Appendix D:
Indirect Cost Supporting Documents

Safety ● Quality ● Sustainability ● Innovation

Appendix D.1:
2014 Mary River Fuel Balance

Fuel Balance

		2013											
								3	3	3	4	4	4
	Total	January	February	March	April	May	June	July	August	September	October	November	December
Motive Fuel Balance													
Opening balance	2,077,000				2,077,000	2,077,000	1,597,928	1,118,857	5,581,618	4,863,744	14,116,669	12,863,819	11,610,969
Deliveries	29,230,083				-	-	-	5,000,000	-	10,000,000	-	-	-
Motive consumption - Before Oct.	(2,785,831)				-	(479,072)	(479,072)	(479,072)	(659,708)	(688,908)	-	-	-
Motive consumption - After Oct.	(18,280,650)				-	-	-	(58,167)	(58,167)	(58,167)	(1,252,850)	(1,252,850)	(1,252,850)
Motive consumption - Dock construction	(546,703)				-	-	-	-	-	-	-	-	-
Closing balance	9,693,898				2,077,000	1,597,928	1,118,857	5,581,618	4,863,744	14,116,669	12,863,819	11,610,969	10,358,119
Thermal Fuel Balance													
Opening balance	200,000				200,000	200,000	130,000	74,000	5,025,000	4,976,000	18,472,880	16,715,180	14,957,480
Deliveries	42,000,000				-	-	-	5,000,000	-	14,000,000	-	-	-
Thermal consumption - Power and heat before Oct.	(727,120)				-	(70,000)	(56,000)	(49,000)	(49,000)	(503,120)	-	-	-
Thermal consumption - Power and heat after Oct.	(25,987,500)				-	-	-	-	-	-	(1,732,500)	(1,732,500)	(1,732,500)
Thermal consumption - Explosives	(534,825)				-	-	-	-	-	-	(25,200)	(25,200)	(25,200)
Closing balance	14,950,555				200,000	130,000	74,000	5,025,000	4,976,000	18,472,880	16,715,180	14,957,480	13,199,780
Jet A Fuel Balance													
Opening balance	150,000				150,000	100,000	50,000	-	1,350,000	1,300,000	1,250,000	1,200,000	1,150,000
Deliveries	2,150,000				-	-	-	1,400,000	-	-	-	-	-
Jet A fuel consumption	(1,050,000)				(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)
Closing balance	1,250,000				100,000	50,000	-	1,350,000	1,300,000	1,250,000	1,200,000	1,150,000	1,100,000
Total fuel closing balance, litres					2,377,000	1,777,928	1,192,857	11,956,618	11,139,744	33,839,549	30,778,999	27,718,449	24,657,899

