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ENVIRONMENT AND WATER RESOURCES

INTERIM ABANDONMENT AND RESTORATION PLAN

SHELL FAREWELL CAMPSITE AND STOCKPILE SITE

PREPARED FOR:

SHELL CANADA LIMITED

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1. INTRODUCTION

1.1 OVERVIEW

Komex International Ltd. (Komex) was retained by Shell Canada Ltd. (Shell) to develop a Restoration Plan (Plan) for Shell's Camp Farewell (Site). Camp Farewell is located in the Mackenzie Delta area of the Northwest Territories, Latitude 69° 12'30'' N and Longitude 135° 06'04'' W (Figure 1).

The Restoration Plan addresses the camp as a whole (Figure 2), and segregates out restoration requirements associated with the plant water systems. Submission of an interim abandonment and restoration plan is required as part of the Water Licence, as issued by the Northwest Territories Water Board. Abandonment and restoration activities outlined in this plan include decommissioning (dismantling), remediation and reclamation.

It should be noted that Shell Canada Limited plans to retain this site for future use.

1.2 PURPOSE AND SCOPE

The purpose of this report is to summarize information pertaining to the restoration of Camp Farewell. The report is being prepared to:

- address the Northwest Territories Water Board (the Board) 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.

At the present time, Shell plans to continue operating (or sub-leasing) the camp facility. The following tasks have been undertaken to address the objectives of the Restoration Plan:

- review of the Phase II environmental assessment and identification of data gaps;
- evaluation of subsequent land use alternatives and selection of a base case for subsequent land use;
- discussion of potential remediation criteria;
- determination of reclamation objectives for the Site;
- development of a plan for dismantling facilities and removing Site inventory;
- development of conceptual remedial programs to address areas of impact that exceed the assumed criteria; and
- development of 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, scope and background of project;
- site characterization: regional setting and site description;
- restoration criteria: decommissioning, remediation and reclamation criteria;
- nature and extent of contamination: soil contamination associated with camp;
- restoration plan – for the water systems, including the camp facilities; and
- restoration plan – for the remainder of the camp, including materials stored on the Site, power generation and work areas, as well as the airstrip and areas of off-Site contamination.

1.4 WATER BOARD RESTORATION REQUIREMENTS

The Restoration Plan satisfies Item 1 of Part G of Licence No. N7L1-1762 (Appendix I) granted to Shell Canada by the Northwest Territories Water Board (Board) in accordance with the “Northwest Territories Waters Act” (NWTWB, 1992). Item 1 of Part G of the Licence states:

The Licensee shall submit to the Board for approval within one year of issuance of this Licence, an Interim Abandonment and Restoration Plan in accordance with the Board’s “Guidelines for Mines in the Northwest Territories” September 1980, or subsequent edition.

“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 Northwest Territories 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 camp operations have been discontinued and decommissioned. For this reason, restoration of the camp facilities and storage area have been presented separately.

1.5 SCOPE AND REQUIREMENTS OF SITE RESTORATION

Requirements for restoration of the entire Site also provide Shell with a better understanding of final Site abandonment and reclamation requirements. Where required, 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 the NWT Water Board.

Lease No. 107 C/4-2-10 and Lease No. 107 C/4-1-7 (Appendix II) 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.

1.6 BACKGROUND

Camp Farewell was established in the winter of 1970 and the first crew was brought in during the summer of 1971. The crew accommodations consist of a single story building that accommodates up to 70 people. The camp was operated on a full-time basis until 1978 and has operated periodically from 1978 until present. In the mid-1980's, the original crew accommodations were replaced with the current accommodation facilities (i.e., main camp accommodations) having a capacity of approximately 36 people.

The main purpose of the camp is to act as a staging and storage site for Shell's Delta Drilling Program. Facilities include storage for up to 2.5 million litres of fuel (including, aviation fuel, diesel, and gasoline), material storage (such as building materials 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 (Figure 2).

Currently, a portion of Camp Farewell is sub-leased from Shell on a seasonal basis by WesternGeco (December to April) as a staging site for seismic operations (Figure 2). WesternGeco added accommodation trailers with a capacity to house approximately 80 personnel, which are located east of the main camp accommodations. A summary of structures within the lease boundary includes:

- crew accommodations (including both main camp accommodations and accommodation trailers, the Camp Fuel Tank and Generator Building and Generator Day Tank);
- sewage lagoon and sewage treatment system;
- Shed #1, #2 and #3 and
- the Burn Pit.

2. SITE CHARACTERISATION

2.1 REGIONAL SETTING

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 tundra that includes shallow lakes and intermittent ponds. The distance from Camp Farewell's lease boundaries to these water bodies varies from 20 m (southwest to the Mackenzie River) to a maximum of approximately 360 meters north and 660 meters east to several unnamed lakes. Drainage from the lease is predominantly to the southwest.

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 a minimum of 20 m thick. The quaternary surficial deposits found at Camp Farewell are characterized by glaciofluvial deposits associated with the Toker Member, Melloch Till, or those deposited during the Buckland Glaciation. Generally the deposits are composed of sand and gravel with some silt (Rampton, 1987).

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 m below ground level (bgl). The region is characterized by sparse ice wedges, no massive ground ice, and sparse pingo ice (Heginbottom, 1995).

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*). Dwarf shrubs and ground covers such as mosses and lichens compose the majority of the surrounding vegetation.

With respect to the hydrogeological conditions at Camp Farewell, no direct reference to the camp or the surrounding areas was discovered during a detailed search of the catalogues of the University of Calgary, Arctic Institute of North America, and Geological Survey of Canada. As a result, it is not possible to comment on the hydrogeological conditions at Camp Farewell. However, the depth of the active layer (*i.e.*, the layer of soil subject to seasonal thaw) was as little as 0.30 m at some sample locations and extended beyond the 1.0 m reach of a Dutch auger at others. The active layer is the zone of highest groundwater flow, which is expected to mirror topography.

Climatic data is available for Tuktoyaktuk which is located approximately 80 km northeast of Camp Farewell and is situated on the Beaufort Sea coast. Over the period from 1957 to 1990 the

mean daily temperature at Tuktoyaktuk was -10.5°C with the temperature exceeding 0°C 138 days each year. Average annual precipitation for this period was 142.1 mm, consisting of 75.4 mm of rainfall and 66.8 mm of snowfall. The ice free period on the Mackenzie River is approximately four to five months (June to October) (Environment Canada, 2000). The active layer is similarly governed by this period of time.

2.2 SURROUNDING LAND USE

The area surrounding Camp Farewell (i.e., the Mackenzie Delta) is protected and managed by the Canadian Wildlife Service (CWS) and has been since the establishment of the Kendall Island Bird Sanctuary in 1961. Given the remote and protected status of the lands surrounding Camp Farewell, there are and have been no industrial settlements within several kilometers of the Site. Industrial activity in the form of seismic exploration and exploratory drilling have been ongoing, albeit intermittently, since the 1960's. The Mackenzie Delta is a traditional hunting and trapping area for both of the region's indigenous populations, the Gwich'in and the Inuvialuit. With respect to local land use, anecdotal evidence in conjunction with a review of relevant air photos and a site visit indicates that there are no permanent hunting/fishing camps in the vicinity of Camp Farewell.

Camp Farewell is located within the southern boundary of Kendall Island Bird Sanctuary. Shell is required to hold and meet the conditions set out in a permit (Permit # NWT-MBS-99-02, Appendix III) that allows its personnel and/or delegates to enter and conduct activities in the sanctuary. This sanctuary was established to protect the staging and breeding grounds of over 100 species of shorebirds, songbirds, and waterfowl, especially the Lesser Snow Goose (Environment Canada, 2000). The sanctuary includes over 600 km^2 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 the Kendall Island Bird Sanctuary) 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 (Environment Canada, 2000).

The Kendall Island Bird Sanctuary 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 (Environment Canada, 2000).

Barren-ground grizzly bears are also indigenous to the outer islands of the sanctuary. The site visit in September 2000, discovered evidence of at least one bear as well as ungulates (likely moose) at Camp Farewell.

2.3 SITE DESCRIPTION

2.3.1 SOILS

The base of the majority of the lease Site (including airstrip) is underlain with either 50 mm of urethane foam or urethane pads, which was placed there during initial Site construction (Figure 2). Approximately 450 mm of compacted gravel was placed over the urethane. Drilling mud products were mixed with the gravel in order establish good gravel adhesion and compaction. Both base materials were used as a thermal barrier to protect underlying permafrost.

The graveled portion of the Camp Farewell lease covers an area of approximately 8.7 hectares. During soil sampling, the depth of gravel was determined to vary between approximately 0.45 m and 0.75 m. The characteristics of the gravel pad were fairly consistent across the test pits. The pad material is a silty sand that is dark coloured, varied in mottle from none to slight, and is slightly moist. In general, its density is similar to that of loose sand; however, compaction was encountered at certain sites at Stockpiles 1, 2, and 3. In terms of composition, the sand is generally gravelly containing about 15-20% pebbles and 5% coarse pebbles. Pan sieve analysis on sample S00-02 (Figure 3) indicated that the median grain size of the pad material exceeds 0.75 μm ; 94% of the sample material was captured by the 0.75 μm pan sieve. Little to no root matter was encountered, especially at depths exceeding 0.30 m.

The native soil lithology surrounding and underlying the lease is sandy silt (with sandy clay encountered at one test pit) with an organic layer to a depth of approximately 0.15 m. No mottling was encountered in these dark, moderately moist soils. The density of this soil is similar to that of loose sand. No coarse fragments were encountered. Pan sieve analysis on sample S00-23 indicated that the median grain size of the native soils slightly exceeded 0.75 μm with 54% of the sample material captured by the 0.75 μm pan sieve. Root matter extends to a depth of 0.30 m. According to Rampton (1987), the quarternary surficial deposits found at Camp Farewell are characterized as glaciofluvial. These deposits are composed of sand and gravel with some silt (Rampton, 1987).

2.3.2 SPILLS

A search of the Government of the Northwest Territories Hazardous Spills Database indicated two recorded Site spills (Appendix IV). The first spill consisted of approximately 80 L of diesel from a pipe or line. The second was 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. The spill was attributed to an act of vandalism/theft.

During the major spill (approximately 800,000 litres), fuel was released into the tank farm berm, overtopped the berm and/or traveled through the berm onto the lease site. The majority of fuel not contained in the tank farm followed the site topography moving west/southwest over the steep banks to the 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 4 to 6 week clean-up effort, a Sacke portable burner was used 24 hours/day to burn the recovered fuel. Product that migrated 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 product, no soil/water remediation was conducted. No sumps were dug or collection pits constructed. All tankage used in the cleanup was brought onto site and subsequently removed.

3. RESTORATION CRITERIA

3.1 DECOMMISSIONING REQUIREMENTS

Decommissioning (i.e., dismantling and removal) requirements, for the purpose Site restoration, are outline 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” (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.
- Buildings and Other Structures.

The Environmental Code of Practice for Aboveground Storage Tank 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 Northwest Territories Regulations and Guidelines; and
- contaminated materials that must be managed, treated and/or disposed of in accordance with Northwest Territories Regulations and Guidelines.

3.2 REMEDIATION CRITERIA

For the purpose of developing this plan, remediation criteria for soil (i.e., soil base material and native soil) will be based on values outlined in:

- Canadian Council of Ministers of the Environment (CCME) 1999, Canadian Environmental Quality Guidelines;
- CCME Canada Wide Standards for Hydrocarbons, 2000; and

- Government of the Northwest Territories (GNWT) Department of Resources, Wildlife and Economic Development (RWED) 1998, Guideline for Contaminated Site Remediation.

For both the CCME and GNWT RWED guidelines, it is assumed that remediation values will be based on residential / parkland criteria for the purpose of this Plan. If base soil is slated for removal and re-sale as an industrial substrate following on-Site remediation, it is assumed that industrial criteria would be applied for this material. It is recognized that the selection and approval of appropriate remediation criteria will need to be re-visited and formally approved at the time of actual facility restoration.

3.3 RECLAMATION CRITERIA

Reclamation criteria for the Site will parallel those outlined in “Reclamation Guidelines for Northern Canada” (INAC, 1987). 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.

4. NATURE AND EXTENT OF CONTAMINATION

A limited Phase I and Phase II Environmental Site Assessment (Komex, 2001) of Camp Farewell was conducted to identify the nature and extent of possible contamination on the Site. The Phase I site investigation of Camp Farewell and the Phase II soil and surface water sampling program were completed between September 12 and September 15, 2000. A second surface water sampling program was conducted on October 9, 2000.

Although the analytical results from the soil sampling program were evaluated against several assessment criteria, the following discussion is based primarily on the CCME Residential/Parkland criteria found the Canadian Environmental Quality Guidelines (1999). With respect to hydrocarbon parameters, this discussion is limited to the NWT/CCME BTEX and the TPH (NWT) Residential/Parkland criteria. The analytical results from the soil sampling program are presented in Tables 1A, 1B and 1C. Values that exceeded generic assessment criteria (territorial or federal) have been shaded. Figure 3 presents the soil sampling locations and any associated exceedences of the CCME and TPH (NWT) criteria. These exceedences are also presented in Table 2. The only reference to the CCME's PHC CWS (2000) criteria is found in Table 1A. Notably, for the majority (81%) of exceedences of the TPH (NWT) criterion, one or more of the PHC CWS fractions were also exceeded.

For the purpose of this report, the surface water analytical results were compared to the following criteria:

- CCME. 1999. Canadian Environmental Quality Guidelines; and,
- Northwest Territories Water Board. 1992. Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories.

Results for surface water sampling can be found in Tables 3, 4 and 5.

4.1 WATER FACILITIES

4.1.1 SOILS UNDERLYING THE CAMP

Soil contamination was not expected in the camp area (Figure 2) of the Site, therefore soil assessment was not performed in this area. Testing in this area focused on both the water and sediment in the treatment lagoon.

4.1.2 LAGOON WATER

The analytical results for the samples of lagoon water (S00-43 and S00-W01) that was contained in the lagoon at that time are given in Tables 3, 4 and 5.

The analytical results for Sample S00-43 indicated that all hydrocarbon parameters including BTEX, TPH, and TEH were non-detectable. No oil and grease sheen was observed and pH was within the criterion specified in NWT Water Board Licence NL1-1762 (amended November, 2001).

The analytical results for total and dissolved metals analysis conducted on Sample S00-W01, were below the criteria set in Table 4.2 of the NWT Water Board Guidelines with the exception of two parameters, dissolved iron (1.90 mg/L) and dissolved manganese (0.471 mg/L). The criteria for dissolved iron is 0.3 mg/L and dissolved manganese is 0.05 mg/L. The elevated levels of dissolved iron and dissolved manganese are characteristic of the strong reducing environment present in sewage lagoons. These levels may also be attributed to background water quality. All other parameters, including pH, were within the criteria set in Table 4.1 of the NWT Water Board Guidelines.

4.1.3 LAGOON SEDIMENTS

One composite sediment grab sample (S00-42) was collected from the southwest quadrant of the sewage lagoon. The sediment was a combination of silty sand and organic material. No coarse materials (*i.e.*, pebbles) were encountered.

The sample's toluene concentration of 0.94 ppm exceeded the CCME residential/parkland criterion of 0.8 ppm. As the other BTEX parameters were not detected, a second round of sampling is recommended to confirm or refute the presence of toluene. A detectable concentration of TPH (NWT) – 196 ppm, was reported. None of the metals parameters that were analyzed exceeded CCME Residential/Parkland criteria.

Assuming that 0.5 metres of sludge has accumulated on the lagoon base and toluene has occurred throughout, the volume of sediments requiring remediation is estimated to be 1,300 m³.

4.2 STORAGE AREA, AIRSTRIP AND SURROUNDING LAND

Surface soil sampling of the storage area and airstrip was performed in areas showing visual staining contamination or having a high probability of contamination based on current and historic Site operations (Komex, 2001). Figure 4 shows the sampling locations. The analytical results from the soil-sampling program are presented in Table 1A, 1B and 1C. The storage area and airstrip have been divide into eleven sub-areas to simplify evaluation of the extent of contamination and to determine additional assessment requirements.

