TRUE GRIT
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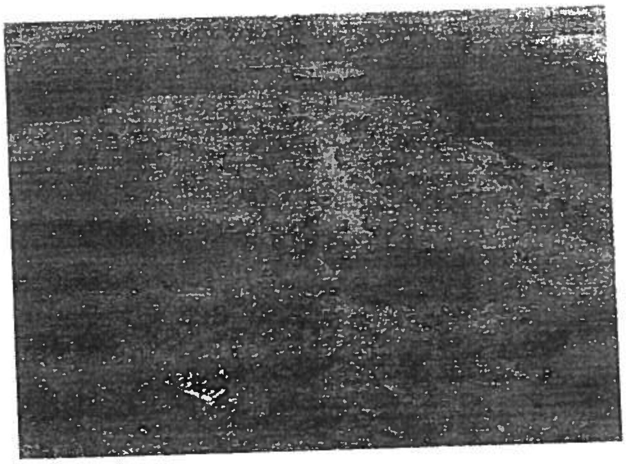
Starfield Resources Inc.

Remedial Action Plan

Old Camp and Air-Strip, Ferguson Lake, Nunavut

DRAFT REPORT



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December 21, 2007

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1.0 Introduction

True Grit Consulting Ltd. (TGCL) has been retained by Starfield Resources Inc. (Starfield) to provide engineering and environmental services in association with the preparation of a Remedial Action Plan (RAP) for petroleum hydrocarbon impacts to soil at the Old Camp Site, Ferguson Lake, Nunavut (Figure 1). The purpose of the work was to prepare the RAP for submission to the Kivalliq Inuit Association (KIA), and other applicable agencies for their review and approval prior to proceeding with remedial actions. In addition, the RAP will provide Starfield with a go forward plan to restore the site to an acceptable condition.

1.1 Background Information

Starfield has been exploring mineral deposits (nickel, copper, palladium and platinum group) at Ferguson Lake, Nunavut since 1999. Ferguson Lake is located in the Kivalliq Region of Nunavut Territory. The Site is approximately 186 kilometers south west of the Hamlet of Baker Lake and 240 kilometers west of the Hamlet of Rankin Inlet. The general location of the site is shown in Figure 1.

Inco initially began exploration of the property in 1950 and maintained the mineral rights for approximately 40 years. The Homestake Mineral Development Company obtained the property rights in 1987 and in 1998; the property was acquired by Starfield, who have maintained an exploration and development presence since that time. Results of exploration activities are positive with the discovery believed to be the largest recent discovery of base and precious metals in North America. Starfield are currently completing final exploration drilling and a scoping study at the Site. Mine feasibility studies are scheduled to be complete by 2009 with final permitting and mine construction set for 2010.

The original exploration camp (Old Camp) and the existing airstrip are located on Ferguson Island (Figure 2). The camp and airstrip facilities were leased by Starfield from Ferguson Lake Lodge in 1999 to support the ongoing exploration activities at the Ferguson Lake area. Starfield has recently constructed a New Camp on the western shores of Ferguson Lake (approximately 3.5 kilometers to the northwest of the Old Camp site) and no longer uses the Old Camp. It is important to note that several temporary buildings were constructed by Starfield at the Old Camp site and that these buildings/facilities have either been relocated to the New Camp site, decommissioned and disposed of or will be relocated in spring/summer of 2008. These buildings/facilities include:

- Tractor Shed.
- Temporary Lodging/Office Tents.
- Temporary Office Facilities.
- Shop Facilities.
- Old and New Incinerators (Old Incinerator has been decommissioned).
- Various storage sheds/structures.

Starfield will continue to use the airstrip on the island until the completion of the construction of a new airstrip near the New Camp in the summer of 2008. Upon completion of demobilization by Starfield, the buildings labelled as Camp and First Aid Post will remain on site, as shown in Figure 3.

1.2 Previous Studies

Rescan Environmental Services Limited (Rescan) were retained by Starfield to complete baseline environmental work at the Ferguson Lake site related to obtaining the data required for site development, operation and closure. As part of Rescan's ongoing site activities, two site investigations regarding the assessment of petroleum hydrocarbon impacts at the Old Camp and Airstrip were completed:

1. Rescan Environmental Services Ltd. (Rescan), November, 2007, *Assessment of Hydrocarbon Soil Contamination at Ferguson Lake,* Prepared for Starfield Resources Inc. by Rescan Environmental Services Ltd.

2. Rescan Environmental Services Ltd. (Rescan), May, 2007, *Hydrocarbon Contamination Assessment at Ferguson Lake Camp*, Prepared for Starfield Resources Inc. by Rescan Environmental Services Ltd.

Both of these reports were provided to TGCL by Starfield and serve as the basis for the characterization and delineation of petroleum hydrocarbon impacts at the Site.

1.3 Scope of Work

Based on the results of previous environmental site assessment reports, and information obtained through correspondence with Starfield for the site, TGCL recommended the following work in order to prepare the RAP:

- Complete a detailed review of the 2006 and 2007 Rescan Site Assessment Reports to assess the characterization of environmental impacts and site conditions.
- Assess potential options for site remediation including feasibility, schedule and cost implications. The options assessment will include typical in-situ (i.e. multi phase extraction, in-place risk management etc.) and ex-situ treatment (i.e. engineered bioremediation/landfill facilities etc) systems.
- Evaluate remedial options in consideration of site characteristics and applicable receptors.
- Prepare DRAFT RAP document including conceptual site plans, drawings, etc.
- Prepare a Class B capital cost estimate, bound under separate cover, for implementation and construction of the preferred RAP.
- Review DRAFT RAP and Class B cost estimate with Starfield.
- Prepare FINAL RAP, incorporating results of client review.
- Present FINAL RAP to Starfield to submit to the KIA for review and approval.
- Finalize RAP after KIA review and commentary.

2.0 Site Setting

The following section documents the physiographic site conditions including on and off-site land use, topography, hydrology and hydrogeologic conditions.

2.1 Site Description

For the purposes of this RAP, site conditions referenced and utilized in the generation of remedial criteria will be those anticipated to exist upon the completion of the demobilization of Starfield buildings and equipment in spring/summer of 2008.

The Old Camp site is located at the north end of Ferguson Island on one of three substantial bedrock outcroppings, while the airstrip is located towards the south end on a different bedrock outcrop. A third outcrop is located on the western end of the island which appears to have no evidence of past development. A small gravel access route runs from the airstrip to the camp site and to what appears to be a seasonal boat launch on the north side of the island. Soil cover at the Site (both the camp and the airfield) is limited to shallow pockets of overburden located in localized bedrock depressions with overburden thickness anticipated to increase towards the shores of the island. Permafrost is anticipated to be encountered at varying depths depending on overburden thickness and soil conditions.

Starfield has constructed a "New" Camp and Airstrip near the exploration site and have removed the majority of their structures and equipment from the Site. Remaining structures owned by Starfield and/or their sub-contractors will be removed in spring of 2008. The airstrip on Ferguson Island will continue to be used by Starfield until the completion of a new airstrip in 2008 at the New Camp site. The island will continue to be used for core storage for some period of time. Once the demobilization of Starfield infrastructure is complete, the remaining structures on the Site will consist of the several camp buildings and supporting infrastructure as well as core storage.

2.2 Surrounding Land Use

The Site and surrounding sites are located entirely within Inuit Owned Lands. The lands surrounding the Site are not developed and consist primarily of undisturbed areas of exposed bedrock with pockets of surficial soils and tundra. The Site is located on a small island and is therefore surrounded by the waters of Ferguson Lake. There are no permanent communities located in the general vicinity of the Site with the only occupation being that of the Starfield New Camp and several seasonal hunting and fishing camps used by the residents of local Hamlets and/or outfitters.

2.3 Topography

Both the camp site and airstrip are located on topographic high points on Ferguson Island.

Available aerial photography for the Old Camp site shows what appears to be a seasonal drainage course to the south east of the camp (near the former incinerator locations), localized drainage will likely flow towards this low lying area and follow a south east direction along the apparent drainage course. Resulting regional runoff will be directed to Ferguson Lake to the east. Specific regional drainage characteristics will be confirmed during subsequent site work in the spring/summer of 2008.

Local drainage from the impacted areas at the airstrip is likely to either the north or the south as the eastern and western areas surrounding the airstrip appear to contain exposed bedrock ridges. Although the available aerial photography does not provide sufficient information to definitively determine local drainage patterns, based on the presence of bedrock outcrops and what appears to be a large seasonal drainage course to the north east of the airstrip, runoff is likely directed towards this channel and subsequently discharges to Ferguson Lake on the east side of Ferguson Island.

2.4 Hydrogeology

The Site is located on an island in Ferguson Lake with numerous bedrock outcroppings. Groundwater will likely be encountered in the overburden present in bedrock depressions, however would be considered seasonal only and is not considered to be hydraulically connected to the regional groundwater table do to the presence of both shallow bedrock and permafrost. Site data from the active exploration zone on the western shores of Ferguson Lake indicate that permafrost thickness averages approximately 100 to 120 meters in depth.

2.5 Geology

Based on information available from Starfield and a review of available online geological resources, bedrock in the area likely consists of gabbro with intermittent sulphide deposits. Exposed bedrock is a smooth glaciated rock with intermittent shallow depressions containing granular overburden with a shallow organic mat (tundra).

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3.0 Site Conditions

3.1 Site Assessment and Remediation Criteria

The KIA has adopted the CWS as well as the CCME Soil Quality Guidelines for BTEX. TGCL has completed a review of the Site and its characteristics with respect to the selection of the appropriate CWS and CCME Criteria.

Based the potential future use of the site for residential (fishing camp) purposes and the sensitive nature of the ecological receptors in the area, we propose that the residential (sensitive) site criteria be used as remedial objectives. Surface soils standards (CWS) are selected as the maximum depth of soil encountered as per the Rescan reports was less than the 1.2 meter defining depth for surface soils.

The governing pathways selected (CWS) for remedial objectives were vapour inhalation for a slab on grade foundation for the lighter hydrocarbons (F1 and F2). Although the buildings remaining are on elevated, pier type foundations, the potential for the inhalation of soil vapours is considered higher with this type of construction, thus the more conservative remedial objective was selected.