	2014											
	5	5	5	6	6	6	7	7	7	8	8	8
	January	February	March	April	May	June	July	August	September	October	November	December
Motive Fuel Balance												
Opening balance	10,358,119	9,099,102	7,840,086	6,581,069	5,276,219	3,971,369	2,666,519	1,359,169	3,281,902	1,837,876	11,789,883	10,741,891
Deliveries	-	-	-	-	-	-	-	3,230,083	-	11,000,000	-	-
Motive consumption - Before Oct.	-	-	-	-	-	-	-	-	-	-	-	-
Motive consumption - After Oct.	(1,259,017)	(1,259,017)	(1,259,017)	(1,304,850)	(1,304,850)	(1,304,850)	(1,307,350)	(1,307,350)	(1,307,350)	(911,317)	(911,317)	(911,317)
Motive consumption - Dock construction	-	-	-	-	-	-	-	-	(136,676)	(136,676)	(136,676)	(136,676)
Closing balance	9,099,102	7,840,086	6,581,069	5,276,219	3,971,369	2,666,519	1,359,169	3,281,902	1,837,876	11,789,883	10,741,891	9,693,898
Thermal Fuel Balance												
Opening balance	13,199,780	11,442,080	9,684,380	7,926,680	6,168,980	4,411,280	2,653,580	895,880	3,138,180	1,380,480	18,572,380	16,764,280
Deliveries	-	-	-	-	-	-	-	4,000,000	-	19,000,000	-	-
Thermal consumption - Power and heat before Oct.	-	-	-	-	-	-	-	-	-	-	-	-
Thermal consumption - Power and heat after Oct.	(1,732,500)	(1,732,500)	(1,732,500)	(1,732,500)	(1,732,500)	(1,732,500)	(1,732,500)	(1,732,500)	(1,732,500)	(1,732,500)	(1,732,500)	(1,732,500)
Thermal consumption - Explosives	(25,200)	(25,200)	(25,200)	(25,200)	(25,200)	(25,200)	(25,200)	(25,200)	(25,200)	(75,600)	(75,600)	(81,225)
Closing balance	11,442,080	9,684,380	7,926,680	6,168,980	4,411,280	2,653,580	895,880	3,138,180	1,380,480	18,572,380	16,764,280	14,950,555
Jet A Fuel Balance												
Opening balance	1,100,000	1,050,000	1,000,000	950,000	900,000	850,000	800,000	750,000	700,000	650,000	1,350,000	1,300,000
Deliveries	-	-	-	-	-	-	-	-	-	750,000	-	-
Jet A fuel consumption	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)	(50,000)
Closing balance	1,050,000	1,000,000	950,000	900,000	850,000	800,000	750,000	700,000	650,000	1,350,000	1,300,000	1,250,000
Total fuel closing balance, litres	21,591,182	18,524,466	15,457,749	12,345,199	9,232,649	6,120,099	3,005,049	7,120,082	3,868,356	31,712,263	28,806,171	25,894,453

Appendix D.2:
Mary River Landfarm Design Brief

BAFFINLAND IRON MINES CORPORATION

DESIGN BRIEF- MILNE INLET LANDFARM

REPORT

NOVEMBER 2012
ISSUED FOR USE
EBA FILE: E14101174
version 2.0

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APPENDICES

1.0 INTRODUCTION

EBA Engineering Consultants Ltd. operating as EBA, A Tetra Tech Company (EBA) was requested by Baffinland Iron Mines Corporation to provide engineering services for the design of a landfarm at the Milne Inlet, Nunavut. This facility is required for the bioremediation treatment of existing petroleum hydrocarbon impacted soils that will be moved during the decommissioning of the Milne Inlet fuel bladder containment facility that was constructed in 2007.

Construction drawings and specifications have been prepared for the facility and are attached to this design brief. In the case of discrepancies, "The Specifications and Design Drawings" supersede this Design Brief.

2.0 DESIGN INTENT

A soil sampling program of soils contained in the Baffinland Milne inlet bladder fuel was conducted by EBA in September 2011 (Summary Report on Assessment of Hydrocarbon-Impacted Soils within the Bulk Fuel Storage Facility at Milne Inlet, Nunavut, November 23, 2012, included in Appendix A). The laboratory analytical results indicated that, of the 2,700 m^3 of soil within the contained within the bladder farm facility, approximately 1,700 m^3 did not meet the Government of Nunavut guidelines for industrial land use for coarse-grained soils and therefore require treatment prior to re-use. The soil contaminants include the F2 and F3 petroleum hydrocarbon (PHC) fractions.

A soil biotreatment study was carried out to determine how amenable the soils are to a landfarm treatment method. The study was carried out by SiREM Laboratories (SiREM). The SiREM report, "Laboratory Biotreatability Study to Evaluate Biodegradation of Petroleum Hydrocarbons", Milne Inlet, Nunavut, is presented in Appendix B. The results of the study were favorable and concluded that the soil was amenable to land treatment.

It is proposed that the soils be treated within a landfarm. The proposed landfarm design consists of a bermed area lined with a geomembrane liner. Contaminated soil will be landfarmed in the upgradient portion of the facility, while summer precipitation runoff is contained in a downgradient sump area.

The landfarm will accommodate all of the hydrocarbon contaminated soil originating from the bladder farm. Other PHC-impacted soils may be treated in the facility if they meet the acceptance criteria outlined in the Hydrocarbon Impacted Soils Storage and Landfarm Facility Operations, Maintenance and Monitoring Plan (EBA 2012). Soils will be treated in two batches with an estimated two summer seasons of treatment, resulting in a minimum four-year design life of the landfarm and soils storage facility.

