.5 If used in the landfarm protective layer, soils originating from the Milne Inlet bulk fuel facility must be tested for benzene, toluene, ethylbenzene and xylenes (BTEX), CCME hydrocarbon fractions F1-F4, and lead at a minimum frequency of one (1) set of samples per stockpile or per 200 m^3 of soil.

3.2.6 Placing Hand-Laid Riprap

.1 Hand-laid riprap shall be placed at culvert inlets and outlets and at other locations as shown on the Drawings.

.2 The stones shall be placed with their beds at right angles to the slope, the larger stones being placed first in the bottom courses and graduating to the smaller stones at the top. Stones shall be laid in close contact so as to break joints, and in such manner that the weight is carried by the earth and not by the adjacent stones. The spaces between the larger stones shall be filled with spalls, securely rammed into place. The finished work shall present an even, tight surface.

3.2.7 Quality Assurance

.1 General

.1 This section describes the required quality assurance testing that shall be carried out for fill materials.

.2 The testing will be carried out by the Owner's Representative or an independent testing firm engaged by the Owner.

.2 Testing Requirements

.1 Samples of Type 2 and Type 5 material shall be tested as follows to verify that they meet the specified requirements. Additional testing shall be carried out as requested by the Owner's Representative.

.2 Table

Test	Material	Frequency
Particle Size Analysis	Type 2 and Type 5	One per 500 m^3 placed, per borrow source
Standard Proctor	Type 2	One per 1,000 m^3 placed, per borrow source
In-situ Density	Type 2	One per 100 m^3 placed

PART 1 GENERAL

1.1 Summary

.1 This specification includes furnishing and installing HDPE geomembranes with a formulated sheet density of 0.940 g/cc or greater associated with HDPE geomembranes.

1.2 References

Where material properties are specified the following standards are applicable:

.1 American Society for Testing and Materials (ASTM):

.1 D 413, Standard Test Methods for Rubber Property—Adhesion to Flexible Substrate

.2 D 638, Standard Test Method for Tensile Properties of Plastics.

.3 D 751, Standard Test Methods for Coated Fabrics.

.4 D 792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

.5 D 1004, Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.

.6 D 1204, Standard Test Method for Linear Dimensional Changes of Non Rigid Thermoplastic Sheeting or Film at Elevated Temperature.

.7 D 1238, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.

.8 D 1505, Standard Test Method for Density of Plastics by Density-Gradient Technique.

.9 D 1603, Standard Test Method for Carbon Black in Olefin Plastics.

.10 D 3895, Test Method for Oxidative Induction Time of Polyolefins by Thermal Analysis.

.11 D 4218, Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique.

.12 D 4437, Standard Practice for Determining the Integrity of Field Seams Used in Joining Flexible Polymeric Sheet Geomembranes.

.13 D 4833, Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.

.14 D 5199, Standard Test Method for Measuring Nominal Thickness of Smooth Geomembranes.

.15 D 5397, Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefins using Notched Constant Tensile Load Test.

.16 D 5596, Standard Practice for Microscopical Examination of Pigment Dispersion in Plastic Compounds.

.17 D 5641, Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber.

.18 D 5820, Test Method for Air Testing.

.19 D 5994, Standard Test Method for Measuring Nominal Thickness of Textured Geomembranes.

.20 D 6365, Standard Practice for the Nondestructive Testing of Geomembrane Seams using The Spark Test.

.21 D 6392 Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods.

.22 D 5820-95, Pressurized Air Channel Test for Dual Seamed Geomembranes.

.2 Geosynthetic Research Institute (GRI):

.1 GRI GM 9, Cold Weather Seaming of Geomembranes

.2 GRI GM 10, The Stress Crack Resistance of HDPE Geomembrane Sheet

.3 GRI GM 12, Measurement of the Asperity Height of Textured Geomembranes Using a Depth Gage

.4 GRI GM 13, Test Properties, Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes

.5 GRI GM 14, Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes

.6 GRI GM 19, Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes

1.3 Submittals

.1 Submit the following to the Engineer or Owner, for review and approval, within a reasonable time so as to expedite shipment or installation of the Geomembrane:

.1 Documentation of manufacturer's qualifications as specified in subsection 1.4 of this Section.

.2 Manufacturer's Quality Control program manual or descriptive documentation.

.3 A material properties sheet, including at a minimum all properties specified in GRI GM 13, including test methods used.

.4 Sample of the material.

.5 Documentation of Installer's qualifications, as specified below and in Subsection 1.4 of this Section.

a. Submit a list of at least ten completed facilities. For each installation, provide: name and type of facility; its location; the date of installation; name and telephone number of contact at the facility; type and thickness of geomembrane and; surface area of the installed geomembrane.

b. Submit resumes or qualifications of the Installation Supervisor, Master Seamer and Technicians to be assigned to this project.

c. Submit written Welding Procedures for each type of weld to be used, describing the following minimum parameters. The Welding Procedure shall incorporate

   i. Joint geometry.

   ii. Specific base resins or range of resin properties for sheet and filler material to which the procedure applies (identify by manufacturer and resin name).

   iii. Limitations with respect to positions or locations, such as slopes, vertical, overhead, etc.

   iv. Type and extent of surface preparation required.

   v. Temperature settings for equipment, including descriptions for method and frequency of monitoring.

   vi. Ambient conditions at which the procedure is applicable. Indicate method of measurement for each parameter.

d. Submit all information pertaining to the type of welding equipment to be used and provide the Owner with the opportunity to inspect a log record of maintenance and overhaul history of the seaming equipment and accessories (generator, power cords, volt meter, etc.).

e. Quality Control Program.

.6 Example Material Warranty and Liner Installation Warranty

.2 Shop Drawings

.1 Submit copies of shop drawings for Engineer's approval within a reasonable time so as not to delay the start of geomembrane installation. Shop drawings shall show the proposed panel layout identifying seams and details. Seams should generally follow the direction of the slope. Butt seams or roll-end seams should not occur on a slope unless approved by the Owner or Engineer. Butt seams on a slope, if allowed, should be staggered.

.2 Placement of geomembrane should not be allowed to proceed until Owner's Representative has received and approved the shop drawings.

.3 Additional Submittals (In-Progress and at Completion)

.1 Manufacturer's warranty

.2 Geomembrane installation warranty

.3 Low-temperature seaming procedures

.4 Field seam non-destructive test results

.5 Field seam destructive test results

.6 Daily field installation reports

.7 Installation record drawing

1.4 Quality Control

.1 Manufacturer's Qualifications:

.1 The manufacturer of geomembrane of the type specified or similar product shall have at least five years experience in the manufacture of such geomembrane.

.2 In addition, the geomembrane manufacturer shall have manufactured at least 1,000,000 m^2 (10,000,000 ft^2) of the specified type of geomembrane or similar product during the last five years.

.2 Installer's Qualifications

.1 The Geomembrane Installer shall be the Manufacturer, approved Manufacturer's Installer or a contractor approved by the Owner's Representative to install the geomembrane.

.2 The Geomembrane Installer shall have at least three years experience in the installation of the specified geomembrane or similar. The Geomembrane Installer shall have installed at least 10 projects involving a total of 500,000 m^2 of the specified type of geomembrane or similar during the last three years.