The governing pathway selected (CWS) for the heavier hydrocarbons was ecological soil contact, based on the site use after remediation is complete.

BTEX remediation limits were as per the current CCME Soil Quality Guidelines for residential/parkland sites.

The following table summarizes the selected remedial objectives for the site:

Table 1: Remedial Criteria

Parameter	Criteria
Benzene	0.5 mg/kg
Toluene	0.8 mg/kg
Ethylbenzene	1.2 mg/kg
Xylene	1.0 mg/kg
F1 hydrocarbons (C_6-C_{10})	30 mg/kg
F2 hydrocarbons (C_{19}-C_{16})	150 mg/kg
F3 hydrocarbons (C_{16}-C_{34})	400 mg/kg
F4 hydrocarbons (C_{35} +)	2800 mg/kg

3.2 Previous Soil Investigations and Results

Rescan has completed two environmental site investigations at the Site under separate contract to Starfield. Reports for both investigations have been provided to TGCL by Starfield for use as reference material regarding the environmental site conditions for the preparation of this RAP

The first investigation involved the collection of several soil samples from areas of suspected petroleum hydrocarbon impact around the camp and airfield site in the summer of 2006. The associated report for the 2006 program is entitled "*Hydrocarbon Contamination Assessment at Ferguson Lake Camp*" and dated May, 2007 and is included in Appendix A. Samples were analysed against British Columbia standards for petroleum hydrocarbons in soil and compared to the Canada Wide Standards (CWS). Analytical results indicated the presence of elevated levels of petroleum hydrocarbons around the tractor shed, the huts, the old and new incinerators, and the shop. Delineation was not completed during this preliminary investigation and recommendations were made for further sampling and analysis to be completed during the summer of 2007.

The 2007 investigation involved the further sampling and characterization of soils in areas previously flagged as potentially impacted during the 2006 field program. Samples were analysed against CWS remedial criteria for ecological soil contact to determine areas requiring remedial action.

Fuel and heavy oil (i.e. lubricants) impacts were noted in most areas investigated with soils in the vicinity of the shop and tractor shed being mostly limited to heavy oil impacts. Most samples were noted to exceed the selected remedial criteria for the areas investigated. The extent of impact was not completely delineated and additional soil sampling was recommended.

Analysis was completed for F1-F4 hydrocarbon fractions only. Additional analysis of Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) will be required in the future as site remediation should be completed as dictated by CWS for F1-F4 fractions and CCME Soil Quality Guidelines for BTEX.

3.3 Petroleum Hydrocarbons in Soil

The application of the more stringent remedial criteria for the Site results in little difference to the volume of soil to be remediated. Please refer to Appendix A for the Rescan results.

3.3.1 Old Camp

Figure 3 illustrates the estimated lateral extents of petroleum hydrocarbon impacts to soil based on the Rescan results. Average depths of impacts were noted to equal the total depth of soil to bedrock in most cases and can be estimated to average approximately 0.1 meters. It is noted that impacts around the tractor shed and shop were mostly in the heavier hydrocarbon range suggesting that they consist primarily of heavy oil impacts.

As the two larger camp buildings are scheduled to remain on the Site once Starfield's demobilization is complete, two approaches are possible regarding any impacts under these buildings. Firstly, the buildings could be temporarily moved or shored to facilitate the removal of any impacted soil from beneath them. Alternatively, remedial excavations can be ended within a specified distance of the buildings (approximately 1 meter). If impacts are confirmed to extend under these buildings, it is recommended that they be removed, as leaving impacts will result in an incomplete remediation and will leave potential liabilities at the Site that could be attributed to Starfield in the future. Should Starfield decide to leave these impacts (if they exist) in place, delineation of the extents should be completed so as to document the environmental condition to preclude any potential confusion or debate regarding the condition of the Site upon Starfield's final demobilization in the future. For the purposes of this RAP, it has been assumed that impacts will be removed from under these buildings.

Based on the numerous visible bedrock outcrops at the Site, remedial excavations are anticipated to be limited to isolated pockets of overburden. The estimated fraction of the total delineated area which will require excavation or remediation is approximately 70%.

Based on the total delineated area and the estimated fraction of soil coverage, a total volume of petroleum hydrocarbon impacted soil at the Old Camp is calculated at approximately 1,330 m^3. Of this total, approximately 140 m^3 is estimated to consist primarily of heavy oil impacts. The remainder consists of lower weight hydrocarbons such as fuel oils and gasoline.

Final delineation has not been completed at the Old Camp Site. Estimated soil volumes could require adjustment based on final delineation results.

3.3.2 Airstrip

Figure 4 illustrates the estimated lateral extents of petroleum hydrocarbon impacts to soil based on the Rescan results. Average depths of impacts were noted to equal the total depth of soil to bedrock in most cases and can be estimated to average approximately 0.1 meters.

Based on the presence of visible bedrock outcropping in the area, it is estimated that 90% of the total delineated area will require excavation or remediation.

Based on the total delineated area and the estimated fraction of soil coverage, a total volume of petroleum hydrocarbon impacted soil at the Air-Strip is calculated at approximately 80 m^3. The impacts consist of lower weight hydrocarbons such as fuel oils and gasoline.

3.4 Petroleum Hydrocarbons in Groundwater

No assessment was carried out with respect to petroleum hydrocarbon impacts to groundwater. While regional groundwater is anticipated to be hydraulically and physically disconnected from seasonal groundwater (i.e. ground frost melt water and snow melt infiltration), it would be prudent to complete some preliminary assessments of this during the spring/summer site visit.

3.5 Petroleum Hydrocarbons in Bedrock

No assessment was carried out with respect to petroleum hydrocarbon impacts in bedrock. Bedrock appears to be solid with no notable levels of cracking or fracturing. A formal assessment of bedrock is not considered necessary at this time. Once remediation of the petroleum hydrocarbon impacted soil is completed, a confirmatory assessment of bedrock can be undertaken. If excavation is implemented as a remedial option, this assessment can be a visual inspection of the bedrock surface underlying the excavated areas. If in-situ options are implemented, a test pit or borehole program can be implemented to effectively inspect selected areas for fracturing and the potential for migration of impacts in fractured bedrock.

3.6 Additional Investigation

As noted in previous sections of this report, additional soil investigations will be required in order to obtain final delineated areas of soil impacts. In addition, the collection of additional soil samples for analysis of BTEX is required to ensure that adequate delineation of soils impacted above the appropriate CCME Soil Quality Guidelines has been completed.

We anticipate that the number of additional samples will be on the order of 25 – 50 and will required in select areas only. Augmentation of the existing site data with that collected in the spring/summer of 2008 should result in a relatively complete coverage of the Site with respect to impact delineation and remedial systems detailed design and implementation.

We anticipate the completion of this additional investigation during a brief site visit in the spring/summer of 2008. Additional work such as topographical survey, facility site selection and design will also be completed during this site visit.

The results of this additional site visit and investigation will provide additional data regarding the extent of impacts and the detailed design requirements for the select remedial systems. Detailed engineering design and construction drawings for the remedial facilities will be provided at that time and will be integrated into the existing RAP.

4.0 Remedial Options

Options for the remediation of petroleum hydrocarbon impacts to soil generally fall into two categories, In-Situ and Ex-Situ options. The following sections present details regarding the definitions of each category and present several options for site remediation.

4.1 In-Situ Options

In-Situ remedial options involve the treatment of the impacted soils in place using a variety of different remedial technologies. These techniques may involve *passive remediation* where the naturally occurring processes (biological and physical) in the soil are allowed to continue to provide environmental protection and overall reduction in contaminant concentrations. Alternatively, the in-situ approach may involve *active remediation* where efforts are made to enhance the progress of the natural processes in order to speed up or improve the remediation process. The goal of each is to obtain adequate reductions in contaminant levels to meet the established remedial criteria and obtain site closure.

There are several in-situ techniques that could be implemented at the Site and the following presents a synopsis of each potential approach.

4.1.1 Soil Vapour Extraction (SVE)

Soil Vapour Extraction (SVE) involves extracting soil gas from the zone between the ground surface and groundwater surface (vasdose zone). The purpose of this process is to transport the volatile organic compounds (VOC's) associated with petroleum hydrocarbon impacts to the ground surface for treatment or destruction. The process involves the installation of screened wells in the unsaturated and impacted soil zones. The wells are generally connected to a header and a vacuum pump which will be used to introduce a negative pressure into the soil in order to extract the vapours. As the vapours are extracted, a chemical gradient is established which encourages additional volatization of additional VOC's from the impact plume. As the process continues, an overall reduction in petroleum hydrocarbon concentration will be realized in the contaminated zone.

In some cases, and recommended for arctic sites, the process is thermally enhanced. This is accomplished by introducing heat into the soil zone to enhance the vapour transport and removal process. This essentially enhances both the physical process of vapour travel and the chemical process of phase partitioning from liquid (in groundwater or soil moisture) phase to the gas phase (vapours) as governed by Henry's Law or from the soil pore space surfaces to the vapour phase (Raoult's Law). This technique is best suited to course grained soils with the majority of impacts being confined to the soil matrix and little groundwater and free product impacts being present.

Extracted soil vapours are treated by ancillary equipment that use treatment technologies such as granular activated carbon or catalytic oxidation. Regular monitoring of the in-situ soil conditions is required in order to track remediation progress and determine final closure schedules.

In the case of arctic sites, active zone (zone of soil between the ground surface and permafrost surface) will be the area where vapours will be extracted. The active zone is the layer of soil that is subject to thawing during summer months. Groundwater may be encountered in a perched fashion during the summer thaw. Depending on the specific site conditions, in the case of the Site, the depth of bedrock depressions, the active layer may vary substantially in depth. Given the climactic conditions anticipated at the Site, the seasonal window for effective implementation of the SVE technique is estimated to be between one and two months.

