the payment of any bonds or other indebtedness of the lessee, or to any assignment made to or by any securing holder as a result of default by the lessee under any mortgage or pledge; however, copies of any such instruments must be forwarded to the Minister.

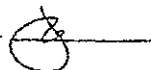
BREACH:

8. Where any portion of the rental herein reserved is unpaid for more than thirty (30) days after it becomes due, whether formally demanded or not, the Minister may by notice in writing terminate this lease and on the day following the mailing of such notice, this lease is cancelled.
9. Where the lessee breaches or fails to perform or observe any of the covenants, terms, conditions or agreements herein contained, other than the covenant to pay rent, the Minister may so advise the lessee by written notice and if the lessee fails to remedy the breach or non-performance within a reasonable time thereafter or within the time granted in the said notice, the Minister may, by notice in writing, terminate this lease and on the day following the mailing of such notice, this lease is cancelled.
10. Unless a waiver is given in writing by the Minister, Her Majesty will not be deemed to have waived any breach or non-performance by the lessee of any of the covenants, terms, conditions or agreements herein contained and a waiver affects only the specific breach to which it refers.

TERMINATION:

11. Upon the termination or expiration of this lease, the lessee shall deliver up possession of the land in a condition satisfactory to the Minister.

Initial



DUPLICATE

Lease No.: 107 C/4-2-10

- 4 -

12. Termination or expiration of this lease will not prejudice Her Majesty's right to unpaid rental or any other right with respect to a breach or non-performance of any covenant, term, condition or agreement herein contained nor will the lessee be relieved of any obligation contained herein.

RESTORATION:

13. Where the lessee fails to restore the land as required and within the time allowed by the Regulations or by the Minister, the Minister may order the restoration of all or any part of such land and any expenses thus incurred by the Minister shall be recoverable from the lessee as a debt due to Her Majesty.

WASTE DISPOSAL:

14. The lessee shall dispose of all garbage and debris by incinerating all combustible materials and burying all noncombustible materials in a manner and at a site approved by the Minister, or by removal to an approved dumping site.
15. The lessee shall dispose of human waste in a manner satisfactory to the Minister.
16. The lessee shall not discharge or deposit any refuse substances or other waste materials in any body of water, or the banks thereof, which will, in the opinion of the Minister, impair the quality of the waters or the natural environment and any areas designated for waste disposal shall not be located within thirty-one (31) metres of the ordinary high water mark of any body of water, unless otherwise authorized by the Minister.

ENVIRONMENTAL:

17. The lessee shall at all times keep the land in a condition satisfactory to the Minister.
18. The lessee shall not do anything which will cause erosion of the banks of any body of water on or adjacent to the land, and shall provide necessary controls to prevent such erosion.
19. The lessee shall not unduly interfere with the natural drainage pattern of the land, except with the permission of the Minister.

FUEL AND HAZARDOUS CHEMICALS:

20. The lessee shall take all reasonable precautions to prevent the possibility of migration of spilled petroleum fuel over the ground surface or through seepage in the ground by:
- (i) constructing a dyke around any stationary petroleum fuel container where the container has a capacity exceeding four thousand (4,000) litres; and
 - (ii) ensuring that the dyke(s) and the area enclosed by the dyke(s) is impermeable to petroleum products at all times; and
 - (iii) ensuring that the volumetric capacity of the dyked area shall, at all times, be equal to the capacity of the largest petroleum fuel container plus ten (10) percent of the total displacement of all other petroleum fuel containers placed therein; or

such other alternate specifications submitted by the lessee that may be approved, in writing, by the Minister.

Initial

DUPLICATE

Lease No.: 107 C/4-2-10

- 5 -

21. The lessee shall ensure that fuel storage containers are not located within thirty-one (31) metres of the ordinary high water mark of any body of water unless otherwise authorized by the Minister.
22. The lessee shall mark with flags, posts or similar devices all petroleum fuel storage facilities, including fill and distribution lines, such that they are clearly visible at all times.
23. The lessee shall immediately report all spills of petroleum and hazardous chemicals in accordance with the Government of the Northwest Territories Spill Report and any amendments thereto, or in a manner satisfactory to the Minister.
24. The lessee shall take all reasonable precautions to prevent the migration of petroleum products into bodies of water.
25. The lessee shall, within six (6) months of the execution of this lease deliver to the Minister, for his approval, an Oil Spill Contingency Plan and shall maintain the provisions of the said Plan, and any modifications approved by the Minister, throughout the term of this lease. *prob not would be standing agreement* *sch. must have own plan in place.*
26. The lessee shall handle, store, dispose and keep records of all hazardous and toxic chemicals in a manner satisfactory to the Minister.
27. The fuel storage facilities of the lessee, including all tanks, bladders, hoses, pumps, fuel transfer lines and associated mechanical connections and valves shall be installed and maintained to the satisfaction of the Minister and the lessee agrees to make such reasonable modifications and improvements as are deemed necessary by the Minister.

IMPROVEMENTS:

28. The lessee is responsible for ensuring that all improvements to the land are made within the boundaries of the land.
29. The lessee shall maintain the existing improvements now situated on the land on the effective date of this lease, or any similar improvements which may be constructed, in a manner and condition satisfactory to the Minister.
30. The lessee shall not construct any facilities within thirty-one (31) metres of the ordinary high water mark of any body of water without the written approval of the Minister.

BOUNDARIES/SURVEY:

31. Her Majesty is not responsible for the establishment on the ground of the boundaries of the land.
32. The boundaries of the land are subject to such adjustment and alteration as may be shown to be necessary by survey.

Initial 

DUPLICATE

Lease No.: 107 C/4-2-10

- 6 -

32. The Minister may, during the term herein granted, by notice in writing, order the lessee to survey the boundaries of the land and the lessee shall, at its own expense, within one (1) year from the date of said notice, make or cause to be made a survey of the land, such survey to be made in accordance with the instructions of the Surveyor General, and upon completion of the survey and the production of survey plans suitable for recording in the Canada Lands Surveys Records and filing in the Land Titles Office for the Northwest Territories Land Registration District, Her Majesty will execute an Indenture in amendment of this lease for the purpose of incorporating herein descriptions of the land based on the said plans.

ACCESS:

33. Her Majesty assumes no responsibility, express or implied, to provide access to the land.
34. It shall be lawful for Her Majesty or any person duly authorized at all reasonable times to enter upon the land for the purpose of examining the condition thereof.
35. The Minister may grant to such persons as he may consider fit, rights-of-way or access across, through, under or over all or any portion of the land for any purpose whatsoever, but such rights-of-way or access will not unreasonably interfere with the rights granted to the lessee hereunder, or with any improvements made by the lessee on the land.

INDEMNIFICATION:

36. The lessee will not be entitled to compensation from Her Majesty by reason of the land or any portion thereof being submerged, damaged by erosion, or otherwise affected by flooding.
37. Her Majesty will not be liable for damages caused by vandalism or interference by others with the lessee's facilities and equipment.
38. The lessee shall at all times hereafter indemnify and keep Her Majesty indemnified against all claims, demands, actions or other legal proceedings by whomsoever made or brought against Her Majesty by reason of anything done or omitted to be done by the lessee, his officers, servants, agents or employees arising out of or connected with the granting of this lease.

REVIEW:

39. At the request of the lessee, any decision of the Minister will be reviewable by the Trial Division of the Federal Court of Canada; costs of such review are the responsibility of the lessee unless otherwise ordered by the Court.

