Stand Alone Abandonment and Restoration Plan
Iqaluit Airport, Nunavut
Water License Number 1BR-LTU1013

Prepared by:
Transport Canada

REVISED
November 2010

Table of Contents

1.0 Scope of Work

Transport Canada is required to meet the required Petroleum Hydrocarbon criteria under the Water License issued: Number 1BR-LTU1013, Nunavut Environmental Guidelines (most current edition), CCME Petroleum Hydrocarbon Guidelines (most current edition) and the CCME Interim Canadian Environmental Quality Criteria for Contaminated Sites (most current edition) remediation criteria for coarse grain soil, industrial zoned sites. Once the LTU has been sampled and shows PHC levels are below the required criteria, the facility will be decommissioned and restored back to its original state. Environment Canada has provided advise in a letter dated June 30, 2006. The advise has been included in Appendix I for reference and will be used to abandon and restore the site when required.

The decommissioning will be done by removing the treated soil from the liner and removing the liner from the LTU. Using a gas Photo Ionization Detector (PID) or similar equipment to monitor hydrocarbon vapours, random samples of the material below the liner will be tested to ascertain if any contamination leached beneath the liner. In addition to the portable hydrocarbon vapour testing, 10 soil samples will be taken from under the liner area and sent to a certified laboratory for analysis of the same parameters as listed earlier. The liner itself will be taken to an approved landfill site for proper disposal. If contaminated soil is found below the LTU, this material will be removed and placed in an adjacent LTU TC is operating on site (please see attached drawing).

The treated soil will be used to backfill the LTU excavation and compacting, if necessary, to match the surrounding soil conditions. All monitoring wells will remain in place for future sampling until it is determined no contamination exists (approximately one year). Once this is completed the monitoring wells will be removed and sealed with bentonite using accepted standards under the Environmental Protection Agency (EPA).

Finally, once the LTU area has been replaced with the treated soil, the soil and berms shall be leveled and compacted to match the surrounding conditions, unless the Airport Manager wishes for a different land use for the area. The former LTU area will be re-seeded with vegetation that is natural and noninvasive to the area (to be determined). The estimated time frame to complete the restoration plan is 25 to 35 day.

The LTU is located at the Iqaluit Airport 63 degrees 45' 26.99"N 68 degrees 32' 59.72"W. The 2 LTUs are approximately 55m X 45m and 90m X 40m. The construction of the LTUs were initiated and completed in the fall of 2006. TC anticipated constructing one large LTU cell on site, however the topographic conditions and airport operations made this difficult due to restriction related to the runway and the adjacent taxiway and apron. Therefore, TC constructed two

smaller LTU cells (C & D) adjacent to the previously constructed LTU cells (A & B) that will be decommissioned in the near future. Cell D is approximately 55m X 40m and cell C is approximately 90m X 40m. Both cells were constructed to the same specifications as described in the water license application and as the engineered drawing indicates.

In addition, a geofabric was placed overtop of the liner material as extra protection from tears and punctures from rocks, branches and equipment. Clean remediated soil from cell B was used as ballast material for both cells since no contaminated soil was placed in cell C and D in 2006. TC anticipated remedial works at the airport for future years that would require the use of the LTU. Each LTU is constructed to hold a maximum depth of 1m of material. Therefore, cell D has the potential capacity of 2200m^3 and cell C has the potential capacity of 3600 m^3. The nearest building is the Airport Maintenance Garage approximately 400m to the northeast, the Air Terminal Building approximately 1000m to the southeast and the nearest drainage channel is located adjacent to the airport runway approximately 155m to the southwest of the LTU site. The nearest water body is the Ocean located approximately 3.0 km to the southeast. The topography of the site is flat and nearly at sea level. The area surrounding the airport (as indicated by the topographic map with contour lines) has a gentle slope to the southeast toward the ocean. See Appendix 2 Figure 1 and 2.

2.0 Decommissioning

Upon closure of the facility the following tasks will be completed:

- Soil located in the facility will be tested to ensure the water license guideline criteria are met identified in Table No. 1 – Remediation Requirements in the license.
- Water will be tested in the sump to ensure it meets the remediation guidelines under the water license Section D Part 4.
- The soil will be removed from the facility and stockpiled adjacent to the liner
- The liner will be removed and sent to an approved licensed facility outside of Nunavut for disposal.
- The stockpiled soil will be used to fill in the excavation to match the surrounding topography.

3.0 Effective Period of Project/Schedule of Abandonment

The requested temporal scope of the project is 15 years, commencing in April 2006 and finishing in June 2021. The scope will allow for the continued operation of the existing facility, which has been in operation for 4 years. The estimated timeframe is dependant on many uncontrolled factors such as contamination levels, weather conditions and hiring contractors.

4.0 Project Description

The following terms of reference will be used to abandon and close the site once the contaminated soil has been remediated:

4.1 TITLE & PREFACE

Land Treatment Unit Decommissioning, Iqaluit, Nunavut

Environmental Affairs, Programs, Transport Canada, Prairie and Northern Region, is requesting interested contractors to submit proposals for the supply of materials, equipment, and labour that are necessary to conduct the required 'Environmental Work' at the Iqaluit Airport as described in the following request for proposal.

4.2 INTRODUCTION

Prior to July 1, 1995 Iqaluit Airport was owned by the Government of Canada and operated by the Quebec Region of the Department of Transport. From July 1, 1995 until April 1, 1999 the airport was owned by the Government of Northwest Territories and operated by the Arctic Airports Division of the Department of Transportation. Since April 1, 1999 the airport has been owned by the Government of Nunavut and operated by the Nunavut Airports Division of the Nunavut Department of Community Government, Housing and Transportation.

As a condition of the Arctic A Airport transfer agreement (July 1995) between GNWT and Transport Canada, the environmental issues, which existed prior to the airport transfer, are to be remediated as well as any items identified by the GN within six years of the transfer date. Works identified under this document address some of the issues identified in the Transfer agreement as well as post transfer issues.

Transport Canada is obligated to remediate all hazardous substances that are the department's responsibility that do not comply with the applicable environmental laws.

Remediation of the former Fire Training Area (FTA) was initiated in July 2002. A landfarm with an oil resistant reinforced polyethylene liner was constructed on site to contain the contaminated soil. Monitoring wells were installed down gradient of the landfarm location to facilitate future monitoring of these sites. The site was backfilled with clean fill that was excavated during landfarm construction. The landfarm requires a soil sampling program as well as decommissioning to complete the project

The following table provides some background information for the project.

Landfarm area	
Liner - one piece OR-PRE	
Approximate depth of material in landfarm	1 m

4.3 SCOPE OF WORK

The following details the methodology the contractor is to perform to complete each of the project tasks. The methodology may be adjusted through a change order authorized by TC if the changes result in a more practical and/or cost effective and/or timely approach.