The landfarm design was completed in general conformance with Nunavut Water Board information requirements, including the Industrial Supplemental Information Guideline (SIG) for Hydrocarbon Impacted Soil Storage and Landfarm Treatment Facilities (February 2010, draft).

The following documents were also taken into consideration:

- Mine Site Reclamation Policy for Nunavut, Indian and Northern Affairs Canada, 2002;

- Federal Guidelines for Landfarming Petroleum Hydrocarbon Contaminated Soils. SAIC Canada, 2006; and
- Guidelines on the Ex-Situ Bioremediation of Petroleum Hydrocarbon Contaminated Soils on Federal Crown Land. Environment Canada, 1993.

3.0 SCOPE OF WORK

As per the proposal submitted to Baffinland by EBA on January 11, 2012, the landfarm design task comprises the following elements:

- Selection of a landfarm site;
- Prepare construction design drawings in plan and profile, construction specifications with a schedule of quantities, and field QA/QC protocol for earthworks;
- Prepare a design brief for the landfarm.

4.0 SITE SELECTION

In September 2011, EBA staff observed two candidate areas for the landfarm construction as shown in Figure 2. Based on the features of the location and in consultation with the Client, the terrace east of the camp was selected. The footprint of the proposed facility is shown on Drawing C101 in Appendix C and shown in Photo 1.

