Cape Christian Cleanup

Operations and Maintenance Manual
Bio-treatment Area (Windrows)

QESin 2007P6
September 2009

1.0 Introduction

This manual was developed to present operational and maintenance procedures related to the biological treatment of Type B[1] contaminated soils at Cape Christian, as requested in Part E, Item 2 of the Water License (1BR-LOR0813) issued by the Nunavut Water Board.

The hydrocarbon contaminated soils will be bio-treated by way of windrows. Typically, hydrocarbon contaminated soils in northern Canada are treated by means of landfarming. However, space constraints, soil quantity and machinery availability onsite impose the adoption of a different approach in order to successfully treat the Cape Christian soils within the allotted time frame. An *ex situ* windrow treatment is being used to biologically treat the Type B contaminated soils.

The Bio-treatment Area is located north of the Beach AST (refer to Figure 1). The location was selected based on the required soil treatment capacity, distance to the soils to the contaminated soils, and proper surrounding drainage to prevent ponding, seepage and surface run-off into the biological treatment area.

Generally, windrows are long layers of material having a width that allows mixing with hydraulic shovels and allows passive aeration to favour aerobic biological degradation. The windrows can be 1.5 to 2 m high and 4 m wide. A contact water collection system surrounds the perimeter of the Bio-treatment Area.

2.0 Equipment List

The following equipment is required to operate the Bio-treatment:

- 1 x Caterpillar 320 excavator
- 1 x Caterpillar D250E Rock Truck

[1] *Type B Soil* means soil contaminated with hydrocarbons in which the primary petroleum product present in the soil as determined by laboratory analysis consists of fuel oil and/or diesel fuel and /or gasoline.