Preliminary insitu volume estimates based on current contaminant delineation for contaminated soils in the storage area and airstrip are discussed below. These volume estimates are based on

the assumption that contamination is only in the near-surface soils (e.g., above 1.0 mbgl to 0.5 mbgl) due to limited mobility of the contaminants, impermeability of the urethane layer and the presence of permafrost below this depth. While this assumption is considered reasonable, it is possible that the depth of impacts has migrated deeper, particularly in areas of higher contaminant concentrations. A summary of estimated insitu contaminated soil volumes above 1 mbgl, within the Site base pad area, includes:

- 5,500 m³ of soils contaminated by only hydrocarbons;
- 5,500 m³ of soils contaminated by barium, above residential/parkland criteria but below industrial criteria; and
- 5,300 m³ of soils contaminated by both organic and/or inorganic parameters above industrial criteria.

Hydrocarbon contamination comprises primarily fuel-impacted soils, which are expected to be treatable. Soils impacted by barium below industrial standards could potentially be re-used as fill at a different development location.

Analysis of leachable barium was completed on one sample exhibiting elevated concentrations of barium (see [Section 4.2.6](#)). The low leachability of the barium suggests that the barium that is present at Camp Farewell does not necessarily pose a human health or ecological risk. This issue is common to all soil samples that contained elevated barium, in the form of barite (barium sulphate), which has low solubility and toxicity.

4.2.1 SHED #1

Soil samples were collected from 6 locations (S00-04, -05, -07, -08, -10 and -41) inside and outside Shed #1, as indicated on Figure 4. Two samples (S00-07 and 08) were collected from the Maintenance Area (Warm Storage) half of the building and one sample (S00-10) was collected from the Cold Storage side of the building. These samples were advanced in areas of heavy hydrocarbon staining. Three additional samples were taken outside the building within the vicinity of its north wall. Two samples were collected from areas of stressed vegetation and surface staining at the northwest (S00-05) and northeast (S00-04) corners outside the building. The third sample (S00-41) was collected from heavily stained soils beneath the Machine Shop's heating oil AST.

Both samples taken in the Maintenance Shop exceeded the TPH (NWT) residential criterion. Sample S00-07 was collected at 0.15 – 0.60 mbgl near the used lube oil drums and had a TPH (NWT) value of 1061 ppm, exceeding the residential/parkland criterion of 500 ppm. Sample S00-08, taken at 0.15-0.45 mbgl in an area traditionally used for vehicle maintenance had a TPH (NWT) value of 10,187 ppm.

Sample S00-10, collected at 0.15 – 0.50 mbgl from the Cold Storage half of Shed #1 exceeded the CCME residential/parkland criteria for ethylbenzene (1.2 ppm), and xylene (1.0 ppm) with results of 4 ppm and 31.2 ppm, respectively. The laboratory was unable to furnish an accurate benzene concentration. The NWT (TPH) residential/parkland criterion was also exceeded with a result of 8,290 ppm. The laboratory analysis for glycol resulted in a non-detectable reading.

Sample S00-41 was collected beneath the Heating Oil AST for Shed #1 at the 0.15 – 0.45 mbgl depth interval. The reported total xylene concentration of 7.35 ppm and TPH (NWT) concentration of 10,731 ppm were in excess of their respective residential/parkland criteria.

Although samples S00-04 and 05 were collected in areas of stressed vegetation and soil staining, neither exceeded the CCME BTEX or TPH (NWT) residential/parkland criteria. The lab analysis for both samples did, however, indicate the presence of hydrocarbons in the C₁₁-C₆₀ range.

Assuming contamination does not extend beyond 1 mbgl, a preliminary minimum insitu volume estimate of impacted soils in this area is 450 m³. This volume estimate represents soil that is expected to be treatable.

4.2.2 SHED #2

Shed #2 could not be accessed; however, two large stains were noted in the area east of its doors. One test pit (S00-06) was advanced in the 2 m x 2 m stain located 7 m east of Shed #2 and 10 m south of Shed #1.

Sample S00-06 was collected from the 0.45 – 0.60 m depth interval. The laboratory analysis indicated that the sample had a TPH (NWT) concentration of 690 ppm versus the 500 ppm residential/parkland criteria.

Assuming contamination does not extend beyond 1 mbgl, a preliminary minimum in-situ volume estimate of impacted soils in this area is 10 m³. This volume estimate represents soil that is biologically treatable. Additional characterization is warranted inside Shed #2, which could increase the estimated volume of contaminated soil.

4.2.3 SHED #3

One sample (S00-09) was collected from Shed #3 and another sample (S00-40) was collected from the culvert along the road, downgrade of the shed. Shed #3 was characterized by poor housekeeping with extensive surface staining from hydrocarbons as well as other industrial chemicals including potash and potentially caustic soda. The purpose of this culvert was to collect and channel runoff from the west side of the lease pad.

Sample S00-09 was collected from the 0.15 - 0.50 m depth interval. The laboratory results for this sample indicated that the TPH (NWT) and xylene parameters were elevated. The reported concentration of the TPH (NWT) parameter was 9,367 ppm, exceeding the criterion of 500 ppm. The xylene concentration for S00-09 was 2.98 ppm, exceeding the CCME xylene criterion of 1.0 ppm. The metals analysis indicated an elevated concentration of barium in the sample. The CCME residential/parkland criterion for barium is 500 ppm, while the recorded barium concentration was 3,160 ppm.

Detectable concentrations of TPH (NWT) were reported for Sample S00-40. The results of the metals and salinity analyses indicated that the respective parameters did not exceed those of the background sample.

Assuming contamination does not extend beyond 1 mbgl, a preliminary minimum in-situ volume estimate of impacted soils in Shed #3 is 150 m³.

4.2.4 GENERATOR BUILDING AND CAMP HEATING OIL AST

Two samples were collected at the Generator Day Tank (S00-11 and -12) and two samples were collected from the 91,000 litre Camp Heating Oil AST (S00-13 and -14). The area outside of the Generator Day Tank Berm exhibited minor staining (S00-11). The gravel in the Generator Day Tank Berm beneath the tank valve possessed free product and heavy hydrocarbon odour (S00-12). One sample (S00-13) was taken below the AST's valve and another (S00-14) was taken approximately 12 m to the southwest of the tank berm. The area to the southwest (down grade) of the berm was characterized by moderate grass and plant growth. Minor root matter was observed throughout the test pit for S00-14 to a depth of 0.75 m. The test pit for S00-13 was established beneath the fuel valve for the Camp Heating Oil AST. The liner was encountered at 0.15 mbgl. The gravel from the test pit possessed a hydrocarbon odour.

Both of the samples (S00-12 and -13) collected beneath the valves of the Generator Day Tank and the Camp Heating Oil AST exceeded TPH (NWT) criteria. The reported TPH (NWT) concentrations for Sample S00-12 and S00-13 were 33,000 ppm and 3,501 ppm, respectively. For samples S00-11 and S00-14 hydrocarbons in the C₃-C₆₀ range were detected but were below NWT (TPH) criteria. BTEX concentrations for all of the samples were non-detectable.

Assuming contamination does not extend beyond 1 mbgl, a preliminary in-situ volume estimate of impacted soils in the area is 230 m³. This volume estimate represents soil that is biologically treatable.

4.2.5 MAIN FUEL AREA

The Main Fuel Area extends from the northwest corner of the lease to the northeast corner of the lease, a distance of approximately 360 m. There have been two recorded spills in this area of Camp Farewell. The most significant spill being an 800,000 litre spill of diesel contaminated fuel in 1981 from the two 5,000 bbl tanks at the west section of the tank farm area.

Fifteen soil samples were collected from this area, of which 13 were submitted for laboratory analysis. To facilitate this discussion, the Main Fuel Area is divided into five sub-areas:

- Bolted Tanks (S00-15, -16, -17 and -18);
- Bermed Tank Farm (S00-19, -20, -21, -22, -23, -24 and -25);
- 300 bbl Horizontal API Fuel Tanks (S00-26);
- 300 bbl Skid Mounted Fuel Tanks (S00-27 and -28); and,
- Aircraft Refueler (S00-29).

Bolted Tanks: Given the history of tank failure for bolted tanks as well as the fact that this area (on-lease and to the west-southwest off-lease) is reported to have been most affected by the 800,000 litre spill, four samples (S00-15, -16, -17 and -18) were collected from this area. Permafrost was encountered at 0.4 mbgs at sampling location S00-17 which is not on the gravel base pad. These tanks have been subsequently removed from the site.

The TPH (NWT) concentrations of Samples S00-17 and 18 were elevated. The TPH (NWT) concentration for S00-17, which was collected 24 m west of the pad, was 817 ppm. The TPH (NWT) residential/parkland criterion of 500 ppm was also exceeded at S00-18. It had a TPH (NWT) concentration of 615 ppm (note anecdotal evidence suggests that bolted tanks were only stored on-site and were not used for fuel storage. Any hydrocarbon contamination will be minor and localized in the area of the tank valves). S00-16 did not exceed the TPH (NWT) criterion; however, it did have a reported concentration of 203 ppm. BTEX concentrations of all samples were non-detectable.

Assuming contamination does not extend beyond 1 mbgl, a preliminary minimum insitu volume estimate of impacted soils in this area is 50 m³. This volume estimate represents soil that is biologically treatable.

Bermed Tank Farm: Seven samples (S00-19, -20, -21, -22, -23, -24 and -25) were collected from this area. The bermed tank farm was the source of the 800,000 litre spill; therefore, areas in and surrounding the tank farm have a high potential for contamination.

Within the tank farm berms, the TPH (NWT) residential/parkland criterion of 500 ppm was exceeded by Samples S00-19 (3,390 ppm), -21 (6,064 ppm), and -22 (5,898 ppm). Sample S00-

22 also had an elevated xylene concentration. Its reported concentration of 1.8 – 2.1 ppm exceeded the CCME xylene residential/parkland criterion of 1.0 ppm.

Sample S00-24, collected 8 m north of the 2,000 bbl tank berm, had elevated levels of TPH (NWT) and xylene, with concentrations of 2,056 ppm and 2.06 ppm, respectively. It also had detectable levels of toluene and ethylbenzene. Notably, the reported TPH (NWT) concentration of 479 ppm for Sample S00-23, collected 20 m north of the 2,000 bbl berm, approached the TPH (NWT) residential/parkland criteria of 500 ppm.

Assuming contamination does not extend beyond 1 mbgl, a preliminary minimum in-situ volume estimate of impacted soils in this area is 3,600 m³. This volume estimate represents soil that is biologically treatable.

300 bbl Horizontal API Fuel Tanks: One sample (S00-26) was collected from a depression in the lease pad 3 m to the west of the fuel tanks.

Sample S00-26 had elevated concentrations of TPH (NWT) and xylene. The reported TPH (NWT) concentration of 729 ppm and xylene concentration of 1.57 ppm exceeded their respective residential/parkland criteria of 500 ppm and 1.0 ppm. Detectable concentrations for toluene and ethylbenzene were also recorded.

Assuming contamination does not extend beyond 1 mbgl, a preliminary minimum in-situ volume estimate of impacted soils in the area is 500 m³. This volume estimate represents soil that is biologically treatable.

300 bbl Skid Mounted Fuel Tanks: Two samples (S00-27 and –28) were collected from this area. Sample S00-27 was collected from a test pit excavated in a stained area below an open valve on the second tank from the east. Sample S00-28 was collected 3 m south of the east most 1,000 bbl tank at the northeast end of the lease from the trench running along the north perimeter of the lease.

The reported TPH (NWT) concentration of 21,166 ppm for Sample S00-27 exceeded the TPH (NWT) criterion of 500 ppm. BTEX concentrations were not detected. Detectable levels of TPH (NWT) – 332 ppm and xylene – 0.29 ppm, were reported for Sample S00-28.

Assuming contamination does not extend beyond 1 mbgl, a preliminary minimum in-situ volume estimate of impacted soils in the area is 400 m³. This volume estimate represents soil that is biologically treatable.

Aircraft Refueler: One sample (S00-29) was taken in the area. The test pit for Sample S00-29 revealed a surface layer of organic material and silty sand.

Sample S00-29 had elevated TPH (NWT) levels. Its reported TPH (NWT) concentration of 569 ppm exceeded the TPH (NWT) residential/parkland criterion of 500 ppm. BTEX concentrations were non-detectable.

Assuming contamination does not extend beyond 1 mbgl, a preliminary minimum in-situ volume estimate of impacted soils in the area is 30 m³. This volume estimate represents soil that is biologically treatable.

4.2.6 BURN PIT

Two samples (S00-30 and -31) were collected from the Burn Pit area. Sample S00-30 was collected from a test pit excavated from the southeast quadrant of the pit. Sample S00-31 was collected 6 m southeast (down grade) of the Burn Pit.

The laboratory results for Sample S00-30 indicated several parameters with concentrations that exceeded CCME and GNWT criteria. The TPH (NWT) concentration from the sample was 25,324 ppm, exceeding the residential/parkland criterion of 500 ppm. Detectable concentrations were reported for several PAH parameters. The CCME residential/parkland criterion for naphthalene (0.6 ppm) was exceeded by the sample's concentration of 2.31 ppm. The reported barium concentration of 6,480 ppm exceeded the 500 ppm CCME residential/parkland criterion. A subsequent leachable barium analysis reported a leachable barium concentration of 4.28 mg/l. There are currently no CCME or GNWT criteria for leachable barium; however, Part 4 of Alberta Environment's 1995 "Alberta User Guide for Waste Managers" has a disposal criterion for leachable barium of 100 mg/l. Again, the low solubility of barium suggest there may not be a human health or ecological concern associated with these elevated concentrations.

Elevated concentrations of copper, lead and zinc were also reported. The reported copper concentration was 188 ppm, which exceeded the 63 ppm criterion established by the CCME for residential/parkland use. The lead concentration of 617 ppm exceeded the CCME residential/parkland criterion of 140 ppm. Finally, the reported concentration for zinc was 727 ppm, which exceeded the CCME residential/parkland criterion of 200 ppm.

Downgradient, Sample S00-31 had elevated TPH (NWT) concentrations. The reported concentration of TPH (NWT) was 596 ppm where as the TPH (NWT) residential/parkland criterion is 500 ppm. BTEX concentrations were non-detectable under the chosen laboratory analysis.

A preliminary minimum in-situ volume estimate of impacted soils in this area is 300 m³. This volume estimate represents soil that is not biologically treatable because of the inorganic (metals) impacts that are present.

4.2.7 STOCKPILE #1

Two composite samples were collected from the Stockpile #1 area (S00-32 and -33). Sample S00-32 was comprised soils sampled from three test pits. Two test pits were used for the collection of soils for Sample S00-33. Other than minor compaction, no issues were noted during the excavation of the test holes.

For both samples, barium concentrations were elevated. Sample S00-32 had a reported barium concentration of 519 ppm and Sample S00-33 had a barium concentration of 2,380 ppm, these concentrations exceeded the CCME residential/parkland criterion of 500 ppm. Detectable concentrations of hydrocarbons were reported for Sample S00-33.

Given the elevated barium concentrations of the two samples and the fact that these samples were taken from multiple test pits, it is expected that the majority of Stockpile #1 is impacted by barium. Assuming contamination does not extend beyond 0.5 mbgl (estimated average depth to urethane base material in Stockpile #1 area), a preliminary minimum in-situ volume estimate of impacted soils in Stockpile #1 is 2,300 m³. This volume estimate represents soil that may be used as fill for other industrial / commercial sites if the appropriate barium criterion is met.

4.2.8 STOCKPILE #2

One composite sample (Sample S00-34) and three grab samples (S00-35, -36, and -37) were taken from Stockpile #2. The composite sample comprised soils from two test pits adjacent to the sea cans and rig mats in the northern quarter of the stockpile. The test pit excavations were limited to a depth of 0.30 m due to compacted soil conditions. At the east-most test pit, the top 0.05 m consisted of a compacted, chalky white substance. Three samples were collected from the drum dock area. At 0.30 mbgl at S00-35 the urethane foam insulation was encountered. The liner was in an advanced state of deterioration. When a free portion of the insulation was squeezed, it produced an apparent mixture of water and hydrocarbon. Sample S00-36 was collected from a large stained area beneath the second drum dock from the east in an area labeled Kerosene. The liner was encountered at 0.30 mbgl.