4.1.2 Multi-Phase Extraction (MPE)

The term Multi-Phase Extraction (MPE) represents a generic category of in-situ remediation technologies that simultaneously extract more than one fluid phase from wells or trenches installed in the contaminated soil and groundwater zone. The extracted phases generally gas (including VOC's) and liquid (including groundwater with dissolved contaminants and free product). The setup is generally similar to that of the SVE technique with the addition of a screened section of well that spans the water table to ensure that both the soil vapours and groundwater/free product are removed with the negative pressure pump.

The gas and liquid phase can be conveyed to the surface either in the same conduit (two phase extraction) or different conduits (dual phase extraction), depending on site specific considerations and budgetary limitations.

Extracted contaminated vapours are treated using similar techniques as described for the SVE system. Contaminated liquids are generally treated similarly with free product generally being separated from the water stream using oil water separators. The contaminated water is then treated through use of active oxidation or activated carbon filtration.

This technique is best suited for situations involving a high degree of groundwater contamination and the presence of free product.

Again, with arctic sites, the season for this technology will be short (2 to 3 months) and the groundwater table will likely be perched and encountered at varying depths depending on permafrost and bedrock conditions.

4.1.3 Enhanced Biodegradation

Enhanced biodegradation is a general term used to describe the acceleration of naturally occurring microbial and physical processes in the soil matrix that result in an overall reduction in petroleum hydrocarbon concentration. There are numerous methodologies that can be implemented to enhance the natural reduction of contaminant levels. The specific methodology implemented depends on numerous site specific conditions such as nutrient level, moisture content, groundwater characteristics and impact levels, soil conditions and organic content.

As a general rule, enhanced biodegradation involves the provision of air, nutrients, heat, organics, etc. to optimize the environment for microbial growth and increase the potential for the desired populations (i.e. petroleum hydrocarbon metabolizing) to thrive. The result is an acceleration of the natural attenuation process and timelier overall reduction in contaminant levels.

The addition of air (soil venting) whether passive or active is also considered to add to the volatization of the petroleum hydrocarbons and, similar to SVE, result in a reduction of contaminant levels.

As with the previously mentioned technologies, the harsh environmental conditions of the arctic will have an effect on the performance of any of the above noted enhancement techniques. The effective window for natural bioremediation processes to occur would be midsummer (approximately 1-2 months).

These measures are usually considered applicable in situations where large volumes of impacts are found and where high levels of site disturbance are precluded (i.e. under buildings, tanks farms, roads, etc).

4.1.4 Natural Attenuation and Risk Management

Natural Attenuation is the process of reliance on the natural physical, chemical, or biological processes occurring in the soil and groundwater matrix to reduce the contaminant concentration to the site specific remedial objectives. The Risk Management portion of this alternative involves the regular monitoring of soil and groundwater conditions to ensure that the remedial process is occurring and that no immediate risks exist or come to existence to the various receptors that may be present on the Site.

Essentially, the alternative involves no intervention to remove, contain or enhance the biological and physical remediation of the site impacts. The monitoring program will serve to track the remedial progress and to ensure that processes such as contaminant migration do not pose an unacceptable risk to receptors.

This process is commonly implemented for impacts such as landfill leachate when facilities are sited such that the natural attenuation process is optimized by existing site conditions. Also, for petroleum hydrocarbon impacts at non-sensitive sites with conditions such that these processes occur in a very timely fashion this alternative might prove attractive.

In the case of the Ferguson Lake site, this alternative, if implemented, would require the completion of several up-front investigations to determine the rate of degradation, level of nutrients, soil moisture, oxygen, bacterial populations, etc. prior to its implementation. Additionally, the selection of such an alternative would require that Starfield provide justification and rationale to the KIA and other interested parties.

4.1.5 In-Situ Containment

In-Situ Containment essentially involves the physical containment of impacts to their existing area which precludes the potential for contaminant migration and/or impact on the various receptors in the area. Several options exist for In-Situ Containment, some of which have been successfully utilized in the Canadian Arctic.

In some cases, in climates such as the Canadian arctic, permafrost can be utilized to provide a natural containment of petroleum hydrocarbons. TGCL personnel have completed work in the arctic that involved the promotion of permafrost migration to encapsulate areas of soil impact by placing an insulating layer of gravel over areas of known contamination. The layer of gravel will insulate the underlying permafrost from the warmer summer air temperatures resulting in an upward migration of the permanent permafrost depth to encompass the impacted zone and effectively eliminate transport in the active zone during summer thaw. Once complete, the contaminated areas must remain covered since disturbance of the cover will result in reduction of permafrost containment and thus can lead to impact migration. Such techniques must be carefully planned and involve the collection of sufficient baseline environmental, climactic, geotechnical and geothermal data along with detailed and complete contaminant delineation. Additionally, land use for areas treated with such techniques must remain the same as for the design scenarios.

Other forms of In-Situ Containment involve the installation of impermeable barriers along the lateral extents of the contaminated zone and the provision of adequate top treatments (impervious soil, liners, etc) to ensure that no infiltration occurs into the contaminated zone from precipitation and runoff and that no lateral migration of impacts occurs as a result of this. Such techniques, known as encapsulation, are suitable for arctic environments as lateral barriers are often "locked" into the permafrost layer providing additional assurance against breakthrough. As with the above noted re-grading alternative, detailed delineation and site specific climactic and geotechnical data are required in order to effectively implement such techniques.

Given the soil conditions at the Site (numerous pockets of soil in bedrock depressions) implementation of this technique would be considered complicated and would likely involve the encapsulation of numerous areas of impact.

4.2 Ex-Situ Options

Ex-Situ remedial options involve the removal of impacted soils and/or groundwater from the existing area of impact for treatment and/or disposal at another location. As all the options presented for ex-situ remediation will involve the excavation of impacted soil, a brief description of the excavation process is presented below.

In cases of soil impacts only (as is the case with the Site), excavation limits will be established by the delineated (both laterally and vertically) limits of the contaminated areas with petroleum hydrocarbon concentrations in excess of the applicable remedial criteria. Soils within the delineated area will then be excavated to clean limits and transported to the designated storage or treatment area. It is recommended that on site monitoring of excavation limits be completed by a qualified environmental professional to ensure that the remedial criteria are being met. Monitoring should involve the collection of confirmatory samples during the excavation process. Confirmatory samples should be screened both visually and by measuring organic vapour concentrations to assess the potential for petroleum hydrocarbon impact in order to direct further excavation if necessary. Organic vapour concentrations are typically measured by agitating the sample within a polyethylene bag, creating a small puncture hole in the bag and then inserting the probe of an organic vapour analyzing device, such as a GasTech Model hydrocarbon analyzer or Photo Ionizing Detector (PID) into the bag to measure the corresponding vapour concentration.

Once remedial excavation operations are confirmed to be complete, verification samples should be collected from the walls and base (unless founded on bedrock) of the excavation for laboratory analysis for petroleum hydrocarbon content. Given the remote location of the Site and the long turnaround times to ship samples to laboratories in the south, it is suggested that verification samples be analysed in the field to provide further confirmation that remedial measures are met. Several field analytical products are available for such use. The excavated area can then either be backfilled with clean imported fill or left in its excavated state to naturally attenuate over time. In the case of the Ferguson Island areas, it is recommended that, based on the shallow depth of overburden, that backfilling is not completed. Completion of backfilling of these areas would not be considered to provide a measurable improvement to the local environmental conditions and, in fact, the transport of backfill material to the excavation areas may result in environmental impacts (i.e. damage to tundra, habitat, etc.) that would supersede any benefits realised by the backfilling operations.

Once the excavation of impacted soil is complete, several options regarding the treatment and/or disposal of the impacted soil exist. We have selected several options that would be considered to be applicable to the Ferguson Lake Site. The following sections present a description of the selected ex-situ remedial options.

4.2.1 On-Site Disposal (Engineered Landfill)

Once the soil has been excavated from the impacted area, it can be disposed of on-site in an Engineered Landfill. The landfill would be constructed at an appropriate area near the impacted soil areas to minimize transportation requirements. The landfill should be constructed on a suitable area of the island where topography is as flat as possible so as to minimize fill requirements. In addition, considerations such as regional drainage, soil conditions (type, bearing capacity, etc), proximity to camp buildings, travelled routes, etc. are important to the site selection.

Once an appropriate site is selected, the landfill is constructed by shaping a level area with perimeter berms sufficient in size and volume to contain the petroleum hydrocarbon impacted soil. The base and berms of the facility are typically lined with an impervious material (HDPE liner, geosynthetic clay liner, etc.) to contain the impacted material. The liner typically receives a protective layer of gravel before the placement of the impacted soil within the landfill. Soil is usually placed in layers and compacted to maximize the density (minimize the volume) and stability. Once all soil is placed the landfill is capped with clean granular material and secured with an impervious material similar to that used in the base and perimeter berms. This will result in a complete containment of the impacted soil eliminating the potential for migration and impact on the surrounding environment.

In some cases, ongoing monitoring of the soils and groundwater surrounding (in particular, downstream of) the landfill is required to ensure stability and integrity of the engineered structure. In most cases, groundwater monitor wells are installed around the perimeter of the landfill and sampled annually for petroleum hydrocarbon analysis. Sampling of these wells is a relatively simple process and could easily be completed by Starfield personnel as required.

Engineered landfills usually employ a multi-barrier approach that aids to ensure that breakthrough does not occur. While in southern climates this can typically involve the use of a double liner system, in arctic situations permafrost can be utilized to provide a second barrier to contain the contaminated soil. Similar to the re-grade option presented above, the placement of the landfill and cover material will result in an insulating layer that will promote the upward migration of permafrost.

This alternative would be considered to work very well at the Site. A review of available site information and aerial photos suggests that a location for such a landfill would be relatively easy to select. Climactic considerations also indicate that thermal containment would be effective at the Ferguson Lake Site.

4.2.2 On-Site Treatment (Bio-Pile)

A Bio-Pile is a facility in which excavated contaminated soil is placed on a treatment area that includes leachate collection systems and some form of aeration. It is used to reduce concentrations of petroleum constituents in excavated soils through the use of biodegradation. Moisture, heat, nutrients, oxygen, and pH can be controlled to enhance biodegradation.

