

1. GENERAL

1.1 RELATED WORK

- .1 Section 31 23 00 – Excavation, Trenching and Backfilling.
- .2 Section 31 32 19 – Geosynthetics.
- .3 Section 31 37 00 – Riprap.
- .4 Section 33 41 00 – Sewer Mains.
- .5 Section 33 42 13 – Culverts.

1.2 SUBMITTALS

- .1 The Contractor shall submit shop drawings to the Engineer no later than fifteen (15) working days prior to installation.

1.3 QUALITY ASSURANCE

- .1 The Engineer may at any time require the Contractor to produce certification by an independent testing agency that materials used conform to the specified standards.
- .2 All concrete box sections shall be marked with the date of manufacture.
- .3 The Contractor and supplier shall provide reasonable access to the Engineer during and after manufacture for all required testing.

1.4 HANDLING OF BOX SECTIONS

- .1 Handle box sections and appurtenances with approved equipment to prevent damage as well as in accordance with the manufacturer's recommendations.
- .2 Store box sections in accordance with the manufacturer's recommendations.

1.5 MEASUREMENT AND PAYMENT

- .1 Measurement for the supply and installation of precast concrete box sewers will be made in lineal metres based on the total invert length of pipe as identified within the approved Shop Drawings, excluding bends and bevelled end sections, or other specialized (i.e., non-linear) sections. Measurements will be derived from the centreline of the proposed Shop Drawing alignment. Payment will be made at the unit price bid per lineal metre for the various types and sizes of linear precast concrete box sewers, as specified within the Bid Forms. This payment will be full compensation for removing and disposing existing pipe and bedding, if applicable, supplying all precast concrete box sewer materials including couplers and appurtenances, excavation, preparing the precast concrete box sewers bed including supplying, hauling and placing the granular material, installing the pipe, backfilling and compaction, and all materials, labour and supervision, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Engineer. No separate payment will be made for the installation of mortar or approved joint sealer in

the joints. Payment for this work shall be included in the unit price bid for supplying and installing the precast concrete box sewers.

- .2 Measurement for supply and installation of bend and bevelled end sections will be made per each unit installed. Payment will be made at the unit price bid per unit for the various types and sizes of bend and bevelled end sections installed, as specified within the Bid Forms. This payment will be full compensation for supplying all bends and bevelled end section materials including couplers, jointing material and appurtenances, excavation, preparing the bend and bevelled end sections bedding including supplying, hauling and placing the granular material, installing the bend and bevelled ends, backfilling and compaction, and all materials, labour and supervision, equipment, tools and incidentals necessary to complete the Work to the satisfaction of the Engineer. No separate payment will be made for the installation of mortar or approved joint sealer in the joints. Payment for this work shall be included in the unit price bid for supplying and installing the bend and bevelled end sections.
- .3 Measurement for supply, installation, operation, and maintenance of heating and hoarding equipment, tools, fuel, and all other related appurtenances will not be made under separate payment. All costs associated with the supply, installation, operation, and maintenance of heating and hoarding appurtenances shall be included in the unit prices provided associated with Sections 1.5.1 and 1.5.2 of Measurement and Payment. As such, there will be no separate payment made due for work associated with or deemed incidental to the supply, installation, operation, and maintenance of heating and hoarding appurtenances such that all manufacturer's recommendations and requirements are adhered to with respect to grout and mortar placement or other requirements associated with the installation of the precast concrete box and bevelled end sections.

2. PRODUCTS

2.1 CONCRETE BOX SECTIONS

- .1 Precast reinforced box sections shall conform to the latest version of C1433M-02a Standard Specification for Precast Reinforced Box Sections for Culverts, Storm Drains, and Sewers (Metric), made with Type HS, high sulphate-resistant Portland cement, as indicated on the drawings.
- .2 The box sections shall have male and female joints.
- .3 Prefabricated end sections as indicated.

2.2 CEMENT MORTAR

- .1 Cement mortar joint filler for the concrete box sections joints shall conform to the following mix or approved alternative.
 - .1 Portland cement: to CSA A3000, Type HS, high sulphate-resistant.
 - .2 Sand: to ASTM C144
 - .3 Mortar: one (1) part by volume of cement to two (2) parts of clean, sharp sand mixed dry. Add sufficient water after mixing to give optimum consistency for hand application.