The four samples collected in the Stockpile #2 area possessed elevated barium concentrations. The CCME residential/parkland criterion for barium is 500 ppm. The reported barium concentration reported for each of the samples was 1,620 ppm (Sample S00-34), 912 ppm (Sample S00-35), 1,000 ppm (S00-36), and 2,090 ppm (S00-37). No other metal or salinity parameters were exceeded. A reported calcium concentration of 19,500 ppm explains the white staining encountered at the test pit for Sample S00-34.

For those samples analyzed for hydrocarbons (Samples S00-35, 36, and 37), BTEX concentrations were undetectable. Each of these samples, however, had elevated TPH (NWT) concentrations. The reported TPH (NWT) concentration for Samples S00-35 and 36 were 19,809 ppm and 14,209 ppm, respectively.

Given the elevated barium concentrations of the four samples and the fact that these samples were taken from multiple locations, it is expected that the majority of Stockpile #2 is impacted by barium. Assuming hydrocarbon impact is limited to the two east drum docks and contamination does not extend beyond 1.0 mbgl, a preliminary minimum in-situ volume estimate of hydrocarbon and barium impacted soils in Stockpile #2 is 1,600 m³.

Assuming barium contamination does not extend beyond 0.5 mbgl (estimated average depth to urethane base material in Stockpile #2 area), in areas where hydrocarbon contamination is not present, a preliminary minimum in-situ volume estimate of barium impacted soils in Stockpile #2 is 3,200 m³. This volume estimate represents soil that may be used as fill for other industrial / commercial sites if applicable criteria are met.

4.2.9 STOCKPILE #3

Two composite samples (S00-38 and -39) were collected from Stockpile 3. Sample S00-38 was collected from two test pits located in an area formerly used for pipe storage. This area was vegetating and no staining was observed. Sample S00-39 was also comprised of soils from two test pits. One test pit was located adjacent to a sea can containing Spersene. No staining was noted in the vicinity of the test pit. The second test pit was excavated from an area adjacent to a breached sea can of caustic soda. Caustic soda was noted on the soil surface in the area of the test pit.

Samples S00-38 and -39 exceeded the CCME residential/parkland criterion of 500 ppm for barium. The barium concentration reported for Sample S00-38 was 616 ppm and the concentration for Sample S00-39 was 4,820 ppm. A leachable barium analysis was conducted on Sample S00-39. The reported concentration of leachable barium was 0.992 mg/L. Sample S00-39 also exceeded the CCME residential/parkland criteria for several salinity parameters. The reported EC for S00-39 was 4 dS/m, which exceeded the CCME criterion of 2 dS/m. Its SAR value of 37 exceeded the CCME residential/parkland criterion of 5. The pH value of the soil collected for Sample S00-39 was 11.2 units which exceeded the CCME criterion of 6-8 units. Notably, a high concentration of calcium (19,500 ppm) was also reported for this sample.

As with Stockpiles 1 and 2, Stockpile 3 had elevated levels of barium for all samples. These impacts are likely due to past drilling mud storage and handling operations. Notably, anecdotal evidence indicates that the drilling muds were mixed into the gravel used on the lease pad to promote adhesion and compaction. The reported barium concentrations for the stockpiles lend

credence to this evidence. Importantly, the leachable barium analysis indicates that the barium encountered at Sample S00-39, as well as S00-30, is not mobile. It is believed, however, that the entire area of Stockpile # 3 is impacted by barium.

The elevated SAR, EC, and pH levels are likely the result of the presence of soluble sodium originating from the caustic soda (NaOH) encountered at one of the test holes for Sample S00-39. Given the number of sea cans containing caustic soda in Stockpile #3, it is believed that similar or marginally less contamination will exist throughout the sea can area in Stockpile #3.

Assuming barium contamination and elevated SAR, EC, and pH levels do not extend beyond 0.5 mbgl, (estimated average depth to urethane base material), a preliminary minimum in-situ volume estimate of impacted soils in Stockpile #2 is 3,200 m³. The presence of high concentrations of barium and elevated SAR, EC, and pH levels should be addressed using risk assessment if the hydrocarbon is treated and the soils are to be reused.

4.2.10 AIRSTRIP

One sample (S00-02) was taken of the airstrip soils. Analysis revealed no criteria exceedances.

4.2.11 SPILL IMPACTED AREAS OUTSIDE GRAVEL BASE PAD

The major spill (800,000 litres) that occurred at the tank farm in 1981 is reported to have traveled north, west and southwest off the gravel base (Komex, 2001). Therefore, areas west of the base pad (native leased land) and north of the base pad (native land not leased) have potential for contamination, although no surface affects were noted (Komex, 2001).

Four samples (S00-14, -17, -23 and -24) were taken in the native soil area (which were discussed previously) where notable impact had occurred. Sample S00-17, which was collected 24 m west of the pad, had an elevated TPH (NWT) concentration of 817 ppm. Sample S00-24, collected 8 m north of the 2,000 bbl tank berm, had elevated levels of TPH (NWT) and xylene, with concentrations of 2,056 ppm and 2.06 ppm, respectively. It also had detectable levels of toluene and ethylbenzene. Notably, the reported TPH (NWT) concentration of 479 ppm for Sample S00-23, collected 20 m north of the 2,000 bbl berm, approached the TPH (NWT) residential/parkland criteria of 500 ppm. For S00-14, hydrocarbons in the C₃-C₆₀ range were detected but were below NWT (TPH) criteria.

Soil volumes or extent of contamination cannot be estimated at this time due to insufficient characterization of off-base areas.

4.3 MATERIAL INVENTORY

4.3.1 WATER RELATED FACILITIES

Restoration will include removal of all materials and facilities being stored on the Site. A summary of the materials associated with the water supply, distribution and disposal facilities is provided in Table 6. The camp and temporary mobile trailers have been included with the facilities associated with the water systems. It is reasonable to assume that the water systems will remain on the site as long as the accommodation facilities are present. The remaining facilities associated with the water systems include:

- the storage tank;
- the water intake system and tank;
- the distribution system which is essentially part of the camp facilities; and
- transfer, treatment and discharge systems.

4.3.2 REMAINING FACILITIES AND MATERIALS

A summary of facilities and materials associated with the remainder of the camp is provided in Table 7. The large majority of these materials and facilities can be divided into the following groups:

- drilling materials, such as pipe and mats;
- drilling consumables, such as muds, barite and additives;
- fuels and tankage associated with the fuels;
- construction materials; and
- support facilities associated with Camp Farewell.

Restoration options for each of these material groups will be discussed.

5. RESTORATION OF WATER-RELATED FACILITIES

5.1 OVERVIEW

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

- 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.

5.2 DECOMMISSIONING AND DISMANTLING ACTIVITIES

All facilities located in the camp accommodation area, including water systems (Figure 2) will be dismantled in support of restoration. The audit of the materials and structures in the camp area should 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 probably reasonable to plan for the following program.

- The temporary trailers would be removed by WesternGeco as part of their sub-lease agreement with Shell.
- 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, either in Tuktoyaktuk or in Inuvik. Mr. Eddie Dillon has been contacted with respect to potential landfill availability in Tuktoyaktuk and the inert demolition wastes that would be generated by Camp Farewell abandonment. At the present time there is sufficient space available in the landfill and the demolition materials would be acceptable. At the time of final reclamation planning, appropriate municipality permission will be sought. Based on the results of the Phase 1 assessment, no significant quantities of potentially hazardous materials are suspected to be present.

- Water collection, transfer and treatment facilities likely have residual value and would be sold for subsequent application elsewhere.
- 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 in the Arctic.

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.

5.3 REMEDIATION ACTIVITIES

No contaminated soil is expected in the camp area. Treatment of the sediment that has accumulated in the lagoon is required to comply with remedial standards and Inspector concurrence will be sought at the time of lagoon reclamation planning. Prior to remediation, effluent from the lagoon will be required to meet discharge criteria set out in Northwest Territories Water Board Licence # N7L1-1762, Item 4 of 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 3 months with at least 2 of the 3 months having an average daily temperature above 0 °C.; therefore drying should incorporate the months of June to September. 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 is required to meet Item 6 of Part D of the Water Board Licence, as confirmed by the District Inspector. 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.

5.4 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 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 2.1](#)). The final reclamation plan will be proposed to and approved by the NWT Water Board as well as Indian and Northern Affairs Canada.

6. RESTORATION OF THE SITE

6.1 OVERVIEW

The restoration plan to be implemented for the Site as a whole will consist of the following:

- decommissioning (i.e., dismantling and removal) of structures and materials;
- treatment (e.g., remediation or disposal) of contaminated soils;
- management of waste generated by these activities; and,
- reclamation of the area to a condition compatible with undisturbed conditions and surrounding land use.

6.2 DECOMMISSIONING AND DISMANTLING ACTIVITIES

An audit for verification of the inventory list as of October, 2000 (Table 7) of the materials and structures in the storage area of the Site should 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 probably reasonable to plan for the following program.

- Drilling materials such as pipe and rig mats that are still in operable condition would be recycled or re-used. Worn materials or drilling materials that are no longer functional would be recycled or disposed.
- Drilling consumables, such as muds, barite and additives are likely no longer suitable for use as their performance characteristics have likely been compromised through the long period of storage. It is expected that bentonite-based products would serve a useful function locally and hence would be used. The remaining consumables, which contain potentially toxic substances, would be transferred south for legal disposal.
- Fuels would be removed from their storage facilities and beneficially reused locally. Fuel storage tanks would be reused or recycled.
- 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 with prior approval.
- 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, and shipped south for disposal. 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 at a local municipal landfill. Based on the results of the Phase 1 assessment, no significant quantities of potentially hazardous materials are suspected to be present.

- 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.

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.

6.3 REMEDIATION ACTIVITIES

6.3.1 GENERAL

The remediation objectives will be accomplished using treatment methods that are applicable to the type and location of contamination. A general summary of proposed remediation treatment methods includes:

- exsitu biological treatment (i.e., on-Site Biocell) to remediate hydrocarbon contaminated soils (estimated insitu volume of 5,500 m³) located within the Site base pad area;
- excavation and disposal of soils contaminated with hydrocarbons, salts, bases and metals (estimated insitu volume of 5,300 m³) in excess of industrial / commercial criteria;
- excavation, treatment, and reuse of soils (either on- or off-site) contaminated with hydrocarbons, salts, bases and metals (estimated insitu volume of 5,500 m³) below of industrial / commercial criteria but above residential / parkland criteria; and
- insitu biological treatment (e.g., air injection/ soil vapour extraction - AI/SVE) for native soils located outside the base pad area (treatment method and contaminated soil volumes to be determined following additional assessment of off-base pad areas).

The review of disposal options is based on application of remediation criteria published by GNWT and CCME. It is recognized that risk assessment could (and likely would) be applied to the Camp Farewell Site to establish criteria that are most suited to its unique environment. The application of risk assessment would change the proportions of materials fitting into the above groupings but would likely not eliminate any one of the groupings.

6.3.2 EXSITU BIOLOGICAL TREATMENT

Exsitu biological treatment will be implemented to reduce total hydrocarbon concentrations to less than criteria levels in soils located within the base pad area. Biological treatment cells (two or more, depending on time constraints) could be constructed on a portion of the storage base

pad area. The estimated volume of hydrocarbon contaminated soil that could be treated is on the order of 16,000 m³. Volumes have the potential to change upon further assessment of contamination.

Exsitu biological treatment has been applied successfully at similar project locations and for similar contaminant conditions. Komex has been involved in two similar projects on behalf of Amoco Canada with Canmar's former Tuk Base and with the Government of the Northwest Territories' (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.

Comparison of Hydrocarbon Contamination

<u>Parameter</u>	<u>Tuk Airport</u>	<u>Canmar Tuk Base</u>	<u>Camp Farewell</u>
• Contaminant	diesel, gasoline and jet fuel	diesel and jet fuel	diesel
• contaminated media	sandy gravel	sandy gravel	sandy gravel
• volume of soil (m ³)	2,000	2,000	>5,500
<u>Before Treatment</u>			
• primary carbon chain length range	C8 to C60	C10 to C20	C10 to C24
• primary TPH concentration (mg/kg)	2,500 to 10,000	3,000 to 20,000	500 to 25,000
<u>After Treatment</u>			
• 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	CCME, 2000

It is important to note that Komex's previous experience involved sites that were continued to be used for industrial purposes. As such, more stringent clean-up criteria (residential/parkland) will be applied at Camp Farewell. After abandonment, the Site will no longer be classified as commercial/industrial landuse and therefore residential/parkland criteria levels may have to be met. The addition of nutrients and oxygen, in conjunction with the previously applied moisture amendment that was 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).

6.3.3 RE-USE OF BASE PAD SOILS

Base pad soils that are non-treatable using bioremediation techniques would require excavation and removal from the Site. Non-treatable soils have been designated as soils contaminated with salts, basic materials or metals, or a combination of these contaminants with or without the addition of hydrocarbons, in concentrations greater than Site criteria.

Base pad soils in the storage area are contaminated with barium at concentrations below commercial / industrial criteria but above parkland criteria. Insitu volumes are estimated to be on the order of 5,500 m³. Leachable barium levels are low, indicating the barium in this soil is not in soluble form and therefore, the risk of this soil contaminating other soils they contact is low (Komex, 2001). As such, it may be possible to leave these soils on-site. Alternately, the barium impacted soils can be reused in an industrial application off-site.

6.3.4 DISPOSAL OF BASE PAD SOILS

Base pad soils containing salts, basic materials, or barium above Site criteria and commercial / industrial criteria will be assessed for environmental risk. Insitu volumes are estimated to be on the order of 5,300 m³. Risk assessment should be used to evaluate potential reuse options for these materials. Alternately, it is reasonable to assume that these materials would be transferred south, for disposal at an adequate commercial facility. All materials would be classified as non-hazardous and non-dangerous in accordance with current transportation and disposal regulations.

6.3.5 INSITU TREATMENT OF NATIVE SOIL

Areas west and southwest of the bolted tank area and north of the tank farm area, located outside the base pad, have been impacted by the 800,000 litre spill that occurred in 1981. Based, on the information available, insitu treatment would likely be the preferred remediation method based on the following:

- limited ground and vegetation disturbance;
- documented success based on similar contaminated sites and locations; and
- logistics and cost.

Limited ground and vegetation disturbance is an important variable in considering remediation methods for these areas. Currently, vegetation in these areas is healthy and shows no sign of stress from contamination (Komex, 2001). The fragile nature of the local vegetation and

difficulties associated with revegetation in northern climates are reasons to discourage remediation techniques involving excavation.

Studies that have examined contaminated sites with similar characteristics (Gould and Wallace, 1996, Reynolds et al., 1998) report that insitu remediation is a viable treatment option for both groundwater and vadose zones. One example (Gould and Wallace, 1996) of a successful insitu method employed is that of air injection / soil vapour extraction (AI/SVE). AI/SVE was applied at Fort Wainright, Alaska. The project focused on remediation of hydrocarbon contaminated soils in both the vadose and saturated zones. The soils in the contaminated zone consisted of sandy gravel and gravelly sand. Volatilization and bioremediation were the two main mechanisms for hydrocarbon decontamination. AI/SVE is just one example of an insitu treatment method that is applicable.

6.4 RECLAMATION ACTIVITIES

Reclamation of the storage area will focus on returning the base pad area to a level compatible with the surrounding undisturbed land.

The Reclamation Plan involves leaving the current urethane and gravel layers of the base pad in place. Permanently removing these layers would expose the pre-camp natural surface, which has experienced subsidence due to static loading and melting caused by the Site base. The depressed exposed surface would likely be void of plant material, which acts as an insulative layer. The dark colour and lack of vegetation will lead to ground thawing. Due to the depression created by removal of the Site base excavation, compaction of soils and elevated ground temperatures, ponding in the depression is a strong possibility if the Site base material is removed. If base materials are left in place, topography of the Site will remain relatively unchanged. Reclamation focus would be on revegetation of the Site. A summary of Reclamation Plan A consists of:

- 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
- revegetate Site with an appropriate mixture of plant species.