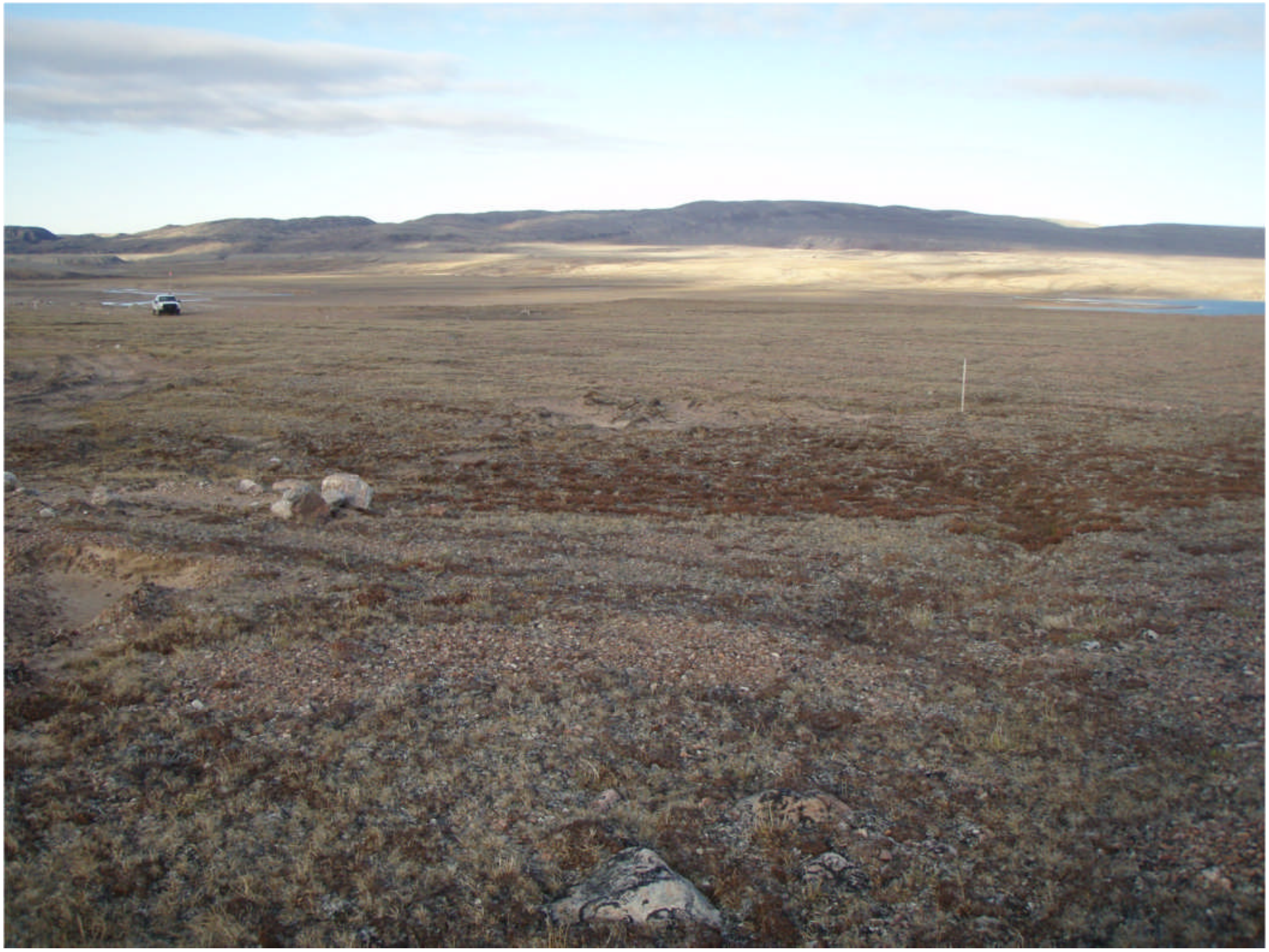

Photo 1: Proposed landfarm location on terrace east of Milne Inlet Camp. Photo is looking southwest from approximate northeast corner of the planned facility.

The following considerations were taken into account for the selection of the site:

1. Proximity to the existing tote road, to minimize site disturbance by road construction.
2. Proximity to Milne Camp and the bladder farm, to reduce haul distances.
3. Use of a previously-disturbed site. There is already a road to an exploration testpit on the terrace.
4. Distance from fish-bearing water bodies and potable water. Environment Canada recommends siting greater than 500 m from a permanent surface water body (for both potable and non-potable surface waters) and from a potable groundwater well (SAIC, 2005).
5. Site is not within a 50 year floodplain (SAIC, 2005).
6. Natural slope of 2% reduces site preparation and engineering costs.
7. Proximity of borrow pits reduces haul costs.

8. Area is windswept, which reduces the potential for snow accumulation within the facility in winter. Snowmelt produces contact water within the landfarm which must be tested and or treated prior to release.
9. Site is located outside of areas known to contain archaeological remains.
10. Site is located in an area with limited access for humans and wildlife. Crosswinds are expected in July through September, reducing the potential for PHC vapours to affect the camp. Based on existing records, the camp may be downwind of the facility some days in June. Odors and dust are only expected to occur during soil tilling.
11. The terrace consists of well-drained sand and gravel with some cobble and underlain by permafrost soils. There is not expected to be any significant water beneath the landfarm within the active layer.

Portions of the terrace area appear to be ice-rich. The ice-rich areas were avoided to the maximum practical extent in siting of the landfarm.

5.0 SITE CONDITIONS

5.1 Precipitation

The North Baffin region is located within the Northern Arctic and the Arctic Cordillera Ecozones, as delineated in the National Ecological Framework for Canada. Northern Baffin Island has a semi-arid climate with relatively little precipitation. Canadian Climate Normals define precipitation as "rainfall plus the water equivalent of snowfall and all other forms of frozen precipitation" (Environment Canada, 1982).

In the Canadian Arctic, precipitation comes in the form of rain, sleet, snow, and ice crystals. In particular, blowing and drifting snow are factors that influence the accuracy of precipitation measurements in the area.

5.1.1 Rainfall

The Updated Baseline Meteorological Assessment (RWDI 2010), submitted as part of the February 2012 Final Environmental Impact Statement for the Mary River Project, indicated that the climate at the Environment Canada meteorological station at Mittimatalik (formerly Pond Inlet), Nunavut (72°41' N, 77°59' W) is the most representative of Milne Inlet. Mean annual precipitation at this location is 190.8 mm, with 144.5 cm of snowfall (equivalent to 105.4 mm of rain) and 85.4 mm of rain. Historical records show that snow can occur in any month and rainfall may occur from April through November. The wettest month in Mittimatalik is August, with an average 32.9 mm of rain.