The treatment area will generally be covered or contained with an impermeable liner to minimize the risk of contaminants leaching into uncontaminated soil. The drainage itself may be treated in a bioreactor before recycling. Nutrients may be added to the soil before placement on the treatment pad to enhance the biodegradation process.

Soil piles and cells commonly have an air distribution system buried under the soil to pass air through the soil either by vacuum or by positive pressure. Soil piles may be covered with an impervious liner to control runoff, evaporation, and volatilization and to promote solar heating. If there are VOCs in the soil that will volatilize into the air stream, the air leaving the soil may be treated to remove or destroy the VOCs before they are discharged to the atmosphere by use of either activated carbon or other treatment technology.

Once treatment is complete, the treated soils may be left in place at the land-farm, or, depending on remedial targets, may be re-used on site.

Groundwater monitoring requirements are typically similar to those of land-fills; however the duration of these monitoring requirements is limited to the life span of the bio-pile.

Duration of operation and maintenance is dependent on specific soil and site climactic conditions such as hydrocarbon concentration and characterization, nutrient availability, temperature, etc. Heavier hydrocarbons such as heavy oils typically require additional time to remediate than lighter hydrocarbons such as gasoline and jet fuel. Arctic conditions will obviously prove difficult as temperatures are low for the majority of the year. Bio-Piles have been utilized with varying degrees of success in arctic applications.

4.2.3 On-Site Treatment (Land-Farm)

Land-farming is the process of making use of the natural occurring process in soils to biologically and physically reduce contaminant concentrations to an acceptable level. Although similar to other bioremediation processes, the land-farm operation almost always involves the regular mixing (tilling) of the soil to promote aeration and to assist in the volatization of VOC's thus facilitating two processes to reduce contaminant concentrations.

Although some land-farms are operated in-situ and do not involve the excavation and removal of impacted soil, most involve the construction of a land-farm facility where soil is placed in shallow layers and allowed to remediate over time. Typically, a land-farm facility will involve a prepared base and berm system that is treated with an impervious membrane (liner) to prevent the migration of leachate to the surrounding environmental receptors. Additionally, as land-farms are open to the atmosphere, leachate collection sand treatment systems are incorporated into the land-farm structure.

Depending on specific soil characteristics (physical and biological) amendments to soil are sometimes provided to assist and accelerate the bioremediation process. Amendments can include the addition of nutrients, moisture, and sometimes mixing with clean soil with preferential properties to assist the microbial and physical processes of remediation. In the case of Ferguson Lake, with the high level of organic material in soils, mixing with a small volume of highly granular soil may be required in order to air in the aeration process. This can be confirmed during the recommended spring 2008 site visit.

Duration of operation and maintenance of land-farms, as with bio-piles, is dependent on specific soil and site climactic conditions such as hydrocarbon concentration and characterization, nutrient availability, temperature, etc. Heavier hydrocarbons such as lubricants typically require additional time to remediate than lighter hydrocarbons such as gasoline and jet fuel. In some cases soils with different impact characteristics are separated on the land-farm structure to allow for differential closure depending on time of remediation. Alternatively, and dependant on situation Arctic conditions will obviously prove challenging as temperatures are low for the majority of the year. That being said, land-farms have been successfully implemented as remedial options in the arctic depending on remedial objectives, etc. Of particular interest is the application of land-farm technology for the remediation of petroleum hydrocarbon impacted soils at DEW (Distant Early Warning) Line sites across the arctic. TGCL personnel have been involved (both from a design and operational perspective) in several land-farms at these sites.

Once treatment is complete, the treated soils may be left in place at the land-farm, or, depending on remedial targets, may be re-used on site as fill material.

Groundwater monitoring requirements would be similar to those of a bio-pile and would be limited to the life span of the land-farm.

Costs of land-farms are generally not prohibitive when compared to other alternatives as material and handling requirements are usually lower than other ex-situ options. The lower costs are usually offset by the longer durations of treatment typically required in northern climates. Operation requirements are also considered high when compared to options such as land-filling and off-site shipment, but comparable when compared to in-situ options such as SVE or MPE.

4.2.4 Off-Site Disposal

Off-site disposal would involve the containerization of impacted soil and shipment to a treatment facility in the south. In the case of the Ferguson Lake site, shipment to the south would involve both an overland transport and ocean transport to the nearest treatment facility (likely Montreal). Given the remoteness of the site and the absence of permanent transportation routes, it is assumed that the impacted soil would be excavated and containerized during the summer season and stored on site until the winter at which time it would be cat trained to Rankin Inlet for shipment to Montreal via Sea-Lift in the spring of the following year. This would also necessitate storage in Rankin Inlet while awaiting the arrival of the Sea-Lift. Once the shipment arrives in Montreal, transport from the port facilities to the treatment facility would also be required.

Critical considerations for this option include the type and size of containers, type of lining for containers, and logistical considerations for the transport and storage of the impacted soil shipments. This option is typically considered only in cases of limited impact volumes and hazardous contaminants (i.e. high metals, PCB's, etc.). Shipping and treatment costs are usually quite high, precluding the favorability of this option for large volumes of non hazardous impacts. Additionally, federal, territorial and provincial transportation, transfer and storage permits will likely be required and can be prohibitively costly and complicated.

4.3 Remedial Options Evaluation

In order to provide effective recommendations for remediation of the documented petroleum hydrocarbon impacts at the Site, TGCL has completed an evaluation of the various options presented in order to ascertain what is likely the most feasible, effective and economical solution to the Site contamination.

The evaluation was completed by selecting evaluation criteria (discussed in the following section of this report) applicable to the remediation of petroleum hydrocarbon impacts at northern sites. Each criterion was given a weighting based on the criteria's overall importance with respect to the Ferguson Lake Site. Each remedial alternative was then assessed for it's anticipated performance with respect to each individual evaluation criteria. If the alternative was considered to perform exceptionally well for a particular evaluation criteria, it was assigned a higher score, if considered to perform poorly against a particular criteria, it was assigned a low score. Scores are based on the weighting of a particular performance criterion. For example, if a particular criteria has a weighting of 20 and the remedial alternative is anticipated to perform exceptionally well with respect to that criteria, it may receive a score of 20, if anticipated to perform extremely poorly, it may receive a score of 1 or 0. Once the evaluation of all alternatives against all evaluation criteria was complete, the results were tabulated and each remedial alternative was given a total score based on the summation of all scores for each criteria. The alternative which exhibited the best overall performance (i.e. the highest score) is considered the most effective and is this selected as the recommended remedial alternative for the Ferguson Lake site.

The following sections outline the selected evaluation criteria complete with explanatory and definitive notes on each. Additionally, the results of the remedial options evaluation is presented in tabular format which summarises the anticipated performance of each alternative as evaluated against each selected performance criteria. Finally, the remedial option achieving the highest overall ranking is presented along with a detailed discussion of the results of the evaluation of the performance of this alternative.

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4.3.1 Evaluation Criteria

Based on the site specific considerations required at the Ferguson Lake Site, the following set of evaluation criteria, and associated weighting were selected for the remedial options evaluation.

Table 2: Summary of Remedial Options Evaluation Criteria

Criteria	Weighting	Details
Capital Cost	20	This criterion represents the capital or construction costs associated with the remedial option. Capital costs will include, but not necessarily be limited to, items such as: • Excavation costs, • Trucking (haulage) costs, • Materials cost (liners, gravel, etc.), • Equipment costs (purchase or rental), • Labour costs. Capital costs represent the completion of the construction of facilities, initial excavation of contaminated soils, etc. Remedial options with higher Capital Costs will receive a lower score against the overall criterion weighting. For the purposes of this evaluation, operational costs are considered as a separate evaluation criteria.
Operational Costs	10	Operational costs represent the financial burden of ongoing operational requirements for the particular remedial option. For example, if a remedial option involves on-going groundwater monitoring, then such costs would be considered operational costs. Remedial options with higher Operational Costs will receive a lower score against the overall criterion weighting.
Schedule	5	This criterion refers to the estimated time required to meet the remedial objectives. That is to say, how long it will take for the soil to be treated to an acceptable level of impact or how long it will take for the Site to be brought into compliance. Depending on the remedial option, the remedial objectives may be met through different procedures. The highest score will be applied to the remedial option which is anticipated to meet the remedial objectives in the shortest period of time. Although this criterion will be scored based on how fast a particular remedial approach is anticipated to meet the remedial objectives, it has been assigned a relatively low weighting. Given that Starfield will be occupying the New Camp site for some time, remedial options that may take several years are not considered overly prohibitive.

Equipment Requirements	10	Equipment requirements represent the burden of the remedial option with respect to the required equipment to complete the remediation as per the remedial objectives. Options with the minimum equipment requirements will receive the highest score against the criterion weighting.
Labour Requirements	10	Labour Requirements represents the overall manpower required to complete the remediation as per the remedial objectives. Options with high labour requirements will receive a lower score against the criterion weighting.
Socio-Economic Benefits	15	This criterion is related to the Labour Requirements as it is essentially a measure of the potential socio-economic benefit to the residents of the local Hamlets. Options with higher labour requirements will likely result in employment for these people. In addition to employment considerations, opportunities for obtaining skills and training in the use of heavy equipment, environmental sampling and remediation are considered a benefit as well.
Remedial Effectiveness	15	This criterion measures the anticipated effectiveness of the various remedial options. Options that are considered to result in meeting the remedial objectives completely will receive the highest score against the criterion weighting. Options that may result in variable effectiveness (i.e. may not completely meet the remedial objectives) will receive a lower score.
Risk Reduction	15	This criterion is a measure of the anticipated reduction in the risk of impact to the surrounding environment and human presence at the Site. A particular remedial option may, in fact, meet the remedial objectives, but may also result in a slight risk of impact on adjoining receptors. Remedial options that are considered to provide the highest level of risk reduction will receive the highest score against the criterion weighting.

4.3.2 Evaluation Matrix

Each of the nine (9) remedial options was evaluated against the above noted criteria and assigned a "score" against each. The overall ranking of the options was determined by tabulating the score against each evaluation criteria. The results of the remedial options evaluation are presented in the following table.

