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NUNATTA ENVIRONMENTAL SERVICES INC.

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PROTECTING OUR ARCTIC ENVIRONMENT

Interim Abandonment and Restoration Plan

Requested Revisions

NWB4NUN0511-B

Prepared for

Nunavut Water Board

December 12, 2011

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☎(867) 979-1488 🖷(867) 979-1478 nunatta@northwestel.net

Reclamation Objectives

1. Remediate cell contents to CCME standards for Industrial Land.
2. Remove all soil not required to correct property grade.
3. Deconstruct cells, dispose of liners to appropriate disposal facility.
4. Grade and level land to pre landfarm development.
5. Maintain monitoring wells for 2 years, post deconstruction.
6. Retain Quonset Building which houses offices, bathroom, maintenance shop and storage mezzanine, sealift containers, lumber, building supplies and perimeter fencing will remain as this property is leased.

Equipment used at the landfarm

(Plan is to leave this equipment deeded to the landfarm until Landfarm deconstructed at which time will be sold off)
The equipment is kept in very good operating condition with low operating hours.
Roto-screen was purchased new in 2010.

Fuel type	Horse power	Brand	Type	Model #	Capacity
Diesel	165 Hp	John Deere	Excavator	892 D	1.5 yard machine
Diesel	75 Hp	John Deere	Backhoe	710C	1 yard loader
Diesel	145 Hp	Case	Loader	621-C	2.5 yard machine
Diesel	180 Hp	Caterpillar	Bulldozer	D6	
Diesel	65Hp	Hewitt Robins	Elliptical Shaker		200 ton per hour
Diesel	65Hp	AR Laprade	Trommel	R-450	150 ton per hour
		AR Laprade	Belt stacker	C-50	150 ton per hour
Gasoline	11Hp	Honda	Hydraulic pump		
Gasoline		Honda	Water pump	WB20XK 2C	30,000 L/hour
Electric	1/2Hp		water pump motor		900L per hour
Gasoline	5 Hp	Champion	Generator	3000 watts	

Infrastruture

The Landfarm has a modern quanset structure which measures 70'x 44' (ft)

Front portion of building contains three furnished offices complete with internet and multiple phone lines and washroom and a mezzanine above for storage.

The back portion is the repair shop. Shop has a cement floor with no drains this ensures any spilled products will not reach the environment. Access is via remote control power operated overhead door.

Washroom and safety features such as medical kits, eye wash station, are located around facility and in the employee lunch area.

Seasonal Shut down and Temporary Closures

The landfarm is monitored all year as staff is on site performing maintenance on equipment or performing office duties. At no time is the land farm left for more than a long weekend and even then someone comes on site to pick up building supplies or to check heat is on.

The land farm does not shut down seasonally. General maintenance is done on all equipment.

In the event of a temporary closure, an inspection of containment facility will take place by General Manager to ensure absolute contianment of contaminationed materials. All equiptment will be winterized (this term is used when fluids are drained and batteries are pulled out and stored inside in proper contianment) and placed with in cells or shop area. Weekly inspections during winter months and during freschet and freeze up inspections will be twice a day to ensure absolute contianment of contaminated materials.

Schedule for Reclamation and implementation

The timing for completion of reclamation of the landfarm is open to many factors. At present there will be no plans to close down this business. Many innovative ideas have come about in past few years and these new approaches to remediation need to be explored and tested in Situ. With all the fuel spills happening each year in Iqaluit and people and organizations being more aware of the environment, the need for a landfarm is more evident now than it has been in past years.

We hope to be able to remove 1000 cubic meters of soil from cell three in the summer of 2012 providing degradation values remain the same as 2011. Laboratory testing indicate it would be possible to use most of this soil as cover at the local landfill or at an industrial or commercial application such as building a parking lot or road in next 2 years. This soil has a sale value of approximately $6 per m³. Clean rocks have value at $6 m³. In the next 2 years we estimate it will be possible to sell 2000 m³ of rocks to local crushers.

Since all the soils in the landfarm will not be removed at one time, remediation practices will change as soils are removed from the cells. We estimate this remediation and deconstruction should be done in as little as 8 years and as long as 10 years from time of closure.