NOTICES:

40. All written notices respecting the land or the covenants, terms, conditions or agreements contained in this lease shall, unless otherwise stipulated herein, be deemed to have been received by the lessee ten (10) days after the mailing thereof or, if hand delivered, on the day of delivery.

Initial 

DUPLICATE

Lease No.: 107 C/4-2-10

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41. Any notice affecting this lease which Her Majesty may desire to serve upon the lessee, or any notice which the lessee may desire to serve upon Her Majesty shall, unless otherwise stipulated herein, be sufficiently served if posted by registered mail to the last known address of the opposite party as follows:

To Her Majesty: Director of Operations
Northwest Territories Region
Northern Affairs Program
Department of Indian Affairs and Northern
Development
P.O. Box 1500
Yellowknife, N.W.T.
X1A 2R3

To the Lessee: Shell Canada Limited
P.O. Box 100
Calgary, AB
T2P 2H5

Either party may change its address for service during the term of this lease by notifying the other party in writing.

42. No notice of breach or default given herein by Her Majesty shall be valid or of any effect unless it is also given to any mortgagee of the lessee, in respect of the leased lands, of which Her Majesty shall have received written notice.

GENERAL:

43. The lessee shall abide by the said Act and Regulations.
44. This lease enures to the benefit of and is binding upon Her Majesty, Her Heirs and Successors and the lessee, its successors and assigns.
45. No implied covenant or implied liability on the part of Her Majesty is created by the use of the words "demises and leases" herein.
46. If an archaeological site is discovered within the land, the lessee shall immediately advise the Minister in writing of such a discovery and shall take all reasonable precautions necessary to prevent any further disturbance or destruction of such site.

Initial 

DUPLICATE

Lease No.: 107 C/4-2-10

- 8 -

IN WITNESS WHEREOF The Director of Operations, Northwest Territories Region, Northern Affairs Program, Department of Indian Affairs and Northern Development, has hereunto set his hand and seal on behalf of Her Majesty the Queen in right of Canada and Shell Canada Limited, has hereunto affixed its corporate seal attested to by its proper officers duly authorized in that behalf.

SIGNED, SEALED AND DELIVERED on behalf
of Her Majesty by The Director of
Operations, Northwest Territories Region,
Department of Indian Affairs and
Northern Development, in the presence of

COOEE M. Robert
Director's Witness

SEALED, ATTESTED TO AND DELIVERED

by the

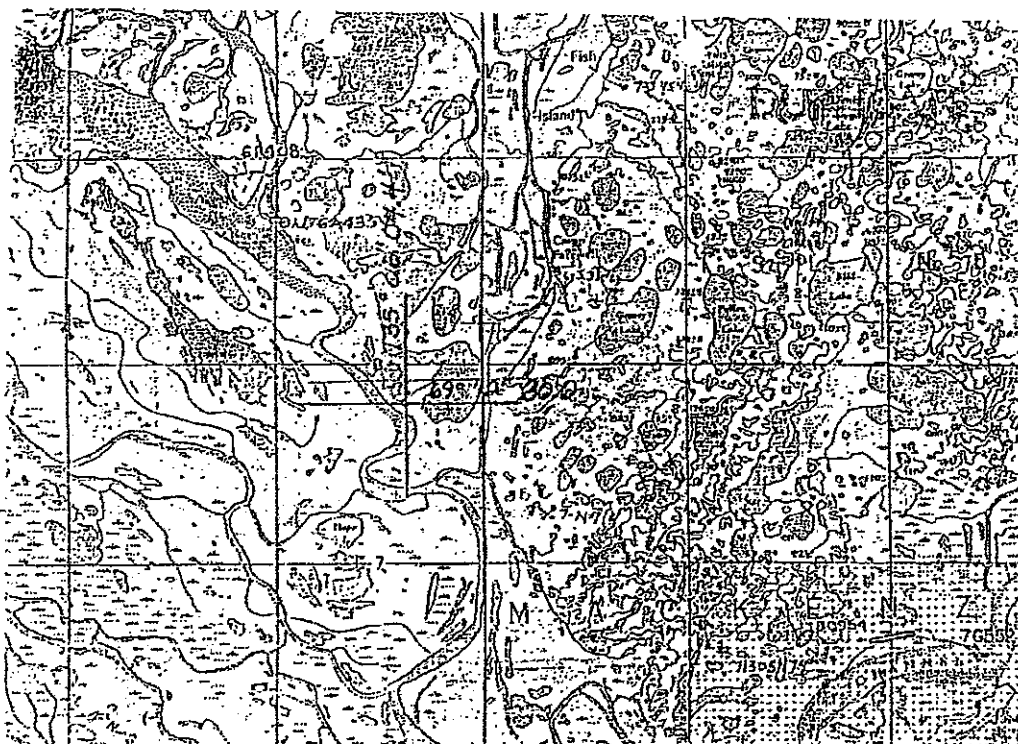
and the

of Shell Canada Limited

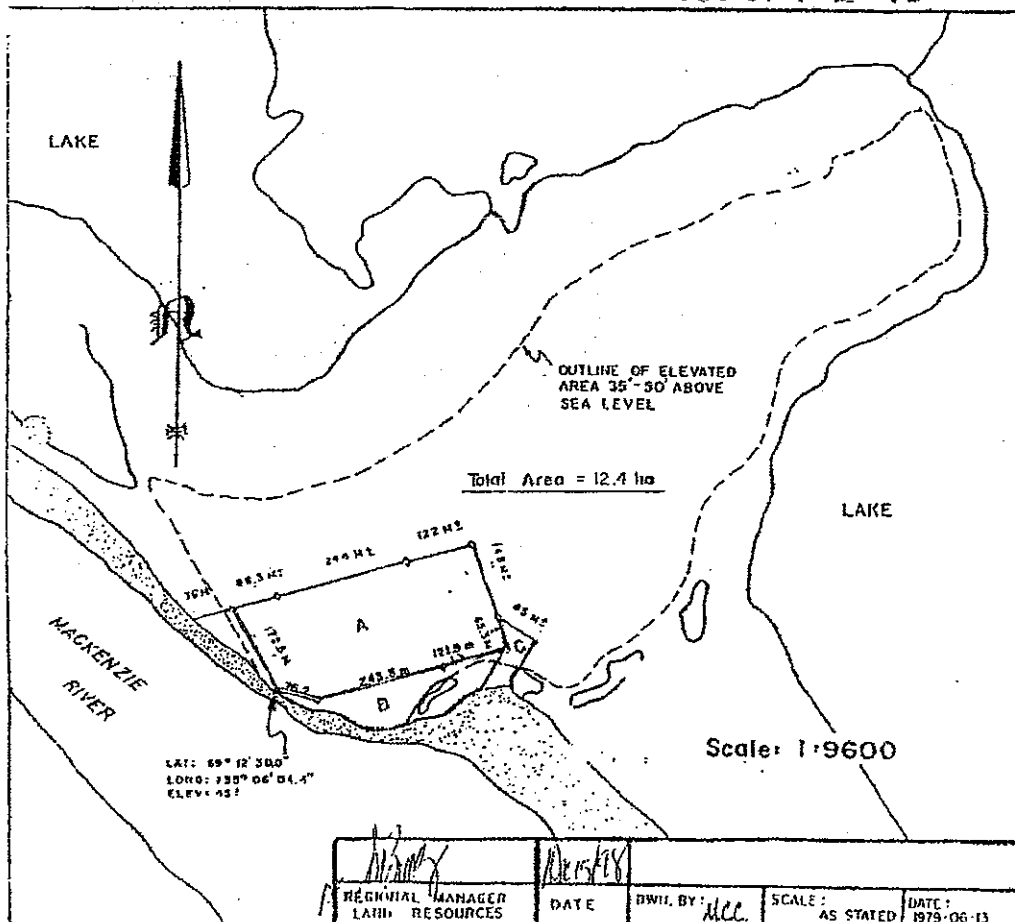
Z.M. O. (SEAL)
Director's Signature

SHELL CANADA LIMITED

J. Coull (SEAL) BW
JANE M. COULL
Assistant Secretary (SEAL)



ANNEXED HERETO AND FORMING PART OF LEASE 107C/4-2-10





Indian and Northern Affairs Canada
Affaires Indiennes et du Nord Canada

SF:2726-03

DUPLICATE

CELLS COPY

Replacement of
Lease No.: 107 C/4-1-6
Lease No.: 107 C/4-1-7
File No.: 107 C/4-1

THIS LEASE made this 20th day of APRIL, 1979

BETWEEN

Her Majesty the Queen in right of Canada, hereinafter called "Her Majesty"