- The first objective is to conduct a comprehensive soil sampling program for the LTU to ensure the soil meets the remediation criteria for closure of the landfarm.

The contractor will obtain eight (8) composite soil samples and a sample from each monitoring well (2) from the LTU for submission to a certified laboratory for analysis. The contractor will be responsible for designing the sampling and analysis program, which must be submitted to the Project Manager for approval. All sampling procedures must be in accordance with the standards contained in the CCME Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites Volume I &II. The contractor must provide details of the field and laboratory QA/QC program for review in the final report. As a minimum the QA/QC program must include:

- Use of trip, field and equipment blanks;
- Use of duplicate and spiked samples;
- Proper sample containment, preservation, handling and transportation; and
- Due regard for necessary health and safety precautions.

- All samples must be analyzed for the following parameters. Unit cost for each of the tests are to be provided in the bid.
  - BTEX;
  - Total Extractable Hydrocarbons (TEH); and
  - Canada Wide Standards for Petroleum Hydrocarbons in Soil for Fractions #1 to #4 for the Tier 1 criteria for Industrial Sites.

The results of the laboratory analysis are to be compared to the Environmental Protection Service, Department of Sustainable Development, Government of Nunavut Environmental Guideline for Site Remediation, CCME Canada-Wide Standards for Petroleum Hydrocarbons (PHC) in Soil (most current edition) and the CCME Interim Canadian Environmental Quality Criteria for Contaminated Sites (most current edition) remediation criteria for commercial/ industrial zoned sites. The results are to be presented in table form highlighting non-compliance with both federal and territorial regulations.

- The second objective of the project will be to decommission the landfarm, if the soil tests indicate all of the soil has reached all of the mandatory limits of contamination. The decommissioning will be done by removing the soils from the liner and removing the liner from the LTU and backfilling the LTU excavation with the treated soils and compacting, if necessary, to match the surrounding soil conditions. All monitoring wells will remain in place.

- Using a gas Photo Ionization Detector (PID) or similar equipment to monitor hydrocarbon vapours, the contractor must take random samples of the material below the liner to ascertain if any contamination leached beneath the liner. In addition to the portable hydrocarbon vapour testing 8 soil samples will be taken from under the area and sent to a certified laboratory for analysis of the same parameters as listed in 3.2 on an expedited basis. **The liner itself will be taken to an approved landfill site for proper disposal (possibly sent outside of Nunavut to a southern location if required). The location of disposal will be determined by the contractor.**

The fourth objective is to landscape the LTU area once it has been replaced with the treated soil. The soil shall be levelled and compacted to match the surrounding conditions including smoothing out the berms to match the surrounding topography, unless the Airport Manager wishes for a different land use for the area.

If a project scope change is anticipated, the Contractor must notify the Project Manager in writing immediately. No additional or supplemental

work shall be undertaken or in substitution of the work specified unless approved in writing by the Contracting Authority.

Preparation of a report detailing works completed as a result of this scope of work.

4.4 PROJECT SCHEDULE AND INITIAL PROJECT MEETING

Ten (10) working days after the selected contractor has been notified of bid acceptance, the contractor is to submit to the Project Manager a detailed project schedule that will outline the time frames for each associated project work activity. After contract award an initial site start-up meeting will be organized by the Project Manager with the Iqaluit Airport Manager and the contractor in order to review and finalize the contractor's project schedule, associated work activities and review airport safety and security requirements. This meeting may also be accomplished through a teleconference from the Project Manager's office to the Iqaluit Airport Manager at the discretion of the Project Manager. All personnel, materials and equipment must be on site to facilitate a start date to be determined after contract award, as negotiated between contractor and Project Manager.

4.5 CONDITIONS FOR PROJECT WORK

Mandatory Items To Be Submitted In the Proposal

With Their Proposal, Bidders <u>Must</u> Submit The Following:

- A 'Work Plan' which includes the following:

  a. The Consultant must provide a qualified site superintendent, with a minimum of 10 years relevant practical experience, who will manage site contractual activities, the coordination of work, provide daily progress reports to the Project Manager and shall remain on the job site when the project is in progress.

  b. The name and credentials of the on-site supervisor. The site supervisor will not be replaced without prior **written** approval from Transport Canada.

  c. A detailed breakdown of the work to be completed by the Contractor under this contract.

d. A detailed description of how each of the tasks will be carried out, ensuring compliance to all applicable legislation and regulations.

e. A list of all consultant/contractor/subcontractor personnel that will be directly involved with the work under this contract, and their relation to the project.

- A project schedule; a detailed schedule is required 10 days after contract award. A proposed schedule for the completion of the work must be provided with your submittal. This schedule should identify the timing of tasks associated with the various project tasks and activities, including required report submissions. The Contractor shall adhere to the detailed schedule established in their proposal.

- A site specific 'Health and Safety Plan' (HASP) which includes, as a minimum, a document complying with Nunavut WCB guidelines, outlining the following:

a. The major hazards that will be encountered on site.

b. The precautions that will be taken to minimize the hazards (Personal Protective Equipment, signage, barriers, etc.) All cost associated with monitoring and conflict control shall be born by the consultant/contractor.

c. Medical emergency procedures that will be followed by the consultant/contractor in case of accident or incident requiring medical attention, including a contact list of hospitals, fire department, etc.

d. A fire safety program that includes fire prevention, fire protection and fire reporting procedures and requirements. Details of the program must be included in the plan of operation that addresses safety and security at the site according to regulatory requirements.

e. A safe work procedure plan for active airports.

Note: a more detailed version of the HASP will be made available to the Project Manager for review prior to the start of work. Transport Canada wants to ensure the bidders are aware of the site-specific conditions and take the time to read and prepare a site-specific document, and not include a generic form or section.

A complete equipment list detailing the year, make and model of the equipment to be used.

During the onsite work phase of the project, the contractor must comply with the following:

- Changes to the personnel list will not be permitted once the contract has been awarded without consultation and written approval by the Project Manager; copies of their CV are required and will be reviewed prior to final acceptance.

- Do not disrupt airport business except as permitted by the Airport Manager;

- Provide barricades and lights where required;

- Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling and storage, and disposal of hazardous materials;

- Observe construction safety measures of the Nunavut Workers Compensation Board and municipal authority provided that in any case of conflict or discrepancy the more stringent shall apply;

- The Project Manager must be notified immediately by the contractor should there be problem areas encountered that are in addition to those covered by this Request for Proposal; and

- Personnel qualifications are to be provided as per Section 5.1(e) to demonstrate their capability to conduct the required field sampling of soil and water for formal laboratory analysis and compaction testing.