.3 Installation shall be performed under the direction of a field Installation Supervisor who shall be responsible throughout the geomembrane installation, for geomembrane panel layout, seaming, patching, testing, repairs, and all other activities of the Geomembrane Installer. The Field Installation Supervisor shall have installed or supervised the installation and seaming of a minimum of 10 projects involving a total of 500,000 m^2 of geomembrane of the type specified or similar product.

.4 Seaming shall be performed under the direction of a Master Seamer (who may also be the Field Installation Supervisor or Crew Foreman) who has seamed a minimum of 300,000 m^2 of geomembrane of the type specified or similar product, using the same type of seaming apparatus to be used in the current project. The Field Installation Supervisor and/or Master Seamer shall be present whenever seaming is performed.

.5 All seaming, patching, other welding operations, and testing shall be performed by qualified technicians employed by the Geomembrane Installer.

1.5 Transport, Storage and Handling

.1 General

.1 Ensure that the geomembrane is not folded at any time during the manufacture, fabrication, shipping or installation processes.

.1 Identification

.1 Each roll of geomembrane delivered to the site shall be labeled by the manufacturer. The label shall be firmly affixed and shall clearly state the manufacturer's name, product identification, material thickness, roll number, roll dimensions and roll weight.

.2 If the manufactured rolls are assembled into panels prior to shipping, the label shall also include the panel number and the roll numbers which comprise the manufactured panel.

.2 Transportation

.1 Place a sacrificial strip of membrane between the geomembrane and each strap.

.2 Cut off the free ends of metal strapping prior to shipping.

.3 Install protective caps to cover and protect the edge of the geomembrane during transportation.

.3 Site Handling and Storage

.1 Store rolls on a sacrificial sheet at site. Continuously and uniformly support rolls on a smooth, level prepared surface.

.2 Geomembrane shall be protected from mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions.

.3 Rolls shall be stored away from high traffic areas.

.4 Any damage to the material resulting from manufacture, shipping or handling shall be identified to the Owner or the Owner's Representative.

1.6 Project Conditions

.1 Geomembrane should not be installed in the presence of standing water, while precipitation is occurring, during excessive winds, or when material temperatures are outside the limits specified in Part 3.

1.7 Material Warranty

.1 Material warranty shall be 5 years or as otherwise agreed by the Manufacturer and the Owner.

1.8 Geomembrane Installation Warranty

.1 The Geomembrane Installer shall guarantee the geomembrane installation against defects in the installation and workmanship for 2 years commencing with the date of final acceptance.

PART 2 PRODUCTS

2.1 Source Quality Control

.1 Manufacturing Quality Control

.1 The test methods and frequencies used by the manufacturer for quality control/quality assurance of the above geomembrane prior to delivery shall be in accordance with GRI GM 13 for HDPE geomembrane or modified as required for project specific conditions.

.2 The manufacturer's geomembrane quality control certifications, including results of quality control testing of the products must be supplied to the Owner's Representative to verify that the materials supplied for the project are in compliance with all product and or project specifications in this Section. The certification shall be signed by a responsible party employed by the manufacturer, such as the QA/QC Manager, Production Manager, or Technical Services Manager. Certifications shall include lot and roll numbers and corresponding shipping information.

.3 The Manufacturer will provide Certification that the geomembrane and welding rod supplied for the project are made from the same material type and are compatible.

.2 Geomembrane

.1 The geomembrane shall consist of new, first quality products designed and manufactured specifically for the purpose of this work which shall have been satisfactorily demonstrated by prior testing to be suitable and durable for such purposes.

.2 The geomembrane rolls shall be seamless, high density polyethylene (HDPE - Formulated Sheet Density ≥ 0.94g/cc) containing no plasticizers, fillers or extenders and shall be free of holes, blisters or contaminants, and leak free verified by 100% in line spark or equivalent testing.

.3 The geomembrane shall be supplied as a continuous sheet with no factory seams in rolls.

.4 The geomembrane will meet the property requirements as shown in Table A (GRI GM 13) below:

Table A

Properties	Test Method	Test Value 1.5 mm	Testing Frequency (minimum)
Thickness (min. ave.) ▪ lowest individual of 10 values	D5199	Nom. -10□	Per roll
Density mg/l (min.)	D 1505/ D 792	0.940 g/cc	90,000 kg
Tensile Properties *(1)* (min. ave.) ▪ yield strength ▪ break strength ▪ yield elongation ▪ break elongation	D 6693 Type IV	 ▪ 22 kN/m. ▪ 40 kN/m ▪ 12□ ▪ 700□	9,000 kg
Tear Resistance (min. ave.)	D 1004	187 N	20,000 kg
Puncture Resistance (min. ave.)	D 4833	480 N	20,000 kg
Stress Crack Resistance *(2)*	D5397 (App.)	300 hr.	per GRI-GM10
Carbon Black Content (range)	D 4218 *(3)*	2.0-3.0□	9,000 kg
Carbon Black Dispersion	D 5596	note *(4)*	20,000 kg
Oxidative Induction Time (OIT) (min. ave.) *(5)* a) Standard OIT □ or □ b) High Pressure OIT	 D 3895 D 5885	 100 min. 400 min.	90,000 kg
Oven Aging at 85°C *(5), (6)* a) Standard OIT (min. ave.) - □ retained after 90 days □ or □ b) High Pressure OIT (min. ave.) - □ retained after 90 days	D 5721 D 3895 D 5885	 55□ 80□	per each formulation
UV Resistance *(7)* a) Standard OIT (min. ave.) □ or □ b) High Pressure OIT (min. ave.) - □ retained after 1,600 hrs *(9)*	GM 11 D 3895 D 5885	 N.R. *(8)* 50□	per each formulation

(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Yield elongation is calculated using a gage length of 33 mm. Break elongation is calculated using a gage length of 50 mm.

(2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer□s mean value via M□C testing.

(3)	Other methods such as D 1603 (tube furnace) or D 6370 (TGA) are acceptable if an appropriate correlation to D 4218 (muffle furnace) can be established.
(4)	Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3.
(5)	The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(6)	It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(7)	The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(8)	Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(9)	UV resistance is based on percent retained value regardless of the original HP-OIT value.

.5 The geomembrane seams shall meet the property requirements as shown in Table 1 of GRI GM 19 and reproduced below:

Table B

Geomembrane Nominal Thickness	1.5 mm
Hot Wedge Seams (1)	
Shear strength (2), N/25 mm	525
Shear elongation at break (3)	50
Peel strength (2), N/25 mm	398
Peel separation, □	25
Extrusion Fillet Seams (1)	
Shear strength (2), N/25 mm	525
Shear elongation at break(3), □	50
Peel strength (2), N/25 mm	340
Peel separation, □	25

1. Also for hot air and ultrasonic seaming methods
2. Value listed for shear and peel strength are for 4 out of 5 test specimens; the 5th specimen can be low as 80□ of the listed values
3. Elongation measurements should be omitted for field testing

PART 3 EXECUTION

3.1 Subgrade Preparation

.1 The subgrade shall be prepared in accordance with the project specifications. The geomembrane subgrade shall be uniform and free of sharp or angular objects that may damage the geomembrane prior to installation of the geomembrane.