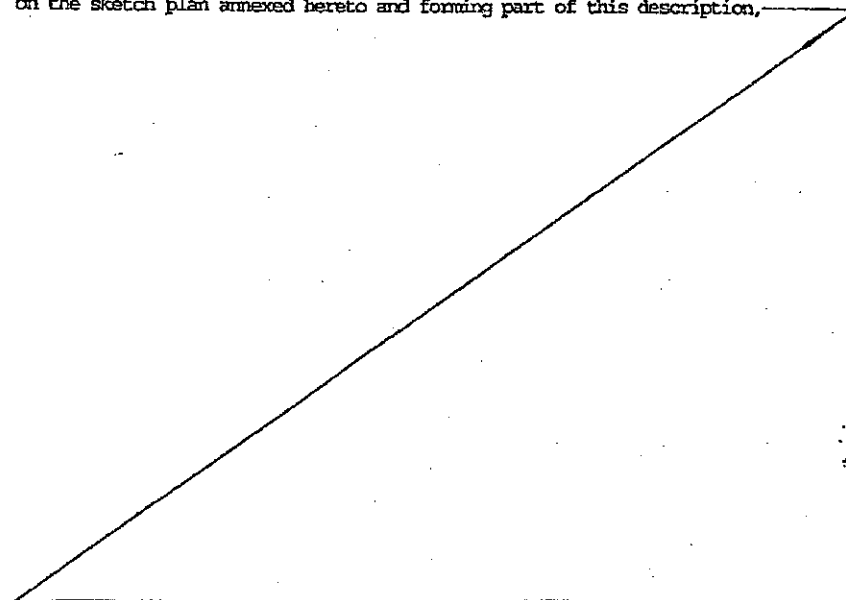
OF THE FIRST PART

AND SHELL CANADA LIMITED, a body corporate, incorporated under the Laws of Canada, having a registered office in the City of Calgary, in the Province of Alberta,

hereinafter called "the lessee"

OF THE SECOND PART

WITNESSETH that in consideration of the rents, covenants and agreements herein reserved and contained on the part of the lessee to be paid, observed and performed, and subject to the Territorial Lands Act and the Territorial Lands Regulations, Her Majesty demises and leases unto the lessee all that certain parcel or tract of land situate, lying and being composed of all that parcel of land at Farewell, located at approximately on 69°12'30" North Latitude and 135°06'04" West Longitude, in QUAD 107 C/4, in the Northwest Territories, as shown outlined in red on the sketch plan annexed hereto and forming part of this description,



hereinafter called "the land", SUBJECT TO the following reservations:

Initial 1/8

Canada

DUPLICATE

Lease No.: 107 C/4-1-7

- 2 -

- (a) all mines and minerals whether solid, liquid or gaseous which may be found to exist within, upon, or under the land together with the full powers to work the same and for that purpose to enter upon, use and occupy the land or so much thereof and to such an extent as may be necessary for the effectual working and extracting of the said minerals;
- (b) the rights of the recorded holders of mineral claims and any other claims or permits affecting the land;
- (c) all timber that may be on the land;
- (d) the right to enter upon, work and remove any rock outcrop required for public purposes;
- (e) such right or rights of way and of entry as may be required under regulations in force in connection with the construction, maintenance and use of works for the conveyance of water for use in mining operations; and
- (f) the right to enter upon the land for the purpose of installing and maintaining any public utility.

THE PARTIES COVENANT AND AGREE AS FOLLOWS:

DEFINITIONS:

- 1. In this lease:
 - (a) "Minister" means the Minister of Indian Affairs and Northern Development and any person authorized by him in writing to act on his behalf;
 - (b) "facilities" means all physical structures or appurtenances placed in or upon the land;
 - (c) "construction" means all manner of disturbance of the natural state of the surface of the land, including the sub-surface and sub-strata;
 - (d) "Surveyor General" means the Surveyor General as defined in the Canada Lands Surveys Act;
 - (e) "body of water" means any lake, river, stream, swamp, marsh, channel, gully, coulee or draw that continuously or intermittently contains water;
 - (f) "airstrip" means any area, either water or land, which is adapted for the take off and landing of aircraft and which provides facilities for the shelter and repair of aircraft, or for the regular receiving and discharging of passengers or cargo;

TERM:

- 2. The term of this lease shall be for a period of Ten (10) years commencing on the 1st day of January, A.D. 1999 and terminating on the 31st day of December A.D. 2008.

Initial *JC*

DUPLICATE

Lease No.: 107 C/4-1-7

- 3 -

RENT AND TAXES:

3. Subject to Clause 4, the lessee shall pay to the lessor yearly and every year in advance the rental of One Hundred and Fifty (\$150.00) dollars.
4. The Minister may, not less than three (3) months before the expiration of the first five (5) year period of the said term, notify the lessee in writing of an amended rental payment for the following five (5) year period, the said amended rental to be based upon the fair appraised value of the land at the time of such notification, but without taking into account the value of any improvements placed thereon by and at the expense of the lessee.
5. The lessee shall during the term of this lease, pay all taxes, rates and assessments charged upon the land or upon the lessee in respect thereof.

USE:

6. The lessee shall use the land for the location of an AIRSTRIP only.

SUBLETTING OR ASSIGNMENTS:

7. The lessee shall not sublet the land or assign or transfer this lease or any portion thereof without the consent of the Minister in writing, which consent shall not be unreasonably withheld.

BREACH:

8. Where any portion of the rental herein reserved is unpaid for more than thirty (30) days after it becomes due, whether formally demanded or not, the Minister may by notice in writing terminate this lease and on the day following the mailing of such notice, this lease is cancelled.
9. Where the lessee breaches or fails to perform or observe any of the covenants, terms, conditions or agreements herein contained, other than the covenant to pay rent, the Minister may so advise the lessee by written notice and if the lessee fails to remedy the breach or non-performance within a reasonable time thereafter or within the time granted in the said notice, the Minister may, by notice in writing, terminate this lease and on the day following the mailing of such notice, this lease is cancelled.
10. Unless a waiver is given in writing by the Minister, Her Majesty will not be deemed to have waived any breach or non-performance by the lessee of any of the covenants, terms, conditions or agreements herein contained and a waiver affects only the specific breach to which it refers.

TERMINATION:

11. Upon the termination or expiration of this lease, the lessee shall deliver up possession of the land in a condition satisfactory to the Minister.