4.6 AIRSIDE SECURITY ACCESS REQUIREMENTS

The LTU is located in a restricted area of the Iqaluit Airport. To access the LTU in the airport restricted area authorization and/or restricted area passes are required from the Iqaluit Airport Manager for contractor's personnel. As well, airside vehicle restrictions are also in place. The contractor will be responsible for obtaining and fulfilling the necessary Airport airside /access requirements from the Iqaluit Airport Manager's office. If the Airport Manager decides that an escort is required, the contractor will be responsible for those costs.

4.7 PROTECTION OF BURIED INFRASTRUCTURE

While the work is in progress the Consultant will protect all utility lines and buried services, water, sewer, gas, electric, telephone and other utilities and structures encountered. If any utilities are damaged, the Consultant will restore them to

original or better condition unless directed otherwise. If any previously unknown underground services are discovered during this project, report the find to the TC Project Manager and discuss with them on how to proceed.

4.8 POST CONSTRUCTION ACTIVITIES

Upon completion of the project works, the Consultant's site superintendent will notify the TC Project Manager to arrange for a contractual final acceptance to be conducted by Transport Canada.

A TC departmental representative will inspect all work. Work not done to the satisfaction of the departmental representative will be redone to the same and the Consultant will incur the cost.

Failure to carry out work to the satisfaction of the departmental representative may result in the termination of the contract and full payment of the contract may be suspended.

4.9 REPORTING

The Contractor will provide reports, and associated documentation including all annexes, tables and photographs as per deliverable format outlined below.

The Contractor will be responsible for the cost of processing the project reports using the Contractor's own or contracted typing/word processing facilities.

The Contractor will be responsible for all proof-reading. CADD Standards will be provided to the Contractor. The CADD drawing format required for drawings is the AutoCAD native format with the DWG file extension, preferably Release 2007 or higher. All drawings are to be produced in the metric system of measurement.

The Contractor shall maintain contact with the Project Manager throughout the contract including the report writing phases. Draft and Final reports shall be submitted to the Project Managers. Submissions include two (2) hard copies & one (1) electronic copy (Adobe Acrobat pdf) of the Draft Reports, and two (2) hard copies & one electronic copy on CD in pdf format of the Final Reports. All report figures and final site survey are to be in AutoCAD format.

The Contractor will provide Draft Documents for review by the Project Manager within four (4) weeks of completion of fieldwork to provide Transport Canada ample time to comment on the contents of the document. Project Manager will provide comments within two (2) weeks of submission. If required, the Consultant will provide written response to Project Managers comments for each review.

The final report is required two (2) weeks after receipt of comments.

Final copies are to be submitted to:

Superintendent, Environmental Affairs, Programs
Transport Canada
Prairie and Northern Region
1100-9700 Jasper Avenue
Edmonton, Alberta T5J 4E6

The report will include as a minimum:

- A Table of Contents
- An executive summary;
- A description of the scope of work;
- Description of field methods, construction activities, and disposal methods;
- Drawings indicating the location of site characteristics and infrastructure;
- Photos of the LTU prior to, during and after completion of the work;
- Drawings and photos of the locations where samples are collected;
- Conclusions based on the field and laboratory results; and
- Appendices containing, analytical methods, lab analysis and certificates.
- Reports will be in Ariel 12 font, on 8 ½ by 11 paper, single spaced, double sided; drawings can be on larger paper.

4.10 CONTRACT WORK SCHEDULE

The following scheduled milestones must be met in order to coincide with site operations:

- Proposal Due Date
- Submission of Contractor complete and detailed Site Specific Health & Safety Plan – 2 weeks prior to field work
- Field work to be completed by
- Completion of Draft Report
- Completion of Final Report - 2 weeks after receipt of client comments

4.11 REGULATORY FRAMEWORK

The contractor must observe the most recent published/current edition of applicable Federal, Provincial and Municipal legislation, regulations, guidelines and codes of practice (including all amendments), including but not limited to the following:

- Federal Guidelines for Land farming Petroleum Hydrocarbon Contaminated Soils remediation criteria for commercial/ industrial zoned sites;
- Current Occupational Health and Safety Regulations;
- Canadian Environmental Protection Act;
- Transport of Dangerous Goods Act;

- National Fire Code, plus amendments;
- National Building Code (with all current amendments);
- CCME Guidance Manual on Sampling, Analysis and Data Management for Contaminated Sites;
- Work Site Hazardous Material Information System Regulation (WHMIS);
- CCME Interim Canadian Environmental Quality Criteria for Contaminated Sites (most current edition);
- CCME Environmental Quality Guidelines (most current edition);
- Canada Wide Standards for Petroleum Hydrocarbons in Soil (with amendments); and
- The regulations and standards of any other local governing agencies.

In case of conflict or discrepancy, the more stringent requirement shall apply. The contractor must meet or exceed requirements of contract documents, specified standards; codes and referenced documents. The contractor must ensure that all on site personnel are familiar with the mitigative measures included in the contractor Health and Safety Plan should a spill on site occur.

No on-site work will be undertaken prior to receipt of written approval of the Occupational Health and Safety Plan from the Project Manager.

The Consultant will be responsible for and must implement and maintain the plan of operation, which addresses safety and security at the site according to the direction received from the Airport Manager as part of his Aerodrome Operations Certificate.

The Consultant must observe and enforce the following safety measures, including but not limited to:

- Canada Labour Code,
- National Fire Code of Canada,
- Worker's Compensation Board,
- All applicable Health and Safety regulations, and Provincial and Municipal authority, provided that is any case of conflict or discrepancy the more stringent requirements shall apply.
- Workplace Hazardous Materials Information system (WHMIS) regarding use, handling, storage and disposal of hazardous materials; and regarding labelling and provision of material safety sheets acceptable to Labour Canada and Health and Welfare Canada.
- Deliver copies of WHMIS data sheets to Project Manager on delivery of applicable materials.

4.12 IMPOSED CONSTRAINTS

Conflict of Interest

The contractor, the team or team member carrying out this contract is expected to identify any conflict of interest, declare them early in the performance of the work and act in accordance with the instructions provided by TC to resolve them.

Standards of Conduct and Confidentiality of information

The successful contractor agrees to hold as confidential and shall not disclose to any person or firm any information gathered through assignment (s) or the knowledge of pending assignments. The only exception is if and only if that disclosure of such confidential information is necessary for the performance of the duties of the contractor, as agreed by the Department.

All information data, material, etc. gathered as part of this project shall be treated as confidential, the property of Transport Canada and shall only be discussed with the Project Manager and Transport Canada personnel unless otherwise directed and authorized.

Language of work

The language of work will be English.

Location of Work

The work as described in this Terms of Reference will be performed at the Iqaluit Airport, Iqaluit, Nunavut.

Appropriate Law

This contract awarded shall be governed by and construed in accordance with the laws in force in the Territory of Nunavut, Canada.

Travel

The contractor and/or their personnel will be required to travel to Iqaluit, Nunavut. Travel arrangements will be the contractors responsibility and travel costs will be reimbursed in accordance with the terms and conditions described in Appendix "H".