Urethane foam has been tested as an effective impermeable liner to prevent contamination of underlying soils and groundwater (EPS, 1977). Removing this 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 without adverse environmental effects (EPS, 1977). Freeze-thaw cycles and exposure to the elements are probably the largest contributor to urethane degradation.

Given the relative scarcity of gravel construction materials in the area, it may be beneficial to remove some of the gravel and reuse these materials off-Site.

6.5 REVEGETATION

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 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.

Shrub species (e.g., willow and alder) planting will also be considered as an additional revegetation measure if Site conditions are conducive to these species after final grading. Monitoring and maintenance will be implemented until the area is self-sufficient.

7. MONITORING PROGRAMS

7.1 SOIL MONITORING

The soil remediation program would be assessed against site-specific remediation objectives as described in [Section 3.2](#). Verification samples would be collected to ensure that prescribed remedial targets were met. The analytical schedule for soil samples would be consistent with contaminants identified during the site characterization program (Komex 2001) and would consist of some or all of the following:

- Soil salinity: pH, EC, soluble chloride, soluble sulphate;
- Benzene, Toluene, Ethylbenzene, Xylenes (BTEX);
- Hydrocarbon Fractions TEH and TPH (NWT);
- Total Metals (As, B, Ba, Be, Cd, Cr, Cu, Hg, Pb, Ni, S, Sb, Se, Sn, Tl, V, Zn);
- Glycols Scan; and
- Polycyclic Aromatic Hydrocarbons (PAHs).

7.2 WASTE CLASSIFICATION

All materials will be tested and classified prior to transportation to a permitted landfill that accepts such materials. A sampling and analytical program would be implemented to evaluate these materials relative to Transportation of Dangerous Goods and Landfilling Regulations. Soils planned for disposal would likely be shipped to the southern Provinces for disposal unless a suitable facility is constructed in the area as an alternative.

7.3 VEGETATION/RECLAMATION MONITORING

The Site will be assessed for reclamation success likely on an annual basis, until vegetation is fully 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.

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9. DISCLAIMER

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Any questions concerning the information or its interpretation should be directed to Joal Borggard or Gord Johnson

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TABLES

Table 1A
Soil Quality Analyses

			Theor. Gypsum Reqmt. (tons/ac)	Salinity													Total Sulphur (mg/kg)	Hydrocarbons													
Monitoring Station	Soil Depth	Date (d-m-y)		Saturation % (%)	EC (dS/m)	pH - Saturated Paste (units)	Sodium Adsorption Ratio (ratio)	Calcium (mg/kg)	Magnesium (mg/kg)	Potassium (mg/kg)	Sodium (mg/kg)	Soluble Ca (mg/L)	Soluble K (mg/L)	Soluble Mg (mg/L)	Soluble Na (mg/L)	Soluble Cl (mg/L)		Soluble SO ₄ (mg/L)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes-total (mg/kg)	TPH (C ₉ -C ₁₀) (mg/kg)	TEH (C ₁₁ -C ₃₀) (mg/kg)	TEH (C ₁₁ -C ₃₀) (mg/kg)	PHC (>C ₁₀ -C ₁₆) (mg/kg)	PHC (>C ₁₆ -C ₃₄) (mg/kg)	PHC (>C ₃₄ -C ₁₀₀ ^h) (mg/kg)	TPH (NWT) (mg/kg)		
CCME Industrial, 91-99			--	--	4	6 - 8	12	--	--	--	--	--	--	--	--	--	--	--	5	0.8	20	20	--	--	--	--	--	--	--	--	
CCME Residential/Parkland, 91-99			--	--	2	6 - 8	5	--	--	--	--	--	--	--	--	--	--	--	0.5	0.8	1.2	1	--	--	--	--	--	--	--	--	
NWT Industrial, 98			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	0.8	20	20	--	--	--	--	--	--	--	2,500	
NWT Residential/Parkland, 98			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0.5	0.8	1.2	1	--	--	--	--	--	--	--	500	
Tier 1 PHC - Ind-Surface Soil Coarse			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	760	1700	3300	--		
Tier 1 PHC - Res-Surface Soil Coarse			--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	450	400	2800	--		
S00-01	(0.00-0.30 m)	13-Sep-00	<0.1	133	0.18	6.30	0.9	10,600	1,500	212	256	26.0	<1	7.4	20.3	32.0	14.4	1,030	--	--	--	--	--	--	--	--	--	--	--	--	
S00-02	(0.00-0.15 m)	13-Sep-00	<0.1	22.0	0.36	7.90	1.1	3,070	563	390	237	43.5	2	7.0	31.0	18.3	66.1	220	--	--	--	--	--	--	--	--	--	--	--	--	
	(0.15-0.45 m)	13-Sep-00	<0.1	24.0	0.3	8.00	1.0	3,600	484	301	249	40.8	2	4.1	25.6	11.5	33.1	197	--	--	--	--	--	--	--	--	--	--	--	--	
S00-04	(0.15-0.45 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	11.0	--	345	252	(88.0 - 116)	<130	356		
S00-05	(0.45-0.60 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.04	0.27	<0.04	<0.12	1.0	--	307	48.1	156	(97.5 - 168)	308		
S00-06	(0.45-0.60 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	(0.03)	<0.02	<0.06	0.9	--	689	42.3	358	289	690		
S00-07	(0.15-0.60 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	0.9	--	1,060	(73.1 - 74.1)	770	(221 - 281)	1,061		
S00-08	(0.15-0.45 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	87.1	--	10,100	2,550	6,200	1,340	10,187		
S00-09	(0.15-0.50 m)	13-Sep-00	--	--	--	--	--	5,730	974	388	326	--	--	--	--	--	--	1,030	<0.02	<0.02	<0.02	2.98	207	--	9,160	5,540	3,340	(269 - 319)	9,367		
S00-10	(0.15-0.50 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.05	<2	4	31.2	1,360	--	6,930	5,790	1,140	<130	8,290		
S00-11	(0.15-0.30 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	4.8	--	225	167	(57.4 - 86.4)	<130	230		
S00-12	(0.00-0.20 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	85.1	--	33,000	25,300	(7680 - 7760)	<520	33,085		
S00-13	(0.00-0.15 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	20.5	--	3,480	2,650	(834 - 839)	<130	3,501		
S00-14	(0.45-0.75 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	1.2	--	(47)	(37.9 - 38.9)	(9.0 - 38)	<130	48		
S00-16	(0.15-0.45 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	4.8	--	198	142	(55.8 - 60.8)	<130	203		
S00-17	(0.15-0.40 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	1.1	--	816	337	(171 - 174)	(308 - 313)	817		
S00-18	(0.15-0.30 m)	13-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	<0.1	--	615	(219 - 220)	(391 - 396)	(5.0 - 130)	615		
S00-19	(0.10-0.25 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	20.4	--	3,370	1,910	(1460 - 1480)	<130	3,390		
S00-21	(0.00-0.25 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	(0.04 - 0.08)	13.9	--	6,050	3,960	(2070 - 2080)	(9.00 - 134)	6,064		
S00-22	(0.00-0.25 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.2	<0.2	<0.2	(1.8 - 2.1)	368	--	5,530	4,930	559	(32.7 - 138)	5,898		
S00-23	(0.15-0.40 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	0.3	--	479	17	166	296	479		
S00-24	(0.15-0.45 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.03	0.46	1.12	2.06	35.9	--	2,020	1,150	(865 - 880)	<130	2,056		
S00-25	(0.15-0.45 m)	14-Sep-00	<0.1	26.0	0.31	7.40	1.0	678	382	249	242	32.3	2	11.6	26.5	14.8	48.7	105	<0.02	<0.02	<0.02	<0.06	<0.1	--	<40	<6	(29 - 49)	<130	<40.1		
S00-26	(0.15-0.45 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	(0.03)	0.26	0.09	1.57	147	--	582	487	(95.0 - 120)	<130	729		
S00-27	(0.15-0.45 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	65.7	--	21,100	19,000	(2120 - 2280)	<780	21,166		
S00-28	(0.00-0.15 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	(0.03)	0.29	0.4	--	332	(33.7 - 35.5)	153	(140 - 175)	332		
S00-29	(0.00-0.15 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	234	--	335	285	(45.4 - 71.4)	<130	569		
S00-30	(0.15-0.45 m)	14-Sep-00	<0.1	40.0	1.98	7.80	4.9	12,000	1,220	1,670	1,130	99.9	226	11.8	193	404	216	2,150	0.13	0.41	0.09	0.58	124	--	25,200	7,820	13,100	4,190	25,324		
S00-31	(0.15-0.45 m)	14-Sep-00	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	<0.02	<0.02	<0.02	<0.06	0.6	--	595	(1.4 - 5.9)	(203 - 204)	390	596		
S00-32	(0.15-0.45 m)	14-Sep-00	<0.1	25.0	0.39	7.40	1.2	1,000	405	286	235	39.9	10.9	10.9	33.5	30.0	62.7	169	<0.02	<0.02	<0.02	<0.06	<0.1	--	<40	<6	(10 - 37)	<130	<40.1		
S00-33	(0.15-0.45 m)	14-Sep-00	<0.1	23.0	0.2	7.60	0.7	764	372	282	216	19.3	11.0	4.3	12.4	8	30.7	898	--	--	--	--	--	--	--	--	--	--	--	--	
S00-34	(0.15-0.30 m)	14-Sep-00	<0.1	25.0	0.83	8.00	0.8	18,100	1,680	652	273	121	29.7	9.2	34.1	49.8	250	808	--	--	--	--	--	--	--	--	--	--	--	--	--
S00-35	(0.15-0.30 m)	14-Sep-00	<0.1	32.0	0.52	7.40	0.8	2,570	495	401	211	80.9	16.1	7.5	28.7	30.2	79.6	656	<0.02	<0.02	<0.02	<0.06	8.6	--	19,800	(24.5 - 28.5)	15,800	3,960	19,809		
S00-36	(0.15-0.30 m)	14-Sep-00	<0.1	30.0	0.37	7.80	0.8	5,440	743	374	244	57.1	5	5.1	23.1	17.8	71.7	696	<0.02	<0.02	<0.02	<0.06	<0.1	--	14,200	(351 -					

NOTES:

- denotes parameter not analyzed
- (0.001) Single bracketed results are values below the reliable detection level, and are subject to reduced levels of confidence.
- (1.3 - 4.5) Bracketed results with a hyphen indicate a range - typically summed fields with a mixture of non-detects and detects (values for summed data may show extra significant digits for clarity).
- denotes values exceeding CCME Interim Remediation Soil Criteria for Industrial 1991 - 1999.
- denotes values exceeding CCME Interim Remediation Soil Criteria for Residential / Parkland 1991 - 1999.
- denotes values exceeding Environmental Guidelines for Site Remediation Industrial, NWT Resources, February 1998.
- denotes values exceeding Environmental Guidelines for Site Remediation Residential / Parkland, NWT Resources, February 1998.
- denotes values exceeding CCME Canada -Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, Industrial-Surface Soil Coarse, June 2000.
- denotes values exceeding CCME Canada -Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, Residential-Surface Soil Coarse, June 2000.

Table 1A
Soil Quality Analyses

Monitoring Station			Soil Depth			Date (d-m-y)			Metals																				Glycols				
									Aluminum (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Boron (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Lithium (mg/kg)	Manganese (mg/kg)	Molybdenum (mg/kg)	Nickel (mg/kg)	Phosphorus (mg/kg)	Selenium (mg/kg)	Silicon (mg/kg)	Silver (mg/kg)	Strontium (mg/kg)	Titanium (mg/kg)	Uranium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)	Diethylene Glycol (mg/kg)
CCME Industrial, 91-99			---	12	2000	8	---	22	87	300	91	---	600	---	---	40	50	---	10	---	40	---	---	---	130	360	---	---	---	---	---		
CCME Residential/Parkland, 91-99			---	12	500	4	---	10	64	50	63	---	140	---	---	10	50	---	3	---	20	---	---	---	130	200	---	960	---	---	---		
NWT Industrial, 98			---	---	---	---	---	---	---	---	---	---	400	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
NWT Residential/Parkland, 98			---	---	---	---	---	---	---	---	---	---	140	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
Tier 1 PHC - Ind-Surface Soil Coarse			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
Tier 1 PHC - Res-Surface Soil Coarse			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-01	(0.00-0.30 m)	13-Sep-00	2,690	2.4	185	<0.7	6	<1	5	2	4.8	7,650	<3	2.6	48.2	<0.5	7	309	<1	492	<0.3	30.5	32.7	<50	10.9	14.7	---	---	---	---	---		
S00-02	(0.00-0.15 m)	13-Sep-00	2,640	3.7	323	<0.7	4	<1	7	3	5.7	6,240	7	2.8	126	<0.5	6	376	<1	492	<0.3	28.7	40.1	<50	17.9	20.4	---	---	---	---	---		
	(0.15-0.45 m)	13-Sep-00	2,400	3.3	290	<0.7	<2	<1	7	3	5.5	6,790	9	2.2	265	<0.5	5	269	<1	229	<0.3	30.1	41.0	<50	16.5	15.5	---	---	---	---	---		
S00-04	(0.15-0.45 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-05	(0.45-0.60 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<3	<2	<10	<10	<6		
S00-06	(0.45-0.60 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<3	<2	<10	<10	<6		
S00-07	(0.15-0.60 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<3	<2	<10	<10	<6		
S00-08	(0.15-0.45 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-09	(0.15-0.50 m)	13-Sep-00	2,430	3.9	3,160	<0.7	9	<1	7	4	8.6	6,750	21.6	3.0	172	<0.5	7	230	<1	437	<0.3	36.5	46.9	<50	14.1	40.7	---	---	---	---	---		
S00-10	(0.15-0.50 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	<3	<2	<10	<10	<6		
S00-11	(0.15-0.30 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-12	(0.00-0.20 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-13	(0.00-0.15 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-14	(0.45-0.75 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-16	(0.15-0.45 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-17	(0.15-0.40 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-18	(0.15-0.30 m)	13-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-19	(0.10-0.25 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-21	(0.00-0.25 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-22	(0.00-0.25 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-23	(0.15-0.40 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-24	(0.15-0.45 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-25	(0.15-0.45 m)	14-Sep-00	1,820	3.6	309	<0.7	(2)	<1	6	2	5.0	5,380	10.4	1.4	105	<0.5	5	248	<1	306	<0.3	24.4	23.0	<50	13.6	12.5	---	---	---	---	---		
S00-26	(0.15-0.45 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-27	(0.15-0.45 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-28	(0.00-0.15 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-29	(0.00-0.15 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-30	(0.15-0.45 m)	14-Sep-00	3,860	4.8	6,480	<0.7	13.7	2	18.7	7	188	27,100	617	3.4	451	1.2	12.7	1,700	<1	358	<0.3	161	80.3	<50	15.3	727	---	---	---	---	---		
S00-31	(0.15-0.45 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-32	(0.15-0.45 m)	14-Sep-00	1,930	3.8	519	<0.7	<2	<1	6	3	6.1	5,110	8	2.1	573	<0.5	8	253	<1	309	<0.3	23.7	32.2	<50	14.8	16.0	---	---	---	---	---		
S00-33	(0.15-0.45 m)	14-Sep-00	1,620	5.4	2,380	<0.7	<2	<1	6	3	6.7	5,810	10.7	1.5	133	(0.7)	5	236	<1	270	<0.3	50.8	17.0	<50	15.0	14.9	---	---	---	---	---		
S00-34	(0.15-0.30 m)	14-Sep-00	3,600	4.5	1,620	<0.7	4	<1	9	3	9.7	9,380	14.6	5.3	260	<0.5	9	349	<1	785	<0.3	77.0	65.8	<50	18.9	39.9	---	---	---	---	---		
S00-35	(0.15-0.30 m)	14-Sep-00	2,090	3.3	912	<0.7	(2)	<1	6	2	5.4	4,740	8	2.2	216	<0.5	5	254	<1	321	<0.3	37.5	36.5	<50	13.8	27.2	<3	<2	<10	<10	<6		
S00-36	(0.15-0.30 m)	14-Sep-00	2,270	4.6	1,000	<0.7	<2	<1	10	3	6.4	8,260	12.4	2.6	195	<0.5	7	298	<1	392	<0.3	34.7	36.5	<50	14.1	24.2	---	---	---	---	---		
S00-37	(0.15-0.30 m)	14-Sep-00	2,690	4.2	2,090	<0.7	(3)	<1	62.7	4	8.8	7,700	12.2	3.4	246	<0.5	8	304	<1	582	<0.3	35.0	49.2	<50	17.0	27.7	---	---	---	---	---		
S00-38	(0.15-0.45 m)	14-Sep-00	2,390	2.7	616	<0.7	<2	<1	6	3	5.3	4,940	8	2.4	2,530	<0.5	12.9	298	<1	378	<0.3	27.2	26.5	<50	14.5	18.9	---	---	---	---	---		
S00-39	(0.15-0.45 m)	14-Sep-00	2,990	3.5	4,820	<0.7	4	<1	7	3	5.6	5,530	13.6	3.2	123	<0.5	6	260	<1	788	<0.3	94.1	71.1	<50	15.8	29.8	---	---	---	---	---		
S00-40	(0.15-0.45 m)	14-Sep-00	2,210	2.8	392	<0.7	(3)	<1	5	2	5.1	4,530	9	2.2	116	<0.5	5	462	<1	335	<0.3	25.9	30.5	<50	14.4	18.4	---	---	---	---	---		
S00-41	(0.15-0.45 m)	14-Sep-00	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---		
S00-42 A-C Sediment Grab Comp	---	14-Sep-00	2,600	2.6	202	<0.7	5	<1	5	3	7.6	8,630	6	4.6	126	<0.5	8	507	<1	445	<0.3	28.3	53.4	<50	11.8	32.7	---	---	---	---	---		