Initial *JS*

DUPLICATE

Lease No.: 107 C/4-1-7

- 4 -

12. Termination or expiration of this lease will not prejudice Her Majesty's right to unpaid rental or any other right with respect to a breach or non-performance of any covenant, term, condition or agreement herein contained nor will the lessee be relieved of any obligation contained herein.

RESTORATION:

13. Where the lessee fails to restore the land as required and within the time allowed by the Regulations or by the Minister, the Minister may order the restoration of all or any part of such land and any expenses thus incurred by the Minister shall be recoverable from the lessee as a debt due to Her Majesty.

WASTE DISPOSAL:

14. The lessee shall remove all garbage and debris from the land to an authorized dumping place.

ENVIRONMENTAL:

15. The lessee shall at all times keep the land in a condition satisfactory to the Minister.

FUEL AND HAZARDOUS CHEMICALS:

16. The lessee shall ensure that fuel storage containers are not located within thirty-one (31) metres of the ordinary high water mark of any body of water unless otherwise authorized by the Minister.
17. The lessee shall mark with flags, posts or similar devices all petroleum fuel storage facilities, including fill and distribution lines, such that they are clearly visible at all times.
18. The lessee shall immediately report all spills of petroleum and hazardous chemicals in accordance with the Government of the Northwest Territories Spill Report and any amendments thereto, or in a manner satisfactory to the Minister.
19. The lessee shall prevent the possibility of migration of spilled fuel over the ground surface or through seepage in the ground.
20. The lessee shall take all reasonable precautions to prevent the migration of petroleum products into bodies of water.
21. The fuel storage facilities of the lessee, including all tanks, bladders, hoses, pumps, fuel transfer lines and associated mechanical connections and valves shall be installed and maintained to the satisfaction of the Minister and the lessee agrees to make such reasonable modifications and improvements as are deemed necessary by the Minister.

IMPROVEMENTS:

22. The lessee is responsible for ensuring that all improvements to the land are made within the boundaries of the land.
23. The lessee shall not erect any building or structure nearer than a distance of three (3) metres from any boundary of the land.

Initial 

DUPLICATE

Lease No.: 107 C/4-1-7

- 5 -

24. The lessee shall not construct any facilities within thirty-one (31) metres of the ordinary high water mark of any body of water without the written approval of the Minister.

BOUNDARIES/SURVEY:

25. Her Majesty is not responsible for the establishment on the ground of the boundaries of the land.
26. The boundaries of the land are subject to such adjustment and alteration as may be shown to be necessary by survey.
27. The Minister may, during the term herein granted, by notice in writing, order the lessee to survey the boundaries of the land and the lessee shall, at its own expense, within one (1) year from the date of said notice, make or cause to be made a survey of the land, such survey to be made in accordance with the instructions of the Surveyor General, and upon completion of the survey and the production of survey plans suitable for recording in the Canada Lands Surveys Records and filing in the Land Titles Office for the Northwest Territories Land Registration District, Her Majesty will execute an Indenture in amendment of this lease for the purpose of incorporating herein descriptions of the land based on the said plans.

ACCESS:

28. Her Majesty assumes no responsibility, express or implied, to provide access to the land.
29. It shall be lawful for Her Majesty or any person duly authorized at all reasonable times to enter upon the land for the purpose of examining the condition thereof.
30. The Minister may grant to such persons as he may consider fit, rights-of-way or access across, through, under or over all or any portion of the land for any purpose whatsoever, but such rights-of-way or access will not unreasonably interfere with the rights granted to the lessee hereunder, or with any improvements made by the lessee on the land.

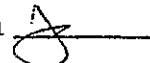
INDEMNIFICATION:

31. The lessee will not be entitled to compensation from Her Majesty by reason of the land or any portion thereof being submerged, damaged by erosion, or otherwise affected by flooding.
32. Her Majesty will not be liable for damages caused by vandalism or interference by others with the lessee's facilities and equipment.
33. The lessee shall at all times hereafter indemnify and keep Her Majesty indemnified against all claims, demands, actions or other legal proceedings by whomsoever made or brought against Her Majesty by reason of anything done or omitted to be done by the lessee, his officers, servants, agents or employees arising out of or connected with the granting of this lease.

REVIEW:

34. At the request of the lessee, any decision of the Minister will be reviewable by the Trial Division of the Federal Court of Canada; costs of such review are the responsibility of the lessee unless otherwise ordered by the Court.

Initial



DUPLICATE

Lease No.: 107 C/4-1-7

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NOTICES:

35. All written notices respecting the land or the covenants, terms, conditions or agreements contained in this lease shall, unless otherwise stipulated herein, be deemed to have been received by the lessee ten (10) days after the mailing thereof or, if hand delivered, on the day of delivery.
36. Any notice affecting this lease which Her Majesty may desire to serve upon the lessee, or any notice which the lessee may desire to serve upon Her Majesty shall, unless otherwise stipulated herein, be sufficiently served if posted by registered mail to the last known address of the opposite party as follows:

To Her Majesty: Director of Operations
Northwest Territories Region
Northern Affairs Program
Department of Indian Affairs and Northern
Development
P.O. Box 1500
Yellowknife, N.W.T.
X1A 2R3

To the Lessee: Shell Canada Limited
P.O. Box 100
Calgary, AB
T2P 2H5

Either party may change its address for service during the term of this lease by notifying the other party in writing.

37. No notice of breach or default given herein by Her Majesty shall be valid or of any effect unless it is also given to any mortgagee of the lessee, in respect of the leased lands, of which Her Majesty shall have received written notice.

GENERAL:

38. The lessee shall abide by the said Act and Regulations.
39. This lease endures to the benefit of and is binding upon Her Majesty, Her Heirs and Successors and the lessee, its successors and assigns.
40. No implied covenant or implied liability on the part of Her Majesty is created by the use of the words "demises and leases" herein.
41. The lessee shall at all times permit emergency landings on the airstrip without the payment of fees.
42. Aircraft owned or under contract to the Government of Canada or the Government of the Northwest Territories shall be exempt from the payment of any charges of landing fees for the use of the airstrip.
43. The lessee shall not levy charges or landing fees for the use of the airstrip by other users without prior written consent of the Minister.

Initial



DUPLICATE

Lease No.: 107 C/4-1-7

- 7 -

IN WITNESS WHEREOF The Director of Operations, Northwest Territories Region, Northern Affairs Program, Department of Indian Affairs and Northern Development, has hereunto set his hand and seal on behalf of Her Majesty the Queen in right of Canada and Shell Canada Limited, has hereunto affixed its corporate seal attested to by its proper officers duly authorized in that behalf.