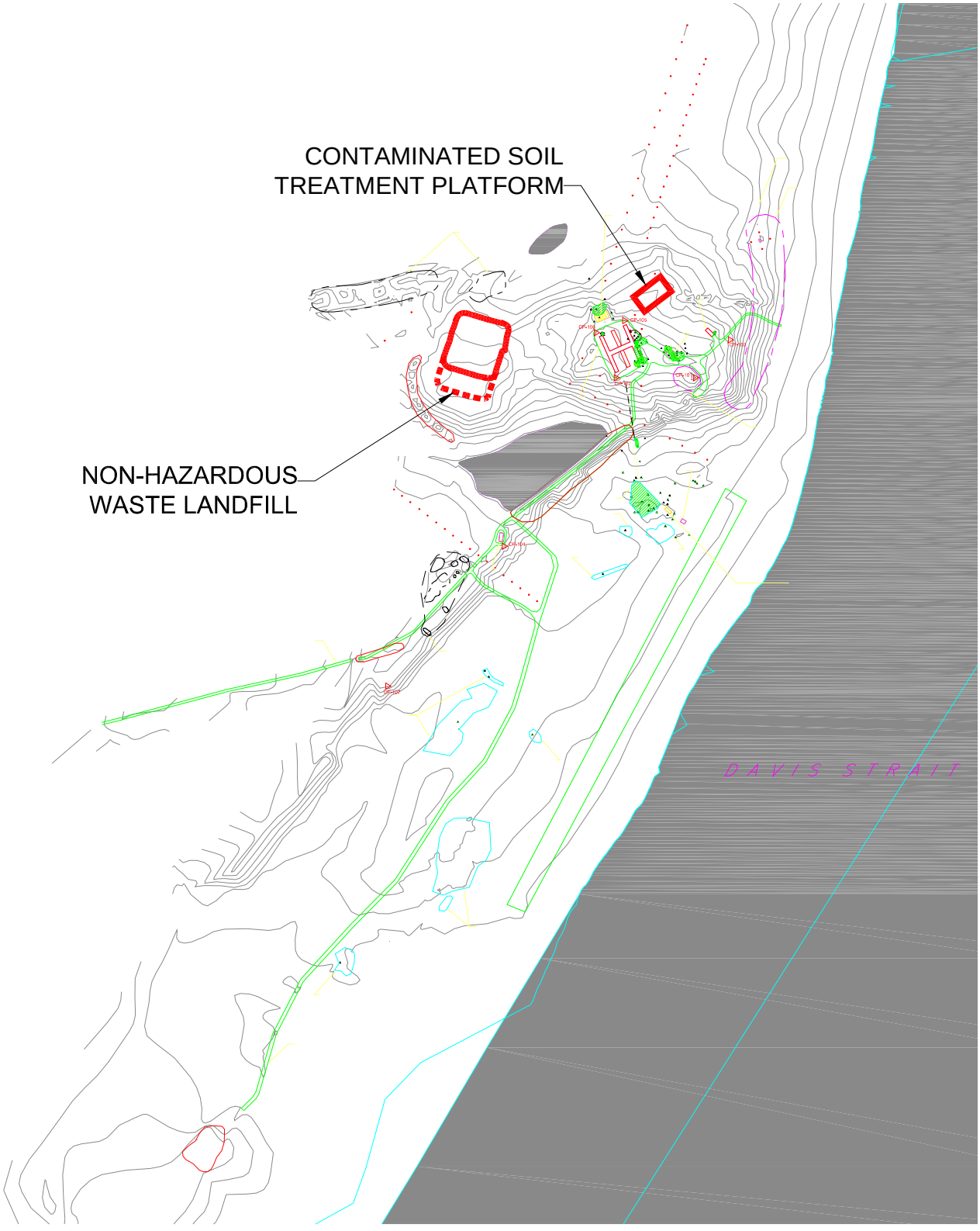

Figure 1 : LOCATION OF BIO-TREATMENT AREA (WINDROWS) FOR CONTAMINATED SOILS

3.0 Personnel

Sanexen (sub-contractor – Soil Remediation Specialist) has the overall responsibility for the construction, operation, maintenance and decommissioning of the Bio-treatment Area. The daily operation and maintenance of the Bio-treatment Area is the responsibility of the Superintendant.

4.0 Operational and Maintenance Procedures

These procedures must be carried out frequently to ensure smooth operation of the Bio-treatment Area.

4.1 Basic Operations and Maintenance Procedures

- Daily visual inspection of the perimeter contact water collection system and after any precipitation event, to ensure overflow has not occurred and that the system has not been damaged. Repair embankments, ditches and sump as needed.
- Place contaminated soils in windrows no higher than 2 meters or wider than 4 meters. Do not compact soils in place (detrimental to biological treatment of soils).
- Remix the windrows, using a hydraulic excavator equipped with a backhoe, twice a week or as directed by Sanexen.
- Re-direct water collected in the perimeter system into the windrows (to add moisture to the soils), as often and as directed by Sanexen.
- Clean and remove soil lumps and particles on the bucket tracks and mixing devices after every use. Dispose of the soil collected from cleaning activities with other contaminated soil in Bio-treatment Area.
- Mitigate against the tracking of contaminated soil out of the Bio-treatment Area.

4.2 Bio-treatment Process Calibration

Sanexen will sample stockpiled contaminated soils newly excavated and soils in the Bio-treatment area in order to verify existing conditions as well as to confirm and/or calibrate treatment process requirements. Composite sample obtained from five discrete soil samples with similar characteristics (hydrocarbons concentrations, type of soil, etc.) will be analysed for:

- F1 and F2 concentrations
- Soil pH and temperature
- Moisture content

In accordance with the QA/QC plan all the samples will be sent on a weekly basis to an accredited laboratory, while 50% of the samples will be duplicated and sent to the Engineer's laboratory for verification.

4.3 Record Keeping

Records are to be kept to assist in planning, evaluating the effectiveness of the treatment system and the creation of reports.

As a minimum, the following information should be recorded daily:

- Nature and volumes of soil placed in the Bio-treatment Area
- Dates when windrows were re-mixed
- Dates and volume of contact water added to the windrows
- Equipment usage
- Modifications to the treatment
- All analytical procedures and results (e.g. baseline, soil, contact water, groundwater)

During contaminated soils treatment activities, a contaminated soils treatment operation report will be submitted to the Engineer, including the following information:

- volume of excavated contaminated soils;
- schedule of treatment process activities;
- results of the visual inspection program;
- effluent and contaminated soils test results, including the results of the baseline sampling and analytical program;

Within 30 days of completion of each season/year of work, an interim remediation report will be prepared, which will include the following information:

- nature and volume of treated soils;
- equipment usage;
- fuel and/or power usage;
- results of all testing, including sampling procedures, analytical procedures, analytical results, and QA/QC procedures for baseline and confirmatory testing programs;
- proposed modifications to the treatment process, as required.

