

Part 1 General**1.1 RELATED SECTIONS**

- .1 Section 01 25 20 – Mobilization and Demobilization.
- .2 Section 01 33 00 – Submittal Procedures.
- .3 Section 01 35 31 – Special Procedure for Traffic Control.
- .4 Section 01 35 43 – Environmental Procedures.
- .5 Section 01 45 00 – Quality Management.
- .6 Section 01 74 11 – Cleaning.
- .7 Section 01 77 00 – Closeout Procedures.
- .8 Section 31 24 14 – Roadway Excavation, Embankment and Compaction.
- .9 Section 32 11 24 – Supply and Place Crushed Granular Base.

1.2 CULVERT WORK

- .1 Culvert work shall be at locations as indicated in the table below. The Stations are from south end of the Park and are approximate. Existing culvert lengths and diameters are also approximate.

Station from South End of the Park	Existing Culvert Length (m)	Existing Diameter (mm)	Work Required
16+110	16.2	1350 Span x 850 Rise	Remove existing culvert. Install 1200 mm x 20 m HDPE pipe.
15+660	12.7	750	Repair inlet. Excavate end and add 3 m CSP extension.
13+860	14.2	450	Remove existing culvert. Install 600 mm x 20 m HDPE pipe.
13+580	13.6	450	Remove existing culvert. Install 600 mm x 20 m HDPE pipe.
9+430	36.0	1800	Repair inlet. Remove 3 m end. Install new 3 m CSP end section.

1.3 MEASUREMENT FOR PAYMENT

- .1 Supply and installation of culverts:
 - .1 The culverts which will be measured for payment shall be the number of linear meters of the types and sizes assembled and accepted by the Departmental Representative, and shall be inclusive of all costs of couplers, labour, materials, and equipment to satisfactorily complete this item as specified. Payment will be made under "**Unit Price Item 10 – Supply and Install Pipe Culverts**".
- .2 Culvert lengths required are provided as estimates. No claim shall be made for deviation to the actual length required.

- .3 The following Work shall be considered incidental to “**Unit Price Item 10 – Supply and Install Culverts**”:
- .1 Excavating the inlets and adding 3 m CSP extension for the pipes at Station 9+430 and pipe at Station 15+660.
 - .2 Environmental measures and temporary sediment and erosion control.
 - .3 Asphalt cutting and removal.
 - .4 Excavation including disposal of waste material outside the park.
 - .5 Supply and installation of geotextile (woven and non-woven).
 - .6 Supply, handling, hauling, and installation of culvert material including couplers.
 - .7 Loading, hauling and placing granular backfill and clay seal around the culvert.
 - .8 Supply and placing riprap on the inlet and outlet of the installed culverts as per Drawing D-05.
 - .9 Supply and spreading topsoil at the locations where culverts have been replaced and repaired.
 - .10 Rehabilitation of the disturbed areas.
 - .11 Removal and disposal of existing culverts.
- .4 Placing hot mix asphalt in accordance with Drawing D-05 will be paid under “**Unit Price Item 10 – Supply, Haul, Place and Compact Hot Mix Asphalt (EPS)**”.
- .5 Mobilization and demobilization required for this Work shall be incidental to “**Lump Sum Price Item 1 - Mobilization/Demobilization**”, and no additional payment will be made.
- .6 Traffic Control required for this Work shall be paid under “**Lump Sum Price Item 2 – General Traffic Accommodation**”.
- .7 A detour shall be constructed on the ditch around a culvert at Station 16+ 660 while replacing a culvert. Material supply, construction and removal of the detour shall be paid under “**Lump Sum Price on the Unit Price Table**”.
- .8 Environmental mitigations required in accordance with Section 01 35 43 – Environmental Procedures, for the Work in this Section shall be incidental to the contract and no separate payment will be made to the Contractor.

1.4 REFERENCES

- .1 CSA G401: Corrugated Steel Pipe Products.
- .2 CSA B182.8: Profile Polyethylene Storm Sewer and Drainage Pipe and Fittings for nominal pipe diameters of 100 mm through to 900 mm.

- .3 CSA B182.11: Recommended Practice for Installation of Thermoplastic Drain, Storm, and Sewer Pipe and Fittings.
- .4 ASTM D883: Standard Terminology Relating to Plastics
- .5 ASTM F667: Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings
- .6 ASTM D3350: Standard Specification for Polyethylene Plastic Pipe and Fittings Materials
- .7 AASHTO M294: Corrugated Polyethylene Pipe, nominal pipe diameter from 300 mm through to 1500 mm.
- .8 BC MoTI Specifications, Section 317

1.5 SUBMITTALS

- .1 Submit manufacturer's specifications, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, coating and limitations. To be submitted at least two (2) weeks prior to beginning Work.
- .2 Certification to be marked on pipe.
- .3 Inform Departmental Representative of source for bedding and backfill materials before beginning of work and provide access for sampling.