SIGNED, SEALED AND DELIVERED on behalf
of Her Majesty by The Director of
Operations, Northwest Territories Region,
Department of Indian Affairs and
Northern Development, in the presence of

 (SEAL)
Director's Signature


Director's Witness

SEALED, ATTESTED TO AND DELIVERED

by the

and the

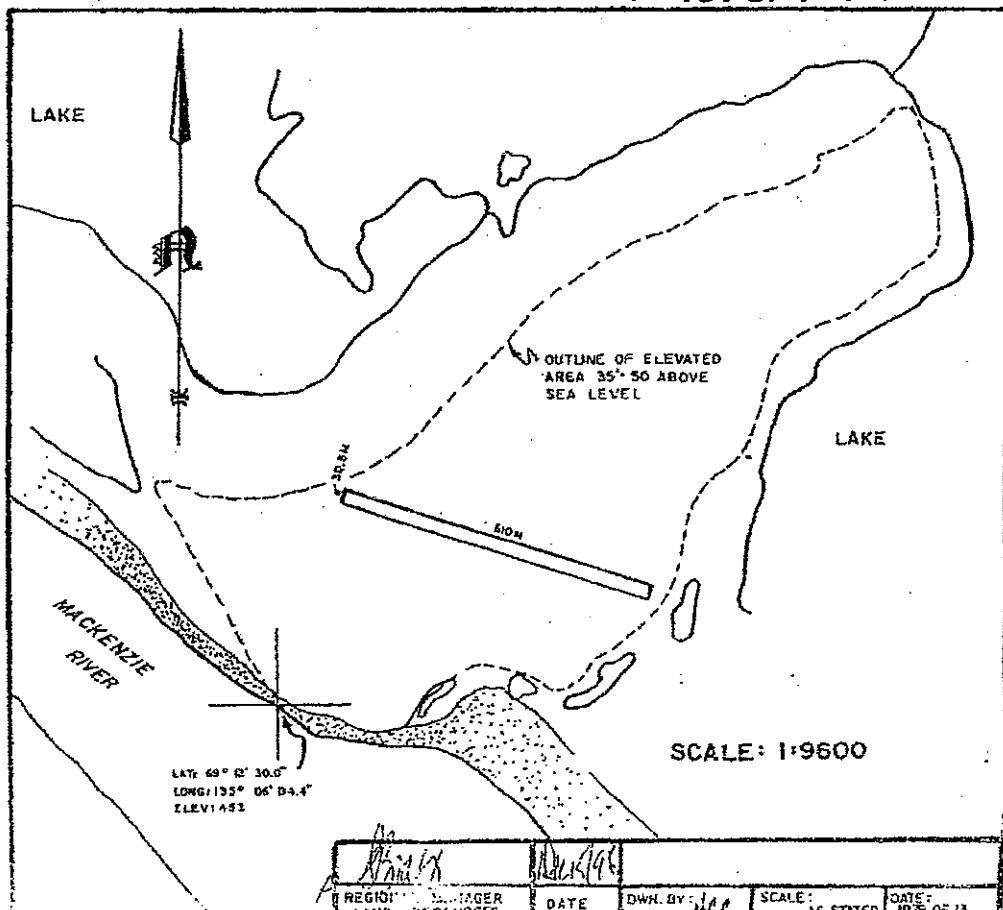
of Shell Canada Limited

SHELL CANADA LIMITED

 (SEAL) *pm*
JANE M. COULL
Assistant Secretary (SEAL)



ANNEXED HERETO AND FORMING PART OF LEASE 107C/4-1-7



Appendix 3 Regulators' Letters of Recommendations as Pertaining to Their Review of the Interim Abandonment and Restoration Plan



Environment Canada
Environnement Canada

Environmental Protection Operations Directorate
Suite 301, 5204 - 50th Avenue
Yellowknife, NT, X1A 1E2

September 20, 2007

Joe Murdoch
Northwest Territories Water Board

Our file:

Via email:

Re: Camp Farewell – 2006 Environmental Site Assessment and Interim Abandonment and Restoration Plan

On behalf of Environment Canada (EC), I have reviewed the information submitted with the above-mentioned documents. The Canadian Wildlife Service of EC also reviewed the information and provided comments which are included here. The following comments are provided pursuant to Environment Canada's mandated responsibilities for the enforcement of the *Canadian Environmental Protection Act*, Section 36(3) of the *Fisheries Act*, and the *Migratory Birds Convention Act*.

Camp Farewell was established in the winter of 1970 primarily as a staging and storage site for Shell's Delta Drilling Program. The lease is currently under the stewardship of Shell Canada Limited and the Camp is used as a staging site for seismic operations, preliminary development assessment work and drilling operations within the Kendall Island Bird Sanctuary. Camp Farewell is located within the Kendall Island Bird Sanctuary in the Mackenzie Delta on an outwash plain bordered to the west and southwest by the Mackenzie river and to the east, north and south by shallow lakes and intermittent ponds. The depth to active layer is typically less than 1 m in an area of discontinuous permafrost.

2006 Environmental Site Assessment, Camp Farewell, NT

Background Sampling Protocol

1. The ESA report refers to the selection of two background soil samples that were taken to the north-east of the site "in areas not likely to have been affected by the facility". The Environmental Site Assessment report further states that the "hydrocarbons reported in these background samples are considered to represent natural organic material rather than facility related hydrocarbon impact". Also, the conclusion in the ESA report seems to be that the PHCs encountered at the background sites originated in the top rich organic layer and not at depth. Is this an accurate interpretation of information in the report? EC has some reservations that naturally occurring PHCs (fractions 2, 3 and 4) would be present in the organic soils of this Mackenzie Delta area.
2. There appears to be insufficient information to conclude that these test locations were not impacted by facility activities. Considering the long history of use (diesel fuel spills, burn pits, above ground tanks, camp housing, home heating fuel, vehicle storage, fuel storage, vehicle lubricants, pipe lubricants etc) at this facility, there is a possibility that the petroleum hydrocarbons detected in test locations S06-1 and S06-2 are the result of human activities. Please note that the CCME provides guidance (*Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites, Volume I: Main Report and Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites, Volume II: Analytical Method Summaries*) on properly selecting sites for accurate background sampling.
3. The ESA report also refers to a 95% confidence interval and mean that was calculated based on the two background soil locations sampled. Given the small sample size (2), this isn't very robust statistically. This analysis seems to form the basis in determining the likelihood of naturally occurring PHCs in other areas of

the site, e.g., the burn pit. Please note that EC does not consider this to be reliable information. A larger sample size with appropriate background locations chosen is recommended.

4. The ESA report also states that elevated selenium was found in one background sample but nowhere else. EC recommends investigating this further in order to determine if indeed selenium is naturally occurring in background soil at this location. With respect to the appropriate guideline to use for selenium at this site, please note that if the site will be left in a natural state in future, then using the regulatory guideline for residential parkland is the appropriate guideline.

Other

5. In the area of the historic spill of 800 000 L in 1981, a number of locations were sampled with a goal of delineating the area of impacted soil. Is the proponent confident that the area impacted has been accurately and completely delineated? Accurate delineation will drive many of the remediation activities in the future.
6. A number of other sites were sampled for hydrocarbons in soil at Camp Farewell, e.g., burn pit area, tank farm, gravel pad, above ground fuel storage tanks (ASTs) etc. Is the proponent confident that all hydrocarbon contaminated soil has been identified in these areas?
7. Please note that the presence of toluene in piezometer P06-2 should be further investigated. The source should be identified and the extent of contamination should be determined with a goal to remediate the contaminated area.
8. *Also, please note that a comprehensive Environmental Site Assessment will often direct restoration activities at a site. EC encourages the proponent to address areas that are lacking sufficient information in this current ESA such that site characterisation is better known and will therefore be better able to inform a more comprehensive A & R Plan.*