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Table 3: Remedial Options Evaluation Matrix

Evaluation Criteria Remedial Option	Capital cost (20)	Operational Cost (10)	Schedule (5)	Equipment Requirements (10)	Labour Requirements (10)	Socio-Economic Benefits (15)	Remedial Effectiveness (15)	Risk Reduction (15)	Total (100)
Soil Vapour Extraction	7	5	2	5	4	6	4	2	***35***
Multi-Phase Extraction	7	5	2	4	3	6	5	3	***35***
Enhanced Biodegradation	10	7	1	7	7	12	1	2	***47***
Natural Attenuation	20	10	0	10	10	1	0	1	***52***
In-Situ Containment	10	9	3	5	2	12	11	10	***62***
Engineered Landfill	7	7	5	5	6	5	15	15	***65***
Bio-Pile	7	4	2	4	5	7	11	12	***52***
Land-Farm	9	5	3	6	5	13	14	14	***69***
Off-Site Disposal	5	10	4	2	8	1	15	15	***60***

Notes:

- Highlighted rows indicate options with highest score.

4.3.3 Recommended Remedial Option

As is indicated in the above table, the Land-Farm option received the highest overall score in the remedial options evaluation. Based on the results of this evaluation, it is recommended that Starfield Resources remediate the documented impacts at the Site using this option.

The following Remedial Action Plan is provided based on the use of land-farm technology for the remediation of petroleum hydrocarbon impacts at the Ferguson Lake Old Camp and Airstrip Site.

5.0 Remedial Action Plan

Based on the use of a land-farm to treat the petroleum hydrocarbon impacts near the Site, the following RAP is presented as a basis for the remedial activities on Site.

5.1 Scope of Remedial Work

The scope of the required remedial work is as follows.

5.1.1 Facility (Land-Farm) Construction

The first step in the remedial process involves the construction of a land-farm facility. The facility, once constructed will serve as an acceptance area for the excavated petroleum hydrocarbon impacted soil. The facility will likely consist of a prepared and lined base with perimeter drainage and leachate collection and treatment systems. The facility will not be capped, but will, however remain open to the atmosphere so as to promote aeration of the soil and volatization of the light hydrocarbons as required.

5.1.1.1 Facility Design Considerations

Design considerations for land-farms essentially involve three considerations:

- Required facility size based on estimated volume of impacted soil,
- Containment of the contaminated soil and runoff/leachate, and,
- Promotion of the bioremediation/volatization process.

Based on the estimated volume of impacted soil, and allowing for a 50% contingency, TGCL anticipates that the land-farm will be approximately 85 meters by 85 meters, based on an average soil depth of 0.3 meters. Berm heights may vary, but at this stage can be estimated to be on the order of 1.5 meters in height on average. At this stage, TGCL suggests that heavy and fuel oil impacts may be stored and treated on separate areas of the land-farm as fuel oil contaminated soils would be anticipated to reach remedial objectives faster than heavy oils. Specific land-farm operational procedures will be created once final soil analytical results are received and site selection activities are completed.

The containment of the contaminated soil can be accomplished by choosing a level area that will allow for the construction of a uniformly graded facility with perimeter berms. Based on the nature of the site and the environmental conditions anticipated, it is suggested that a fully lined facility with perimeter drainage and leachate collection and treatment systems be constructed.

As noted, the facility should remain open to the atmosphere to promote aeration of the soil and volatization of the hydrocarbons. In addition, access to tilling equipment must be provided in such a manner at not to threaten the integrity of the liner or drainage collection and treatment systems.

5.1.1.2 Facility Location Options

Based on the review of available site photographs and mapping, TGCL has completed a preliminary site evaluation for the location of the land-farm facility (Figure 5). The site evaluation considered several issues, such as construction suitability, surrounding receptors and adjacency to the majority of the documented site impacts.

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A final, detailed site selection process will be completed during follow-up site visits in the spring/summer of 2008.

5.1.1.3 Construction Schedule

The schedule for the proposed land-farm construction is as follows:

Detailed siteing and facility design:	June/July 2008
Facility Construction:	July/August 2008
Facility Operation:	September 2008 – September 2011 (estimated)

5.1.1.4 Equipment and Manpower

Land-arm construction will involve the use of readily available and typical heavy equipment such as excavators, front-end loaders and dump trucks. Liner installation will be a relatively labour intensive operation and will likely require a workforce of 10 – 20 people, including labourers, operators and project managers.

5.1.2 Excavation and Transport of Petroleum Hydrocarbon Impacted Soils

Once the construction of the land-farm is complete, and final impact delineation results are received, the excavation and transport of petroleum hydrocarbon impacted soils to the land-farm can commence. This process will require supervision by a qualified environmental professional, familiar with the Site and impact dispersion to ensure that remedial objectives are met.

5.1.2.1 Schedule

The schedule for excavation and transport of petroleum hydrocarbon impacted soil is as follows:

Final site delineation:	June/July 2008
Commence excavation operations	August 2008
Complete excavation operations	September/October 2008

5.1.2.2 Equipment and Manpower

Soils excavations will be relatively labour intensive based on the nature of the impacted areas. As noted earlier, impacts appear to be confined to randomly distributed shallow pockets of soil located in bedrock depressions. Equipment requirements will be small mechanical excavation equipment and trucks along with hand tools to aid in the excavation operations.

Manpower requirements will involve a workforce of approximately 10 – 20 people, including labourers, operators and environmental supervisors.

5.1.2.3 Monitoring Requirements

The remedial excavation operations will require full-time monitoring by a qualified environmental professional.

Monitoring should involve the collection of confirmatory samples during the excavation process. Confirmatory samples should be screened both visually and by measuring organic vapour concentrations to assess the potential for petroleum hydrocarbon impact in order to direct further excavation if necessary. Organic vapour concentrations are typically measured by agitating the sample within a polyethylene bag, creating a small puncture hole in the bag and then inserting the probe of an organic vapour analyzing device, such as a GasTech Model hydrocarbon analyzer or Photo Ionizing Detector (PID) into the bag to measure the corresponding vapour concentration.

Once remedial excavation operations are confirmed to be complete, verification samples should be collected from the walls and base (unless founded on bedrock) of the excavation for laboratory analysis for petroleum hydrocarbon content. Given the remote location of the Site and the long turnaround times to ship samples to laboratories in the south, it is suggested that verification samples be analysed in the field to provide further confirmation that remedial measures are met. The excavated area can then either be backfilled with clean imported fill or left in its excavated state to naturally attenuate over time. In the case of the Ferguson Island areas, it is recommended that, based on the shallow depth of overburden, that backfilling is not completed. Completion of backfilling of these areas would not be considered to provide a measurable improvement to the local environmental conditions and, in fact, the transport of backfill material to the excavation areas may result in environmental impacts (i.e. damage to tundra, habitat, etc.) that would supersede any benefits realised by the backfilling operations.

5.1.3 Remediation Phase

The remediation phase will essentially involve the operation of the land-farm. Land-farm operation generally consists of the following major tasks:

- Regular tilling (aeration) of the impacted soil,
- Irrigation and nutrient addition as required,
- Runoff and leachate monitoring and treatment,
- Regular monitoring to determine remedial progress.

5.1.3.1 Schedule

Based on the anticipated environmental conditions and the available information on the nature of soil impacts, it is anticipated that remedial objectives will take approximately 3 years to be met. This schedule is likely somewhat conservative based on the small volume of impacts and the potential for higher rates of volatization.

Tilling should be completed weekly during the spring and summer season. Leachate and runoff monitoring and any required facility maintenance can be completed during the weekly tilling events.

5.1.3.2 Equipment and Manpower

Tilling operations can likely be accomplished through the use of a small lawn type tractor equipped with a tilling blade. Tilling, monitoring and maintenance requirements can be met by the same personnel. It is anticipated that approximately 8-16 man-hours per event will be required for the operation of the land-farm.

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5.1.3.3 Monitoring Requirements

Monitoring, other than that associated with facility operation, should include bi-annual soil sampling and analysis for petroleum hydrocarbon concentration. Sampling should be completed by a qualified environmental professional and should be scheduled for the beginning and end of each operational season. Samples should be analysed for petroleum hydrocarbon concentration and compared to the remedial objectives to ascertain remedial progress and aid in the ongoing estimation of remediation completion and site closure.

In addition, if required, analysis for moisture and nutrient content could be completed in order to assess the potential for and level of microbial activity in the soil matrix. Results of such sampling and analysis can provide useful data regarding the requirements for additional nutrient addition and site irrigation.

5.1.4 Final Closure Phase

Once ongoing monitoring has confirmed that the soil in the land-farm meets the remedial objectives for the Site, the facility can be closed. Closure can involve the removal of perimeter berms, berm liner sections, runoff and leachate collection and treatment systems and the re-grading of the contained soil. Alternatively, the soil in the land-farm can be removed and re-used on Site for on-going maintenance purposes. This would allow for the land-farm to potentially be used in the future for treatment of petroleum hydrocarbon impacted soil.

Either option would be considered to require similar time, equipment and manpower.

5.1.4.1 Schedule

Based on the assumed remediation duration of three years, it is anticipated that the closure phase will commence in the late fall of 2011 or the spring of 2012. Closure operations should take approximately one month to complete.

5.1.4.2 Equipment and Manpower

Equipment requirements for land-farm closure will be similar to that of construction. Excavation equipment will be required for both closure options. If the land-farm containment structure is left in place, trucking equipment will be required to transport the soil to its final destination. Grading equipment will be required for both closure options.

Manpower requirements are anticipated to be minimal with the majority of the effort being required by equipment. Landfill closure will require a workforce of approximately 466 people including labourers, operators and supervisors.

6.0 Conclusions

Based on the results of the field and laboratory investigations completed, TGCL provides the following conclusions:

- Previous environmental investigations at the site confirm the presence of petroleum hydrocarbon impacts to soil in excess of the applicable CWS criteria for a residential/sensitive site. Final impact delineation was not completed; however available information suggests that the total volume of impacted soil is on the order of 1,400 cubic meters in place.