4.13 CONTRACTOR'S USE OF SITE

The contractor must comply with the following:

- Do not unreasonably encumber the site with materials or equipment.
- Move stored products or equipment, which interfere with operations of the airport.
- Obtain and pay for use of any additional storage or work areas if required by the Airport Manager.

PERSONNEL PROTECTION

The contractor must comply with the following:

- Personnel entering the area must be equipped with steel-toed work boots, hard hats, hearing protection, and safety glasses as required by the Occupational Health and Safety Act.
- Workers must be equipped with appropriate personal protective gear. Should contamination be encountered and exposure to hazardous materials be encountered the worker must use or wear such gear as appropriate and necessary.
- Excavation team may be required to wear respirators as directed by Transport Canada if vapour levels exceed regulations for exposure limits. Ensure that all contractor personnel are instructed for the proper use and maintenance of respirators. All personnel must be fit-tested as well.
- If in a high traffic area, high visibility vests must be worn.
- Use barricades and warning signs where necessary.
- Avoid skin contact and inhalation of hydrocarbon products.
- Promptly wash hydrocarbon contaminated soaked cloths and avoid using soaked leather goods. Properly dispose of any soaked rags.
- Keep work areas clean and well ventilated.
- Shore and brace excavated slopes and banks according to applicable regulations.
- Clean up spills promptly.
- Precautions must be taken to eliminate all potential sources of ignition from the area (i.e. smoking materials and non explosion-proof electrical and internal combustion equipment).
- Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.
- Fires and burning of waste or materials are not permitted on-site.
- Prevent accumulation of vapours at ground level.
- Report fires immediately by fastest means as possible; report all fire incidents to Contractor's site supervisor, Airport Authorities and local fire facilities.
- Maintain fire extinguishers in sufficient quantity to protect, in an emergency, work in progress and personnel on site.
- Smoking is not permitted on work site.

Appendix I

Environment Canada Letter and Landfarming Information

Environment Canada Environnement Canada

Environmental Protection Operations
Qimugjuk Building 969
P.O. Box 1870
Iqaluit, NU X0A 0H0
Tel: (867) 975-4631
Fax: (867) 975-4645

15 October 2010

EC file: 4703 003 028
NWB file: 1BR-LTU1013

Phyllis Beaulieu
Manager of Licensing
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0

Via email:licensing@nunavutwaterboard.org

RE: 1BR-LTU1013 Abandonment and Restoration Plan, and
1BR-LTU1013 Spill Contingency Plan

Environment Canada (EC) has reviewed the above-mentioned abandonment and restoration plan and spill contingency plan submitted to the Nunavut Water Board (NWB). The following specialist advice has been provided pursuant to the *Canadian Environmental Protection Act*, Section 36(3) of the *Fisheries Act*, the *Migratory Birds Convention Act*, and the *Species at Risk Act*.

Transport Canada has submitted a Spill Contingency Plan and an Abandonment and Restoration Plan to the NWB as a requirement of water license 1BR-LTU1013. Under this water license, Transport Canada has constructed a land treatment unit (LTU) lined with a synthetic geomembrane for treatment of petroleum hydrocarbon contaminated soil at the Iqaluit airport with a capacity of 7500 m^3.

Based on the information provided, EC has no major concerns with either of these plans at this time. It should be noted however, that ***all*** spills are to be documented and reported to the NWT - NU 24 hour Spill Line at (867) 920-8130.

If there are any changes in the proposed project, EC should be notified, as further review may be necessary. Comments previously submitted on behalf of EC by C. Spagnuolo on 30 June 2006 would still apply to this project (see attached). Please do not hesitate to contact the undersigned with any questions or comments with regards to the foregoing at (867) 975-4631 or by email at Paula.C.Smith@ec.gc.ca.

Yours truly,

Paula C. Smith
Environmental Assessment Coordinator

cc: Carey Ogilvie (Head, Environmental Assessment-North, EPO, Yellowknife, NT)
Ron Bujold (Environmental Assessment Technician, EPO, Yellowknife, NT)

Environment Canada / Environnement Canada

Environmental Protection Operations
Qimugjuk Building 969 P.O. Box 1870
Iqaluit, NU X0A 0H0
Tel: (867) 975-4639
Fax: (867) 975-4645

June 30, 2006

Our file: 4510 055 T002 / 4703 000

Richard Dwyer
Licensing Trainee
Nunavut Water Board
P.O. Box 119
Gjoa Haven, NU X0B 1J0
Tel: (867) 360-6338
Fax: (867) 360-6369

Via email at licensingtrainee@nwb.nunavut.ca

RE: NWB 1BR-LTU - Transport Canada – Iqaluit Airport Land Treatment Unit

On behalf of Environment Canada (EC), I have reviewed the information submitted with the above-mentioned application. The following specialist advice has been provided pursuant to Environment Canada's mandated responsibilities for the enforcement of the *Canadian Environmental Protection Act*, Section 36(3) of the *Fisheries Act*, the *Migratory Birds Convention Act*, and the *Species at Risk Act*.

Transport Canada is proposing to construct a land treatment unit (LTU) lined with a synthetic geo-membrane for treatment petroleum hydrocarbon contaminated soil at the Iqaluit airport with a capacity of 7500 m^3. Proposed work will include:

- Installation of 3 groundwater monitoring wells;
- Excavation of PHC contaminated soil (approximately 700 m3) from the stockpile area of the former military facility;
- Excavation of PHC contaminated soil (approximately 300 m3) from the five surface stained areas near the two concrete pads at the former military facility;
- Removal and separation of general construction debris from the stockpiled soil;
- Completion of a soil sampling program during the excavation, which will include field screening and the submission of confirmatory soil samples from the sidewalls and base of each excavation to an accredited laboratory;
- Restoration of excavated sites including backfilling with clean fill and site grading;
- Removal of the underground piping at Apron I;
- Sampling of soils under Apron I for contamination from abandoned hydrant system;
- Removal of any contaminated soil from Apron I and deposition in the newly constructed LTU for treatment; and
- Erection of a silt fence south of the existing contaminated soil stockpile to protect the nearby water body

The proposed project also includes the decommissioning of the existing LTU. Proposed activities associated with this component of the project include:

- Removal of approximately 2500m3 of the contaminated soil from the existing cells of the LTU at the Fire Training Area and placement in the newly constructed LTU;
- Removal and disposal of approximately 25 m of chain link fencing and associated posts;
- Removal and disposal of three (3) abandoned transformers including cribbing;
- Removal and disposal of several telephone poles near the transformer area;

Environment Canada requests the following information and clarifications in order to help facilitate our review of this application:

- The Technical and Project Team Proposal included in the application indicates that the proposed work is to be conducted in the 2005 field season. Environment Canada requests confirmation regarding whether this work is already completed.
- There seems to be a discrepancy regarding the size of the facility between the information provided in the Technical and Project Team Proposal and the information in the water license application form. While the Proposal indicates that the LTU will be capable of treating 5000 m^3, the water license application indicates that the facility will have a capacity of 7500 m^3. Environment Canada requests clarification regarding the size and capacity of the LTU.
- Environment Canada requests further information regarding the additional reinforcement at the toe of the sump berm, as indicated in the Technical and Project Team Proposal. The Report states "Since the LTU is to be managed for more than one field season, additional reinforcement will be provided for the berm toe located down-gradient since considerable more pressure can be sustained if the sump area becomes filled with water after a significant rain event and from snow melt runoff in the spring" (page 12). How does the proponent intend to reinforce the berm?
- How was the depth of the monitoring well installation (0.3 m depth) determined?
- Does the proponent plan to conduct any confirmatory sampling at the excavated areas to ensure all contamination has been removed?
- The Technical and Project Team proposal indicates that the transformer oil on site is "non-PCB oil". Generally, industry uses the term "non-PCB oil" to refer to transformer oils that contain less than 50 ppm of PCB. Environment Canada requests confirmation regarding whether PCBs are present in the oil, and if so, in what concentrations? If PCBs are present, the proponent should provide details regarding disposal options. All hazardous wastes, including waste oil, should receive proper treatment and disposal at an approved disposal facility.
- Environment Canada requests confirmation that the telephone poles that will be removed from the site have not been treated with creosote. If the poles have been treated, EC recommends that they be double bagged prior to placement in the municipal landfill, and their location documented.
- While information is provided regarding sampling protocols and quality control/quality assurance protocols, information regarding long-term monitoring plans for the LTU do not seem to be included in the application. Environment Canada recommends that information be submitted outlining the frequency and timing of soil and groundwater well sampling.
- The application lacks a detailed operation and maintenance manual. Successful remediation of hydrocarbon contaminated soils in the arctic requires careful adherence to an appropriate operation and maintenance plan. Details such as nutrient levels, microbial population density, pH control, moisture content, and source testing to ensure heavy metals are allowed in the LTU, etc… need to be carefully managed. Environment Canada strongly recommends that the proponent develop an Operation and Maintenance Plan based on best-practices for northern conditions. Environment Canada has been investigating remediation of hydrocarbon contaminated soils in the north and is pleased to provide an overview of landfarming practices in Appendix A for the proponent's consideration.

Environment Canada recommends that the following conditions be applied throughout all stages of the project:

- Meeting the requirements of the *Fisheries Act* is mandatory, irrespective of any other regulatory or permitting system. Section 36(3) of the *Fisheries Act* specifies that unless authorized by federal regulation, no person shall deposit or permit the deposit of deleterious substances of any type in water frequented by fish, or in any place under any

conditions where the deleterious substance, or any other deleterious substance that results from the deposit of the deleterious substance, may enter any such water. The legal definition of deleterious substance provided in subsection 34(1) of the *Fisheries Act*, in conjunction with court rulings, provides a very broad interpretation of deleterious and includes any substance with a potentially harmful chemical, physical or biological effect on fish or fish habitat.

- The proponent shall ensure that measures to prevent sedimentation of the downstream environment are employed during the installation and excavation of the fill material used to create a suitable crossing to allow access to the work area south of Runway 18-36.
- Should water be encountered during excavation, preventative measures should be implemented at the discharge point to minimize erosion and sedimentation.
- The Technical and Project Team Proposal indicates that a site-specific Spill Contingency Plan will be developed. Environment Canada recommends that this plan be developed and submitted for review as soon as possible. The Spill Contingency Plan should provide a clear path of response in the event of spill and address the key areas of prevention, preparedness, response and recovery.
- The Technical and Project Team Proposal makes reference to the use of annual rye grass to help stabilize soils on site and minimize erosion and sedimentation. Environment Canada recommends that the proponent use native species if vegetation is going to be used as a preventative measure for erosion and sedimentation.
- Environment Canada highly recommends that all soils entering the new LTU be tested to determine the type of contamination present. The proponent is requested to review the information in Appendix A for details regarding characterization of source soils.

If there are any changes in the proposed project, EC should be notified, as further review may be necessary. Please do not hesitate to contact me with any questions or comments with regards to the foregoing at (867) 975-4639 or by email at colette.spagnuolo@ec.gc.ca.

Yours truly,

Original signed by

Colette Spagnuolo
Environmental Assessment / Contaminated Sites Specialist

cc: (Stephen Harbicht, Head, EA North, Environment Canada, Yellowknife)

APPENDIX A: LANDFARMING INFORMATION

Many of the recommendations relative to design, siting, operation, monitoring, sampling and analytical methods, decommissioning and closure as well as record keeping and reporting in this letter reference the following guidance documents:

- *Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils.* SAIC Canada (Science Applications International Corporation), December 2005
- *Bioremediation of Petroleum Hydrocarbons in Soil and Groundwater Under Cold Climate Conditions: A Review, Implications for Applications in Canada* , Dale Van Stempvoort and Pamela Grande, National Water Research Institute in Burlington, December 2005
- *Cold Climate Bioremediation: A Review of Field Case Histories.* Pamela Rogers, Research Assistant, Department of Civil & Environmental Engineering, University of Alberta, July 2005

Environment Canada urges the proponent to follow environmental site assessment steps as established by the following standards:

- Canadian Council of Ministers of the Environment (CCME) *Canada-Wide Standard for Petroleum Hydrocarbons in Soil* (CWS-PHC) (CCME, 2001);
- Canadian Standards Association (CSA) Environmental Site Assessment Standards Z768-01 (2001) and Z769-00 (2000), for Phase 1 and Phase 2; and,
- *Subsurface Assessment Handbook for Contaminated Sites* (CCME, 1994).

As these documents are updated periodically, please consult the CCME and CSA for the most recent versions.

Please find below technical comments and advice that Environment Canada suggests for landfarming facilities in Canada's north.

Assuming that the soils to be admitted to the bio-treatment facility are known to contain primarily petroleum hydrocarbon contamination, following the procedure in the CWS-PHC is recommended. The CWS-PHC allow for a risk-assessment approach. This could take the form of the CWS-PHC Tier 2 or 3 or, other tools to ensure equal or better protection, for example, the Risk-Based Corrective Action (RBCA) process. For information on the CWS-PHC and related documentation, consult with the on-line information available from CCME at **http://www.ccme.ca/ourwork/standards.html**.

The characterization of the contaminants and contaminant levels in the soil determined during the environmental site assessment may be used to determine landfarming applicability. An evaluation of the type and degree of contamination helps to exclude soil material that might be toxic to certain species of microorganisms and also helps to determine if landfarming would be the appropriate remediation technology to be employed for the contaminants of concern. Although landfarming is recommended for petroleum hydrocarbon contaminated soils only, it is understood that other contaminants may also be present. **Table** 1 indicates, through shaded selections, the type of analyses recommended for contaminated soil characterization.