Interim Abandonment and Restoration Plan, Camp Farewell, NT

1. The report states that the permit issued to Shell Canada "allows its personnel and/or delegates to enter and conduct activities in the sanctuary". In fact, the permit is issued to Shell Canada alone and does not apply to delegates. Please note that a separate permit is required by delegates to conduct activities in the sanctuary.
2. Please note the following for any activities associated with this Interim or any subsequent A & R Plan for this site:
 - The proponent shall not deposit, nor permit the deposit of chemicals, sediment, wastes, or fuels associated with the project into any water body. According to the Fisheries Act, Section 36 (3), the deposition of deleterious substances of any type in water frequented by fish, or in any place under any conditions where the deleterious substance, or any deleterious substance that results from the deposit of the deleterious substance, may enter any such water, is prohibited.
3. It is understood that the A & R Plan submitted is an interim one and as such lacks significant detail on final restoration activities. Please note some conditions whereby an updated A & R Plan may need to be submitted:
 - If the facility activities lead to expansion that hasn't been contemplated in the existing Plan
 - If there is a change (or proposed change) in reclamation procedures
 - If there are unforeseen or significant hazards as well as operational changes identified.EC recommends that Shell ensure that A & R / Closure and Reclamation Plans are updated as required through the life of this project.
4. Some metal concentrations (cadmium, copper and iron) in groundwater were above CCME MAL and FWAL. Why was this attributed to background water concentrations? Please note that appropriate background groundwater samples should be taken at locations known to not have been impacted by facility operations.
5. Sampling of the sewage lagoon showed toluene concentrations of 0.94 mg/kg. Was additional sampling carried out to determine the origin and any possible impacts to the receiving environment via out-

migration? The report also states that the lagoon sludge will be dewatered and dried before being released to the environment. Is there a contingency plan in place in the event the sludge isn't adequately dry at the end of the season or if the sludge is considered harmful to the receiving environment? Is there adequate and appropriate storage (i.e., containment) in the event the sludge is not ready to be released to the environment? Please note that steps should be taken to ensure no further releases of toluene or other harmful chemicals are made to the lagoon or receiving environment. Please consider as well steps to be taken to remediate any environmental damage caused by toluene at this site.

6. The Interim Abandonment & Restoration Plan indicates that a 65 x 50 m conductivity anomaly located within or under the gravel pad was likely due to buried metal. Has Shell proposed any further investigations to determine the exact nature of this anomaly and the amounts and nature of any buried metals causing it? Also, this Plan does not indicate the number or nature of buried landfills that are likely at this site. Has the proponent conducted testing to determine the number, contents and volume of these landfills? EC also recommends the monitoring of any future landfills to ensure the contents are known and are safe for the environment.
7. It does not appear that there has been a waste inventory or audit completed that outlines the nature, extent and eventual fate of all waste materials brought to, used and generated at this site. EC recommends the development of such a Plan. Such a waste management plan should include, but not be limited to:
 - Purchasing policies that focus on reduced packaging,
 - A hazardous materials management plan for the site that ensures that all hazardous wastes, including waste oil, receive proper treatment and disposal at an approved facility
 - On-site diversion and segregation programs (i.e. the separation of non-food waste items, non-combustible solid wastes etc. suitable for storage and subsequent transport and disposal or recycling). The proponent is encouraged to make use of recycling facilities for all recyclable materials.
 - If incineration is required, ensure diligent operation and maintenance of the incineration device and ensure appropriate training is provided to the personnel operating and maintaining the incinerator. The proponent is encouraged to develop an incineration management plan in consultation with EC and the GNWT. This would include a submission of an annual incineration management report that provides the following details:
 - Recycling/segregation waste program
 - Incineration technology selected
 - Waste audit – amount and types of waste incinerated
 - Operational and maintenance records
 - Operator training
 - Incineration ash disposal
 - How will the Proponent demonstrate compliance with the Canada Wide Standards for Dioxins & Furans and Mercury?
8. Also, with respect to the large spill of 800 000 L in 1981, has any progressive reclamation been considered? Progressive reclamation is continuous reclamation and rehabilitation of facility property as operations continue. Progressive reclamation has the advantages that terminal closure liability is reduced, closure technology can be demonstrated and the potential of discovering hidden problems and correcting them, prior to final closure, is increased. The risk to both the current operator and the successor custodian is also reduced. Final reclamation is conducted after facility operations have ended. Progressive reclamation dramatically reduces the amount of final reclamation at the end of an operation.
9. Given the location of the spill, EC would encourage Shell to accurately delineate and begin progressive reclamation measures of contaminated soil in the near future. Please clarify whether the 2495 m³ of 'impacted soil' includes the actual berms around the tanks? Also, under Treatment Options, the report states that the preferred option for the excavated base pad material is to treat and reuse because of its scarcity in the Mackenzie Delta. Could the proponent clarify why this approach, i.e., leaving the exposed natural surface, satisfactory here, but elsewhere the report recommends that the gravel pad be left in place to protect the underlying permafrost? This approach would seem to imply that the treated gravel from the 1981 spill area should be placed back over the exposed natural surface.

10. The report states that the vegetation in tundra areas around the base pad "is healthy and appears to be unaffected by the presence of hydrocarbons". Was this assessment based on detailed assessment of the vegetation in these areas compared to similar vegetation types well removed from Farewell (i.e., appropriate background sites)?
11. Also, very little information has been presented that concretely outlines how petroleum hydrocarbon contaminated soils will be treated, whether on or off site. The ESA should have provided accurate volumes of soil that are currently contaminated onsite yet the A&R Plan does not provide a timeframe for addressing this contamination. The A & R Plan should give more details on *in situ* and *ex situ* reclamation measures and information on the likelihood of which method(s) will be adopted for the various locations within this site.
12. EC requests clarification on a number of points relative to the reclamation of PHC contaminated soils. The Interim A & R Plan recommends leaving the existing gravel pad in place in order to retain the underlying permafrost and prevent possible ponding. In a later section, the report states that removal of some of the gravel may be beneficial given the scarcity of it in the area. This appears to be contradictory. Does the proponent know how much gravel (i.e., to what depth) can be removed before there will be degradation of the underlying permafrost?
13. The Interim A & R Plan also states that if the existing gravel pad were retained in its entirety it could be covered with a "thin lift of alluvial soils to match the surrounding soil conditions". Please clarify whether this is a proven technique in this environment. And what would be the source of the above-mentioned alluvial soils? The Reclamation Plan also implies that the site (e.g., gravel pad) could be re-vegetated with an appropriate mixture of plant species. Please note that Shell will need to provide an exact species list of plants being contemplated and the proposed methods to be used (i.e., whether re-seeding or planting). Have any of these revegetation techniques been proven in this environment? Given that the other alternative being considered is light scarification and natural re-vegetating, the Reclamation Plan should provide more detail on the expected outcome of this approach should it be adopted.

Please note the following regarding a Spill Response Plan that should already be in place for Camp Farewell.

14. Please note that there should be a site specific Spill Response Plan that provides a clear path of response in the event of a spill and that indicates how the proponent will meet the requirements of prevention, preparedness, response and recovery.
 - The plan should provide a map of the campsite, indicating the location fuel storage areas and spill kits.
 - The Plan should provide contact information for individuals on site who should be notified if a spill occurs, as well as contact information for relevant government agencies that should be notified.
 - The appropriate contact information for Environment Canada is included below:
 - The 24 hour Emergency Pager, monitored by Environment Canada Emergencies personnel; Tel: 867-920-5131.
15. **All spills** shall be documented and reported to the 24 hour Spill Line at (867) 920-8130. The Plan should provide a copy of the NWT/NU Spill Reporting Form and contact number for the Spill Line (867-920-8130).
16. Drip pans, or other similar preventative measures, shall be used when refueling equipment on site.
17. The Spill Contingency Plan should provide direction regarding response actions for spills on various types of terrain (ex. spills on land, water, snow/ice, muskeg, etc...).
18. The Spill Contingency Plan should provide an inventory of spill response resources, and clearly indicate where these resources are located.