- Various remedial options were presented and evaluated based on the specific conditions anticipated on Site and the expected performance in an arctic environment. Based on the results of the remedial options evaluation, land-farming was recommended as the remedial alternative best suited to the Site impacts.

- Additional delineation work, site surveying and facility site selection and design could be completed in the spring of 2008. Land-farm construction could be completed along with the excavation and transport of petroleum hydrocarbon impacted soil during the summer/fall of 2008.

- The remediation phase of the project is anticipated to be complete in approximately three years. Final land-farm closure is anticipated to be completed in the fall of 2011 or spring of 2012.

- Once all operations are complete, the Site will be in compliance with current CWS for Petroleum Hydrocarbons in Soil and is expected to meet the KIA requirements. As such, this will facilitate Starfield's formal withdrawal from the property and the residual environmental liabilities.

7.0 Closure

The information and data contained in this report, including without limitation, the results of any sampling and analyses conducted by TGCL pursuant to its Agreement with the Client, have been developed or obtained through the exercise of TGCL's professional judgment and are set forth to the best of TGCL's knowledge, information and belief. Although every effort has been made to confirm that this information is factual, complete and accurate, TGCL makes no guarantees or warranties whatsoever, whether express or implied, with respect to such information or data.

The information and data presented in this report are based on the purpose and scope of the project and form the basis for any conclusions and recommendations presented herein. Any conclusions and recommendations presented herein do not preclude the existence of environmental concerns other than those that may have been identified.

Work performed by TGCL personnel employed sound environmental assessment and engineering principles. TGCL cannot guarantee the accuracy and reliability of information provided by others or third parties. Therefore, TGCL does not claim responsibility for undisclosed environmental concerns or conditions that may result in additional costs for environmental clean-up and/or remediation. This report is intended for information purposes only.

Respectfully submitted by:

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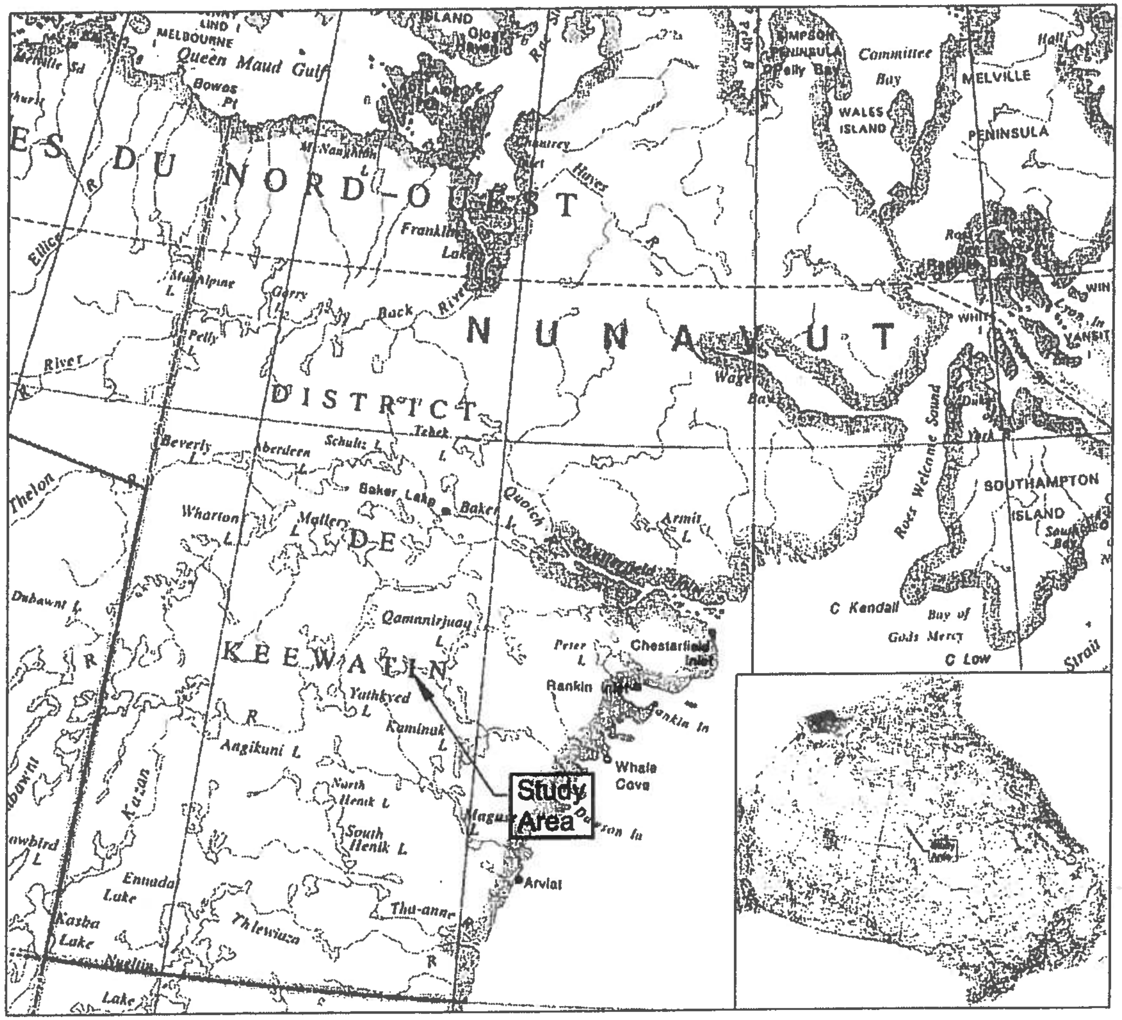
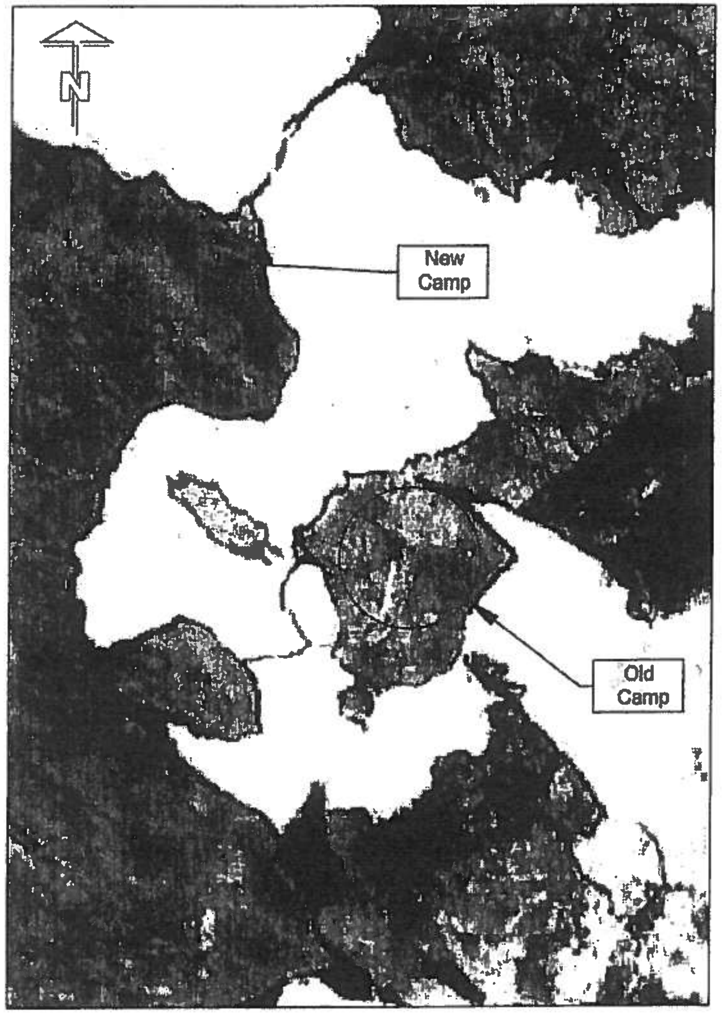
Figures





File No. 07-067-01

Starfield Resources Inc.
Old Camp & Airfield Remedial Action Plan
Ferguson Lake, Nunavut

Site Location Plan

FIGURE 1

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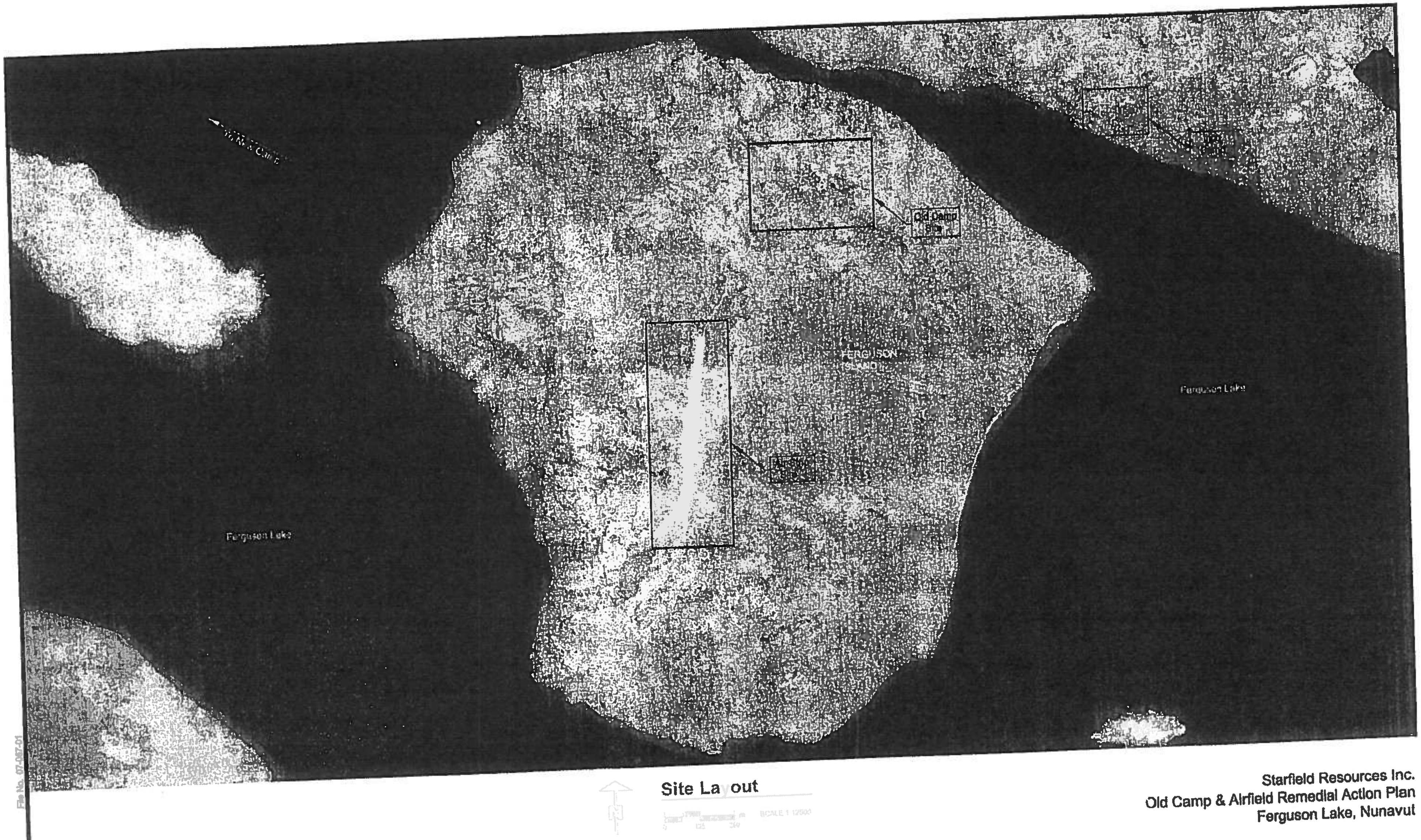
Designed By: CL
Approved By: GH
Date: Dec. 6, 2007



