Part I General

1.1 DESCRIPTION

.1 This Section specifies requirements for:

.1 Recovery and placement of granular material as backfill around new pipe crossings associated with the upgrading of fuel supply piping.

.2 Restoration of road surfaces at culvert crossings.

1.2 DEFINITION

.1 Pipe Bedding Sand: Locally derived sand fill used for bedding material around newly installed culverts. Sand is to be derived from local Blacktop Creek borrow source located approximately 3 km southwest of the airstrip. Given the small quantities required selective recovery of borrow material will be required in lieu of screening the aggregate.

.2 Gradation of pipe bedding sand is to be within the following limits when tested to ASTM C136 and ASTM C117, sieve sizes to CAN/CGSB-8.2:

Sieve Designation	% Pass by Weight
50	100
12.5	55 to 95
5	45 to 90
2	35 to 80
0.425	25 to 70
0.08	15 to 40

.3 Road Surface Aggregate: Existing road surface material will be sidecast from the work area and reused to reinstate the road surface.

1.3 SITE CONDITIONS

.1 Ensure that all work under this section meet the terms and references of applicable operations-use permits for the site.

.2 Suspend operations whenever climatic conditions are unsatisfactory for backfill or road aggregate placement to conform to this Specification.

.3 Only operate equipment in work areas where materials are sufficiently dry to prevent excessive rutting.

.4 Areas to be backfilled and re-instated are to be free from excessive snow, ice or standing water.

1.4 PROTECTION

.1 Protect existing infrastructure during the course of work. Repair or replace at no cost to the Departmental Representative, any damaged by the Contractor's operations.

.2 Protect archaeological features, if encountered, from construction and construction traffic.

1.5 SAMPLES

.1 Inform Departmental Representative of proposed source materials. Given the nature of the work gradation testing by the Contractor will not be required. The Departmental Representative will review the proposed borrow source to confirm its acceptability for the current assignment.

1.6 MEASUREMENT OF PAYMENT

.1 The supply, transport, placement, and compaction of pipe bedding sand, approved by the Departmental Representative, into the trench cuts to facilitate the pipe installation at discrete locations across the Work.

.2 The following work items will be incidental to the work described in this Section, and will not be measured separately:

- .1 Water for moisture conditioning, compaction and dust control.
- .2 All construction surveying.
- .3 Removal of surficial boulders over 300 mm in diameter from construction areas.
- .4 Excavating, separating, and haulage of borrow materials.
- .5 Site preparation, maintenance grading of the site as well as placement, grading and compaction of borrow material. Diversion and draining to keep areas free of standing water comprises part of the site preparation and backfill work
- .6 Draining of wet areas prior to backfill or restoration operations.
- .7 Work undertaken to drain borrow areas prior to excavation.

.3 No measurement for payment will be made for:

- .1 Rejected material.
- .2 Surplus material.

.4 Except as indicated above, work under this section will not be measured.

Part 2 Products

2.1 MATERIALS

.1 Borrow material use as backfill requires the approval of Departmental Representative.

Part 3 Execution

3.1 EXCAVATION FOR CULVERT

.1 Excavate and sidecast road surface aggregate (upper 300 mm) in a temporary stockpile for future reuse.

.2 Excavations are to be sized to meet the pipe installation requirements.

.3 Maintain positive drainage patterns within the trenches and keep work areas free of standing water.

3.2 BORROW SOURCE:

.1 Obtain from borrow source all required pipe bedding sand material.

.2 The existing operational driveway, access route, and roadways at the site are not to be used as granular material borrow sources unless specifically authorized by Departmental Representative.

.3 Advise Departmental Representative of selected borrow source.

.4 Borrow material cannot be obtained from the site unless authorized in writing by Departmental Representative.

.5 Final grading upon completion to be tidy, well drained, free of standing water all to the satisfaction of Departmental Representative.

.6 Upon completion of final grading, leave all slopes in a stable condition and spread all stripped organics.

3.3 PLACEMENT, MOISTURE CONDITIONING, AND COMPACTION OF PIPE BEDDING SAND

.1 Recover and haul pipe bedding sand material from borrow site to designated work areas.

.2 Place and compact pipe bedding sand material to within 300 mm of the final grades within the work area, or as agreed to with the Departmental Representative.

.3 Do not place fill on snow or surface ice.

.4 Maintain positive drainage patterns, unless otherwise directed, and fill depressions to avoid any ponding of water within the trench excavation.

.5 All bedding material is to be placed in an unfrozen state. Bedding material to be free from debris, snow and ice. Do not place bedding material if the outside air temperature is below zero degrees Celsius, unless otherwise directed by Departmental Representative.

.6 Place and compact bedding material in horizontal lifts not to exceed 250 mm in loose thickness. Compaction is to be achieved using portable manually operated vibratory compaction equipment suitable for working in trenches.

.7 Moisture condition granular fill as required to meet compaction requirements. Provide a means to efficiently water bedding material if necessary. If material is excessively moist remove and replace with drier material.