Please note the following in the event this site will be using large quantities of fuel or the use of fuel tanks rather than barrels:

Environment Canada intends to repeal the existing *Registration of Storage Tank Systems for Petroleum Products and Allied Petroleum Products on Federal Lands and Aboriginal Lands Regulations* and replace it with a regulation that has a broader scope of application, *Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations*. The proposed regulations under the *Canadian Environmental Protection Act* (1999), Part 9

will incorporate mandatory technical requirements (secondary containment, leak detection, corrosion protection, overfill, spill containment) and be more in line with those regulations that already exist in most provincial and territorial jurisdictions. Compliance with the proposed regulations will be mandatory, and EC will conduct inspections to ensure compliance with the regulations. The technical requirements of these proposed regulations are based on the 2003 CCME Guidance document PN 1326 "Environmental Code of Practice for Aboveground and Underground Storage Tank Systems Containing Petroleum and Allied Petroleum Products". Environment Canada encourages Shell Canada Ltd. to consult this document and ensure that the existing tanks and related containment system are designed and operated in accordance with it. For further information on EC's proposed regulations please visit <http://www.ec.gc.ca/st-rs>.

Please do not hesitate to contact me with any questions or comments with regards to the foregoing at (867) 669-4708 or by email at ivy.stone@ec.gc.ca.

Sincerely,

Original signed by

Ivy Stone
Environmental Assessment / Contaminated Sites

cc: Carey Ogilvie (Head, Environmental Assessment North, EPOD, Environment Canada, Yellowknife, NT)
Mike Fournier (Northern Environmental Assessment Coordinator, EPOD, Environment Canada, Yellowknife, NT)
Myra Robertson (EA Coordinator, CWS, Environment Canada, Yellowknife, NT)
Paul Latour (Habitat Biologist, CWS, Environment Canada, Yellowknife, NT)



Environment
Canada

Environnement
Canada

at: Camp Farewell

Rm. 200, 4999 - 98 Avenue NW
Edmonton, AB T6B 2X3

May 6, 2008

Mr. Randall Warren
Manager; Reclamation and Drilling Waste
Shell Canada Energy
400 - 4th Avenue SW
Calgary, AB T2P 3H5

Dear Mr. Warren:

Environment Canada (EC) issues Shell Canada an annual Migratory Bird Sanctuary (MBS) permit for the operation and maintenance of the Farewell Camp and Stockpile site (Camp Farewell). In this permit, EC outlines its expectations with respect to site clean-up, restoration, fuel spill mitigation, garbage and waste handling. Project proponents operating within the Kendall Island Bird Sanctuary (KIBS) are required as conditions of their MBS permit to undertake annual cleanup, remediation and reclamation programs if necessary.

In 2006, Shell Canada Limited submitted to the Northwest Territories Water Board (NTWB), an Environmental Site Assessment (ESA) and Interim Abandonment and Restoration Plan for Camp Farewell. The plan identifies the type and distribution of contaminated sediments in and adjacent to Camp Farewell. The plan also provides initial recommendations for interim remediation of the site. An updated ESA and Interim Abandonment and Restoration Plan are due to the NTWB in November 2008. In light of the information presented in the 2006 ESA and Restoration Plan, EC wishes to engage Shell Canada Limited in a discussion regarding remediation options for Camp Farewell and adjacent areas affected by this facility. Clean-up of the existing contaminated areas and Camp Farewell site are viewed as important milestones to be met before further industrial activities occur at this site. EC's management of existing contaminated sites within protected areas must respect present day permit conditions and departmental priorities.

As a first step in this process, EC would like to meet with Shell Canada Limited representatives to discuss a Progressive Reclamation Plan for Camp Farewell. Ideally, this meeting will occur before July 1, 2008, with a draft plan articulating specific reclamation and clean-up activities required at the site, and firm deadlines for achievement being presented to

Canada

www.ec.gc.ca

Ecology Paper / Papier Eco-Loge



Environment Canada, Indian and Northern Affairs Canada and NT Water Board by November 1, 2008. This draft plan would form the foundation for the eventual clean-up of Camp Farewell.

Please direct your enquiries regarding this issue to Craig Dockrill, Habitat Biologist, Mackenzie Delta Programs (867-678-6429 or craig.dockrill@ec.gc.ca). Scheduling of meetings between EC and Shell Canada Limited should also be coordinated with Mr. Dockrill

Yours sincerely,



David Ingstrup
A/Director
Canadian Wildlife Service
Prairie & Northern Division

CD/mma

cc Trish Merrithew-Mecredi, Regional Director General, INAC, NT Region, Yellowknife
Ron Wallace, Executive Director, NT Water Board, Yellowknife
Barry Munson, A/Manager, Risk Assessment & Contaminated Sites, EC, Prairie & Northern Division, Edmonton
Carey Ogilvie, Head, Northern Section, Environmental Protection Operations, EC Prairie & Northern Division, Yellowknife
Garry Bogdan, Director, Wildlife Enforcement, EC, Prairie & Northern Division, Edmonton



Mr. Randall Warren
Manager, Reclamation and Drilling Waste
Shell Canada Limited
400-4th Ave SW
Calgary, AB T2P 2H5

July 3, 2008

Sent by E-mail and Post
randall.warren@shell.com

**Re: Interim Abandonment and Restoration Plan
Shell Camp Farewell Water License N7L1 – 1762**

Dear Mr. Warren:

This letter is in reply to your request for a review of your interim plan sent to the Water Board. Staff and technical advisors to the Water Board have reviewed the plan and we are pleased to provide some technical comments, without prejudice, that we hope will assist you in your final preparations.

Obviously, while the NWT Water Board itself declines any formal comment at this time, the Board Members will formally review any further submissions requesting a Water License for the project if, and when, such is submitted to the Board.

Please do not hesitate to call me should you require any further clarifications or information in regard to this matter.

Yours truly,

Ron R. Wallace, PhD.
A/Executive Director
NWT Water Board

cc. Mr. C. Robertson – cohl.robertson@worleyparsons.com
Mr. Joel Ingram – joel.ingram@ec.gc.ca
Ms. Amy Sparks – amy.sparks@ec.gc.ca
Mr. E. Yaxley – yaxleye@inac-ainc.gc.ca
Ms. Carole Mills – millsc@inac-ainc.gc.ca



Technical Comments from Water Board Technical Advisors

The Interim Abandonment and Restoration Plan as prepared by WorleyParsonsKomex for Shell Canada Limited has been reviewed. The Plan is in partial fulfillment of conditions G1 and 2 of Water License N7L1-1762, "Conditions Applying to Abandonment and Restoration".

Also reviewed were the 2006 Environmental Site Assessment prepared by WorleyParsonsKomex, including review comments from the Department of the Environment and also the Department of Indian Affairs and Northern Development (Water Resources Division).

General Comments

The Water License expires on October 31, 2010. Shell Canada was required to submit to the Water Board an Interim Abandonment and Restoration plan within one year of issuance of the License (November 1, 2005) and to update this interim plan every two years. Submission of this plan and the Environmental Site Assessment fulfills these conditions.

It is assumed that Shell Canada Limited will submit an updated, interim plan later this year to comply with conditions of the Water License. It may also be assumed that, upon renewal of the Water License in 2010, the Board will require before approval, a final abandonment and restoration plan.

The conditions of the Water License lack specifics on what the abandonment and restoration should include; however, I find that the consultants for Shell Canada Limited have provided a comprehensive, interim plan that addresses all site components to be abandoned and restored. They have completed many studies at Camp Farewell, which should guide them in their restoration work.