File No. 07-067-01

Starfield Resources Inc.
Old Camp & Airfield Remedial Action Plan
Ferguson Lake, Nunavut

Site Layout Plan

FIGURE 2

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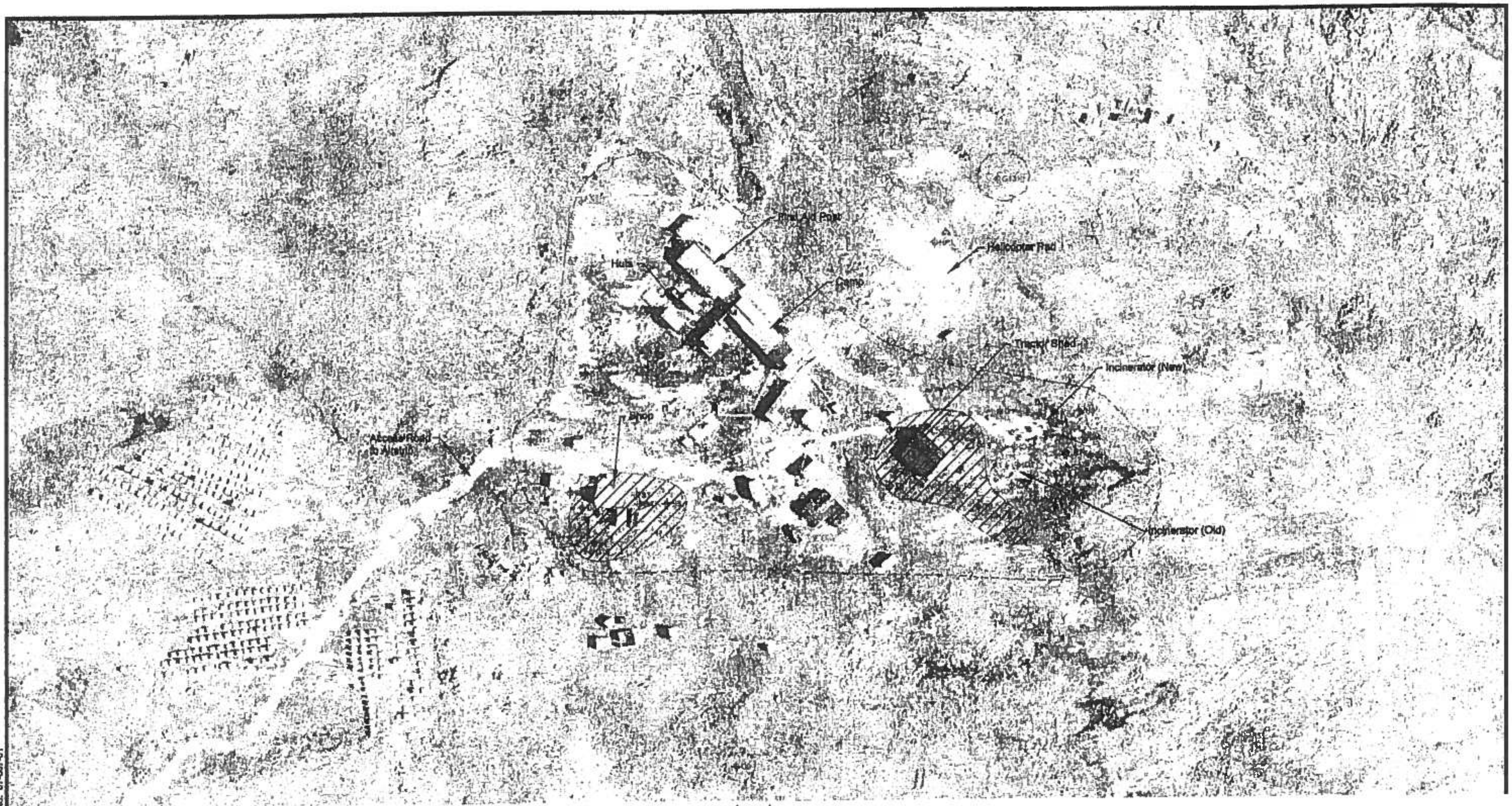

File No. 07-067-01

Old Camp Site

Legend

Soil Sample Location (Rescan, 2007)

Estimated Extent of Impacts (not delineated)

Impacted Area Predominately Lube Oil

Starfield Resources Inc.
Old Camp & Airfield Remedial Action Plan
Ferguson Lake, Nunavut

Estimated Soil Impact Limits - Old Camp Site

FIGURE 3

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Date: Dec. 6, 2007

Starfield Resources Inc.
Old Camp & Airfield Remedial Action Plan
Ferguson Lake, Nunavut

Proposed Facility Sites

FIGURE 5

Appendix A:
Previous Envioronmental Site Investigation Reports

*** To be included in Final Report***

Appendix B:
Canada Wide Standards for Petroleum Hydrocarbons in Soil

Canadian Council of Ministers of the Environment

CANADA-WIDE STANDARDS

for

PETROLEUM HYDROCARBONS (PHC) IN SOIL

CANADA-WIDE STANDARDS
for
PETROLEUM HYDROCARBONS (PHC) IN SOIL

These Canada-Wide Standards (CWS) for petroleum hydrocarbons in soil are established pursuant to the 1998 Canada-wide Accord on Environmental Harmonization of the Canadian Council of Ministers of the Environment (CCME) and its Canada-wide Environmental Standards Sub-Agreement.

The PHC CWS is a remedial standard for contaminated soil and subsoil occurring in four land use categories. The standard is grounded in the science of risk assessment and can be applied at any of three "Tiers": Tier 1 – generic numerical levels; Tier 2 – adjustments to Tier 1 levels based on site-specific information; Tier 3 – site-specific risk assessment. The same high level of environmental and human health protection is required at all three tiers.

Because the PHC CWS is tiered and risk-based there is necessarily some complexity in its development and application. Details regarding development and application of the standards are provided in a Technical Supplement.

The PHC CWS was developed with the input of four multistakeholder technical advisory groups and one dedicated working group involving the Canadian oil and gas industry, government and an academic chair. The PHC CWS represents a consensus view of the national Development Committee, developed with the assistance and input of the technical advisory groups.

RATIONALE

Petroleum hydrocarbons (PHC) are used in nearly every facet of Canadian life. They provide energy to heat our homes and places of work, fuel our transportation systems, power manufacturing processes and tools, as well as providing a source for the numerous synthetic materials we take for granted in our lives. Used as intended, PHC provide great benefits to society. However, when released to the soil environment as raw feedstocks or refined fuels or lubricants, a number of problems can result. These include fire/explosion hazard, human and environmental toxicity, movement through soil to air or water, odour, and impairment of soil processes such as water retention and nutrient cycling.

About 60% of Canada's contaminated sites involve petroleum hydrocarbon (PHC) contamination that, left unaddressed, impairs the quality and uses of both land and water. Presently, management of these sites across Canada varies considerably and generally lacks an adequate scientific basis – resulting in over- and under-management. Where over-management occurs, land sale transactions and real estate redevelopment are limited by remediation costs. Under-managed sites continue to pose risks to human and environmental health. The PHC Canada-wide Standard will provide a consistent approach to managing PHC-contaminated sites across the country.

DEFINITIONS

Petroleum hydrocarbons (PHC) is a general term used to describe mixtures of organic compounds found in or derived from geological substances such as oil, bitumen and coal. For the purposes of this CWS, PHC are considered to be comprised of 4 fractions as defined in Part 1. PHC exclude – for the purposes of this standard – known carcinogens such as benzene and benzo(a)pyrene, which are addressed as target compounds. Because of the relatively long history of managing toluene, ethylbenzene and xylenes ("TEX") as target compounds, these are also excluded from PHC.

CONTEXT

Petroleum products released to the environment typically contain thousands of compounds, in varying proportions, composed predominantly of carbon and hydrogen, with minor amounts of nitrogen, sulphur and oxygen. The properties of PHC contamination in soils varies with the petroleum source, soil type, the composition, degree of processing (crude, blended or refined), and the extent of weathering caused by exposure to the environment.

The complexity of PHC, and the extreme variability of sources and site-specific circumstances, complicates assessment of the human and environmental health risks associated with PHC contamination in soil.