Table 1 Recommended Analyses Based on Suspected Soil Contamination[1]

Contaminant Source	Parameters Analyzed								
	CWS – PHC fractions	BTEX	TPH	Lead	Total Heavy Metals[2]	Chromium/ Cadmium	PCBs	Phenols	PAHs
unleaded gasoline	■	■	■		■				
leaded gasoline, aviation gasoline	■	■	■	■	■				
fuel oil, diesel, kerosene, jet fuel, mineral oil/spirits, motor oil	■	■	■		■				■
petroleum solvents	■		■				■		
crude oils, hydraulic fluids	■		■	■	■				■
waste petroleum products	■	■	■	■	■	■	■	■	■

Please note that if any of the levels detected exceed these maximums, the contaminated soil should be considered hazardous waste and handled accordingly. Landfarming is not recommended for such contaminated soils.

- Total petroleum hydrocarbon (TPH) or total extractable hydrocarbons (TEH) < 3% (Yukon, 2004a and 2004b);
- total heavy metal concentrations < 2500 mg/L (USEPA, 1994);
- electrical conductivity (EC) < 4 dS/m; and
- sodium adsorption ratio (SAR) < 6 (Alberta EUB, 1996).

Site Characterization

Prior to landfarm design, a characterization of the site where the landfarm is to be placed should be conducted such that the following parameters are identified and respected:

- groundwater flow, direction and baseline chemical analysis;
- native soil hydraulic conductivity determination;
- Microbial identification determination and population.
- A landfarm should be sited greater than 500 m from a permanent surface water body. This restriction applies to both potable and non-potable surface waters.
- A landfarm should be sited greater than 500 m from a potable groundwater well.

[1] Modified from: Environment Canada. 1993. "Appendix 3: Guidelines on the Ex-Situ Bioremediation of Petroleum Hydrocarbon Contaminated Soils on Federal Crown Land" in the *Study on the Use of Landfarming and Surface Impoundments in the Management of Hazardous and Non-Hazardous Waste*. Conservation and Protection. June 23, 1993.

[2] Heavy metal analyses required to determine if constituents are not present at levels toxic to micro organisms (>2500 mg/L) (USEPA. 1994). (Soils with heavy metal concentrations below this level but above remediation criteria, will have to undergo further treatment following landfarming to reduce heavy metal concentrations.)

- The geology of the site needs to be considered (e.g. thickness of underlying soil, the presence of bedrock, degree of fracturing) to determine the need for a liner/barrier. It is recommended that at landfarm sites with less than 5 m of low hydraulic conductivity ($<10^{-6}$ cm/s) native underlying soil, a liner/barrier be used.
- The landfarm should be sited at a location with a natural slope of less than 5%; otherwise the site will require grading.
- The landfarm should be sited where the groundwater table is greater than 3 m from the surface. When there is a need to excavate during landfarm construction, cultivation no closer than 3 m above the groundwater table must be ensured. Using groundwater flow direction and rate data, the landfarm should be sited such that groundwater contamination is avoided (otherwise, a barrier to groundwater flow is necessary).
- A landfarm should not be sited on land within a 50 year floodplain.
- Please note that there should be adequate volumes of topsoil at the site that may be required to effectively manage and operate a soil treatment facility.

Prior to landfarm design, an evaluation of the soil characteristics provided in **Table 2** will ensure that the contaminated soil is well-suited to landfarming.

Table 2: Optimal Soil Characteristics for Landfarming

Landfarming Parameter	Optimal Characteristics
Microbial population density	For landfarming to be effective, the minimum heterotrophic plate count should be 10^3 CFU/g (colony forming units/gram). Below this minimum, landfarming may still be effective provided the existing bacteria are stimulated using nutrients or the soil is amended to increase the bacteria population (USEPA. 1994) In the latter case, adding non-indigenous bacteria to a site has had limited success in enhancing degradation of petroleum hydrocarbons. There are also regulatory restrictions associated with the addition of bacteria to sites.
Soil pH	To support bacterial growth, soil pH should be between 6 and 8. Outside this range, landfarming may still be effective through soil amendments.
Moisture content	Bacterial growth requires moisture, optimally between 40-85% of field capacity[3] (USEPA, 1994) Periodically, moisture may be added to landfarmed soil to maintain this moisture level. Excess moisture due to periods of high precipitation, during spring thaw or due to poor site drainage may need to be addressed. Site drainage may be improved through landfarm design, but uncontrollable influx of moisture may simply mean that longer operating times will be required for the landfarm.
Nutrient concentration	For proper growth, micro-organisms require inorganic nutrients that may be naturally-occurring in the soil. Nitrogen and phosphorous may be added in the form of commercial fertilizer. For effective biodegradation, carbon:nitrogen:phosphorus ratios need to be between 100:10:1 and 100:1:0.5 (USEPA. 1994). This ratio may be calculated from the soil bulk density and the total hydrocarbon

[3] The most reliable measure of moisture content is expressed as a percent of field capacity (also referred to as "soil capacity"). Field capacity itself is the maximum %-weight of moisture the unconfined, gravity-drained soil can retain. An example would be a sandy soil with a field capacity of 25%, meaning a maximum of 250 grams of water retained in 1,000 grams (dry wt.) of unconfined soil. Typically the target moisture content is expressed as a percent of the field capacity; for example, 50% of field capacity for the above sandy soil would be 125 grams water per 1,000 grams dry soil.

Landfarming Parameter	Optimal Characteristics
	concentration.
Soil Type:	Clayey soils hamper biodegradation because of difficulties in aeration and the distribution of nutrients and moisture. Soil amendments such as gypsum and bulking agents such as sawdust, may be required. Clumpy soils may also require pre-treatment in the form of shredding, in order for landfarming to be effective. Very coarse soils are not suitable to landfarming as they do not retain moisture and nutrients (University of Saskatchewan, 2002). Volatile compounds will also volatilize more readily from course-grain soils than from fine grain soils. Typically, large diameter soil particles have a low contamination concentration due to their low surface area. As such, these particles can be screened out prior to placing soils in the landfarm.

Once a landfarm is operating, generic or site-specific remediation limits as per the CCME Environmental Quality Guidelines (EQGs) or CWS-PHC should be used to monitor the extent to which the soil has been remediated to acceptable levels. The parameters analyzed during the environmental site assessment should be evaluated using these guidelines to determine chemicals of concern (CoCs) and those identified should be tracked during the remediation process.

Leachate Control

Groundwater and leachate criteria become applicable once the landfarm location is sited. One approach is to follow the **Environment Canada Contaminated Sites Management Working Group (CSMWG) policy: *A Federal Approach to Contaminated Sites* (CSMWG, 1999)**. This policy recommends the use of appropriate provincial/territorial guidelines or criteria when there is an absence of similar guidelines/criteria available.