1.6 STORAGE AND HANDLING

- .1 Handle and store pipe products in a manner to avoid damage, alteration, deterioration and soiling.
- .2 Store pipes on a clean and flat surface.
- .3 Where the material supplied is damaged, the Contractor shall immediately separate the connected pipes to facilitate more detailed inspection. Culvert material designated by the Departmental Representative as unacceptable, due to damage or failure to meet specified requirements, shall be immediately repaired or replaced by the Contractor.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 01 35 43 - Environmental Procedures.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on site bins for recycling in accordance with Section 01 35 43 - Environmental Procedures.
- .4 Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative.

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- | Part 2 | Product |
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| 2.1 | CORRUGATED HDPE PIPE |
| .1 | HDPE pipe (600 mm diameter) to be a dual –wall with a smooth interior and a minimum stiffness of 320 kPa. |
| .2 | HDPE pipe (1200 mm diameter) to be steel reinforced with a smooth interior wall and a minimum stiffness of 125kPa. |
| .3 | Coupling to be soil tight, external split band type. |
| 2.2 | CORRUGATED STEEL PIPE (REPAIRS) |
| .1 | Contractor shall verify the size of the existing culvert and ensure the new material and coupler will achieve a tight fit with the existing culvert end. |
| .2 | Corrugated steel pipe to CSA G401. |
| .3 | Culverts to be annular, or spiral with annular ends. |
| .4 | Coupling bands to be two (2) pieces annular bolted with minimum width of nine (9) corrugations. |
| .5 | Minimum wall thickness to be 2.0 mm. |
| .6 | Coating to be minimum 610 g/m ² galvanized. |
| .7 | For all exposed culvert ends, square end sections will be required. |
| .8 | Design Code CHBDC S6-06. |
| 2.3 | GEOTEXTILE |
| .1 | Geotextile: Woven and nonwoven synthetic fibre fabric supplied in rolls. |
| .2 | Should be composed of minimum 85% polypropylene by mass with inhibitors added to base plastic to resist deterioration by UV and heat exposure. |
| .3 | Physical properties for woven geotextile: |
| .1 | Grab Strength: 1275 N |
| .2 | Elongation (Failure): 15% |
| .3 | Puncture Strength: 275 N |
| .4 | Burst Strength: 3.6 MPa |
| .5 | Trapezoidal Tear: 475 N |
| .4 | Physical properties for non-woven geotextile: |
| .1 | Grab Strength: 650 N |
| .2 | Elongation (Failure): 50% |
| .3 | Puncture Strength: 275 N |
| .4 | Burst Strength: 2.1 MPa |
| .5 | Trapezoidal Tear: 250 N |

2.4 ROCK RIPRAP

- .1 Rock Riprap used for culverts shall conform to the following specifications:
 - .1 Approximate average dimension of angular rock: 175 mm,
 - .2 0% greater than 300 mm diameter,
 - .3 Between 20% and 50% greater than 200 mm diameter,
 - .4 Between 50% and 80% greater than 175 mm diameter,
 - .5 100% greater than 125 mm diameter,

Part 3 Execution**3.1 PREPARATION**

- .1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- .2 Inspect, repair and maintain erosion and sedimentation control measures during course of construction or until permanent erosion control has been established.

3.2 TRENCHING

- .1 Culvert location and elevations to be discussed on site with Departmental Representative prior to initiation of excavation.
- .2 Conduct all trenching Work in accordance with Section 31 00 99 – Earthworks for minor works and Section 31 24 14 – Roadway Excavation, Embankment and Compaction.
- .3 Excavation limits to be as follows:
 - .1 Depth: Minimum 0.3 m below invert.
 - .2 Width: Minimum three (3) times the culvert diameter.
- .4 Excavation slopes to be no steeper than 2H:1V. Slopes shall be monitored for stability and shall be flattened or otherwise stabilized if signs of instability are discovered or suspected.
- .5 Inform Departmental Representative immediately of unfavourable soil conditions upon discovery.
- .6 Upon completion of the excavation, visually inspect bed in presence of Departmental Representative. Obtain Departmental Representative's approval of the excavation and bed condition.