.2 The Geomembrane Installer and Owner's Representative shall inspect the surface to be covered with the geomembrane on each day's operations prior to placement of geomembrane to verify suitability.

.3 The Geomembrane Installer and Owner's Representative shall provide daily written acceptance for the surface to be covered by the geomembrane in that day's operations. The surface shall be maintained in a manner to ensure subgrade suitability.

.4 All subgrade damaged by construction equipment and deemed unsuitable for geomembrane deployment shall be repaired prior to placement of the geomembrane. All repairs shall be approved by the Owner's Representative and the Geomembrane Installer.

3.2 Geomembrane Placement

.1 No geomembrane shall be deployed until the applicable certifications and quality control certificates listed in Part 1 of this Section are submitted to and approved by the Owner's Representative within the timeframe specified in the Contract Documents. If the material does not meet project specifications it shall be removed from the work area.

.2 The geomembrane shall be installed to the limits shown on the project Drawings and essentially as shown on approved panel layout drawings.

.3 No geomembrane material shall be unrolled and deployed if the material temperatures are lower than 0 degrees C unless otherwise approved by the Owner's Representative in writing. The specified minimum temperature for material deployment may be adjusted by the Owner's Representative. Temperature limitations should be defined in the preconstruction meeting. Typically, only the quantity of geomembrane that will be anchored and seamed together in one day should be deployed.

.4 No vehicular traffic shall travel on the geomembrane other than an approved low ground pressure vehicle or equivalent.

.5 Sand bags or equivalent ballast shall be used as necessary to temporarily hold the geomembrane material in position under the foreseeable and reasonably-expected wind conditions. Sand bag material shall be sufficiently close-knit to prevent soil fines from working through the bags and discharging on the geomembrane.

.6 Geomembrane placement shall not be done if moisture prevents proper subgrade preparation, panel placement, or panel seaming. Moisture limitations should be defined in the preconstruction meeting.

.7 Damaged panels or portions of the damaged panels which have been rejected shall be marked and their removal from the work area recorded.

.8 The geomembrane shall not be allowed to "bridge over" voids or low areas in the subgrade. The geomembrane shall rest in intimate contact with the subgrade.

.9 Wrinkles caused by panel placement or thermal expansion should be minimized.

.10 Build in adequate slackness to allow for thermal contraction without significant applied stress at temperatures between ambient temperature at installation and -50 degrees C.

.11 Considerations on Site Geometry: In general, seams shall be oriented parallel to the line of the maximum slope. In corners and odd shaped geometric locations, the total length of field seams shall be minimized. Seams shall not be located at low points in the subgrade unless geometry requires seaming at such locations and if approved by the Owner's Representative. Welds on slopes must be constructed with the upper panel overtop of the lower panel.

.12 Overlapping: The panels shall be overlapped prior to seaming to whatever extent is necessary to affect a good weld and allow for proper testing. In no case shall this overlap be less than 75 mm.

3.3 Equipment

.1 The Geomembrane Installer shall maintain at least one spare operable seaming unit on site at all times.

3.4 Seaming Procedures

.1 The welding technique shall produce a joined interface of uniform properties across the full width of the weld.

.2 Welding may only be performed within the "window" of parameters supplied by the Contractor in the written Welding Procedures.

.3 Portable structures may be used to facilitate attainment of these parameters in the area to be seamed, but must be approved by the Owner’s representative.

.4 Welding shall not proceed when the prepared surfaces cannot be maintained free of moisture.

.5 . All surfaces to be joined shall be cleaned free of grease, oils, dirt and foreign material.

.6 Prepared surfaces shall not remain exposed for more than 30 minutes before welding.

.7 Cold weather installations should follow guidelines as outlined in GRI GM9.

.8 No geomembrane material shall be seamed when liner temperatures are less than 0 degrees C unless the following conditions are complied with:

.1 Seaming of the geomembrane at material temperatures below 0 degrees C (measured 150 mm above the geomembrane surface) is allowed if the Geomembrane Installer can demonstrate to the Owner's Representative, using pre-qualification test seams, that field seams comply with the project specifications, the safety of the crew is ensured, and geomembrane material can be fabricated (i.e. pipeboots, penetrations, repairs. etc.) at sub-freezing temperatures.

.2 The Geomembrane Installer shall submit to the Owner's Representative for approval, detailed procedures for seaming at low temperatures, possibly including the following:

.3 Preheating of the geomembrane

.4 The provision of a tent or other device if necessary to prevent heat losses during seaming and rapid heat losses subsequent to seaming.

.5 Number of test welds to determine appropriate seaming parameters

.9 No geomembrane material shall be seamed when the sheet temperature is above 75 degrees C as measured by an infrared thermometer or surface thermocouple unless otherwise approved by the Owner's Representative. This approval will be based on recommendations by the manufacturer and on a field demonstration by the Geomembrane Installer using prequalification test seams to demonstrate that seams comply with the specification.

.10 Seaming shall primarily be performed using automatic fusion welding equipment and techniques. Extrusion welding shall be used where fusion welding is not possible such as at pipe penetrations, patches, repairs and short (less than a roll width) runs of seams.

.11 Fishmouths or excessive wrinkles at the seam overlaps shall be minimized and when necessary cut along the ridge of the wrinkles back into the panel so as to effect a flat overlap. The cut shall be terminated with a keyhole cut (nominal 10 mm diameter hole) so as to minimize crack/tear propagation. The overlay shall subsequently be seamed. The key hole cut shall be patched with an oval or round patch of the same base geomembrane material extending a minimum of 150 mm beyond the cut in all directions.

3.5 Field Quality Control

The Owner's Representative shall be notified prior to all pre qualification and production welding and testing, or as agreed upon in the pre construction meeting.

.1 Prequalification Test Seams

.1 Test seams shall prepare and tested by the Geomembrane Installer to verify that seaming parameters (speed, temperature and pressure of welding equipment) are adequate.

.2 Test seams shall be made by each welding technician and tested in accordance with ASTM D 4437 at the beginning of each seaming period. Test seaming shall be performed under the same conditions and with the same equipment and operator combination as production seaming. The test seam shall be approximately 3.3 meters long for fusion welding and 1 meter long for extrusion welding with the seam centered lengthwise. At a minimum, tests seams should be made by each technician 1 time every 4–6 hours; additional tests may be required with changes in environmental conditions.

.3 Two 25 mm wide specimens shall be die-cut by the Geomembrane Installer from each end of the test seam. These specimens shall be tested by the Geomembrane Installer using a field tensiometer

testing both tracks for peel strength and also for shear strength. Each specimen should fail in the parent material and not in the weld, “Film Tear Bond"(F.T.D. failure). Seam separation equal to or greater than 25% of the track width shall be considered a failing test.

.4 The minimum acceptable seam strength values to be obtained for all specimens tested are listed in Part 2 of this Section. Four specimens shall pass for the test seam to be a passing seam.

.5 If a test seam fails, an additional test seam shall be immediately conducted. If the additional test seam fails, the seaming apparatus shall be rejected and not used for production seaming until the deficiencies are corrected and a successful test seam can be produced.

.6 A sample from each test seam shall be labeled. The label shall indicate the date, geomembrane temperature, number of the seaming unit, technician performing the test seam and pass or fail description. The sample shall then be given to the Owner's Representative for archiving.