PHC contamination in soil is a concern for a number of reasons. First, the chemically reactive nature and volatility of PHC can pose a fire/explosion hazard, especially if vapours enter confined spaces. Second, most PHC constituents are toxic to some degree. Third, lighter hydrocarbons (i.e. those of lower molecular weights) are mobile and can become a problem at considerable distances from their point of release due to transport in ground, water or air. Fourth, larger and branched-chain hydrocarbons are persistent in the environment. Fifth, PHC may create aesthetic problems such as offensive odour, taste or appearance in environmental media. Finally, under some conditions, PHC can degrade soil quality by interfering with water retention and transmission, and with nutrient supplies.

Canadian regulatory agencies have responded to these concerns with assessment and remediation requirements where PHC contaminate soils and groundwater. A blend of generic guidelines and site-specific, risk-based approaches has emerged across Canada, but there is very little consistency across jurisdictions in the rationale for guidelines, numerical values provided, or application to land uses.

The CWS is founded on documented and scientifically defensible risk-based methodology, namely the *CCME Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines* and the American Society for Testing & Materials (ASTM) *Risk-based Corrective Action (RBCA)* - and additions/improvements thereon, including the Atlantic *Partners in RBCA Implementation (PIRI)* (see Technical Supplement, section 1). Consequently, the derivation of the CWS involves explicitly listed receptors - both human and ecological, and the levels of protection accorded. It also involves defined exposure scenarios, and documented underlying assumptions, equations and policies (see Technical Supplement, sections 1 and 2).

Moreover, a vast array of analytical chemistry options exists for quantifying hydrocarbons in soil. Various methods have been developed to measure most or part of the hydrocarbons present in a sample based on different sampling, storage, extraction, purification, quantification, and data treatment approaches. Lack of measurement standardization has led to high variability in results and confusion for users of the data. The PHC CWS includes an analytical reference method to promote consistency in PHC-in-soil measurement practices and to ensure comparability of data nationally (see Technical Supplement, section 4).

The CWS Tier-1 levels have been selected despite gaps and uncertainties in some of the information used to support them. Nevertheless, the information available is sufficient to conclude that implementing the CWS will protect the environment and is technically and economically feasible. In this regard, jurisdictions will have considerable flexibility in the detailed design of jurisdictional plans and an opportunity to reduce information gaps and uncertainties.

PART 1:

NUMERICAL TARGETS and TIMEFRAMES

The PHC CWS is a remedial standard. The standard does not specify timelines that jurisdictions must follow in remediating PHC contaminated sites. Rather, it specifies consistent methods and outcomes for assessment and management of such sites. The CWS requires jurisdictions to commit to timelines for implementation of this consistent assessment and management approach, however.

The PHC CWS is based on the assessment and consistent management of risks posed to human, plants, animals and environmental processes under four common uses of land – agricultural, residential/parkland, commercial, and industrial. The standard is laid out in three tiers, which incorporate different amounts of site-specific information. Environmental and human health protection goals do not change between the tiers. Additional site-specific information available at Tiers 2 and 3 is used to manage risks through more precise knowledge of actual or potential exposure.

The environmental and human health protection goals of the PHC CWS are stated in the Tier 1 levels. A summary of Tier 1 levels is provided in Table 1. Additional Tier 1 levels are provided in the Technical Supplement along with Tier 2 and Tier 3 guidance. To develop these levels, the Development Committee identified -- in consultation with stakeholders -- for each land use: (1) the receptors and resources to be protected, (2) the pathways by which each could be exposed, and (3) the tolerable exposure along all applicable receptor/exposure pathway combinations. These tolerable exposures acknowledge that people may experience PHC exposures unrelated to contaminated soil and adjustments for known or expected exposures are made. Under Tier 1 and many Tier-2 approaches, exposures are managed below the tolerable level through reduction of PHC concentrations in the soil. Some Tier-2 and Tier-3 approaches achieve the same result by reducing exposures through engineered and/or institutional controls. The former approach is preferred; however, the latter is needed in some cases as indicated by socio-economic considerations. Irrespective of the approach chosen, the same high level of environmental and human health protection is required at each Tier.

Tier-1 levels are used when the proponent accepts the base assumptions and parameters in the Tier-1 exposure scenario. Tier-2 levels may be generated and used when site conditions exist that significantly modify the exposure and risk scenarios. Tier-3 levels are based on site-specific assessment and management of risks.

The PHC CWS implementation differs from other CWS. The trigger for remedial action is usually the need to act on a site-by-site basis to accommodate a new or intensified land use, and thus avoid human and ecological exposure to PHC during the modified land use. In such cases, the timeframe for achieving target cleanup levels at a particular site will depend largely upon the timeframe associated with the proposed land use for the site. The CWS will also find application in the cleanup and restoration phases of responses to pollution emergencies involving petroleum products and crude oils.

One of the guiding principles of the *CCME Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines* is that impairment of relatively clean soil up to guideline levels is not advocated. Consistent with the principle, the PHC CWS target levels are not intended to be used as 'pollute-up-to levels' for uncontaminated land.

Tier 1: Numerical Levels for Different Land Uses

Tier-1 numerical levels are summarized in Table 1, where:

- "Fraction" refers to the equivalent normal straight-chain hydrocarbon (nC) boiling point ranges (Fraction #1: nC6 to nC10; Fraction #2: >nC10 to nC16; Fraction #3: >nC16 to nC34; and, Fraction #4: nC35+).
- "Coarse" means coarse-textured soil having a median grain size of >75 µm as defined by the American Society for Testing and Materials.

- "Fine" means fine-textured soil having a median grain size of ≤75 µm as defined by the American Society for Testing and Materials. .
- Levels without parentheses do not include consideration of the soil-to-groundwater contamination pathway.
- Levels within parentheses do include protection of groundwater.

Table 1. Summary of Tier 1 Levels (mg/kg) for surface soil.*

Land Use	Soil Texture	Fraction 1	Fraction 2	Fraction 3	Fraction 4
Agricultural	Coarse-grained soil	130	450 (150[a])	400	2800
	Fine-grained soil	260 (180[b])	900 (250[b])	800	5600
Residential/ Parkland	Coarse-grained soil	30[c]	150[c]	400	2800
	Fine-grained soil	260 (180[b])	900 (250[b])	800	5600
Commercial	Coarse-grained soil	310 (230[a])	760 (150[a])	1700	3300
	Fine-grained soil	660 (180[b])	1500 (250[b])	2500	6600
Industrial	Coarse-grained soil	310 (230[a])	760 (150[a])	1700	3300
	Fine-grained soil	660 (180[b])	1500 (250[b])	2500	6600

* Additional Tier 1 levels are presented in Technical Supplement.
a= Where applicable, for protection against contaminated groundwater discharge to an adjacent surface water body.
b= Where applicable, for protection of potable groundwater.
c= assumes contamination near residence with slab-on-grade construction.

Tier 2: Site-specific Adjustments to Tier-1 Levels

Tier-2 levels may be generated and used when site-specific information indicates that site conditions exist that modify human or ecological exposure to PHC contamination and, thereby, alter risks significantly, relative to the generic conditions used to derive Tier-1 levels.

Thus, Tier-2 levels are derived on a site-by-site basis using site-specific parameters where necessary; the potentially adjustable parameters and corresponding calculation protocols are summarized and referenced in the Technical Supplement (section 2).

Tier 3: Site-specific Risk Assessment and Management

The process of developing site-specific cleanup levels and related management options requires the appropriate use of both general and site-specific information. Background information and guiding principles have been established to direct and focus this process, and are documented in the *Guidance Manual for Developing Site-specific Soil Quality Remediation Objectives for Contaminated Sites in Canada* (CCME 1996). The use of these guiding principles in developing Tier 3 standards is outlined in the Technical Supplement.

Additional guidance in this connection is also available in *A Framework for Ecological Risk Assessment: General Guidance* (CCME, 1995) and *Risk Assessment Guidance for Superfund Vol I (USEPA 1989).* Other appropriate guidance may also be available from the appropriate jurisdictional authority.

PART 2:

IMPLEMENTATION

Because environmental issues related to PHC release to soil are principally limited to intra-jurisdictional effects, Clause 6.1 of the CWS Sub-agreement applies for this CWS. This means that specific measures undertaken by each government to meet this CWS will be at the discretion of each jurisdiction.

Jurisdictions agree to review current programs and tools and, as required, develop and activate jurisdictional implementation plans to integrate the CWS or ensure equal or better protection.

REVIEW

The CWS will be reviewed as follows:

By the end of year 2003, review of additional scientific, technical and economic analysis to reduce information gaps and uncertainties and allow revision of the PHC CWS in the year 2005 as appropriate.

REPORTING on PROGRESS

Progress towards meeting the above provisions will be reported as follows:

(a) to the respective publics of each jurisdiction on a regular basis, the timing and scope of reporting to be determined by each jurisdiction; and,

(b) to Ministers, with comprehensive reports at five-year intervals beginning in year 2003.

ADMINISTRATION

Jurisdictions will review and renew Part 2 and the Annexes five years from coming into effect.

Any party may withdraw from these Canada-wide Standards upon three month's notice.

These Canada-wide Standards come into effect for each jurisdiction on the date of signature by the jurisdiction.

Canada-wide Standards for Petroleum Hydrocarbons (PHC) in Soil

Signed by:

British Columbia	Honourable Ian Waddell
Alberta	Honourable Lorne Taylor
Saskatchewan	Honourable Buckley Belanger
Manitoba	Honourable Oscar Lathlin
Ontario	Honourable Elizabeth Witmer
Environment Canada	Honourable David Anderson
New Brunswick	Honourable Kim Jardine
Nova Scotia	Honourable David Morse
Prince Edward Island	Honourable Chester Gillan
Newfoundland and Labrador	Honourable Ralph Wiseman Honourable Tom Lush
Yukon	Honourable Dale Eftoda
Northwest Territories	Honourable Joseph Handley
Nunavut	Honourable Olayuk Akesuk

Note: Québec has not endorsed the Canada-wide Accord on Environmental Harmonization or the Canada-wide Environmental Standards Sub-agreement.

Endorsed by CCME Council of Ministers, April 30-May 1, 2001, Winnipeg