Soil and Rock Treatment

The soils in the cells require breaking up to allow micro organisms to break down hydrocarbons into harmless components. This requires addition of fertilizers, moisture and good aeration. This is best achieved when soils are put through a screening plant and stacked in long windrows. This process should be repeated as often as weather permits. Experience has show 2-3 rotations a summer will reduce containment time to approx 5 years for Diesel (P50) contaminated soils. Proper testing and addition of

fertilizer has to be maintained to achieve best results. This is done to ensure that aerobic conditions prevail below soil surface.

Soil aeration starts as soon as soils have thawed and continue until the freezing takes place. When weather conditions permit cell #3 will be turned over 3 times a year, other cells as time and weather permit. The frequency of soil aeration depends on factors such as soil moisture, temperature and weather and other work taking place at land farm.

Impacted soils enter the landfarm into Cell #1 where cobbles and rocks are screened out. Rocks and cobbles are removed screen used removes them down to ¾ inch. These rocks are piles into cell #2 to weather off any soils or hydrocarbons that might be adhered. The freezing thawing action and wetting, drying action as well as movement of air will expel soils and hydrocarbons from the stones. These stones will be screened again at a later date to remove all rocks larger than 2 inches. These will be tested and if confirmed clean will go to the crushers here in town to be used in gravel for road building. The smaller rocks will require additional time to expel contaminates and will be re screened again to further reduce soil count and when they are found to be clean they will be used around land farm for land leveling, road building, and backfilling excavated work sites. The screened out soil will be added to one of the cells being remediated as it will take longer to expel hydrocarbons than the cobbles and stones.

Cell One 60 meters X 30 meters, wall height 1.5 meters:

This is where soils entering the land farm are dumped and piled to await the screening process to remove construction debris and large rocks. There is ample room between soil and walls to allow collection of melt waters. Water pump out points are located on the SE and SW corners.

Cell Two 50 meters X 25 meters, wall height 1 meter:

Contains rocks removed from soils stored in cell #1.

Cobbles are as small as ¾ inch and rocks vary up to a couple feet in diameter.

Cell Three 90 meters X 30 meters, wall height is 1.5 meters:

This is the final or finishing cell. Here all large stones and debris have been removed and all fresh hydrocarbons reduced to weathered status. Fertilizers have been added and soils are piled into tall windrows.

This cell will undergo more frequent aeration and soils will leave the land farm from this cell, when the remediation process is complete. Laboratory sampling is used to verify when the process is complete

Cell Four 60 meters X 25 meters, wall height is 1.5 meters:

Snow, overflow material and excessive water is stored in this cell. Soils will be piled in here when they are cleaned of cobbles and rocks and treatment process will begin. Plan is to allow as much room as possible for surface run off water storage. Large surface area is idea for evaporation of surplus water.

This procedure was developed from consultations with Dr. Steve Siciliano, Professor of Soil Toxicology, University of Saskatchewan.

Once the completion of the remediation to CCME standards is completed the continuation of the reclamtion process with proceed.

After the soil has been removed from cells there will be a layer which has been left undisturbed in order to protect the liner from being ripped by the excavator during the aeration process. This layer will be contaminated from leaching and will contain very weathered hydrocarbons. This layer of undisturbed soils will be transferred into cell three due to the large suface area, and remediation fallowing the a forementioned steps will occur.

The liner which covers the bottom of the cells will be removed and cut into pieces and disposed of at a appropiate disposal facility. The area under the liners will be tested for contaminates and any soil which does not pass CCME standards will be dug up and placed into the single existing cell.

When all cleaned (aerated) soil has been removed from cell three, and any remaining contaminated soil will containerized and shipped to an approved disposal facility.

Disturbed areas remaining from cell construction will be levelled and returned to grade.

Post closure monitoring will be kept up for a time of 2 years using the existing monitoring wells. Water samples will be sent to a Laboratory for analysis and results forwarded to Nunavut Water Board for review. Any test results which exceed CCME standards will be reviewed with regulatory organizations to determine the best approach.

Total estimated time to return this land to commercial standards with current degradation rates 8 years. Improved degradation rates with use of Biochar and better handling techniques might reduce this time to 6 years.

It has been our idea to deed the equipment needed to complete the aeration and reclamation plan. With out some of this specialised equipment the remediation time will be longer. The Case 621-C Loader and John Deere 892D Excavator at Nunatta are in excellent operating condition and are used exclusively here at the landfarm for our operation. This equipment is not rented out for use by construction companies or taken to work sites. We operate service and maintain every piece of equipment used in our operation. The newest piece of equipment is the Roto-screen 450 Trommel screening plant. It was bought new and shipped here in 2010. It is equipped with the proper accessories to make the remediation of soils very fast and very precise. This $120,000 screening plant has a capacity in excess of 100 cubic meters an hour. Extra screens are in stock as well as spare parts. All equipment in our fleet has been serviced on regular scheduled basis. All filters and wear items are kept in stock. These include cutting edges for buckets, teeth for buckets, all filters and brake parts, spare belts and hoses and some electrical items like starters and alternators are also in stock.