5.1.2 Snow

The treeless topography and fine powdery snow produce blowing snow conditions. Drifting snow accumulates in valleys and against obstacles, while most of the flat terrain is swept free wind-blown, as shown in Photo 2.

Photo 2: Proposed landfarm site looking north at the terrace from the tote road.

Snow depth and accumulation is heavily dependent upon wind distribution and sublimation of snow, which are in turn strongly influenced by local topography. The Landfarm berm height is set to accommodate the proposed soil treatment volume as well as the maximum expected quantity of annual precipitation (rainfall and snowmelt) over the design life of the facility.

5.2 Wind

The wind rose for Milne Port indicates that winds from the northeast and south-southeast occur most frequently followed by winds from the southeast and northeast.

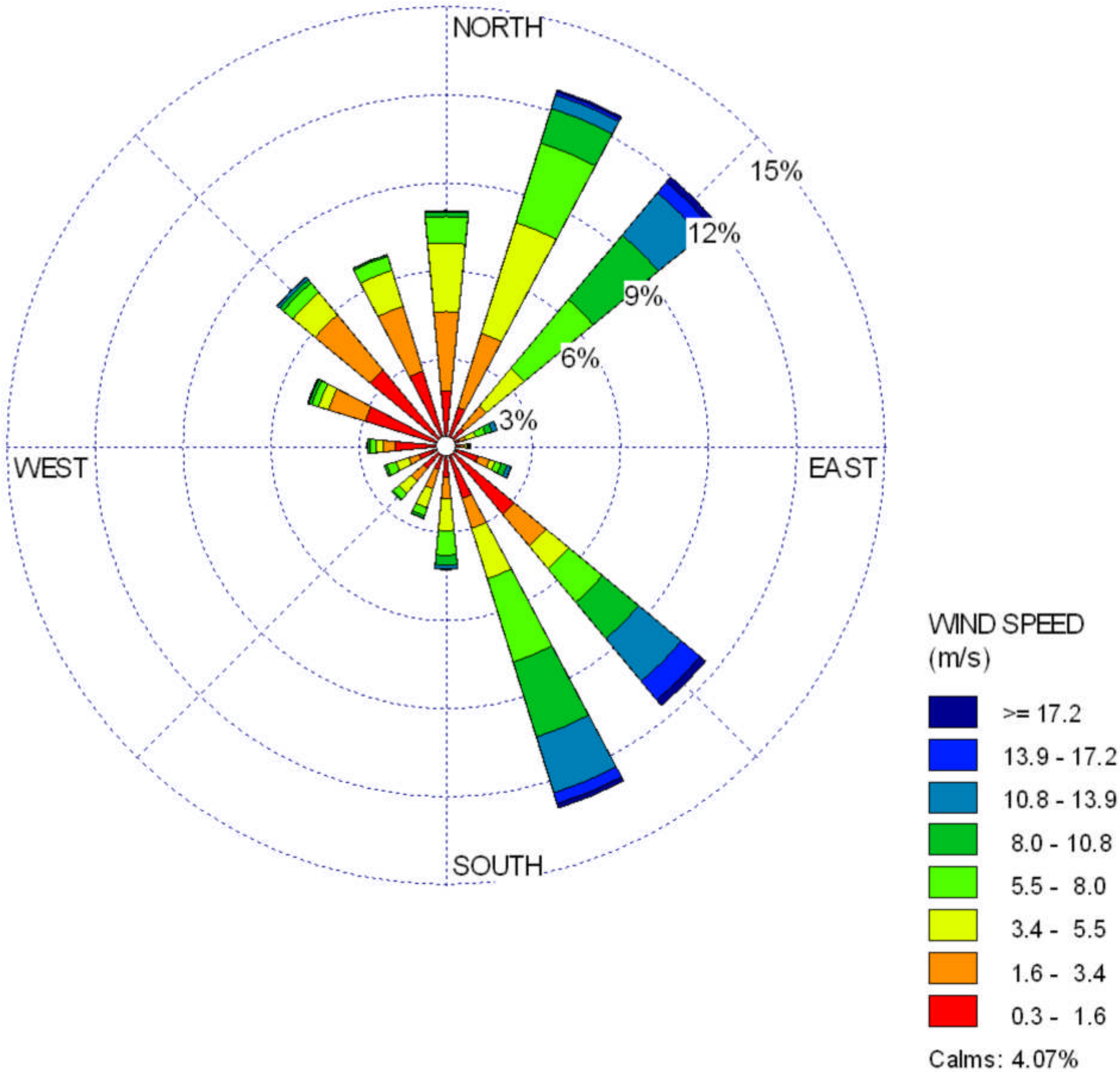

Figure 3 Wind rose for Milne Inlet, 2006-2010 (RWDI 2010).

Light air conditions of 0.3 to 1.6 m/s, occur most frequently followed by light breezes of 1.6 to 3.4 m/s. Strong breezes of 10.8 to 13.9 m/s occur 7 % of the time and near-gale winds of 13.9 to 17.2 m/s occur 2 % of the time.

5.3 Permafrost and Surficial Drainage

The flat-topped surface of a glaciofluvial terrace is characterized with well-defined ice-wedge polygons indicative of the presence of ice-rich permafrost. The terrace slopes are fairly steep (30-50%) and are dissected by thermal erosion along frost cracks (which form the ice-wedge polygons) as a result of melting of the ice wedges. The existing tote road crosses several of these thermal erosion features.

Surface water runs off the hill to the northeast and flows onto the terrace surface. For the most part, it drains through the coarse-grained sediments to the water table within the active layer, but some of it collects, resulting in areas of poor drainage in some areas on the crest of the terrace.

There is a clover-leafed shaped group of rotational landslides identified on the southern slope of the terrace and a skin flow slide on the north slope. The north slope skin flow was the most recent event at the time of air photo acquisition, as it is un-vegetated. This area is well beyond the landfarm footprint and will not impact the landfarm.