NOTES:

- --- denotes parameter not analyzed
- (0.001) Single bracketed results are values below the reliable detection level, and are subject to reduced levels of confidence.
- (1.3 - 4.5) Bracketed results with a hyphen indicate a range - typically summed fields with a mixture of non-detects and detects (values for summed data may show extra significant digits for clarity).
- denotes values exceeding CCME Interim Remediation Soil Criteria for Industrial 1991 - 1999.
- denotes values exceeding CCME Interim Remediation Soil Criteria for Residential / Parkland 1991 - 1999.
- denotes values exceeding Environmental Guidelines for Site Remediation Industrial, NWT Resources, February 1998.
- denotes values exceeding Environmental Guidelines for Site Remediation Residential / Parkland, NWT Resources, February 1998.
- denotes values exceeding CCME Canada -Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, Industrial-Surface Soil Coarse, June 2000.
- denotes values exceeding CCME Canada -Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, Residential-Surface Soil Coarse, June 2000.

Table 1B
Soil Quality Analyses - Pesticides

			Pesticides																			
Monitoring Station	Soil Depth	Date (d-m-y)	4,4'-DDD	4,4'-DDE	4,4'-DDT	4,4'-Methoxychlor	a-Chlordane	Aldrin	Alpha-BHC	Beta-BHC	Delta-BHC	Dieldrin	Endosulphan I	Endosulphan II	Endosulphan SO ₄	Endrin	Endrin Aldehyde	Endrin Ketone	g-Chlordane	Gamma-BHC	Heptachlor	Heptachlor Epoxide
			(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)
CCME Industrial, 91-99			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
CCME Residential/Parkland, 91-99			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
NWT Industrial, 98			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
NWT Residential/Parkland, 98			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Tier 1 PHC - Ind-Surface Soil Coarse			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Tier 1 PHC - Res-Surface Soil Coarse			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S00-07	(0.15-0.60 m)	13-Sep-00	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	

NOTES:

- denotes values exceeding CCME Interim Remediation Soil Criteria for Industrial 1991 - 1999.
- denotes values exceeding CCME Interim Remediation Soil Criteria for Residential / Parkland 1991 - 1999.
- denotes values exceeding Environmental Guidelines for Site Remediation Industrial, NWT Resources, February 1998.
- denotes values exceeding Environmental Guidelines for Site Remediation Residential / Parkland, NWT Resources, February 1998.
- denotes values exceeding CCME Canada -Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, Industrial-Surface Soil Coarse, June 2000.
- denotes values exceeding CCME Canada -Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, Residential-Surface Soil Coarse, June 2000.

Table 1C
Soil Quality Analyses - PAH's

			PAHs																						
Monitoring Station	Soil Depth	Date (d-m-y)	3-Methylcholanthrene	7 ₁₂ -Dimethylbezn(a)anthracene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)-anthracene	Benzo(a)pyrene	Benzo(b&j)fluoranthene	Benzo(c)phenanthrene	Benzo(g,h,i)-perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(a,h)-anthracene	Dibenzo(a,h)-pyrene	Dibenzo(a,i)-pyrene	Fluoranthene	Fluorene	Indeno _(1,2,3-cd) pyrene	Naphthalene	Phenanthrene	Pyrene	D _{-1,4} -Terphenyl	2-Fluorobiphenyl
			(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)
CCME Industrial, 91-99			---	---	---	---	---	10	0.7	---	---	---	10	---	---	---	---	---	---	10	22	50	100	---	---
CCME Residential/Parkland, 91-99			---	---	---	---	---	1	0.7	---	---	---	1	---	---	---	---	---	---	1	0.6	5	10	---	---
NWT Industrial, 98			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
NWT Residential/Parkland, 98			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Tier 1 PHC - Ind-Surface Soil Coarse			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Tier 1 PHC - Res-Surface Soil Coarse			---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
S00-30	(0.15-0.45 m)	14-Sep-00	<0.02	<0.2	<0.05	<0.05	<0.02	0.11	<0.02	<0.05	<0.02	0.05	<0.05	0.15	<0.02	<0.05	<0.05	<0.02	<0.02	<0.05	2.31	0.42	1.30	98	85

NOTES:

- denotes values exceeding CCME Interim Remediation Soil Criteria for Industrial 1991 - 1999.
- denotes values exceeding CCME Interim Remediation Soil Criteria for Residential / Parkland 1991 - 1999.
- denotes values exceeding Environmental Guidelines for Site Remediation Industrial, NWT Resources, February 1998.
- denotes values exceeding Environmental Guidelines for Site Remediation Residential / Parkland, NWT Resources, February 1998.
- denotes values exceeding CCME Canada -Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, Industrial-Surface Soil Coarse, June 2000.
- denotes values exceeding CCME Canada -Wide Standards for Petroleum Hydrocarbons (PHC) in Soil, Residential-Surface Soil Coarse, June 2000.

Table 2
Camp Farewell Soil Sample Results
Criteria Exceedences with Targets

Functional Area/Sub-Area	Target	Sample #	Parameter	Result	GNWT Residential/Parkland Criteria	CCME Residential/Parkland Criteria
<u>Shed #1</u>						
Maintenance (Interior)	Interior (2m W of door)	S00-07	TPH (NWT)	= 1,061 ppm	500 ppm	-
Maintenance (Interior)	Interior (W side of shop)	S00-08	TPH (NWT)	= 10,187 ppm	500 ppm	-
Cold Storage	Interior (E side of shop)	S00-10	Ethylbenzene	= 4 ppm	1.2 ppm	1.2 ppm
			Xylenes	= 31.2 ppm	1.0 ppm	1.0 ppm
			TPH (NWT)	= 8,290 ppm	500 ppm	-
Exterior Heating Oil AST	Beneath Heating Oil AST Valve	S00-41	Xylenes	= 7.35 ppm	1.0 ppm	1.0 ppm
			TPH (NWT)	= 10,731 ppm	500 ppm	-
<u>Shed #2</u>						
E. Exterior	7m E of Shed #2	S00-06	TPH (NWT)	= 690 ppm	500 ppm	-
<u>Shed #3</u>						
Interior	Interior (E side of shop)	S00-09	Xylenes	= 2.98 ppm	1.0 ppm	1.0 ppm
			TPH (NWT)	= 9,367 ppm	500 ppm	-
			Barium	= 3,160 ppm	-	500 ppm
<u>Main Camp Facilities</u>						
Generator	Inside Day Tank Berm (beneath valve)	S00-12	TPH (NWT)	= 33,085 ppm	500 ppm	-
Camp Heating Oil AST	Inside Berm (beneath valve)	S00-13	TPH (NWT)	= 3,501 ppm	500 ppm	-
<u>Main Fuel Area</u>						
Bolted Tanks	24m W of Bolted Tanks (off-pad)	S00-17	TPH (NWT)	= 817 ppm	500 ppm	-
Bolted Tanks	Adjacent to W side of Bolted Tanks	S00-18	TPH (NWT)	= 615 ppm	500 ppm	-
Bermed Tank Farm	Inside berm between 5000 bbl tanks	S00-19	TPH (NWT)	= 3,390 ppm	500 ppm	-
Bermed Tank Farm	Inside 2000 bbl tank berm (Composite)	S00-21	TPH (NWT)	= 6,064 ppm	500 ppm	-
Bermed Tank Farm	Inside berm next to Pump House	S00-22	Xylenes	= (1.8 - 2.1) ppm	1.0 ppm	1.0 ppm
			TPH (NWT)	= 5,898 ppm	500 ppm	-
Bermed Tank Farm	8m N of Tank Farm Berm (off-pad)	S00-24	Xylenes	= 2.06 ppm	1.0 ppm	1.0 ppm
			TPH (NWT)	= 2,056 ppm	500 ppm	-
300 bbl Horizontal API Fuel Tanks	Adjacent to Fuel Tanks	S00-26	Xylenes	= 1.57 ppm	1.0 ppm	1.0 ppm
			TPH (NWT)	= 729 ppm	500 ppm	-
300 bbl Skid Mounted Fuel Tanks	Adjacent to Fuel Tanks	S00-27	TPH (NWT)	= 21,166 ppm	500 ppm	-
Aircraft Refueler	Adjacent to Refueller	S00-29	TPH (NWT)	= 569 ppm	500 ppm	-
<u>Burn Pit</u>						
Interior	Interior	S00-30	TPH (NWT)	= 25,324 ppm	500 ppm	-
			Naphthalene	= 2.31 ppm	-	0.6 ppm
			Barium	= 6,480 ppm	-	500 ppm
			Copper	= 188 ppm	-	63 ppm
			Lead	= 617 ppm	140 ppm	140 ppm
			Zinc	= 727 ppm	-	200 ppm
Exterior - down grade	S (down grade) of Burn Pit	S00-31	TPH (NWT)	= 596 ppm	500 ppm	-
<u>Stockpile #1</u>						
Skid Tanks	Aviation Fuel Stg. and Skid Tanks (Composite)	S00-32	Barium	= 519 ppm	-	500 ppm
Pipes and Rig Mats	Pipes and Rig Mats (Composite)	S00-33	Barium	= 2,380 ppm	-	500 ppm
<u>Stockpile #2</u>						
Sea Cans and Rig Mats	Rig Mats and Metal Scrap (Composite)	S00-34	Barium	= 1620 ppm	-	500 ppm
Drum Docks	E Drum Dock (believe Rotella)	S00-35	TPH (NWT)	= 19808.6 ppm	500 ppm	-
			Barium	= 912 ppm	-	500 ppm
Drum Docks	2nd Drum Dock from E (believe Kerosene)	S00-36	TPH (NWT)	= 14200 ppm	500 ppm	-
			Barium	= 1,000 ppm	-	500 ppm
Drum Docks	Suspected Fueling Platform	S00-37	Barium	= 2,090 ppm	-	500 ppm
<u>Stockpile #3</u>						
Former Pipe Storage	Former Pipe Storage (Composite)	S00-38	Barium	= 616 ppm	-	500 ppm
Sea Cans	Composite Adjacent to B Free and Caustic Soda Sea Cans	S00-39	EC	= 4 dS/m	-	2 dS/m
			pH	= 11.2 units	-	9
			SAR	= 37 ratio	-	5
			Barium	= 4,820 ppm	-	500 ppm
<u>Sewage Lagoon</u>						
Sediment	SW Corner	S00-42	Toluene	= 0.94 ppm	0.8 ppm	0.8 ppm

Notes:
(1) All Criteria are CCME with the exception of TPH (NWT), which is NWT Criteria
(2) TPH (NWT) = total purgeable hydrocarbons + total extractable hydrocarbons

Table 3
Camp Farewell Sewage Lagoon Water Quality Analysis:
Main Parameters

				NWT Water Board Criteria Dilution: 150-600 Lcd ¹ Summer (<150 Lcd Summer)	Licence N7L1-1762 Criteria
Parameter	Unit	Camp Farewell Lagoon (S00-43)	Camp Farewell Lagoon (S00-W01)	>1000:1 <10E4:1	
BOD	Mg/L	16.5	19.3	120 (100)	70
SS	Mg/L	60.0	48.0	180 (120)	70
P	Mg/L	1.18	2.49	TBD ²	No criteria
F.coli. ³	CFU/dL & mpn/dL	Expired	933 mpn/dL	10E5 (10E6) CFU/dL	10E4 CFU/dL
Total Ammonia	Mg/L	4.92	5.4	TBD ²	No criteria
pH	Units	7.52	7.64	6-9	No criteria
Visible Sheen	Visible/None Visible	None	None	None	5 mg/L oil & grease

Notes:

¹ Lcd: litres per capita per day.

² TBD: the criteria to be used are to be determined (TBD) by INAC upon submission of the sewage lagoon sampling results.

³ Fecal coliforms are presented in Table 4.1 of the Guidelines for the Discharge of Treated Municipal Waste Water as CFU/dL or colony forming units/dL – this is calculated by doing a visual count of fecal coliforms in a known amount of water (i.e., the count value is calculated based on a dilution factor). The MPN (most probable number) is a statistically valid count derived from a complex analytical method employed by Maxxam Analytics for the lagoon water sample. These are comparable units.

Table 4
Camp Farewell Sewage Lagoon Water Quality Analysis:
Additional Effluent Parameters

Parameter	Dissolved or Total	Unit	Camp Farewell Lagoon (S00-W01)	NWT Water Board Criteria
Aluminum	Total	mg/L	0.012	2.0
Arsenic	Total	mg/L	<0.005	0.05
Barium	Dissolved	mg/L	0.0385	1.0
Boron	Dissolved	mg/L	0.16	5
Cadmium	Dissolved	mg/L	0.0004	0.005
Chromium	Total	mg/L	0.005	0.1
Cobalt	Dissolved	mg/L	0.0010	0.1
Copper	Dissolved	mg/L	0.0027	0.2
Fluoride	Dissolved	mg/L	0.10	5.0
Iron	Dissolved	mg/L	1.90	0.3
Lead	Dissolved	mg/L	0.0004	0.05
Manganese	Dissolved	mg/L	0.471	0.05
Mercury	Total	mg/L	<0.00005	0.0006
Molybdenum	Total	mg/L	0.0010	0.2
Nickel	Dissolved	mg/L	0.0048	0.3
Selenium	Total	mg/L	<0.007	0.05
Silver	Total	mg/L	<0.0001	0.1
Tin	Total	mg/L	0.003	5
Zinc	Total	mg/L	0.0395	0.5

Notes:

¹ No analyses were conducted for cyanide and methyl blue active substances.


 ² Denotes values exceeding NWT Water Board Guidelines for the Discharge of Treated Municipal Wastewater in the Northwest Territories, 1992.