Groundwater sampling and analysis should adhere to the CCME sampling procedures (CCME. 1993). Leachate monitoring performed during the landfarm operations is primarily for characterization purposes only, as leachate is often recirculated over the landfarm as a means of irrigation (or stored in a tank in the event that irrigation may be required at some point in the landfarming season). If this tank is discharged into the environment, the CCME EQGs apply as a standard.

A means to collect and treat run-off from the landfarm may be necessary. A leachate control system capable of handling a 24 hour duration, 1:10 year frequency storm is required in such a case. Leachate may be recirculated over the landfarm soil surface as a means of irrigation to maintain optimal biodegradation rates, or discharged if surface water analyses indicate contaminant levels are within CCME EQGs. **Environment Canada strongly recommends a containment system where all leachate from the soil treatment facility is fully controlled.**

Barriers/Liners

When native soils at the landfarm site have high conductivity, a barrier or liner having a maximum seepage rate equivalent to clay liner under 0.3 m head of water or a 10^{-7} cm/s hydraulic conductivity at a thickness of 0.6 m, should be used beneath the soil to be treated.

Placement of Soil in Landfarm

A contaminated soil depth less than 0.5 m within cell(s) or in windrows is recommended. However, the type of equipment available for tilling, as well as the land availability, will dictate soil

depth. Typically, landfarming is practiced with soil depths between 0.30 and 0.45 m. Contaminated soil should not be applied on a continuous layer of snow or ice or when the existing soil base is saturated with moisture.

Landfarm Design/Operational Requirements

Land Availability
Please note that the expected landfarm soil depth of between 0.30 and 0.45 m and a maximum soil thickness of 0.5 m is recommended. Therefore, a single plot or multiple plots may be required. Additional area surrounding the plot(s) for berms and leachate control should be considered.

Microbial Population Density Monitoring
If microbial amendments are being considered, the user should be aware that products containing microorganisms, biochemicals (such as enzymes) or biopolymers, are "biotechnology products" and may be subject to the New Substances Notification (NSN) Regulations, pursuant to the Canadian Environmental Protection Act, 1999 (CEPA, 1999). (Contact the New Substances Division of Environment Canada and http://www.ec.gc.ca/substances/nsb/eng/index_e.htm for more information.)

Although a few petroleum hydrocarbon-degradable micro-organisms have been found to be active at temperatures below 0°C (Whyte and Greer, 1999; Whyte, *et al.* 2001 and 2003; Rike, *et al.* (2003)), most biodegradation occurs above freezing. Research has shown appreciable biodegradation may occur after one summer season, additional biodegradation over a second season is usually required. Therefore, it is recommended that the landfarm should operate for a minimum between 6 months to 2 years. This operation period assumes optimal conditions are maintained (i.e. regular tilling; moisture control; nutrient amendment, if required). Please note that soil sampling and analyses are required to confirm remediation progress and completion.

pH Maintenance
The optimal pH for landfarming operations is between 6 and 8. The soil pH may be increased with the addition of lime and decreased with the addition of elemental sulphur.

Moisture Content Monitoring
The amount of moisture in the landfarm soil impacts biodegradation and, therefore, should be monitored and adjusted if possible and necessary. If moisture levels are too high, the movement of air through the soil is restricted thereby reducing oxygen availability. Effective moisture levels are 40 - 85% of water-holding capacity in the soil, but 20 – 85% will support microbes. Water spraying is often needed during summer months, particularly prior to tilling, in order to reduce wind erosion. Soil may be amended with organic matter to increase moisture retention. A rule of thumb is the soil should be moist, not dry and dusty or dripping wet.

Nutrient Amendments Requirements
Biodegradation requires that micro-organisms are meeting nutritional requirements. The optimal range of carbon:nitrogen:phosporus (C:N:P) is 100:10:1 to 100:1:0.5. If the available nutrients are not sufficient, soil amendment in the form of commercial fertilizers, is required. Note that the addition of nitrogen may inadvertently lower the pH. Nutrients can be supplied to the soil in either liquid or solid form. Solid nutrients can be added directly to the soil when the soil is mixed prior to placement in the landfarm or during tilling events once the landfarm is operational. Liquid nutrient can be added to watering or irrigation systems. The frequency of nutrient addition can be reduced by using slow release nutrients.

Tilling
Tilling, with a rototiller or turning over the soil with a backhoe or other similar equipment, is a means of aerating the soil. This provides oxygen for the micro-organisms as well as distributes

nutrients and moisture in the soil, thereby aiding biodegradation. Tilling is recommended once per month during the operating season of the landfarm, provided the soil is uniformly moist but not saturated. Tilling when soil is excessively wet is unproductive, whereas tilling while the soil is excessively dry may erode the soil and cause wind-blown dust problems. Tilling must be carefully carried-out by an experienced operator, since it is possible to disturb or damage the liner placed under the contaminated soil.

System Maintenance

Maintenance of the landfarm is essential in ensuring its effectiveness. At some appropriate point during landfarm construction, inspection of the synthetic liner(s) should be conducted to ensure that the seams and joints are tight, and that there is the absence of punctures, blisters or tears. Imperfections (e.g. lenses, cracks, channels) can occur in soil and clay liners. Weekly, during landfarm operations, and immediately after a major storm or catastrophic event, inspections should be conducted on the:

(i) drainage control systems for evidence of deterioration, malfunction, leaks or improper operation, and
(ii) leachate collection systems to ensure proper functioning and to determine if leachate is being generated or is accumulating.

If any defects or malfunctioning works are detected, immediate repair is required to maintain the integrity of all works.

The drainage control system should be inspected as necessary/required during periods of precipitation or spring thaw to ensure control measures are taken if the system is approaching its capacity.

Closure Procedures

During the system design phase, it is important to determine the requirements for closing the sites once remediation is complete. By laying out the closure procedures at this time, the responsible party or site sponsor can reviewed and endorsed them prior to proceeding with the system construction. This closure plan must be consistent with the current land use and will need to recognize how future land use changes or ownership will be taken into consideration after landfarm closure.

Monitoring and Record Keeping Requirements

For the purpose of monitoring the performance of the land treatment process, soil samples should be taken no less frequently than once every four months, during the period of active land treatment to monitor contamination levels until analytical results are below acceptable levels as set forth in the CCME's Canadian Soil Quality Guidelines (CSQG).

For the purpose of monitoring for potential impact of the facility on groundwater quality in the active layer, groundwater samples should be taken from the down gradient monitoring wells no less frequently than twice per year and analyzed for indicators of petroleum hydrocarbon contamination. Should analytical results indicate groundwater contamination associated with the land treatment facility, corrective action should be taken as soon as possible.