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Detailed Cost estimates for the Reclamation and Abandonment

The following Tables 1: and Table 2: show yearly aeration cost.

Table 1: Are aeration costs of 3rd party supplying all equipment.
Table 1a: Are deconstruction costs of 3rd party supplying all equipment.

Table 2: Are aeration costs of 3rd party labour operating Nunatta equipment.
Table 2a: Are deconstruction costs of 3rd party labour operating Nunatta equipment.

Value of the soils and rocks removed from the landfarm during the decommissioning will supplement income. There will be yearly sales of soil and rocks with an estimated value of $10,000 per year based on $6 a cubic meter for these items (This is the price construction companies pay for pit run material in Iqaluit). Wholesale value of same products once separated in to components like sand, gravel and stone are in the $28-$40 a cubic metre range.

Table 1.xlsx Table 1a.xlsx

Summary: Cost of 3rd party decommissioning

8 years of aeration: $654,572
Deconstruction: $94,296
Total Decommissioning Cost: **$748,868**

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☎(867) 979-1488 🖷(867) 979-1478 nunatta@northwestel.net

What Nunatta proposes is we deed all the equipment and supplies used to maintain operations at the landfarm. In the even we were forced to close this equipment would be a valuable asset as it will speed up remediation. This will reduce operating costs and the need for specialized machines. A local construction company over seen by regulators could supply labour to service and operate existing equipment. Facilities at landfarm allow for delicate equipment to be stored indoors over extended periods. This will protect equipment from elements and vandalism while permitting preseason work to be performed in comfort. Example: charge and connect batteries, check oil levels, coolant levels, adjust and grease linkages. The buildings have electricity, heat, phone and washroom. The property is fenced and this adds an element of security to equipment and buildings.

Tables 2: and 2a : reflect the costs of aeration and deconstruction of landfarm using Nunatta's equipment

Table 2: shows with our specialized equipment and remediation supplies in place the cost is much lower than 3rd party.

$22,156 /yr utilizing our screening plant and stacker remediation is much faster than just turning over soil with excavator. We believe this will save two years of remediation reducing the time to 6 years.

Table 2a: $47,080 this value is a one time only cost which covers complete soil removal, liner uptake and disposal, final grading of cell area, leaving the property ready for commercial development.

Table 2.xlsx Table 2a.xlsx

Summary: Nunatta equipment used

6 years of aeration	$132,936
Deconstruction	$47,080
Total Decommissioning Cost	**$180,071**

When project has been completed the supplies and equipment deeded to the continued operation of the landfarm will be offered up for sale.

Equipment Values:

$10,000 for loader

$10,000 for Excavator

$5000 for bulldozer

$5000 for backhoe

$5000 for elliptical screening plant and generator (40KVA 3 phase diesel generator)

$50,000 for Trommel screening plant

$2000 for hoses, pumps, 8 generators, hand tools

$10,000 for clean up supplies (carbon, clay, absorbent pads and loose absorbent)

Total sales soils and rock sales “$6 per cubic meter and 15,000 M in containment cells $90,000

Total recoverable revenue $187,000

Special Note

Nunatta has entered into a research partnership with the University of Saskatchewan, Yukon College and Nunavut Arctic College to test some new processes in remediation of hydrocarbon contaminated soils in Arctic conditions. Preliminary testing has shown a reduction of 25% in hydrocarbons in four months (in a frozen state) while traditional soil treatment methods resulted in 0% reduction.

Test plots will be in place this summer in Iqaluit at the Nunatta landfarm. This research involves 3 year research program. Nunatta will be partnering with Nunavut Arctic College who will be supplying Environmental Technology support, Yukon College

supplying research and biochar with the University of Saskatchewan Laboratory doing all analysis and documenting of samples and publishing of results. This idea we hope will allow for much faster remediation of hydrocarbon impacted soils in the Arctic. Remediation methods have been improved in southern climates where much longer frost free periods exist but little research has been done for the northern climate.