.2 Field Seam Non-Destructive Testing

.1 All field seams shall be non-destructively tested by the Geomembrane Installer over the full seam length before the seams are covered. Each seam shall be numbered or otherwise designated. The location, date, test unit, name of tester and outcome of all non-destructive testing shall be recorded and submitted to the Owner's Representative.

.2 Testing should be done as the seaming work progresses, not at the completion of all field seaming, unless agreed to in advance by the Owner's Representative. All defects found during testing shall be numbered and marked immediately after detection. All defects found should be repaired, retested and remarked to indicate acceptable completion of the repair.

.3 Non-destructive testing shall be performed using vacuum box, air pressure or spark testing equipment.

.4 Non-destructive tests shall be performed by experienced technicians familiar with the specified test methods. The Geomembrane Installer shall demonstrate to the Owner's Representative all test methods to verify the test procedures are valid.

.5 Extrusion seams shall be vacuum box tested by the Geomembrane Installer in accordance with ASTM D 4437 and ASTM D 5641 with the following equipment and procedures:

.6 The vacuum pump shall be charged and the tank pressure adjusted to approximately 35 kPa.

.7 The Geomembrane Installer shall create a leak tight seal between the gasket and geomembrane interface by wetting a strip of geomembrane approximately 0.3m by 1.2m (length and width of box) with a soapy solution, placing the box over the wetted area, and then compressing the box against the geomembrane. The Geomembrane Installer shall then close the bleed valve, open the vacuum valve, maintain initial pressure of approximately 35 kPa for approximately 5 seconds. The geomembrane should be continuously examined through the viewing window for the presence of

soap bubbles, indicating a leak. If no bubbles appear after 5 seconds, the area shall be considered leak free. The box shall be depressurized and moved over the next adjoining area with an appropriate overlap and the process repeated.

.8 All areas where soap bubbles appear shall be marked, repaired and then retested.

.9 At locations where seams cannot be non-destructively tested alternate non-destructive spark testing or equivalent should be substituted.

.10 Equipment for Spark testing shall be comprised of but not limited to: A hand held holiday spark tester and conductive wand that generates a high voltage

.11 The testing activities shall be performed by the Geomembrane Installer by placing an electrically conductive tape or wire beneath the seam prior to welding. A trial seam containing a non-welded segment shall be subject to a calibration test to ensure that such a defect (non-welded segment) will be identified under the planned machine settings and procedures. Upon completion of the weld, enable the spark tester and hold approximately 25mm above the weld moving slowly over the entire length of the weld in accordance with ASTM 6365. If there is no spark the weld is considered to be leak free.

.12 A spark indicates a hole in the seam. The faulty area shall be located, repaired and retested by the Geomembrane Installer.

.13 Care should be taken if flammable gases are present in the area to be tested.

.14 All seams that are vacuum tested shall be marked with the date tested, the name of the technician performing the test and the results of the test.

.15 Double Fusion seams with an enclosed channel shall be air pressure tested by the Geomembrane Installer in accordance with ASTM D 5820 and ASTM D 4437 and the following equipment and procedures:

.16 Equipment for testing double fusion seams shall be comprised of but not limited to: an air pump equipped with a pressure gauge capable of generating and sustaining a pressure of 210 kPa mounted on a cushion to protect the geomembrane; and a manometer equipped with a sharp hollow needle or other approved pressure feed device.

.17 The Testing activities shall be performed by the Geomembrane Installer. Both ends of the seam to be tested shall be sealed and a needle or other approved pressure feed device inserted into the tunnel created by the double wedge fusion weld. The air pump shall be adjusted to a pressure of 210 kPa, and the valve closed. Allow 2 minutes for the injected air to come to equilibrium in the channel, and sustain pressure for 5 minutes. If pressure loss does not exceed 28 kPa after this five minute period the seam shall be considered leak tight. Release pressure from the opposite end

verifying pressure drop on needle to ensure testing of the entire seam. The needle or other approved pressure feed device shall be removed and the feed hole sealed.

.18 If loss of pressure exceeds 28 kPa during the testing period or pressure does not stabilize, the faulty area shall be located, repaired and retested by the Geomembrane Installer.

.19 Results of the pressure testing shall be recorded on the liner at the seam tested and on a pressure testing record.

.3 Destructive Field Seam Testing

.1 One destructive test sample per 150 linear m seam length or another predetermined length in accordance with GRI GM 14 shall be taken by the Geomembrane Installer from a location specified by the Owner's Representative. The Geomembrane Installer shall not be informed in advance of the sample location. In order to obtain test results prior to completion of geomembrane installation, samples shall be cut by the Geomembrane Installer as directed by the Owner's Representative as seaming progresses.

.2 All field samples shall be marked with their sample number and seam number. The sample number, date, time, location, and seam number shall be recorded. The Geomembrane Installer shall repair all holes in the geomembrane resulting from obtaining the seam samples. All patches shall be vacuum box tested or spark tested. If a patch cannot be permanently installed over the test location the same day of sample collection, a temporary patch shall be tack welded or hot air welded over the opening until a permanent patch can be affixed.

.3 The destructive sample size shall be 300 mm wide by 1 m long with the seam centered lengthwise. The sample shall be cut into three equal sections and distributed as follows: one section given to the Owner's Representative as an archive sample; one section given to the Owner's Representative for laboratory testing as specified in Paragraph 5 below; and one section retained by the Geomembrane Installer for field testing as specified in Paragraph 4 below.

.4 For field testing, the Geomembrane Installer shall cut 10 identical 25 mm wide replicate specimens from the sample. The Geomembrane Installer shall test five specimens for seam shear strength and five for peel strength as per ASTM 6392. Peel tests will be performed on both inside and outside weld tracks. To be acceptable, 4 of 5 test specimens must pass the stated criteria in Part 2 with less than 25% separation. If 4 of 5 specimens pass, the sample qualifies for testing by the testing laboratory if required.

.5 If independent seam testing is required by the specifications it shall be conducted in accordance with ASTM 5820 or ASTM D4437 or GRI GM 6.

.6 Reports of the results of examinations and testing shall be prepared and submitted to the Owner's Representative.

.7 For field seams, if a laboratory test fails, that shall be considered as an indicator of the possible inadequacy of the entire seamed length corresponding to the test sample. Additional destructive test portions shall then be taken by the Geomembrane Installer at locations indicated by the Owner's Representative; typically 3 m on either side of the failed sample and laboratory seem tests shall be performed. Passing tests shall be an indicator of adequate seams. Failing tests shall be an indicator of non-adequate seams and all seams represented by the destructive test location shall be repaired with a cap-strip extrusion welded to all sides of the capped area. All cap-strip seams shall be non-destructively vacuum box tested until adequacy of the seams is achieved. Cap strip seams exceeding 50 m in length shall be destructively tested.

.4 Destructive test results shall be reported prior to covering of liner or within 48 hours.

.5 Identification of Defects

.1 Panels and seams shall be inspected by the Installer and Owner's Representative during and after panel deployment to identify all defects, including holes, blisters, undispersed raw materials and signs of contamination by foreign matter.