3.3 NON-WOVEN GEOTEXTILE

- .1 Non-woven geotextile shall be placed at the bottom of the excavation prior to backfilling the bedding as shown on Drawing D-05.
- .2 The geotextile shall be placed in strips laterally across the excavation. It shall extend a minimum of 2 m above the bottom elevation on each side. The strips shall be placed sequentially from the downstream end to the upstream end with 300 mm lapping between each strip.

3.4 CULVERT REMOVAL/DISPOSAL

- .1 Culvert removal shall include disposal of sections to an approved site outside of the National Parks.
- .2 Existing culverts may be fitted with concrete headwalls. All concrete and associated materials shall be removed with the existing culvert.
- .3 Where existing culvert material is to remain in place, the Contractor shall ensure that the culvert is not damaged in any way.

3.5 BEDDING

- .1 Dewater excavation as required to allow placement of culvert bedding in dry condition.
- .2 Place 200 mm minimum thickness of approved granular material on bottom of excavation and compact to minimum of 95% of maximum dry density to ASTM D698.
- .3 Shape bedding to fit lower segment of pipe exterior so that pipe bottom is in close contact with bedding.

3.6 LAYING AND ASSEMBLING CULVERT MATERIAL

- .1 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .2 Ensure couplers are secured tightly around the corrugations of each culvert end at each joint. Tap couplers firmly with a rubber mallet or similar non-marring tool as they are being tightened, to take up slack and ensure snug fit.
- .3 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.
- .4 Repair spots where damage has occurred to coating in the field by applying two coats of zinc rich paint approved by the CSP supplier. Allow each coat to dry before placing second coat, bedding or backfill.

3.7 BACKFILLING

- .1 Metal pipes are flexible, and their resistance to deformation depends on careful bedding and backfilling. As they deflect under vertical load they must build up wide support and therefore, to obtain maximum load bearing capacity, it is essential that the material under and beside the pipe be of good quality, carefully placed and properly shaped and compacted.
- .2 Backfill around and over culvert as indicated or as directed by Departmental Representative.
- .3 The rectangular granular backfill envelope shall extend to the following minimum limits:
 - .1 0.3 m below invert,
 - .2 1.5 m on each side of the culvert, and
 - .3 0.6 m above the culvert.

- .4 Clay seals shall be backfilled at each end of the culvert. The clay seal shall extend to the same backfill extents as the granular envelope. Its length shall be two (2) culvert diameters measured longitudinally along the culvert, starting at each culvert end. The clay seal material shall be approved by the Departmental Representative prior to installation.
- .5 All other structural fill shall be compacted to a minimum of 95% of Maximum Density to ASTM D698 at optimum moisture content. Special care shall be taken to obtain the required density under haunches. Hand tamp where necessary to obtain compaction.
- .6 Place granular backfill material, in 150 mm layers to full width, alternately on each side of culvert, so as not to prevent displacement or shape deflections.
- .7 The backfill shall be placed and compacted by equipment moving parallel to the pipe with simultaneous handwork along the pipe. Large earth moving equipment and large compaction equipment shall not be permitted within 1.0 m of the pipe.
- .8 The first 300 mm of the backfill over the pipe shall be placed, leveled and compacted without vibration. Subsequent fill over the pipe shall be placed and compacted by equipment moving perpendicular to the longitudinal axis of the pipe. The Contractor shall obtain the Departmental Representative's approval before using any equipment above the pipe.
- .9 To protect installed culvert a minimum of 900 mm cover of compacted fill before heavy equipment is permitted to cross is required. The culvert elevations and cover should be discussed with the Departmental Representative before setting the invert elevations.

3.8**RIPRAP**

- .1 Place riprap on each end of the installed culvert. Riprap aprons should be at least three (3) culvert diameters wide, and three (3) culvert diameters long. It should also surround the culvert a width of at least half a culvert diameter on each side and top.
- .2 Rock shall be placed as indicated or as directed by Departmental Representative.
- .3 Stone should be hard with relative density no less than 2.65, free of seam, cracks and structural defects, and meeting the following size distribution for use intended.
- .4 Place woven geotextile filter fabric under all rock riprap.

3.9**REHABILITATION OF DISTURBED AREA**

- .1 The ground has to be returned to its original condition without compromising operation or maintenance requirements. The Contractor shall take the following steps to ensure that natural species will regenerate at all disturbed areas:
 - .1 Minimize disturbance to the existing ground;
 - .2 During construction salvage excavated sod/top soil in all disturbed areas and stockpiles the material separate from other excavation;

- .3 Place salvaged sod/top soil following construction; and
- .4 Harden the site to prevent erosion.

END OF SECTION