A sampling plan should include sampling methods (grid, composite) and frequency (number of samples per surface area). Since the landfarmed material is relatively thinly applied and homogenized through tilling, only one depth of sample collection is required. The samples should then be analyzed for the contaminants of interest and compared with the remediation guidelines presented in the CCME EQG and the CWS-PHC documentation. These protocols are recommended for the landfarm soils to determine at which point the soils have been remediated and the landfarm can be closed. Monitoring of contaminant levels in the leachate is only required prior to discharge to the environment; during recirculation, testing may be done for purposes of tracking remediation progress. It is also recommended that groundwater on-site be monitored

and compared to the appropriate CCME EQGs. **Table 3** summarizes the criteria that should be used for the various media involved in landfarming operations.

The landfarm soils may be considered remediated once analyses confirms these soils are within the CCME EQGs or CWS-PHC for the particular land use of the property. The remediated soil may then be used in a manner that is consistent and appropriate with the site use. If other contaminant levels (such as heavy metals, PCBs, etc.) exceed CCME EQGs, the landfarmed materials should be then further remediated using an alternative remediation technique.

Accurate records should be maintained by the owner/operator which contain the following information:

- A detailed description of the size and location of the land treatment facility
- Quantitative and qualitative data on the soil treated at the site
- Monitoring data as set forth above
- The final destination of the treated soil and its intended use.

Table 3: Summary of Landfarming Standards for Federal Contaminated Sites

Media Monitored	Criteria
Landfarm soil and soil remaining at the delineated (excavation) site	Canada Wide Standard for Petroleum Hydrocarbons (CWS-PHC) (CCME, 2003)
	Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health (CCME, 2003)
Groundwater	Non-potable - none; as per *A Federal Approach to Contaminated Sites* (CSMWG, 1999) whereby provincial/territorial guidelines are recommended. Potable - Guidelines for Canadian Drinking Water Quality (Health Canada, 1996)
Leachate	For recirculation – none (operations monitoring only) For discharge to environment ▪ Into surface water: CCME Environmental Quality Standard (EQS) for Freshwater Aquatic Life (CCME, 2003) for surface water reception; and ▪ Into groundwater: none, as per *A Federal Approach to Contaminated Sites* (CSMWG, 1999) whereby provincial/territorial guidelines are recommended
Surface Water	CCME Environmental Quality Standard (EQS) for Freshwater Aquatic Life (CCME, 2003) or, for potable water, the Guidelines for Canadian Drinking Water Quality (Health Canada, 1996)
Ambient Air	Canadian National Ambient Air Quality Objectives: Process and Status (CCME, 2003)

Appendix II

Location Map Iqaluit Airport LTU, Nunavut

Figure 1: Location Map Iqaluit Airport LTUs

Scale 1:10,000

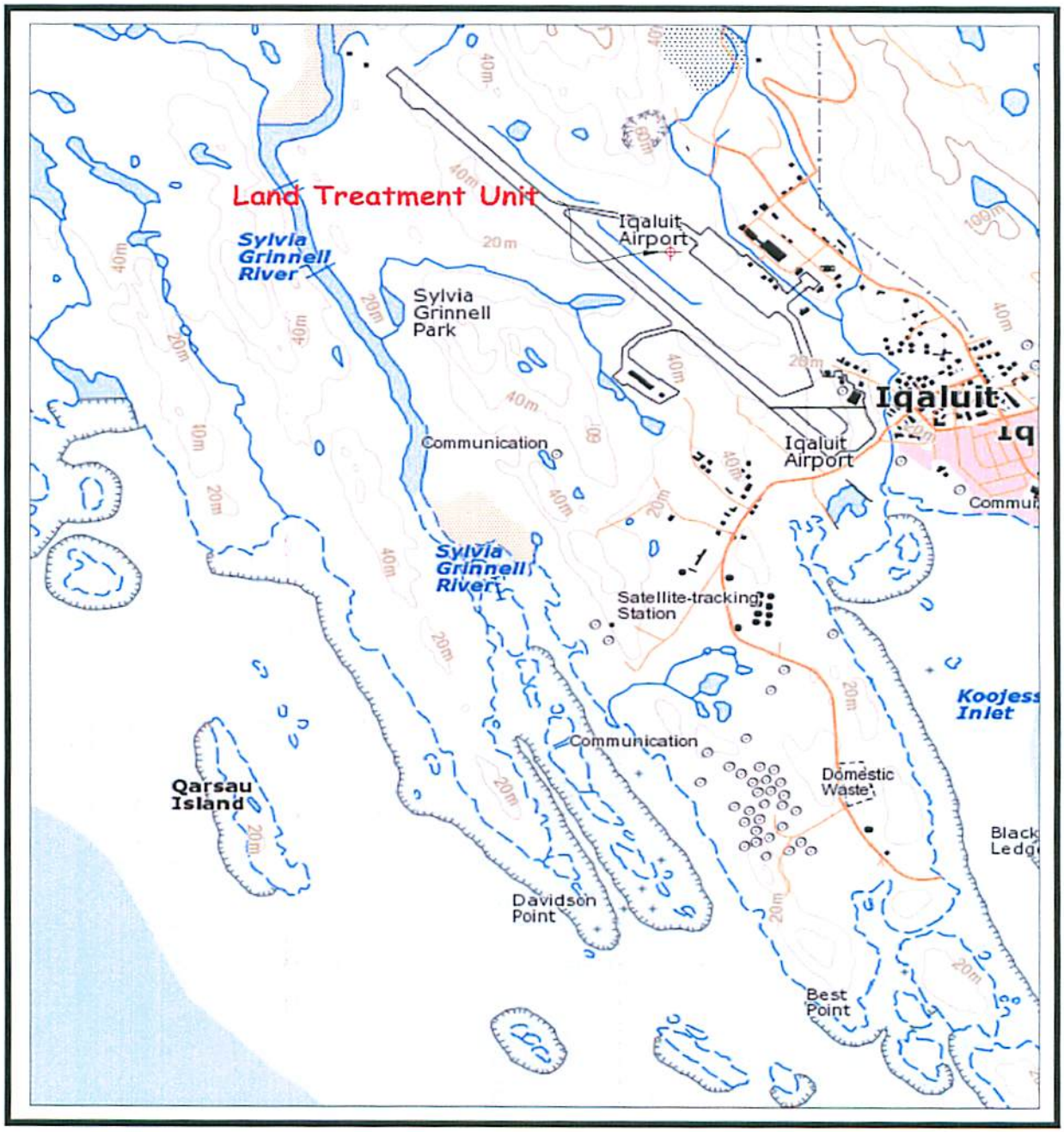

Figure 2 : Location map of LTUs at Iqaluit Airport, Nunavut

Note: LTU A and B are historic and will be decommissioned. LTUs C and D were constructed in 2006 under NWB License # 1BR-LTU1013.

Scale 1:2000