.6 Evaluation of Defects: Each suspect location on the liner (both in geomembrane seam and non-seam areas) shall be non-destructively tested using one of the methods described previously. Each location which fails non-destructive testing shall be marked, numbered, measured and posted on the daily "installation" drawings and subsequently repaired.

.1 If a destructive sample fails the field or laboratory test, the Geomembrane Installer shall repair the seam between the two nearest passed locations on both sides of the failed destructive sample location.

.2 Defective seams, tears or holes shall be repaired by reseaming or applying a extrusion welded cap strip.

.3 Reseaming may consist of either:

a. Removing the defective weld area and rewelding the parent material using the original welding equipment; or

b. Reseaming by extrusion welding along the overlap at the outside seam edge left by the fusion welding process.

.4 Blisters, larger holes, and contamination by foreign matter shall be repaired by patches and/or extrusion weld beads as required. Each patch shall extend a minimum of 150 mm beyond all edges of the defects.

.5 All repairs shall be measured, located and recorded.

.7 Verification of Repairs on Seams: Each repair shall be non-destructively tested using either vacuum box or spark testing methods. Tests which pass the non-destructive test shall be taken as an indication of a successful repair. Failed tests shall be reseamed and retested until a passing test results. The number, date, location, technician and test outcome of each patch shall be recorded.

.8 Daily Field Installation Reports: At the beginning of each day's work, the Installer shall provide the Owner's Representative with daily reports for all work accomplished on the previous work day. Reports shall include the following:

.1 Total amount and location of geomembrane placed;

.2 Total length and location of seams completed, name of technicians doing seaming and welding unit numbers;

.3 Drawings of the previous day's installed geomembrane showing panel numbers, seam numbers and locations of non-destructive and destructive testing;

.4 Results of pre-qualification test seams;

.5 Results of non-destructive testing; and

.6 Results of vacuum testing of repairs.

.7 Hourly temperatures during seaming which includes the actual temperature of the surface of the geomembrane (using a pyrometer) and the ambient air temperature measured approximately 1 m above the geomembrane.

.8 The method of removing frost from the area to be seamed (if any is present), as well as drying and cleaning of the surfaces involved, should be described.

.9 The condition of the subgrade beneath the area being seamed should be assessed. If a rub sheet is used during the seam process it should be noted.

.10 Complete identification of the field seaming system used, including material, methods, preheat, seaming rate, use of tents or enclosures and other details of the procedure should be documented.

.11 The type, nature, number, condition and details of trial seams, as well as the results of such tests, should be detailed.

.12 The type, nature, number and details of destructive samples and disposition of sections of the sample should be described. Proper identification is required to identify results of CQA laboratory testing in the final as-built plans of the project.

.13 Any unusual condition with respect to personnel, equipment, sampling and/or testing that may be attributable to the cold weather should be described and documented.

.9 Additional Documentation

.1 A panel is defined as the unit area of geomembrane which is to be seamed in the field. If the liner is not fabricated into panels prior to delivery, then a panel is considered to be a roll or a portion of a roll of material.

.2 Each panel shall be given a Panel Identification Code, consistent with the layout plan. The Panel I.D. Code will be used for all Quality Assurance records.

.3 Each Field-seam shall be identified and sequentially numbered on the as-built drawing. Include the date of seaming, identifying number of welding machine, and operator name. Identify on the drawing where the machine or operator was changed.

.4 If a fabricated panel is being used, the Contractor shall also indicate the locations of all factory seams on this drawing, and shall differentiate between field seams and factory seams.

3.6 Liner Acceptance

.1 Geomembrane liner will be accepted by the Owner's Representative when:

.1 The entire installation is finished or an agreed upon subsection of the installation is finished;

.2 All Installer's QC documentation is completed and submitted to the owner

.3 Verification of the adequacy of all field seams and repairs and associated geomembrane testing is complete.

3.7 Anchor Trench

.1 Construct as specified on the project Drawings.

3.8 Disposal of Scrap Materials

.1 On completion of installation, the Geomembrane Installer shall dispose of all trash and scrap material in a location approved by the Owner, remove equipment used in connection with the work herein, and shall leave the premises in a neat acceptable manner. No scrap material shall be allowed to remain on the geomembrane surface.

PART 1 GENERAL

1.1 General

.1 This specification covers nonwoven geotextile test properties for subsequent use as protection (or cushioning) materials. The typical use will be as a protective covering or underlayment of a geomembrane against puncture or tear due to rock, stones, concrete or other hard surfaces and/or objects.

1.2 References

Where material properties are specified the following standards are applicable:

American Society for Testing and Materials (ASTM)

.1 ASTM D 4354 Practice for Sampling of Geosynthetics for Testing.

.2 ASTM D 4355 Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).

.3 ASTM D 4533 Test Method for Trapezoidal Tearing Strength of Geotextiles.

.4 ASTM D 4632 Test Method for Grab Breaking Load and Elongation of Geotextiles.

.5 ASTM D 4759 Practice for Determining the Specification Conformance of Geosynthetics.

.6 ASTM D 4833 Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.

.7 ASTM D 4873 Guide for Identification, Storage and Handling of Geotextiles.

.8 ASTM D 5261 Test Method for Measuring Mass per Unit Area of Geotextiles.

.9 ASTM D 5494 Test Method for the Determination of Pyramid Puncture Resistance of Unprotected and Protected Geomembranes.

.10 ASTM D 6241 Test Method for Static Puncture Strength of Geotextiles and Geotextile Related Product Using a 50-mm Probe.

Geosynthetic Research Institute (GRI)

.1 GRI GT12. Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials.

PART 2 PRODUCTS

2.1 Materials

.1 12 oz. needle-punched nonwoven geotextile made of 100% polypropylene staple fibers conforming to the following properties to meet or exceed GRI GT12.

.1 Table

PROPERTY (1)	TEST METHOD	UNIT	MARV (12 oz.)
Weight (Typical)	ASTM D5261	oz/yd^2 (g/m^2)	12.0 (407)
Grab Tensile	ASTM D4632	lbs (kN)	300 (1.33)
Grab Elongation	ASTM D4632	□	50
Trapezoid Tear Strength	ASTM D4533	lbs (kN)	115 (0.511)
Puncture Resistance	ASTM D6241	lbs (kN)	790 (3.51)
U.V. Resistance (2)	ASTM D4355	□ /hrs	70/500

Notes:
(1) All values are Minimum Average Roll Value except UV resistance which is a minimum value.
(2) Evaluation to be on a 2.0-inch strip tensile specimen after 500 hours of exposure.

PART 3 EXECUTION

3.1 General

.1 Deliver, store, and handle geotextile in accordance with ASTM D4873.

.1 Delivery: Each geotextile roll shall be wrapped with a material that will protect the geotextile, including the ends of the roll, from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during periods of shipment and storage. The plastic wrapping shall not be removed until deployment. Geotextile or plastic wrapping damaged during storage or handling shall be repaired or replaced, as directed. Label each roll with the manufacturer's name, geotextile type, roll number, roll dimensions (length, width, gross weight), and date manufactured.

.2 Storage: During storage, geotextile rolls shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F (71°C), and any other environmental condition

that may damage the property values of the geotextile. To protect geotextile from becoming saturated, either elevate rolls off the ground or place them on a sacrificial sheet of plastic in an area where water will not accumulate.