Since the thermal erosion features form mainly by surface water flow and because there are slides on the north and south slopes of the terrace, it appears that the subsurface drainage pathways are to the north and south. Wetting of the slopes in these areas has resulted in thawing of permafrost and localized failure of the slope materials.

The landfarm site has been selected to avoid thermal erosion features as well as the landslide areas on the southern and northern slopes.

6.0 DESIGN PARAMETERS

6.1 Soil Containment

Details of the landfarm are shown on the construction drawings. The dimensions of the quadrilateral facility are approximately 80 m by 60 m on the longest sides. The total floor area is 4,000 m^2 and the treatment area is nearly 3,750 m^2. There is sufficient area in the landfarm to treat half the volume of soils originating from the bladder farm at a recommended treatment depth of 0.3 m, while stockpiling the other half of the soils in the facility for an anticipated two years.

The facility has been positioned to allow for expansion of the treatment area to the north or to the east, if additional PHC soils require treatment.

Surface preparation of the area is minimal. It includes the removal of open graded boulders and other unsuitable materials. The thin organic layer should be left in place to help preserve the thermal regime.

The berms have been designed with a minimum 2.5 m top width; however, adjustments to increase the top of berm width may be made during construction to accommodate site-specific foundation conditions and available equipment. Lifts should not exceed 0.3 m in thickness, and Type 2 materials should be compacted to 95% of corrected maximum dry density.

Estimated design quantities of granular material are as follows:

Table 1: Schedule of Quantities

Geomembrane (m^2)	Geotextile (m^2)	Fill Material Type	
		Type 2 Granular Fill (m^3)	Type 5 Granular Fill (m^3)
5,350□	10,700□	9,100	2,350
□no allowance for seams or overlap have been included in these values			

The liner system consists of a 60 mil HDPE liner protected between layers of 12-oz non-woven geotextile. The liner system is supported on a 150 mm layer of clean Type 5 granular fill material suitable for the embedment of geomembranes, and covered with an additional 300 mm layer of Type 5 granular fill material. Soil from the bladder farm that has contaminates below the Government of Nunavut PHC industrial guidelines can be used for Type 5 granular fill on top of the geomembrane liner. The geomembrane liner is terminated in a key trench around the berm perimeter.