Table 5
Camp Farewell Sewage Lagoon Water Quality Analysis:
Hydrocarbons

Parameter	Unit	Camp Farewell Lagoon (S00-43)	CCME Water: Community Criteria
Benzene	mg/L	<0.0004	0.005
Toluene	mg/L	<0.0004	≤0.024
Ethylbenzene	mg/L	<0.0004	≤0.0024
Total Xylenes	mg/L	<0.0012	≤0.3
TPH (C ₃ -C ₁₀)	mg/L	<0.1	N/A
TEH (C ₁₀ -C ₃₀)	mg/L	<0.7	N/A

\\CAL0\DATA2\X\PROJECTS\52360000\52360200\REPORTS\Sewage Lagoon Analytical Results-table 3, 4 and 5_NEW.doc

Table 6

FAREWELL INVENTORY - WATER RELATED FACILITIES		
	Description	Quantity
Buildings	~ 36 man main Camp Facility 2 story building	1
	~ 80 man Camp Facility composed of mobile trailers	1
Water Treatment Lagoon		1
Water System	Water intake system Storage system – storage tank inside crew accommodations Distribution system (part of accommodations dismantling) Water-use facilities - toilets, sinks, showers and associated piping Gravity collection system (part of accommodations dismantling) Lift station tank and pump Primary treatment system - containerized Ecotech treatment system UV disinfection unit and chlorine dosing system Final transport tank, pump and piping	

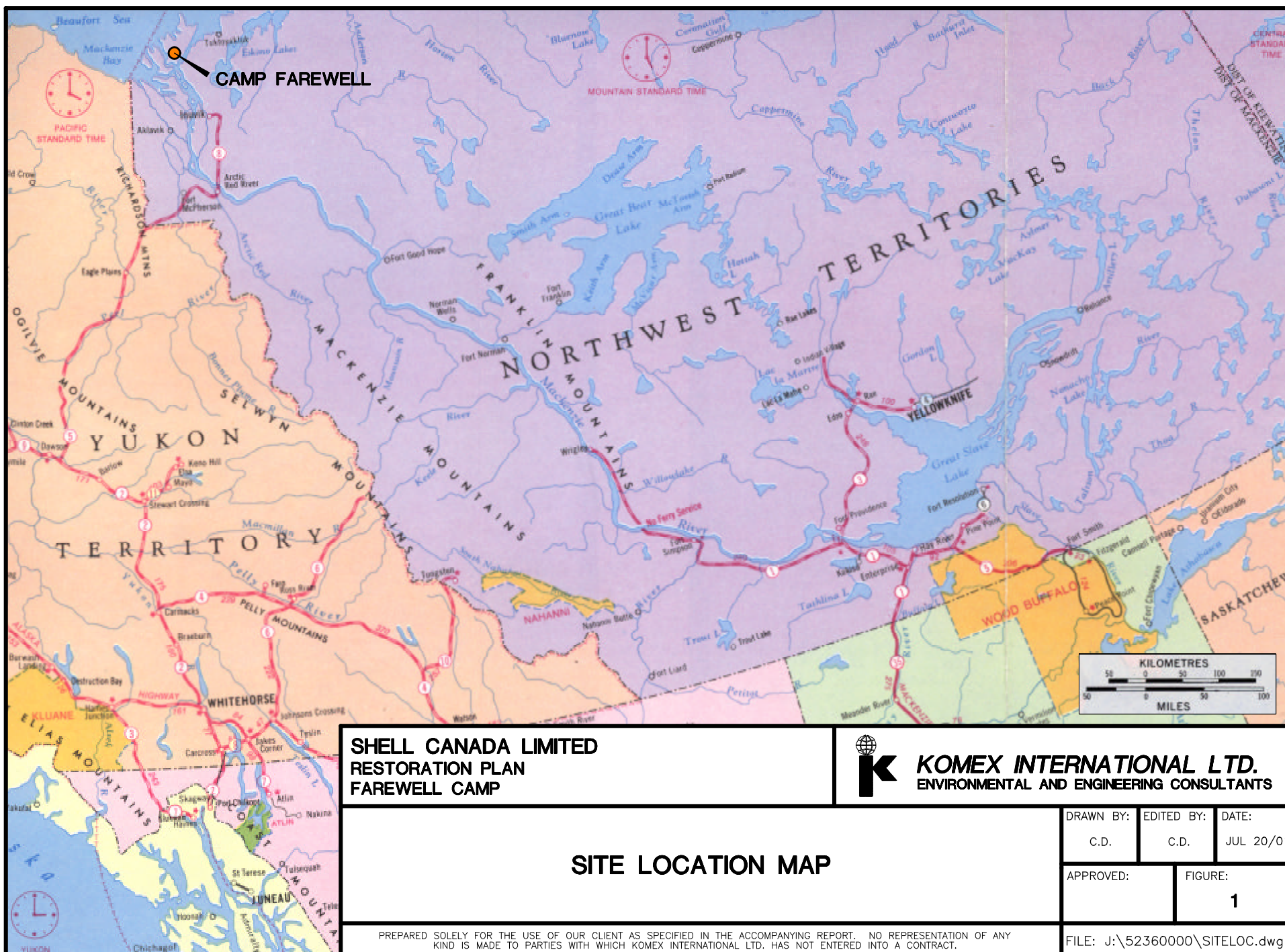
TABLE 7

FAREWELL INVENTORY - STORAGE AREA (Fall 2000)		
	Description	Quantity
Drilling Materials	Barite Bentonite Potash Caustic HR5 Interlock Aquagel Kwik Seal B-Free	497 containers ¹ 49 containers 179 containers 31 containers 5 containers 9 containers 26 containers 6 containers 18 containers
Cement	Perma-frost Class G	554 containers 168 containers
Miscellaneous Materials	45 gal. drums - used lube oil 45 gal. drums - Turbo Fuel B 45 gal. drums - various contents pails of used lube oil	3 5 30 ?
Rig Mats	8' x 35'	287 sections
I Beams	14" x 35' 14" x 20' 14" x 10'	210 pcs. 45 pcs. 13 pcs.
Culverts	12" x 30'	108 pcs.
Pipe	Insulated - 2" x 30' Lt. Wt. Casing - 7" x 20'	103 jts. 60 jts.
Tanks (not in use)	1000 bbl. (bolted) 5000 bbl. (welded) 2000 bbl. (welded) 2000 bbl. (bolted) 1000 bbl. (dismantled) 400 bbl. (welded) 300 bbl. (welded) 300 bbl. (skid) 210 bbl. (skid) 500 gal. (skid) 500 gal. (skid)	10 2 3 1 1 1 5 9 3 20 (4 sleighs) 4 (mounted)

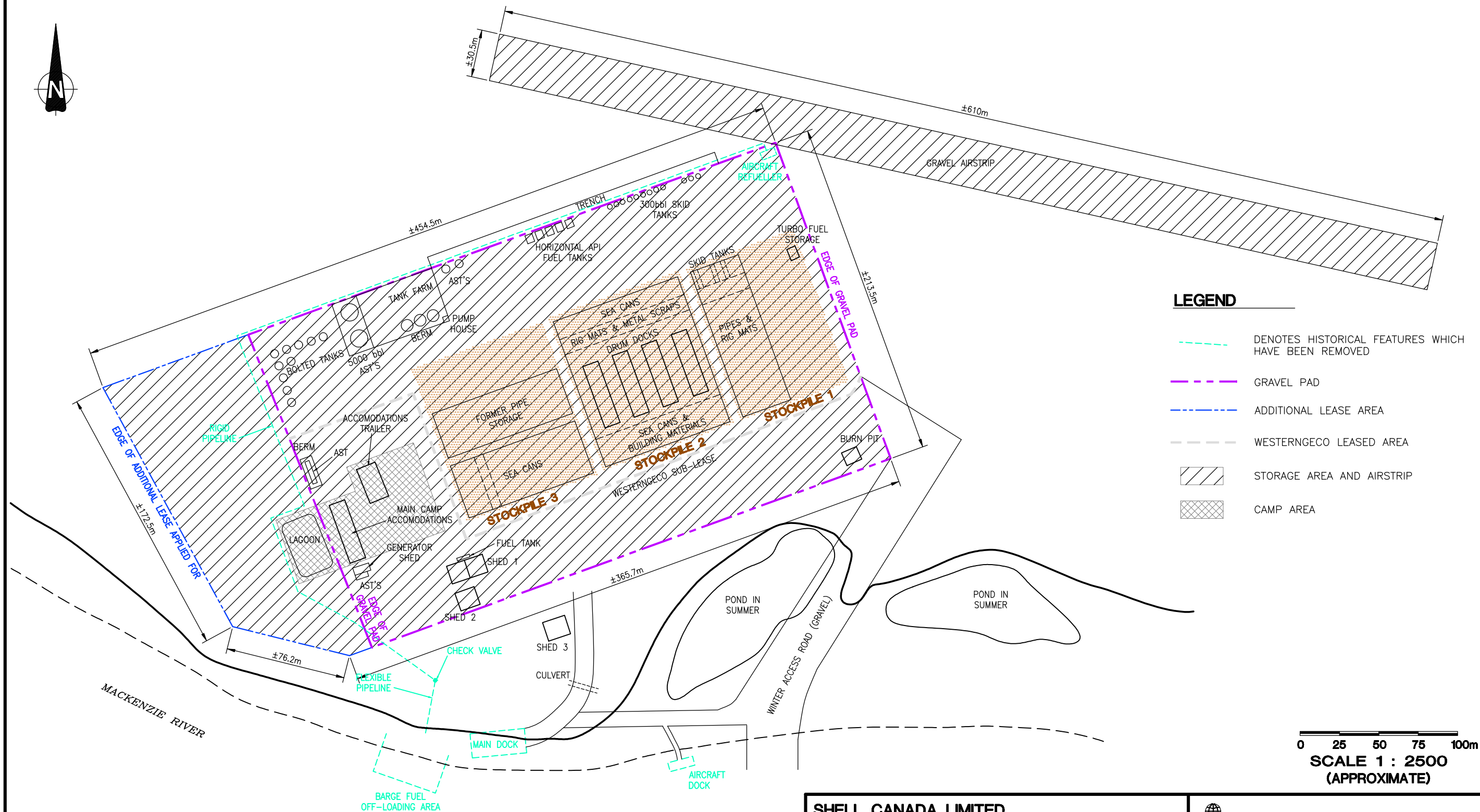
TABLE 7

Tanks (in use)	20,000 gal. (skid)	1
	1000 gal. (heating oil tank)	1
	500 gal. (fuel storage)	1
	500 gal. day tank for generator	1
Buildings	Shed #1 - warm and cold storage	1
	Shed #2 - equipment storage	1
	Shed #3 - material and debris storage	1
	Generator Building	1
Sleigh		1
Incinerator		2
Oil Spill Equipment		1
Sleigh Runners		5
Electric Generators		4
Skid		1
Tester		3
Equipment	Rig Platform	2
Satellite Dish		1

FIGURES



SITE LOCATION MAP



DIGITIZING SOURCES:
SHELL CANADA LIMITED SURVEY PLAN,
April 9, 1973

INDIAN AND NORTHERN AFFAIRS CANADA,
SURVEY PLAN, June 13, 1979

GOLDER ASSOCIATES Project 002-6232,
March 15, 2000

LOCATIONS OF INFRASTRUCTURE AND
TOPOGRAPHICAL FEATURES ARE APPROXIMATE.
DIMENSIONS OF PROPERTY BOUNDARY AND
AIR STRIP FROM:
INDIAN AND NORTHERN AFFAIRS CANADA,
SURVEY PLAN, June 13, 1979

THIS PLAN WAS DERIVED FROM UNVERIFIED SOURCE DATA. ERRORS MAY EXIST IN LOCATIONS SHOWN.

SHELL CANADA LIMITED
RESTORATION PLAN
FAREWELL CAMP

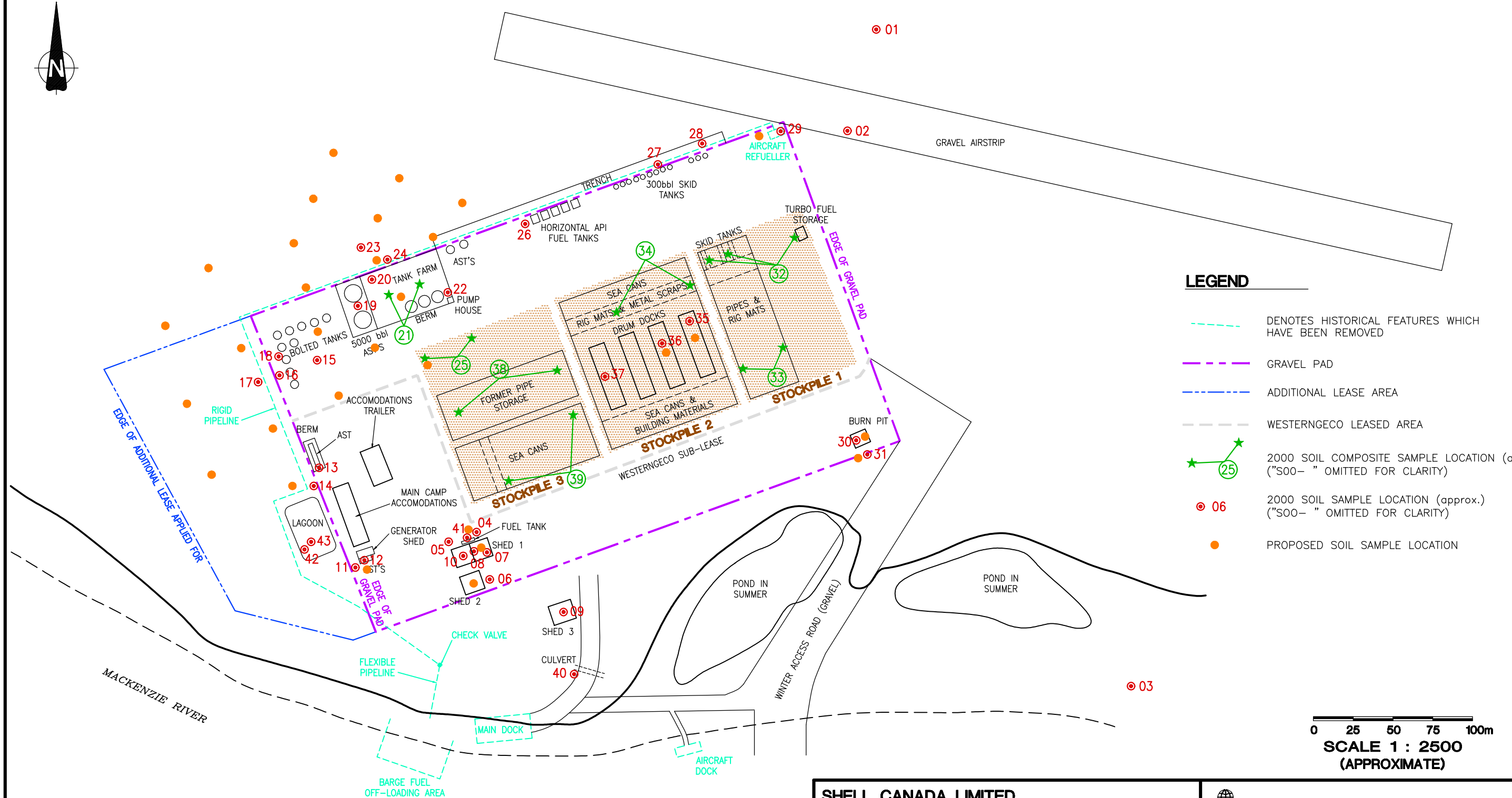


KOMEX INTERNATIONAL LTD.
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

SITE PLAN

DRAWN BY: C.D.	EDITED BY: C.D.	DATE: JUL 20/01
APPROVED:	FIGURE: 2	
FILE: J:\52360000\FAREWELL.dwg		

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 KOMEX INTERNATIONAL LTD. HAS NOT ENTERED INTO A CONTRACT.



DIGITIZING SOURCES:
SHELL CANADA LIMITED SURVEY PLAN,
April 9, 1973

INDIAN AND NORTHERN AFFAIRS CANADA,
SURVEY PLAN, June 13, 1979

GOLDER ASSOCIATES Project 002-6232,
March 15, 2000

THIS PLAN WAS DERIVED FROM UNVERIFIED SOURCE DATA. ERRORS MAY EXIST IN LOCATIONS SHOWN.