.3 Handling: Handle and unload geotextile rolls with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Rolls shall not be dragged along the ground, lifted by one end, or dropped to the ground.

.2 Installation

.1 Place geotextile directly on top of and below geomembrane as shown on the drawings. The surface must be smooth and free of sharp objects.

.2 Where located below a geomembrane, maintain intimate contact between geotextile and soil so that no void spaces occur. Avoid laps and folds in the geotextile.

.3 Employ sufficient anchorage to hold the geotextile in place during deployment and backfilling.

.4 Do not cover geotextile prior to inspection and approval by the Owner's Representative.

.5 Place fill material or geomembrane immediately after inspection is complete.

.6 Placement of soil cover soil:

a. Place in a manner that prevents soil from entering the geotextile overlap zone, prevents tensile stress from being mobilized in the geotextile, and prevents wrinkles from folding over onto themselves.

b. Maximum drop height for fill directly onto geotextile is one metre.

c. Minimum lift thickness prior to starting compaction is 300 mm.

.7 On side slopes, soil backfill shall be placed from the bottom of the slope upward.

.8 Seams and Joints: Seams shall be overlapped, minimum overlap 600 mm.

.9 Heat tack or sew seams.

.10 Anchor the geotextile at the perimeter of the landfarm as shown on the Drawings.

.3 Protection

.1 Do not permit passage of any vehicle directly on the geotextile.

PART 1 GENERAL

1.1 Qualifications of Surveyor

.1 Qualified, experienced Surveyor(s), acceptable to Owner's Representative.

1.2 Survey Reference Points

.1 Locate, confirm and protect control points prior to starting site work.

.2 Preserve permanent reference points during construction.

.3 Make no changes or relocations without prior written notice to Owner's Representative.

.4 Report to Owner's Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

PART 2 PRODUCTS

2.1 Survey Equipment

.1 RTK GPS receiver and base station with minimum 0.01 m accuracy, tripod, spare battery, battery charger, downloading hardware and software and all associated ancillary items (cables, hardlock, etc.).

.2 Automatic level with tripod.

.3 Single prism with 5 metre collapsible range pole.

.4 Triple prism with tripod.

.5 50 metre cloth tape (steel reinforced).

.6 5-metre collapsible level rod.

.7 Magnetic pin finder (high frequency).

2.2 Survey Markers

.1 Provide all survey markers and other items required to complete work as specified, including, but not limited to:

.1 Pointed stakes (minimum 1.2 m in length, 12 mm thick, 38 mm wide)

.2 Pointed hubs (minimum 0.5 m in length, 20 mm thick, 38 mm wide)

.3 Nails (100 mm long), spikes (250 mm long), pins (1 m long), etc.

.4 Fluorescent paint, flagging, etc.

.5 Felt markers, chalk, wax pens, etc.

.2 Maintain supply of survey markers for Owner's Representative's use.

PART 3 EXECUTION

3.1 General

.1 Establish stable temporary survey control points for use in laying out work.

.2 Establish lines and levels, locate and lay out, by instrumentation.

.3 Prepare a topographic map of work sites prior to construction as directed by Owner's Representative to provide a baseline survey.

.4 Stake location of facilities in the field, and prepare a record drawing showing final location and contours of the facilities.

.5 Maintain surveys for quantity calculations.

3.2 Records

Maintain a complete, accurate log of control and survey work as it progresses.

3.3 Submittals

.1 Submit name of Surveyor(s) to Owner's Representative.

.2 On request of Owner's Representative, submit documentation (e.g. raw survey observations) to verify accuracy of work. Maintain accuracy to 0.01 m vertically and 0.01 m horizontally.

.3 Topographic survey data shall include sufficient points and changes in slope to accurately depict the topography.

.4 Submit survey data backup for quantities of earthworks fill materials.

.5 Submit survey data in the following electronic formats or equivalent:

.1 Survey point file (.csv or .xls).

.2 AutoCAD File (.dxf or .dwg).

.3 Copy of survey field book or field book file (.fbk).

.6 All survey data files must include the following information:

.1 Date of survey, descriptive site name, and site location.

.2 Survey point information including point number, descriptor, UTM co-ordinates with NAD83 datum, and elevation from sea level.

APPENDIX E
GENERAL CONDITIONS

GENERAL CONDITIONS

DESIGN REPORT

This Design Report incorporates and is subject to these "General Conditions".

1.0 USE OF REPORT AND OWNERSHIP

This Design Report pertains to a specific site, a specific development, and a specific scope of work. The Design Report may include plans, drawings, profiles and other support documents that collectively constitute the Design Report. The Report and all supporting documents are intended for the sole use of EBA's Client. EBA does not accept any responsibility for the accuracy of any of the data, analyses or other contents of the Design Report when it is used or relied upon by any party other than EBA's Client, unless authorized in writing by EBA. Any unauthorized use of the Design Report is at the sole risk of the user.

All reports, plans, and data generated by EBA during the performance of the work and other documents prepared by EBA are considered its professional work product and shall remain the copyright property of EBA.

2.0 ALTERNATIVE REPORT FORMAT

Where EBA submits both electronic file and hard copy versions of reports, drawings and other project-related documents and deliverables (collectively termed EBA's instruments of professional service), only the signed and/or sealed versions shall be considered final and legally binding. The original signed and/or sealed version archived by EBA shall be deemed to be the original for the Project.

Both electronic file and hard copy versions of EBA's instruments of professional service shall not, under any circumstances, no matter who owns or uses them, be altered by any party except EBA. EBA's instruments of professional service will be used only and exactly as submitted by EBA.

Electronic files submitted by EBA have been prepared and submitted using specific software and hardware systems. EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless so stipulated in the Design Report, EBA was not retained to investigate, address or consider, and has not investigated, addressed or considered any environmental or regulatory issues associated with the project specific design.

4.0 CALCULATIONS AND DESIGNS

EBA has undertaken design calculations and has prepared project specific designs in accordance with terms of reference that were previously set out in consultation with, and agreement of, EBA's client. These designs have been prepared to a standard that is consistent with industry practice. Notwithstanding, if any error or omission is detected by EBA's Client or any party that is authorized to use the Design Report, the error or omission should be immediately drawn to the attention of EBA.

5.0 GEOTECHNICAL CONDITIONS

A Geotechnical Report is commonly the basis upon which the specific project design has been completed. It is incumbent upon EBA's Client, and any other authorized party, to be knowledgeable of the level of risk that has been incorporated into the project design, in consideration of the level of the geotechnical information that was reasonably acquired to facilitate completion of the design.

If a Geotechnical Report was prepared for the project by EBA, it will be included in the Design Report. The Geotechnical Report contains General Conditions that should be read in conjunction with these General Conditions for the Design Report.

6.0 INFORMATION PROVIDED TO EBA BY OTHERS

During the performance of the work and the preparation of the report, EBA may rely on information provided by persons other than the Client. While EBA endeavours to verify the accuracy of such information when instructed to do so by the Client, EBA accepts no responsibility for the accuracy or the reliability of such information which may affect the report.