4.4 Health and Safety

Special precautions should be taken by workers involved in the operation and maintenance of the Bio-treatment Area:

- Hands are to be washed frequently, as a minimum after work and before eating or smoking
- Work gloves and boots should be worn at all times while performing work activities. Work clothes and boots should not be worn inside the Camp.
- Reflective safety vests should be worn when working around heavy equipment

5.0 Runoff and Contact Water Management

The proper management of runoff will prevent erosion, minimize the production of contact water, and prevent it from leaving the Bio-treatment Area in an uncontrolled fashion. By providing ditches, swails and a continuous grade away from the Landfarm, surface runoff will be diverted away. On the other hand, the contact water collection system surrounding the perimeter of the Bio-treatment Area will collect the water that does come into contact with the contaminated soil in a sump and prevent it from escaping into the tundra.

At a minimum, contact water collected in the perimeter collection system shall be sampled and tested prior to the end of each field season. In compliance with Part D, Item 12 of the Water License, a representative composite sample is to be composed from a minimum of 5% of the total volume to be released from the Final Discharge Point of the Bio-treatment Area (LOR-4). Sanexen (sub-contractor) will be responsible for all testing associated with the treatment or disposal of the contact water.

The Bio-treatment contact water shall meet the following Wastewater Discharge Limits stipulated in the water license in Part D, Item, prior to being released onto land to a location at least thirty (30) metres distance from the ordinary high water mark of any adjacent water body, where direct flow into a water body is not possible and no additional impacts are created:

- pH - 6 to 9
- Oil and Grease – 5 000 µg/L
- Arsenic (total) – 100 µg/L
- Cadmium (dissolved) – 10 µg/L
- Chromium (dissolved) – 100 µg/L
- Cobalt (dissolved) – 50 µg/L
- Copper (dissolved) – 200 µg/L
- Lead (dissolved) – 50 µg/L
- Mercury (total) - 0.6 µg/L
- Nickel (dissolved) – 200 µg/L
- PCB (total) – 1 000 µg/L
- Phenols – 20 µg/L
- Zinc (total) – 500 µg/L

If the contact water does not meet the Wastewater Discharge Limits, it shall be considered hazardous waste and disposed off-site at an approved facility.

A written notice is to be sent to Nunavut Water Board at least ten (10) days prior to initiating any decant or discharge from the Bio-treatment Area.

6.0 Monitoring Program (water and soil)

The Bio-treatment Area will be monitored each season that it is in operation. Soils underneath the Bio-treatment Area will be sampled pre and post treatment in order to verify that the operations did not contaminate them. If such soils were contaminated, they will be decontaminated prior to the end of the project.

7.0 Soil Quality Remediation Objectives

The contaminated soils will be designated as treated soil when the analytical results demonstrate that hydrocarbon fractions are below the following remediation performance criteria:

- F1 – 15 000 ppm
- F2 – 8 000 ppm

Composite samples obtained from five discrete samples representative of 100 cubic meters of treated soil volume will be sent for analysis. The Engineer is responsible for the confirmatory sampling. In accordance with the QA/QC program duplicates' analysis of 10% of the confirmatory samples sent to another accredited laboratory.

8.0 Decommissioning Procedures

The Bio-treatment Area will be decommissioned at the end of the second field season in accordance with Closeout Procedures of Section 01 77 00 of the tender documents or else as directed by the Engineer. The Bio-treatment Area will only be decommissioned once it has been confirmed by the Engineer that all the Type B soils have been treated. The contact water in the perimeter collection system will be sampled and disposed of as stipulated in the Water License (refer to section 5.0 above). The base of the treatment area will be tested to determine if any of the underlying soils were impacted by the treatment activities. Any impacted soils will be excavated and either treated in the treatment area or shipped off site depending on the time available. All excavations will be backfilled and graded to match the surrounding terrain. The perimeter collection system will be backfilled and graded to match the surrounding terrain.

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