- .2 In freezing weather, the Contractor shall heat the sand, cement and apply mortar hot. Protect joints from freezing until mortar has set.

2.3 BEDDING AND BACKFILL AROUND THE BOX SECTION

.1 Granular material:

- .1 Gradation is to be within specified limits when tested to ASTM C136 and ASTM C117 (AASHTO T11 and T27) and giving a smooth curve without sharp breaks when plotted on a semi log grading chart.
- .2 Type I Granular Backfill (20mm or ¾"):

Sieve Designation	% Passing
20.0mm	100
16.0mm	84-94
10.0mm	63-86
5.0mm	40-67
1.25mm	20-43
0.630mm	14-34
0.315mm	9-26
0.160mm	5-18
0.080mm	2-10

- .1 Minimum 60% Fracture by Weight (+5mm, 2 Faces)
- .2 Maximum Plasticity Index of 6
- .3 Bedding Sand:
- .1 Natural sand or crushed rock screenings to follow grading requirements:

Sieve Designation	% Passing
10.0mm	100
5.0mm	50-100
2.5mm	30-90
0.315mm	10-50
0.08mm	0-10

- .1 Liquid limit: ASTM D4318 (AASHTO T89), maximum 25.
- .2 Plasticity index: ASTM D4318 (AASHTO T90), maximum 6.
- .4 Bedding Stone: crushed stone or crushed gravel to following grading requirements:

Sieve Designation	% Passing
20.0mm	100
16.0mm	75-100
12.5mm	65-90
5.0mm	35-55
2.5mm	0

.5 Washed Rock

Sieve Designation	% Passing
25mm	100
10mm	30-55
2.5mm	5-25
0.315mm	0-5

- .6 The Contractor must submit a complete sieve analysis of a minimum of two (2) samples of the above referenced granular material to the Engineer for approval, prior to delivery to site.

- .2 Geotextile material shall be non-woven in accordance with Section 31 32 19 – Geosynthetics.
- .3 Box Sewer Backfill:
 - .1 Material for precast concrete box sewer backfill shall be a mixture of the excavated material obtained from the excavations on the road alignments, where suitable, or granular backfill as directed by the Engineer or as per the drawings.
 - .1 Use of random precast concrete box sewer backfill shall be subject to the approval of the Engineer.
 - .2 Concrete Fill, to a minimum strength of 15MPa, shall be used for precast concrete box sewer backfill when specified by the Engineer or identified on the drawings. Where two (2) or more box sections are installed parallel to each other, the Concrete Fill shall only be used to fill the void between the adjacent box sections.

2.4 CONCRETE

- .1 Concrete for forming additional concrete box fillets, if required, shall conform to CSA A3000 Type HS, high sulfate-resistant, Portland cement. Concrete shall develop a compressive strength of not less than 32MPa in twenty-eight (28) days.

2.5 GEOTEXTILE

- .1 Non-woven geotextile as per Section 31 32 19 – Geosynthetics.

3. **EXECUTION**

3.1 TRENCHING AND BACKFILL

- .1 Do trench and backfill work in accordance with Section 31 23 33 – Excavating, Trenching and Backfilling. The excavation for the precast concrete box section shall be carried out to a depth of not less than 200mm below the invert grade, as established by the Engineer or identified in the plans and drawings and shall be of sufficient width to permit pipe assembly and to accommodate the operation of compaction equipment on either side of the precast concrete box.
- .2 Trench line, depth and bottom of excavation require approval by the Engineer prior to placing bedding material.
- .3 Remove and replace unsuitable material from trench bottom as directed by the Engineer.
- .4 Keep the excavation free of water. Dispose of water in accordance with Section 01 35 43 – Environmental Protection, and Section 01 57 13 – Erosion and Sedimentation Control.

3.2 BEDDING

- .1 Prepare the box sewer bedding in accordance with the drawings. Any soft and yielding or other unsuitable material below this level shall be removed to the depth required by the Engineer and backfilled with approved washed rock compacted to a uniform density of 95% Standard Proctor Density throughout the entire length of the culvert.

- .2 Place washed rock specified in Clause 2.3.1 as shown on the drawings and compact to 95% of Standard Proctor Density across the full width of the trench.
- .3 Place washed rock in uniform layers not exceeding 150mm thickness.
- .4 Trench line and grade requires the Engineer's approval prior to placing bedding material or pipe.
- .5 Do not backfill until the pipe grade and alignment are checked and accepted by the Engineer.