Appendix D.3:
Charter Flight Costs

FACTURE / INVOICE: 011704

No. réf./ref.:

BAFFINLAND IRON MINES CORPORATION

2275 UPPER MIDDLE ROAD
SUITE 300
OAKVILLE ON Canada
L6H 0C3

DATE: 25/09/2013

AIRCRAFT C-GNLN

DESCRIPTION			Litres/Qty/Lb	Price/Prix	Total
FLIGHT 996					
25-09-2013 KITCHENER	IQALUIT	CARGO	2772.00		
25-09-2013 IQALUIT	MARY RIVER	CARGO	2772.00		
25-09-2013 MARY RIVER	KITCHENER	CARGO			
FRAIS DE VOL \ TRIP COST:					106773.36
EXTRA ESSENCE \ EXTRA FUEL:					5534.87

NOTE: DE-ICE NOT INCLUDED

RECEIVED
OCT 02 2013
HATCH

MONTANT / AMOUNT	112308.23
TPS/TVH/GST 132418302	5615.41
TVQ/PST 1012299237	0.00
TOTAL: **CND**	**117923.64**

PAYABLE SUR RÉCEPTION/ DUE UPON RECEIPT
LES INVESTISSEMENTS NOLINOR INC.

Des frais d'administration de 2% par mois seront ajoutés sur tout solde impayé
Any outstanding balance will be subject to a 2% service charge per month

Appendix D.4:
Worker Accommodation and Camp Operation

Costs-Flights into Iqaluit

Rotation 4/4

Day in Month 30

60 Persons in Camp

Position	Days	Day Rate	Staffing Fee	Travel Day	Staffing Fee Travel Day	Flight	Hotel	Flight/Hotel Travel	Per Diems	Excess Baggage	Total
Executive Chef	30	$605.00	$18,150.00	3	$1,815.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$24,156.00
First Cook	30	$495.00	$14,850.00	3	$1,485.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$20,526.00
Second Cook	30	$451.00	$13,530.00	3	$1,353.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$19,074.00
Second Cook #2	0	$451.00	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Executive Night Baker	30	$548.00	$16,440.00	3	$1,644.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$22,275.00
Night Baker	0	$468.00	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Camp Kitchen Attendant (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitorial Manager	30	$495.00	$14,850.00	3	$1,485.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$20,526.00
Janitor #2 (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitor #3 (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitor #4 (Local Hire)	0	$385.00	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Janitor #5 (Local Hire)	0	$385.00	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Staff Total	240		$112,470.00	27	$12,402.00	$15,200.00	$3,450.00	$18,650.00	$1,700.00	$605.00	$145,827.00
Meals, Cleaning and Camp Supplies	1800	$33.00									$59,400.00
Total (Without Stats)											**$205,227.00**
Per Man Day Costs (with stats)											**$116.10**

80 Persons in Camp

Position	Days	Day Rate	Staffing Fee	Travel Day	Staffing Fee Travel Day	Flight	Hotel	Travel	Per Diems	Excess Baggage	Total
Executive Chef	30	$605.00	$18,150.00	3	$1,815.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$24,156.00
First Cook	30	$495.00	$14,850.00	3	$1,485.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$20,526.00
Second Cook	30	$451.00	$13,530.00	3	$1,353.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$19,074.00
Second Cook #2	0	$451.00	$0.00	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Executive Night Baker	30	$548.00	$16,440.00	3	$1,644.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$22,275.00
Night Baker	30	$468.00	$14,040.00	3	$1,404.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$19,635.00
Camp Kitchen Attendant (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitorial Manager	30	$495.00	$14,850.00	3	$1,485.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$20,526.00
Janitor #2 (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitor #3 (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitor #4 (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitor #5 (Local Hire)	0	$385.00	$0.00	0		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Staff Total	300		$138,060.00	34	$15,346.00	$18,240.00	$4,140.00	$22,380.00	$2,040.00	$726.00	$178,552.00
Meals, Cleaning and Camp Supplies	2400	$33.00									$79,200.00
Total (without Stats)											**$257,752.00**
Per Man Day Costs (with stats)											**$109.31**

100-120 Persons in Camp

Position	Days	Day Rate	Staffing Fee	Travel Day	Staffing Fee Travel Day	Flight	Hotel	Travel	Per Diems	Excess Baggage	Total
Executive Chef	30	$605.00	$18,150.00	3	$1,815.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$24,156.00
First Cook	30	$495.00	$14,850.00	3	$1,485.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$20,526.00
Second Cook	30	$451.00	$13,530.00	3	$1,353.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$19,074.00
Second Cook #2	30	$451.00	$13,530.00	3	$1,353.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$19,074.00
Executive Night Baker	30	$548.00	$16,440.00	3	$1,644.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$22,275.00
Night Baker	30	$468.00	$14,040.00	3	$1,404.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$19,635.00
Camp Kitchen Attendant (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitorial Manager	30	$495.00	$14,850.00	3	$1,485.00	$3,040.00	$690.00	$3,730.00	$340.00	$121.00	$20,526.00
Janitor #2 (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitor #3 (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitor #4 (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Janitor #5 (Local Hire)	30	$385.00	$11,550.00	4	$1,540.00	$0.00	$0.00	$0.00	$0.00	$0.00	$13,090.00
Staff Total	360		$163,140.00	41	$18,239.00	$21,280.00	$4,830.00	$26,110.00	$2,380.00	$847.00	$210,716.00
Meals, Cleaning and Camp Supplies (100 Persons)	3000	$33.00									$99,000.00
100 Persons TOTAL (without Stats)											**$309,716.00**
Per Man Day Costs (with Stats)											**$105.05**
Meals, Cleaning and Camp Supplies (120 Persons)	3600	$33.00									$118,800.00
120 Persons TOTAL (without Stats)											**$329,516.00**
Per Man Day Costs (with Stats)											**$93.04**

Appendix D.5:
Environmental Site Assessment – Contaminated Soil Delineation Proposal

Baffinland Iron Mines Corporation

PROPOSAL
TREATMENT PLAN – HYDROCARBON CONTAMINATED SOIL
MILNE INLET, MARY RIVER PROJECT
NUNAVUT

PE14101092

January 2010

TABLE OF CONTENTS

APPENDICES

1.0 INTRODUCTION

1.1 GENERAL

[redacted] is pleased to provide this proposal to Baffinland Iron Mines Corporation (Baffinland) for consulting services related to the treatment of hydrocarbon contaminated soil at their Mary River project.

[redacted] understanding of the project objectives and details are the following:

- [redacted] scope is to develop a plan for the treatment of hydrocarbon soils from Baffinland's fuel farms at the Milne Inlet site and Mary River site;
- The quantity of contaminated soil is estimated to be 3500 m^3 and primarily consists of liner bedding sand and gravels inside the fuel farms;
- The fuel farm is lined with a HDPE liner which may be able to be converted to a treatment facility;
- The fuel farm infrastructure (bladders and piping) will be removed in 2010; therefore, preparation for the treatment area can be in late 2010, or 2011; and
- Treatment can be over 3 years (or less) beginning in 2011.