3.4 RESTORATION OF ROAD SURFACE

.1 Recover sidecast road surface aggregate and grade across work area.

.2 Compact road surface aggregate by passing the bulldozer track over the area a minimum of six times or until the Departmental Representative is satisfied with the level of compaction. The compactor used to compact the bedding material may be used however will require thin lifts (<150 mm) to be placed to achieve reasonable compaction.

3.5 TESTING

.1 Compaction testing will be carried out and paid for by Departmental Representative.

.2 Frequency of testing will be determined by Departmental Representative.

3.6 FINISHING AND TOLERANCES

.1 All areas to be restored with road aggregate are to be uniform without projections or depressions exceeding 25 mm in one (1) metre.

.2 Finished surfaces are to be graded to promote positive drainage, to minimize standing water and to match existing site road conditions.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 ASTM International

.1 ASTM D413-98(2007), Standard Test Methods for Rubber Property-Adhesion to Flexible Substrate.

.2 ASTM D638-10, Standard Test Method for Tensile Properties of Plastics.

.3 ASTM D746-13, Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

.4 ASTM D792-13, Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.

.5 ASTM D1004-13, Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.

.6 ASTM D1204-08, Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.

.7 ASTM D1238-13, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.

.8 ASTM D1593-13, Standard Specification for Nonrigid Vinyl Chloride Plastic Film and Sheeting.

.9 ASTM D1603-12, Standard Test Method for Carbon Black in Olefin Plastics.

.10 ASTM D1693-13, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.

.11 ASTM D882-12, Standard Test Methods for Tensile Properties of Thin Plastic Sheeting.

.12 ASTM D1203-10, Standard Test Methods for Volatile Loss from Plastics Using Activated Carbon Methods.

.13 ASTM D1790-08, Standard Test Method for Brittleness Temperature of Plastic Sheeting by Impact.

1.2 ACTION AND INFORMATIONAL SUBMITTALS

.1 Submit in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for geomembranes and include product characteristics, performance criteria, physical size, finish and limitations.

.3 Certificates:

.1 Submit certificates, including test results 2 weeks before delivery to job site.

1.3 QUALITY ASSURANCE

.1 Test quality of resin and membrane to ensure consistency of raw material and geomembrane quality in accordance with manufacturer's recommendations.

.2 Test seams in strength and peel at beginning of each seaming period, and at least once every 4 hours if welding operation is interrupted, for each seaming apparatus and seamer used that day.

.1 Also test at least two samples from each panel, with samples taken from extra material, such that panel is not damaged and blanket geometry is not altered.

.3 If seam test specimen fails in seam, repeat on new specimen.

.1 If new specimen fails in seam, material will not be used for seaming until deficiencies are corrected and two consecutive successful test seams are achieved.

.4 Test seams by non-destructive methods over their full length, using vacuum test unit or air pressure test.

.1 Vacuum chamber to contain glass viewport and seal for sealing chamber to seam area. With chamber sealed in place and after partly filling chamber with water, apply vacuum of 17.2 kPa. Seam failure is detected by presence of air bubbles through water.

.2 Use air lance to apply air at 343 kPa through nozzle directed at edge of overlap seam. Seam failure is indicated by inflation or lifting of any part of geomembrane.

.5 Provide test results to Departmental Representative, for each shift's production, including documentation of non-destructive testing and repairs at end of each shift.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 During delivery and storage, protect geo-membranes from direct sunlight, ultraviolet rays, excessive heat, mud, dirt, dust, debris and rodents.

.4 Storage and Handling Requirements:

.1 Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

Part 2 Products

2.1 MATERIALS

.1 Geomembrane: extruded synthetic sheet.

.1 Composed of high density polyethylene resin with inhibitors added to base plastic to resist deterioration by ultra-violet and heat exposure for 60 days.

.2 Reinforced with scrim.

.2 Physical properties:

.1 Specific gravity of resin: to ASTM D792, Method A, minimum 0.93.

.2 Melt index of resin: to ASTM D1238, Condition E, minimum 0.15-0.60 g/min.

.3 Thickness: to ASTM D1593, minimum 1.5 mm.

.4 Tensile strength and elongation at yield: to ASTM D638.

.1 Tensile strength: minimum 14.5 MPa.

.2 Elongation: minimum 12%.

.5 Tensile strength and elongation at break: to ASTM D638:

.1 Tensile strength: minimum 27.5 MPa +/- 10%.

.2 Elongation: minimum 600%.

.6 Modulus of elasticity: to ASTM D882, minimum 318 kPa.

.7 Tear resistance: to ASTM D1004, Die C, minimum 173 N.

.8 Dimensional stability, each direction: to ASTM D1204, 100 degrees C, 1 hour, maximum 2%.

.9 Low temperature brittleness: to ASTM D746, Procedure B, minus 60 degrees C.

.10 Seam strength (at yield point): 280 N and film tear bond.

.11 Seam peel adhesion: to ASTM D413, ASTM D638, ASTM D882.