The consultants make reference to the 1990 Guidelines for Abandonment and Restoration and it is encouraging that they also reference the 2002 ministerial policy on mine site reclamation for the Northwest Territories, which describes recent government thinking about liabilities to the Crown from industrial activities in the north. The intent of the policy should be the main guidance document for the proponent as they develop the updated, or final, plan for 2008. The final land use should be clearly identified for each abandonment and restoration activity. If the Lands Directorate of INAC is also requiring an abandonment and restoration plan, the Board may choose to consider a joint review with INAC.

Water-related Activities

Section 6 describes the water-related restoration activities. The main area of concern is the treatment of sediments from the sewage lagoon. The proposed treatment method is air-drying potentially contaminated sediments and the consultants cite literature to show the effectiveness of this option. However, this literature may be "southern-based" and its effectiveness in Arctic conditions may not been demonstrated. Shell Canada Limited may consider a test of this option to prove its effectiveness, and perhaps more importantly, its cost. It is also noted that the consultants suggest the final restoration plan will be based on feedback from the Land Use Inspector.

Hydrocarbon-affected areas

Section 7.2 "Near-Term Site Remediation and Monitoring" identifies several thousand cubic metres of hydrocarbon-affected soils. Options are presented for remediation. The consultants also note that disturbing this land could cause more environmental damage than leaving it as is. The Water Board may request a quantitative risk assessment of various options to remediate the hydrocarbon-affected areas, especially the urethane foam/gravel pad. It is noted that the consultants cite the NWT Guidelines for parklands and residential lands for hydrocarbon contamination (ie. a concentration of 0.8 mg/kg of toluene in soil).

Reclamation Costs

Section 7.3 introduces the notion of a site audit to verify on-site materials and structures. Such an audit will ensure that decommissioning activities are implemented in a safe manner. More importantly, an initial restoration cost estimate should be provided to the Water Board when this audit is conducted as it could affect the amount of the security deposit, which at present is two million dollars.

Monitoring

Sections 7.2.6 and 7.5.3 describes the intended monitoring programs following final abandonment and restoration. It is noted that the plan considers a one, two and five-year follow-up period for post-abandonment monitoring. Specifics of such a monitoring plan including locations, frequency of monitoring and further remedial actions should be identified in the event monitoring shows unanticipated site conditions. The NWT Water Board has issued monitoring guidelines for exploration activities in the delta and these guidelines could assist in developing a comprehensive monitoring program.

Summary

The interim conceptual plan has been reviewed. Current technical review comments are based on the conceptual nature of the plan. It may be assumed that the NWT Water Board, at the time of a Water License submission by the proponent, may require a more detailed final plan that includes a quantitative risk assessment of restoration options, the costs of these options and the timing of reclamation activities.



Minutes of Farewell Camp and Stockpile Site Reclamation Meeting

Capital Suites

Inuvik, NT

July 7, 2008

In attendance:

(RW) Randall Warren, Manager Reclamation and Drilling Waste, Shell Canada Energy

(CR) Cohl Robertson, Staff Environmental Scientist, WorleyParsons Komex

(DW) David Wells, Northern Manager, IEG Consultants Ltd.

(AS) Amy Sparks, Contaminated Sites Officer, Environment Canada

(JI) Joel Ingram, Head Mackenzie Delta Programs, Canadian Wildlife Service, EC

(CD) Craig Dockrill, Habitat Biologist, Canadian Wildlife Service, Environment Canada

1) Introductions and Agenda

Following introductions, RW proposed that a discussion of the NWT Water Board's comments regarding the 2006 ESA of Farewell be added to the agenda. The group resolved to add this discussion to the agenda.

2) Context of Meeting

Representatives of EC and Shell discussed the letter requesting this meeting, and agreed that the opening and maintenance of a dialogue regarding reclamation plans and activities at Camp Farewell was a positive step.

3) Environment Canada's Comments Regarding ESA/IARP

AS led a discussion of Environment Canada's comments to the NWT Water Board regarding the 2006 Environmental Site Assessment and Interim Abandonment and Restoration Plan for Camp Farewell. Five priority issues were outlined by AS:

i. Accurate background sampling required

1. CR, DW and RW indicated that rich organic layers in the Mackenzie Delta interfere with laboratory analyses
2. Background water samples should be taken from sites known to be free of impact from facility

ACTION: Background water and soil samples to be taken from sources unaffected by Farewell site during future reclamation program.

ii. More rigorous delineation of contamination

1. Agreed that further delineation at burn pit, historic spill site and NE corner of gravel pad were appropriate during future reclamation activities.

ACTION: RW and CR to incorporate further delineation of these contaminated areas into reclamation plans.

iii. AS indicated Environment Canada's preference for further investigation of certain discoveries:

1. Elevated Selenium and Toluene as concerns
2. Sizeable conductivity anomaly within the gravel pad

ACTION: RW and CR to undertake additional background sampling to resolve issue of Toluene concentrations, believed to be false positive.

ACTION: RW and CR to investigate conductivity anomaly further during next reclamation activity.

iv. Clean up concentrations should be developed using a risk assessment

1. Residential Parkland guidelines would be most appropriate in absence of risk assessment.
2. Shell concerned that Residential guidelines may not be appropriate for an active industrial site, but is prepared to meet those guidelines at time of abandonment

v. Clarify the desired goal for gravel on the site, report is currently inconsistent

1. Report is not clear on desired end result for gravel at the site

ACTION: CR/RW to clarify intentions with respect to gravel in updated 2008 ESA.

4) NWT Water Board Response to ESA/IARP

The group reviewed the NWT Water Board response to the 2006 ESA/IARP. The comments were found to be fairly positive, but also highlighted the toluene issue as one requiring resolution. CR and RW indicated that removing concerns about toluene concentrations at this site would be a priority during upcoming reclamation activities.

5) Progressive Reclamation

CR presented a draft 5 year plan for Shell Canada Ltd's progressive reclamation of the Farewell site. The draft plan focused on the treatment and/or removal of

affected soils near the Tank Farm, Burn Pit, and NE perimeter of gravel pad. The program also proposes monitoring of groundwater, surface water, shallow soil and vegetation.

6) Timelines

The group discussed appropriate timelines for action at Camp Farewell. RW indicated that the reclamation activities discussed by Environment Canada and Shell representatives today should have varying timelines for achievement that are compatible with Shell's long term plans for the Farewell Site.

CD and JI indicated that Environment Canada is comfortable with the adoption of progressive 5 year plans, recognizing that Camp Farwell will be an important facility in the proposed Mackenzie Gas Project. The reclamation plans should be updated every 5 years to reflect the operational needs of the Farewell Site and the ecological implications of the site for Kendall Island Bird Sanctuary.

ACTION: CR/RW to assign appropriate target dates to reclamation activities based upon information exchanged today, including Environment Canada's comments regarding the 2006 ESA/IARP, the NWT Water Board's comments regarding same, and the draft progressive reclamation plan presented by CR. Potential reclamation activities will be group according to timeline, and presented at next meeting:

- a) activities that are achievable in less than 5 years
- b) activities that are continuous or related to annual programs
- c) activities that are long term, appropriate upon abandonment

7) Path Forward

The next meeting was tentatively scheduled for the end of November. Specific location, date and venue were not decided. It was agreed that other regulators (DFO, INAC, and NWTWB) should be incorporated at that time. However, there was also concern that INAC and DFO be solicited to provide comments on the 2006 ESA/IARP for Farewell prior to October.

ACTION: CD to circulate draft minutes of this meeting to attendees for comment. CD to circulate finalized minutes to other regulators along with suggestion to provide NWTWB with comments regarding 2006 ESA/IARP and preliminary invitation to participate in next Camp Farewell Reclamation meeting.