1.2 PROJECT DESCRIPTION

[redacted] will prepare a plan for the treatment of the soil. The plan will include:

- A treatment methodology and a plan for the treatment of the soil;
- Design for the treatment facility;
- A proposed cleanup criteria for the soil;
- Amendment types and quantities;
- Operation plan for the facility including tilling procedures, tilling equipment requirements, amendment application procedures and application rates, water management within the facility;
- Monitoring plan during operations including groundwater sampling, surface water sampling, contaminated soil sampling; and
- Closure Plan.

The manual is intended to have sufficient detail that it can be submitted to the regulatory bodies to obtain authorization to construct and operate the facility.

1.3 PROJECT CHALLENGES

The existing fuel farm area is a geomembrane lined facility. It will be available as a landfarm facility; however, there are several challenges to using the existing facility.

It is understood that the soil in the fuel farm is wet. Treatment of the hydrocarbon soil requires moisture and oxygen. Saturated soil does not treat very well. A means to drain and partially dry the soil will be required. It is anticipated that the contaminated soil is sitting directly on the geomembrane liner. It will be difficult to till the soil within the lined facility or to move the soil without damaging the liner. These issues must be considered when developing the plan.

Baffinland has an idea of the fuel loss that may have occurred in the facilities; however, it is understood that there has been little sampling of the soil within the lined facility. The spatial extent of the contaminated soil and concentrations is unknown.

2.0 APPROACH AND METHODOLOGY

A phased approach to the project is recommended given the unknowns and project challenges. A preliminary treatment plan will be developed based on our knowledge of site conditions. The site conditions will be based on both [redacted] experience and site observations by Baffinland personnel. The preliminary treatment plan can be used to procure the amendments, equipment, and construction materials, if required.

A site visit will be carried out following the removal of the tank bladders. It has been assumed that the bladders will be removed by the end of July. The extent of contamination will be evaluated at this time through sampling and analytically testing. A combination of PID and analytical tests will be used characterize the area. The PID will be "calibrated" with analytical samples collected. The current proposal is based on 120 PID measurements and 30 BTEX CCME F1 to F4 tests.

[redacted] will prepare a regrading civil works plan by mid August. The intent of the civil works plan is to reduce the amount of water that will be impounded within the tankfarm berms the following freshet and summer. The plan will be based on visual observations and PID measurements. The analytical results will likely be available 7 days after the samples have been shipped. The results will be considered in the civil works plan when they are available.

The soil treatment plan will be finalized after site observations this summer. The site observations will confirm that the method of treating the soils is practical or whether some adjustments to the plan are required. It is also recommended that the soil samples be collected and tested to determine the spatial extent of the contamination and concentrations.

It has been assumed that detailed as-builts and topography are available and no additional surveying will be required for design.

A weekly report will be prepared to keep Baffinland informed of the project progress.

APPENDIX E

PROJECT BUDGET

Phase No.	Item/Individual	Classification	No. of Units	Units	Unit Rate	Cost
1.0	**Preliminary Landfarm Design and Operations Manual**					
	[redacted]	E5	25	HRS	$195.00	$4,875
	[redacted]	E4	70	HRS	$167.00	$11,690
	Drafting	T4	70	HRS	$134.00	$9,380
	WP	WP	12	HRS	$83.00	$996
	Support/Supplies/Communications				4% of Fees	$1,038
					Subtotal	**$27,979**
2.0	**Site Reconnaissance**					
	[redacted]	E4	84	HRS	$167.00	$14,028
	Analytical Testing					$7,500
	PID Rental		2	Weeks		$1,000
	Shipping					$800
	Miscellaneous					$500
	Travel - Flights, Taxis		1	Each	$3,900.00	$3,900
	Travel Accommodation and Meals		2		$580.00	$1,160
	Support/Supplies/Communications				4% of Fees	$561
					Subtotal	**$29,449**
3.0	**Civil Works Plan**					
	Horne	E5	12	HRS	$195.00	$2,340
	Drafting	T4	12	HRS	$134.00	$1,608
	Support/Supplies/Communications				4% of Fees	$158
					Subtotal	**$4,106**
4.0	**Finalize Landfarm Design and Operations Manual**					
	[redacted]	E5	8	HRS	$195.00	$1,560
	[redacted]	E4	30	HRS	$167.00	$5,010
	Drafting	T4	8	HRS	$134.00	$1,072
	WP	WP	5	HRS	$83.00	$415
	Support/Supplies/Communications				4% of Fees	$322
					Subtotal	**$8,379**
					Estimated Project Costs*	**$69,913**

Notes: *GST not included in costs

Appendix E:
Proposed Schedule for Complete Project Financial Security Assessment

Table 1: Schedule for 2014 Complete Project Financial Security Assessment

Month	Date/Time	Meeting Status	Proposed Agenda[1]
February	February 10th, 2014, 10:00 EST	COMPLETE (Teleconference)	▪ Initial teleconference o Establish the topics, priorities and schedule for joint discussions.
March	March 6, 2014 9:00 to 16:00	COMPLETE (at Baffinland Head Office)	▪ Security estimate methodology/process and QIA A&R Policy ▪ Roles and responsibilities ▪ Communication plan ▪ Discussion on pre-2013 Work Plan Estimate and path forward
April	April 22, 2014 9:00 to 16:00	COMPLETE (at Baffinland Head Office)	▪ Estimate Plan discussion ▪ Site Specific Costs Development
May	-	-	▪ Meeting postponed until June 3, 2014
June	June 3, 2014 9:00 to 16:00	COMPLETE (Teleconference)	▪ Meeting was originally scheduled for the month of May but was postponed to a June 3, 2014 teleconference ▪ Estimate Plan Review ▪ Unit Cost Development Status Update ▪ Confidential Information Distribution
July	June 8, 2014 9:00 to 16:00	COMPLETE (at Baffinland Head Office)	▪ Reporting Methodology ▪ Direct Costs First Principle Development ▪ Unit Cost Development Review (Labour Rates, Equipment Rates, Fuel Rates) ▪ Unit rate application
August	August 7 to 12, 2014	COMPLETE **Site Visit**	▪ To be used for confirmatory inspection for Complete Project Security Assessment purposes. ▪ Participants: VanGlulck, Jamie (Arktis Solutions), Fairthorne, Greg (Arktis Solutions), Purdy, Colin (Arktis Solutions), Ottenhof, Jared (Arktis Solutions), Mackay, Tessa (Hatch), Grzegorczyk, Adam (Hatch)
September	September 26, 2014 9:30 to 11:30	COMPLETE (Teleconference)	▪ Availability of fuel and equipment currently on-site required for reclamation ▪ Direct cost items still open ▪ Preliminary Discussion in Indirect Cost
September/ October	September 29 – October 1, 2014 8:00 to 17:00	COMPLETE (at Baffinland Iqaluit Office)	▪ Direct Cost Recap ▪ Indirect Costs Discussion and Agreement ▪ Application Moving Forward
October 10, 2014	Complete Project Financial Security Assessment for 2014 Finalized		
October 2014	2015 Mary River Work Plan Finalized		
October 31, 2014	2015 Mary River Work Plan Issued 2015 Marginal Closure Cost Estimate Issued		

Note 1: One (1) week prior to monthly conference call/meeting proposed position of each party (Hatch, Arktis), with any supporting documentation, shall be submitted electronically to distribution list for review prior to conference call/meeting.