SHELL CANADA LIMITED
RESTORATION PLAN
FAREWELL CAMP

 **KOMEX INTERNATIONAL LTD.**
ENVIRONMENTAL AND ENGINEERING CONSULTANTS

HISTORIC AND PROPOSED SAMPLING LOCATIONS

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 KOMEX INTERNATIONAL LTD. HAS NOT ENTERED INTO A CONTRACT.

DRAWN BY: C.D.	EDITED BY: C.D.	DATE: JUL 20/01
APPROVED:		FIGURE: 4
FILE: J:\52360000\FAREWELL.dwg		

APPENDICES

APPENDIX I

WATER LICENCE #N7L1-1762

NORTHWEST
TERRITORIES
WATER BOARDALBERTA
WATER BOARDRec'd 12/11/2000
JH.

WATER REGISTER: N7L1-1762

November 30, 2000

Mr. Randy H. Hetman
Construction Manager
SHELL CANADA
400-4th Ave. S.W.
PO Box 100, Station M
CALGARY, ALBERTA T2P 2H5

Dear Mr. Hetman

ISSUANCE OF A "B" TYPE LICENCE



Attached is a duplicate of Licence No. N7L1-1762 granted to SHELL CANADA. by the Northwest Territories Water Board in accordance with the *Northwest Territories Waters Act*. The other original of this Licence has been filed with the Department of Indian Affairs and Northern Development in Yellowknife, Northwest Territories.

Also attached are general procedures for the administration of licences in the Northwest Territories. I request that you review these and address any questions to the Board's office.

In conclusion, please be advised that this letter with attached procedures, all inspection reports, and correspondence related thereto are part of the public Water Register, and are intended to keep all interested parties informed of the manner in which the Licence requirements are being met. All Water Register material will be considered when the Licence comes up for renewal or amendment.

The full cooperation of SHELL CANADA is anticipated.

Sincerely,



Gordon Wray
Chairman
N.W.T. Water Board

Attachments (2)

P.O. Box 1500, Yellowknife, NT, X1A 2R3, 2nd Floor Goga Cho Building
Phone: (867) 669-2772 Fax: (867) 669-2719

**GENERAL PROCEDURES FOR THE ADMINISTRATION OF LICENCES
ISSUED UNDER THE NORTHWEST TERRITORIES WATERS ACT
IN THE NORTHWEST TERRITORIES**

1. At the time of issuance, a copy of the Licence is placed on the Water Register in the Office of the Northwest Territories Water Board in Yellowknife, and is then available to the public.
2. To enforce the terms and conditions of the Licence, the Minister of Indian Affairs and Northern Development has appointed Inspectors in accordance with Section 35(1) of the *Northwest Territories Waters Act*. The Inspectors coordinate their activities with officials of the Water Resources Division of the Department of Indian Affairs and Northern Development. The Inspector responsible for Licence No. N7L1-1762 is located in the North Mackenzie- Inuvik District.
3. To keep the Water Board and members of the public informed of the Licensee's conformity to Licence conditions, the Inspectors prepare reports which detail observations on how each item in the Licence has been met. These reports are forwarded to the Licensee with a covering letter indicating what action, if any, should be taken. The inspection reports and covering letters are placed on the public Water Register, as are any responses received from the Licensee pertaining to the inspection reports. It is therefore of prime importance that you react in all areas of concern regarding all inspection reports so that these concerns may be clarified.
4. If the renewal of Licence No. N7L1-1762 is contemplated it is the responsibility of the Licensee to apply to the Water Board for renewal of the Licence. The past performance of the Licensee, new documentation and information, and points raised during a public hearing, if required, will be used to determine the terms and conditions of any Licence renewal. Please note that if the Licence expires and another has not been issued, then water and waste disposal must cease, or you, the Licensee, would be in contravention of the *Northwest Territories Waters Act*. It is suggested that an application for renewal of Licence No. N7L1-1762 be made at least eight months in advance of the Licence expiry date.
5. If, for some reason, Licence No. N7L1-1762 requires amendment, then a public hearing may be required. You are reminded that applications for amendments should be submitted as soon as possible to provide the Water Board with ample time to go through the amendment process. The process may take up to six (6) months or more depending on the scope of the amendment requested.

The Surveillance Network Program annexed to the Licence can be modified at the discretion of the Board and does not require a public hearing. A request for any proposed change to the Surveillance Network Program should be forwarded to the Board in writing, including a rationale for the change.

.....2

- 2 -

6. Specific clauses of your Licence make reference to the Board, Analyst or Inspector. The contact person, address, phone and fax number of each is:

BOARD: Executive Assistant
Northwest Territories Water Board
P.O. Box 1500
YELLOWKNIFE, NT X1A 2R3

Phone No: (867) 669-2772
Fax No: (867) 669-2719

ANALYST: Analyst
Water Laboratory
Northern Affairs Program
Department of Indian Affairs
and Northern Development
Box 1500
4601 - 52nd Avenue
YELLOWKNIFE, NT X1A 2R3

Phone No: (867) 669-2780
Fax No: (867) 669-2718

INSPECTOR: Inspector
Inuvik District Office
Northern Affairs Program
Department of Indian Affairs
and Northern Development
P.O. Box 2100
INUVIK, NT X0E 0T0

Phone No: (867) 777-3361
Fax No: (867) 777-2090

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

SHELL CANADA
(Licensee)
400-4th Avenue S.W.
PO BOX 100, STATION M
of Calgary, Alberta T2P 2H5
(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	<u>N7L1-1762</u>
Licence Type	<u>"B"</u>
Water Management Area	<u>NORTHWEST TERRITORIES 07</u>
Location	<u>LATITUDE 69°12'30" N. AND</u> <u>LONGITUDE 135°06'04" W.</u> <u>NORTHWEST TERRITORIES</u>
Purpose	<u>WATER USE AND WASTE DISPOSAL</u> <u>FOR MUNICIPAL UNDERTAKINGS</u>
Quantity of Water Not To Be Exceeded	<u>150 CUBIC METRES DAILY</u>
Effective Date of Licence	<u>DECEMBER 1, 2000</u>
Expiry Date of Licence	<u>NOVEMBER 30, 2005</u>

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

NORTHWEST TERRITORIES WATER BOARD

Witness



Chairman

- 1 -

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

- a) This Licence entitles Shell Canada to use water and dispose of waste for municipal undertakings in oil and gas exploration and associated uses at Camp Farewell in the MacKenzie River Delta, located at Latitude 69°12'30" N. and Longitude 135°06'04" W., 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*;

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

"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;

- 2 -

"Maximum Average Concentration" means the moving average of any four (4) consecutive analytical results submitted to the Board in accordance with the sampling and analysis requirements specified in the "Surveillance Network Program";

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

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

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

"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 31 of the year following the calendar year reported which shall contain the following:
 - a) the total quantities 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 results of sampling carried out under the Surveillance Network Program;
 - d) a summary of any modifications carried out on the Water Supply and Waste Disposal Facilities, including all associated structures;
 - e) a list of any spills and unauthorised discharges; and
 - f) any other details on water use or waste disposal requested by the Board within forty-five (45) days before the annual report is due.

- 3 -

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. 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.
5. The Licensee shall, within thirty (30) days of the issuance of this 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.
6. Prior to the use of water for municipal undertakings or the disposal of waste and 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 Hundred Fifty Thousand dollars (\$250,000.00) in a form suitable to the Minister.
7. 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 the Mackenzie River or the unnamed lake as described in the project description or as otherwise approved by an Inspector.
2. The daily quantity of water used for all purposes shall not exceed 150 cubic metres.
3. 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.

- 4 -

PART D: CONDITIONS APPLYING TO WASTE DISPOSAL

1. The Licensee shall within one (1) year of the issuance of this Licence, submit to the Board for approval an Operation and Management 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. The Licensee shall direct all piped and pumpout sewage to the Sewage Treatment Facilities or as otherwise approved by the Board.
3. The Licensee shall provide at least five (5) days notice to an Inspector prior to commencement of any discharges to the Mackenzie River.
4. 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:

<u>Sample Parameter</u>	<u>Maximum Average Concentration</u>
BOD ₅	30.0 mg/L
Total Suspended Solids	35.0 mg/L
Faecal Coliforms	250 CFU/dL
Oil and Grease	5.0 mg/L

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

5. The Licensee shall maintain the Sewage Treatment Facilities to the satisfaction of and Inspector.
6. The Licensee shall dispose of all solid wastes in a manner acceptable to the Inspector.

- 5 -

PART E: CONDITIONS APPLYING TO MODIFICATIONS

1. The Licensee may, without written approval from the Board, carry out modifications to the Water Intake and Waste Treatment Facilities provided that such modifications are consistent with the terms of this Licence and the following requirements are met:
 - a) the Licensee has notified the Board in writing of such proposed modifications at least forty-five (45) days prior to beginning the modifications;
 - b) such modifications do not place the Licensee in contravention of either the Licence or the Act;
 - c) the Board has not, during the forty-five (45) days following notification of the proposed modifications, informed the Licensee that review of the proposal will require more than forty-five (45) days; and
 - d) the Board 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 the Board.
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 issuance of this Licence, a Contingency Plan in accordance with the Board's "Guidelines for Contingency Planning, January 1987," or subsequent edition.
2. If, during the period of this Licence, an unauthorised discharge of waste occurs, or if such a discharge is foreseeable, the Licensee shall:
 - a) employ the appropriate contingency plan;

- 6 -

- b) report the incident immediately via the 24 Hour Spill Report Line. The current telephone number is (867) 920-8130; and
- c) 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

- [Handwritten mark]*
- 1. The Licensee shall submit to the Board for approval within one year of issuance of this Licence, an Interim Abandonment and Restoration Plan in accordance with the Board's "Guidelines for Mines in the Northwest Territories," September 1980, or subsequent edition.
NWT Water Board
 - 2. The Licensee shall implement the Plan specified in Part G, Item 1 as and when approved by the Board.
 - 3. The Licensee shall review the Abandonment and Restoration Plan every two years and shall modify the Plan as necessary to reflect changes in operations, technology. All proposed modifications to the Plan(s) shall be submitted to the Board for approval.

NORTHWEST TERRITORIES WATER BOARD

Witness

[Signature]

Chairman

NORTHWEST TERRITORIES WATER BOARD

LICENSEE: SHELL CANADA
LICENCE NUMBER: N7L1-1762
EFFECTIVE DATE OF LICENCE: DECEMBER 1, 2000
**EFFECTIVE DATE OF
SURVEILLANCE NETWORK PROGRAM:** DECEMBER 1, 2000

SURVEILLANCE NETWORK PROGRAM

A. Location of Sampling Stations

<u>Station Number</u>	<u>Description</u>
1762-1	Treated Effluent Discharge Prior to Entering the Mackenzie River

B. Sampling and Analysis Requirements

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

BOD ₅	Total Suspended Solids
Oil and Grease	Faecal Cloiforms
Ammonia	

2

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 analysis shall be performed in a laboratory approved by an Analyst.
5. The Licensee shall, by January 31, 2001, 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 II

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

EXPIRES
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 20th 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:

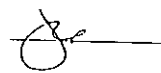
1. In this lease:
 - (a) "Minister" means the Minister of Indian Affairs and Northern Development and any person authorized by him in writing to act on his behalf;
 - (b) "facilities" means all physical structures or appurtenances placed in or upon the land;
 - (c) "construction" means all manner of 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. *Proctor -> Denay Chalwars*

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.

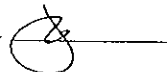
BREACH:

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 AK

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. *Sch. must have con plan in place.*
26. *could not report to Govt as agreed* 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

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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.

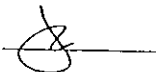
REVIEW:

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.

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DUPLICATE

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

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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

(Circular Seal) M. Robert
Director's Witness

SEALED, ATTESTED TO AND DELIVERED

by the

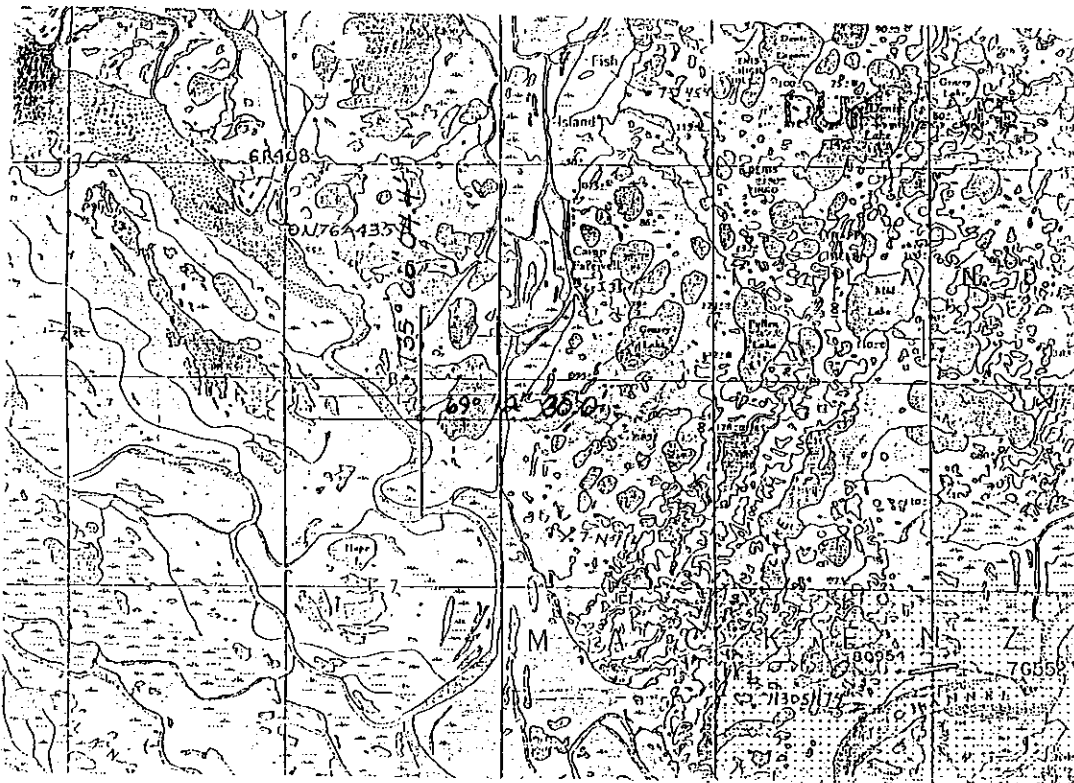
and the

of Shell Canada Limited

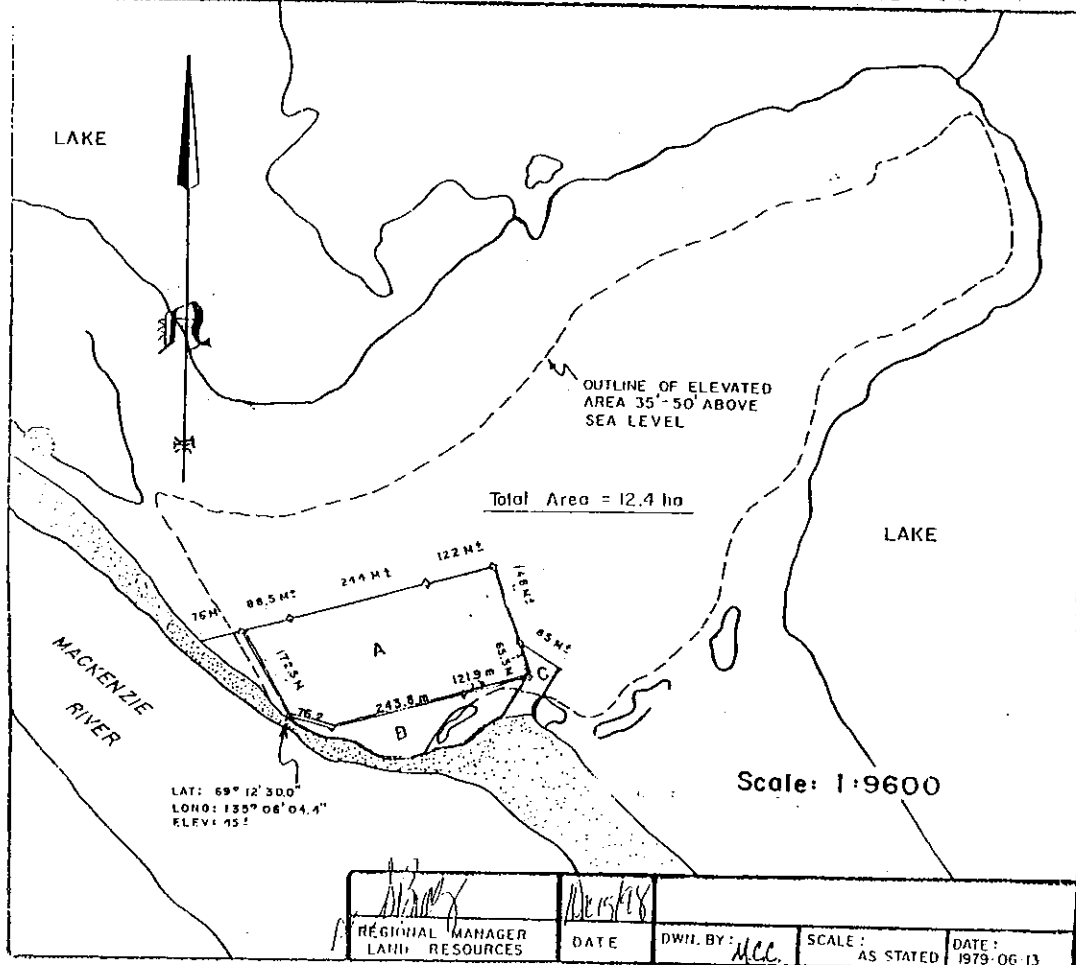
(Signature) (SEAL)
Director's Signature

SHELL CANADA LIMITED

(Signature) (SEAL) *BN*
JANE M. COULL
Assistant Secretary (SEAL)