.12 Total content of additives, fillers or extenders: maximum 3% by weight.

.13 Geomembrane: free of striations, roughness, pinholes, bubbles, blisters, un-dispersed raw materials and any sign of contamination by foreign matter.

.3 Seams: welded in accordance with manufacturer's recommendations.

.1 Physical properties for resin used for welding are same as those for resin used in manufacture of membrane.

2.2 PREFABRICATED FITMENTS AND SEALING OF JOINTS

.1 Where piping must go through the membrane material, prefabricated fitments shall be factory fabricated of liner membrane material, as specified herein, continuously seamed to provide an unbroken fitment and leak proof joint. No grounding cable, electrical conduit or teck cable shall pass through the liner. The base panel shall be sized to provide no less than 300 mm overlap with the liner. There shall be allowance for movement of pipe, i.e., contraction, expansion, settlement, etc., in the fitment, as shown on the Drawings.

.2 Where pipes must go through the liner, the sealing shall be done as per the manufacturer’s recommended practice, provided that the details of installation are submitted by the Contractor to the Departmental Representative for approval prior to manufacture or installation. No installation shall proceed prior to obtaining approval.

.3 The physical properties of the finished joints shall equal or exceed the liner membrane specification.

Part 3 Execution

3.1 EXAMINATION

.1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for geomembranes installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate in presence of Departmental Representative.
- .2 Inform Departmental Representative of unacceptable conditions immediately upon discovery.
- .3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

3.3 INSTALLATION

.1 Maintain area of installation free of water and snow accumulations.

.2 Prepare excessively soft supporting material as directed by Departmental Representative.

.3 Do not proceed with panel placement and seaming when ambient temperatures are below minus 5 degrees C or above 40 degrees C, during precipitation, in presence of excessive moisture (i.e. fog, dew), nor in presence of high winds.

.4 Place and seam panels in accordance with manufacturer's recommendations on graded surface in orientation and locations indicated. Minimize wrinkles, avoid scratches and crimps to geomembranes and avoid damage to supporting material.

.5 Protect installed membrane from displacement, damage or deterioration before, during and after placement of material layers.

.6 Keep seam area clean and free of moisture, dust, dirt, debris and foreign material.

.7 Make field seam samples in accordance with requirements described in PART 2 on fragment pieces of geo-membrane and test to verify that seaming conditions are adequate.

.8 Test field seams as seaming work progresses by non-destructive methods over their full length. Repair seams which do not pass non-destructive test. Reconstruct seam between failed location and any passed test location, until non-destructive testing is successful.

.9 Repair minor tears and pinholes by patching until non-destructive testing is successful. Patches to be round or oval in shape, made of same geomembrane material, and extend minimum of 75 mm beyond edge of defect.

.10 Sleeves shall be installed where pipes go through the membrane and sealed against the pipes as recommended by the manufacturer or as detailed on the Drawings. The manufacturer’s recommended method of sealing around pipes may be utilized if approved.

3.4 VACUUM BOX TESTING

.1 Extrusion seams shall be vacuum box tested by the Contractor according to the following methods:

.1 Equipment for testing extrusion seams shall be comprised of, but not limited to: a vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft rubber gasket attached to the base, port hole or valve assembly and a vacuum gauge, a steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections, a rubber pressure/vacuum hose with fittings and connections, a plastic bucket, a wide paint brush or mop, and a soapy solution. The vacuum box should be similar to the Series A 100 Straight Seam Tester as supplied by the American Parts Service Company.

.2 The vacuum pump shall be charged and the tank pressure adjusted to 35 kPa absolute.

.3 The Departmental Representative shall observe that a leak tight seal is created. The Contractor shall create the leak tight seal by wetting a strip of geomembrane approximately 300 mm by 1,200 mm (length of box) with a soapy solution, placing the box over the wetted area then compressing. The Contractor shall then close the bleed valve, open the vacuum valve, maintain 35 kPa gauge pressure for a period of approximately 5 seconds and examine the geomembrane through the viewing window for the presence of soap bubbles. If no bubbles appear after 5 seconds, the area shall be considered leak tight. The box shall be moved over the next adjoining area with an appropriate overlap and the process repeated. The extrusion seams should be vacuum box tested under the observation of the Departmental Representative.

.4 All areas where soap bubbles appear shall be marked and repaired and then retested under the observation of the Departmental Representative.

.5 At locations where seams cannot be non-destructively tested (including pipe penetrations), as determined by the Departmental Representative, and the seam cannot be tested prior to final installation, the seaming operations shall be observed by the Departmental Representative for uniformity and completeness.

.6 The Departmental Representative shall observe all testing operations for uniformity and completeness.

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

3.5 CLEANING

.1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

.1 Leave Work area clean at end of each day.

.2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment in accordance with Section 01 74 11 - Cleaning.

3.6 PROTECTION

.1 Do not permit vehicular traffic directly on membrane.

END OF SECTION