6.2 Water Containment

6.2.1 Rainfall

The landfarm design includes a sump in the lowest corner. The sump has an area of approximately 250 m^2 and has a capacity of approximately 100 m^3. The capacity is more than sufficient to contain all the runoff from an assumed 15 mm rainfall event (60 m^3). Periodic emptying of the sump is recommended to prevent saturating the soils undergoing treatment. Saturated soils are difficult to aerate by tilling and bioremediation rates are suboptimal. Also, it is difficult to operate equipment on saturated sands.

6.2.2 Snowmelt

The landfarm will capture drifted snow. For drift control, rectangular objects should be oriented with the long axis in the direction of the prevailing drift-producing winds. Prevailing winds at Milne Inlet during winter are from the north to northeast. The current design accommodates this guideline to the extent possible given the other site constraints; however, the volume of snow accumulating in the facility was conservatively estimated to include drifts on all four sides of the landfarm. The drift zone was calculated as being six times longer than the berm height (Gray and Male, 1981). Average snow thickness was assumed in the remainder of the landfarm. The estimated snow volume within the landfarm containment facility was 2,005 m^3.

Low snow accumulation, cold air temperatures, and strong winds contribute to hard-packed snow. Wind transport causes snow crystals to become rounded and abraded, resulting in high densities in the upper part of the snow-pack. Benson et al. (1975) described the structure of the snow-pack on the Arctic Coastal Plain of Alaska as consisting of a high-density wind-packed surface layer (305 and 450 kg/m^3) overlying a low-density(200-300 kg/m^3) depth-hoar layer, with transitional layers in between. For the purpose of water management, a conservative, average snow density of 325 mg/m^3 was selected.

Based on these assumptions, it is estimated that the annual snowmelt in the landfarm will be 650 m^3.

6.2.3 Emergency Water Containment

The 2010 RWDI report indicated a return period of 13 years for an extreme precipitation event of ≥25 mm/day, based on climate normals datasets (1971 – 2000) from Environment Canada. No analysis of extreme annual precipitation estimates was included in the report. In order to determine an adequate berm design height ensuring containment of water during extreme rainfall events, the maximum yearly rainfall recorded at Mine Inlet (166.1 mm in 2006) was doubled, resulting in approximately 1,300 m^3 of annual rainfall accumulation in the landfarm.

Adding the annual snowmelt (650m^3), the design maximum water level in the landfarm was calculated to be 1,950 m^3, excluding all evaporative losses. The minimum freeboard (crest of liner) at this design water volume is 0.3 m. This water holding capacity is a contingency to the worst case scenario, where no pumping and treatment of contact water occurs during operations that same year.

6.3 Permafrost Protection

The proposed landfarm footprint was selected to minimize overlap with the ice-rich areas on the terrace to the north. During site preparation of the landfarm footprint, ground disturbance should be minimized, and the thin organic cover should be left in place in order to help preserve the thermal regime. Construction over the natural ground will create a thermal barrier, causing the permafrost table to aggrade upwards to the base of the fill. Although construction of the landfarm overtop the ice-rich areas is not expected to cause significant permafrost degradation, the naturally-occurring patterns in the ground may eventually translate to the top and side surfaces of the berms, which may require periodic maintenance.

Selection of a discharge point for treated water should consider the potential for thermal erosion of the terrace slopes.

7.0 CLOSURE

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Sincerely,
EBA Engineering Consultants Ltd.

Prepared by:

REGISTERED PRO
W. T. HORNE
LICENSEE
Nov 23, 2012
N.W.T.

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/ktd

PERMIT TO PRACTICE
EBA ENGINEERING CONSULTANTS LTD.
Signature
Date NOV. 23, 2012
PERMIT NUMBER: P 018
NWT/NU Association of Professional
Engineers and Geoscientists

REFERENCES

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