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





DUPLICATE

ORIGINAL 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"

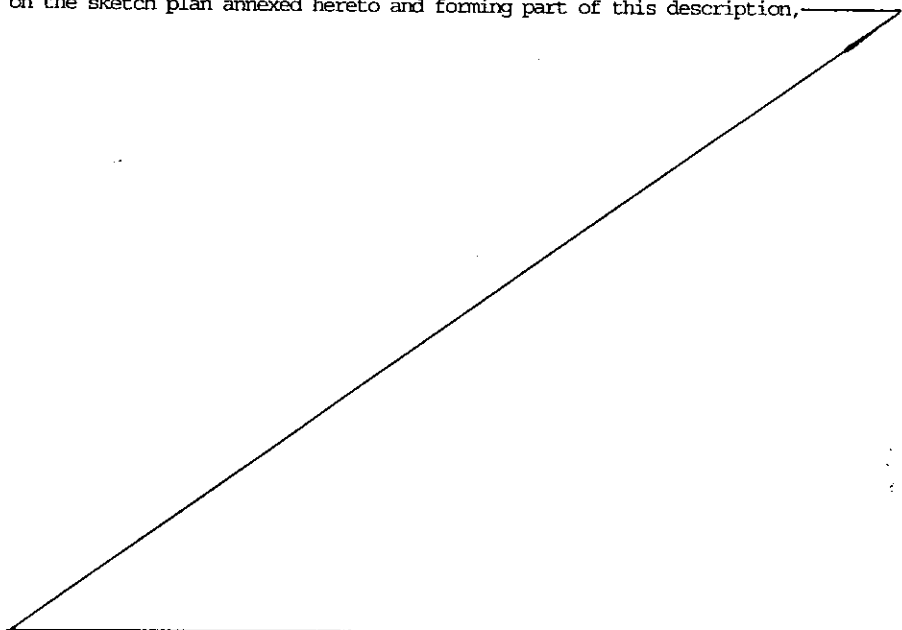
OF THE FIRST PART

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 JS

Canada

DUPLICATE

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

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- (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.

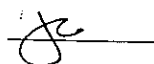
THE PARTIES COVENANT AND AGREE AS FOLLOWS:

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.

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DUPLICATE

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

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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.

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

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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.

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DUPLICATE

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

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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.

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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 enures 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

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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)

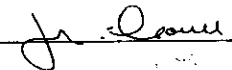
 (SEAL)
Director's Signature


Director's Witness

SEALED, ATTESTED TO AND DELIVERED

SHELL CANADA LIMITED

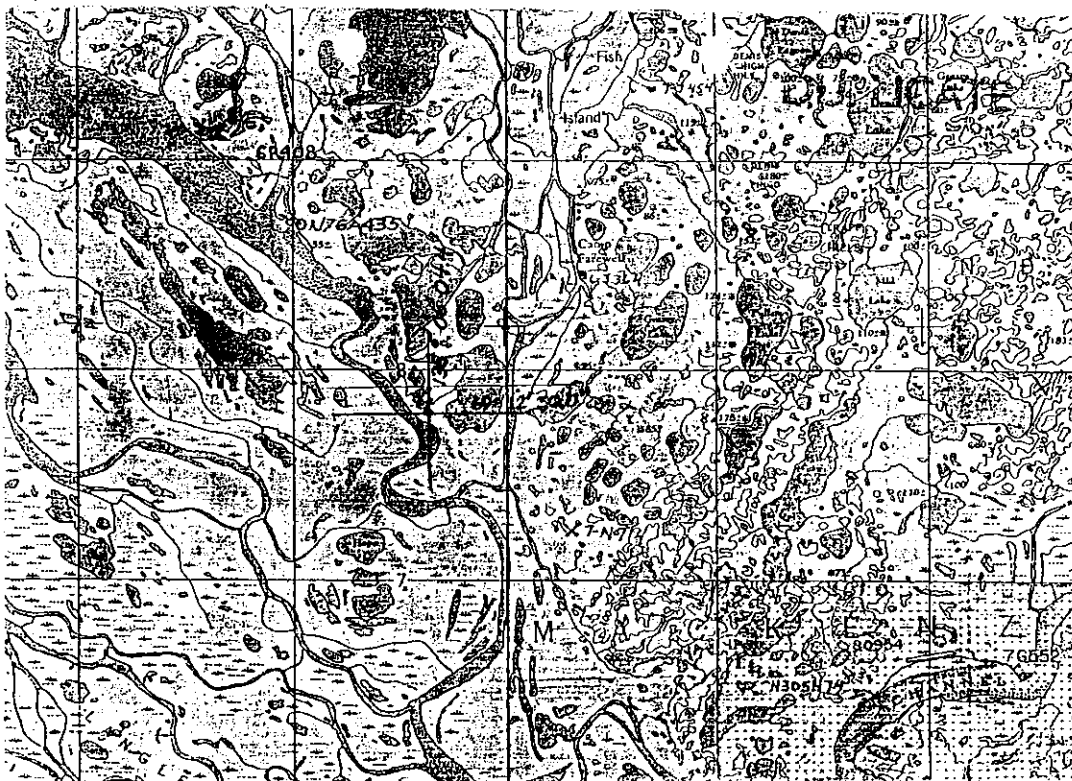
by the

 (SEAL) JMC

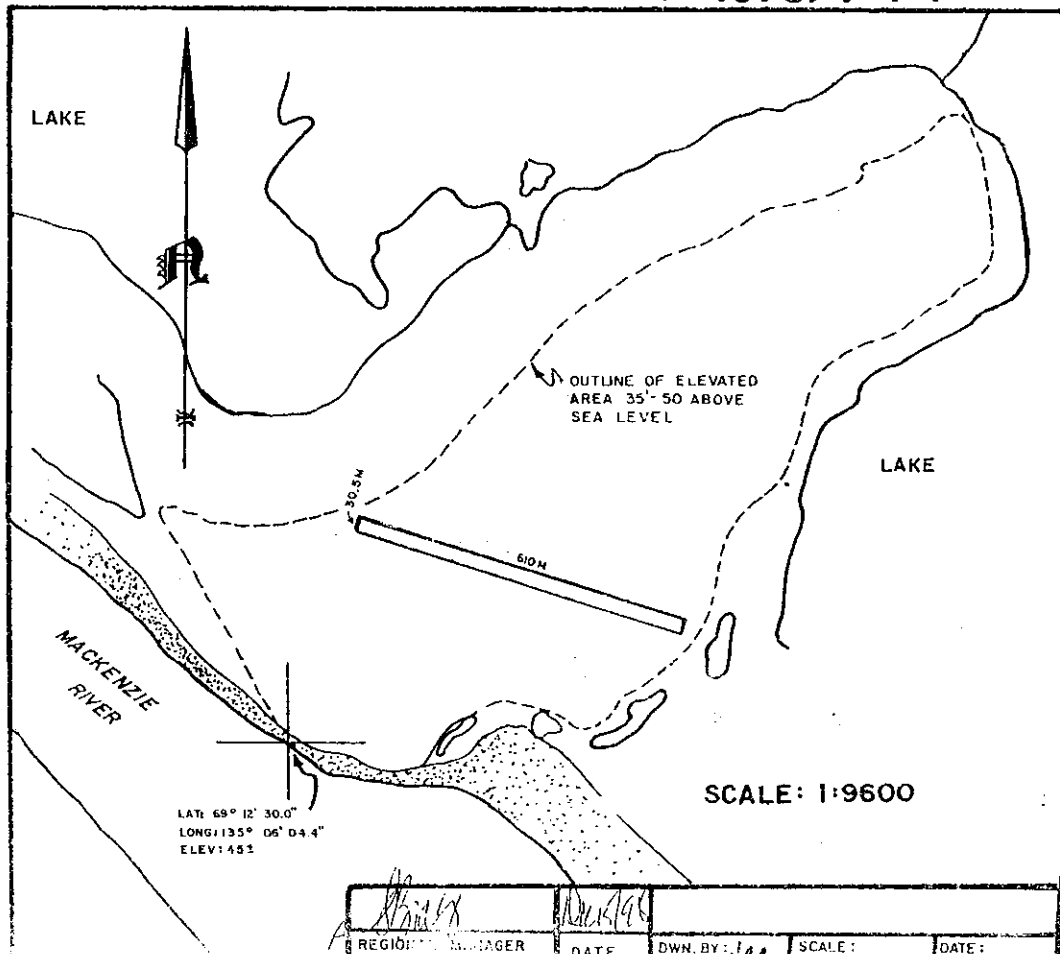
and the

JANE M. COULL
Assistant Secretary (SEAL)

of Shell Canada Limited



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



REGION: MACKENZIE	DATE: 1975 06 13	DWN. BY: J.A.P.	SCALE: AS STATED	DATE: 1975 06 13
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APPENDIX III

PERMIT # NWT-MBS-99-02

PERMIT TO: Enter and conduct activities in the Kendall Island Migratory Bird Sanctuary

ISSUED TO: Shell Canada Limited,
400-4th Avenue, S.W.,
P.O. Box 100, Station M
Calgary, AB
T2P 2H5

DATE OF ISSUE: November 19, 1998

DATE OF EXPIRY: December 31, 2001

PERMIT NUMBER: NWT-MBS-99-02

ISSUED BY: Paul Latour,
Canadian Wildlife Service,
Yellowknife, NT

PERMIT CONDITIONS:

See attached.

NOTE: Although you are being issued a three year permit, we will require a brief summary report of your activities in the Sanctuary at the end of each year.

signature of holder

Staff Land and Forest
Shell Canada Limited

for the Minister

Canada

See letter dated
Nov 19/98. - covers
both sites.

(enc)

Permit Conditions:

1. This permit is not valid unless signed by the permittee (holder) or authorized representative, in the space designated as "signature of holder".
2. All activities of personnel carried out under the authority or on behalf of the permittee fall under the conditions of this permit.
3. All special conditions are part of this permit. Special conditions can be added at a later date, and will be in force at time of issuance of amended permit.
4. Regardless of the expiry date of the permit, the permittee will be responsible for the activity necessary and the cost of that activity for the clean up or restoration of habitat as deemed necessary by Environment Canada.
5. The permittee or his/her delegate must carry a copy of this permit with them at all times. He/she must also ensure that all persons engaged in the activity understand and abide by permit conditions.
6. The permittee is responsible for obtaining whatever other permits are necessary to undertake the activity, and must obtain them prior to beginning the activity.
7. Issuance of this permit does not exempt the permittee from other relevant Canadian laws and regulations.
8. Additional restrictions may be imposed by an Environment Canada Enforcement Officer if that Officer deems it necessary.
9. Access by helicopter or fixed-wing aircraft is permitted only if such aircraft are equipped with tundra tires or the equivalent.
10. The activity must be undertaken in such a way as to minimize disturbance to wildlife and wildlife habitat.
11. All combustible garbage and debris must be incinerated on a daily basis. Other garbage and debris must be removed from the Sanctuary.
12. The presence of a wild animal that may potentially create a hazard to people or property shall be reported immediately to the nearest Renewable Resources Officer (Pond Inlet) or RCMP officer (Pond Inlet).
13. At no time shall persons under this permit feed wildlife, or attempt to attract wildlife into an area of human activity.

14. One aircraft per day only is permitted, and no more than one of each type of aircraft for the purpose of protection.

15. Aircraft shall maintain heights of 1500 feet (457 metres) above ground level whenever possible.

16. Aircraft approaches and take-offs shall be conducted in a manner that will minimize both the disturbance of wildlife and the extent of the sanctuary that must be overflown at altitudes below 1500 feet above ground level.

17. The permittee shall submit a detailed report within thirty (30) days of the expiration date of this permit. The report shall include the number and species name of all wildlife observed, camping sites and travel routes, and other items of interest.

APPENDIX IV

SPILL SEARCH RESULTS

**FAX TRANSMISSION**

Date: August 21, 2000

Pages: 2, Including Cover

To: **Wes Funk or Jennifer Mead**
Komex International Ltd.
Fax: (403) 247-4811

From: **Lisette Self**
Research Assistant
Environmental Protection Service
Resources, Wildlife and Economic Development
Government of the Northwest Territories
600, 5102 – 50th Avenue
Yellowknife NT X1A 3S8

Telephone: (867) 873-7654
Fax: (867) 873-0221

Subject: **Spill Report Camp Farewell**

Attached is a report showing only two spills for the noted location. This report is for spills from 1971 to August 3, 2000.

If you want more information on these spills call or fax me at the above numbers. Bye for now.

I am unable to answer your questions about waterwells, landuse and environmental regulatory information, Ken or Harvey will be the ones who will be responding to you regarding these items. Harvey is away until the 28th and I am not sure of Ken's schedule as he is covering off a couple of positions at this time. I would suggest calling again next week if know one has returned your call.

Lisette

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Resources, Wildlife and
Economic Development
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Hazardous Materials Spill Database

Environmental Protection Service of RWED

600, 5102-50th Avenue; Yellowknife, NT X1A 3S8
Phone: (867) 873-7654 Fax: (867) 873-0224



Northwest
Territories

Monday, August 21, 2000

Sorted by Spill Number for the year(s) : 1971-2001

Page 1 of 1

Spill No	Spill Date	Region	Location	Description	Commodity	Quantity (L or kg)	Party	Source	Agency
1978004	23-Jan-78	INU		Shell Oil Farewell Base Plant	Diesel Fuel	80 Imperial Oil		PL	INAC
1981029		INU		Camp Farewell Between Inuvik & Tuk	Sludge/Water Mix	788596 Canmar		ST>	INAC

Total Spills on this Report: 2

This report contains information regarding spills that were reported to the NWT 24-Hour Spill Line. The absence of information on any particular location in no way guarantees that contamination has not occurred at that location.

LEGEND

Region:	Source:	Agency:
BAF - Baffin	AIR - Aircraft	CCG - Canadian Coast Guard
DEH - Deh Cho	DRUM - Drum or Barrel	EP - Environment Canada
INU - Inuvik	MV - Marine Vessel	GN - Government of Nunavut
KEE - Keewatin	NS - Natural Seepage	GNWT - Government of the Northwest Territories
KIT - Kitikmeot	OTH - Other Transportation	ILA - Inuvialuit Land Administration
		INAC - Indian and Northern Affairs Canada
		NEB - National Energy Board