3.3 INSPECTION OF BOX SECTIONS

- .1 Inspect box sections for defects, immediately before lowering into the trench.
- .2 Damaged or defective box sections shall be immediately reported to the Engineer and repaired or replaced according to the Engineer's direction.
- .3 Do not install any box sections earlier than seven (7) days after the date of manufacture, unless otherwise approved by the Manufacturer and the Engineer.

3.4 ALIGNMENT AND GRADE

- .1 Begin at downstream end of precast concrete box section with the female end of first pipe section facing upstream.
- .2 Ensure the barrel of each pipe is in contact with the precast concrete box section bedding throughout its length.
- .3 Do not allow water to flow through the precast concrete box sections during construction, except as permitted by the Engineer.
- .4 The precast concrete box sections and bevelled ends shall be laid true to line and grade as established by the Engineer and the pipe shall be carefully handled to prevent damage. Damaged box sections and beveled ends shall be immediately reported to the Engineer and repaired and/or replaced according to the Engineer's direction.
- .5 Lay box sections to the alignment and grade shown on the drawings.
- .6 Laser equipment used to maintain alignment and grade shall be operated by a qualified technician.
- .7 The centreline of the box sewer shall not be more than 100mm off the given line.
- .8 The invert of the box sections shall not deviate from the required grade by a measurement greater than 15mm. Any deviations in excess of this shall be corrected by the Contractor, in a manner approved by the Engineer, at no cost to the Owner.
- .9 All box sections shall be laid sloping in the desired directions, with no reversed grades on any box section.

- .10 Box sections shall be level across their width.
- .11 Where two (2) or more box section alignments are required, the box sections shall be separated a minimum of 50mm or as directed in the Drawings or by the Engineer. This separation shall be backfilled with concrete fill to seal the exterior joint(s) as well as fill the void under the installed culverts.

3.5 LAYING AND JOINTING

- .1 Lower the box sections carefully into the trench in a manner adhering to the manufacturer's specifications and to prevent damage. Do not drop box sections or materials into the trench.
- .2 Lay box sections in accordance with manufacturer's recommendations and proceed upgrade.
- .3 The washed rock shall be placed such that the placement of the box sections produces a smooth, uniform invert.
- .4 Forming gasket joints:
 - .1 Place sealing compound gasket inside the female end of the box section.
 - .2 Gasket diameter shall be not less than 19mm and shall be lapped at the top.
 - .3 Insert the male end of the box section into the female end and drive in until meeting resistance.
 - .4 Ram the gasket solidly and tightly into the annular space using caulking tools and fill the joint with cement mortar.
 - .5 Overfill the joint with mortar and level off to the outside of the box.
 - .6 Grout/Mortar the interior joint of the pipe to create a uniform surface between pipes.
 - .7 Set two (2) box sections ahead of the joint, before mortaring the joint.
 - .8 A 600mm wide strip of non-woven geotextile shall be placed to form a continuous barrier centred around the exterior of all buried joints if one (1) box section alignment is proposed. In the case there are to be two (2) or more box sections side by side, the non-woven geotextile shall only be required on the furthest outside joints with concrete fill (Minimum Strength of 15MPa) being placed within the cavity between the parallel box sections such that the concrete fill flows under the box sections to seal the joint from the exterior. The concrete fill shall be level with the top of the box sections prior to proceeding with backfilling.
 - .9 Non-woven geotextile shall be free of folds, tears, and wrinkles. The non-woven geotextile shall be joined so that the material laps a minimum of 500mm and shall be pinned together.

3.6 BACKFILLING

- .1 Backfill around the box sections with approved native material or imported granular backfill deposited uniformly in the trench on both sides of the box sections, for the full width of the excavation. Compact in layers of 150mm maximum depth to 95% Standard Proctor Density until the compacted backfill is to the top of the box section.
- .2 Frozen material shall not be used for backfilling or bedding. When conditions are such that unfrozen, native material is not obtainable, provide unfrozen imported granular material at no additional cost.

3.7 RIPRAP

- .1 Riprap shall be placed in accordance with Section 31 37 00 – Riprap. At a minimum:
 - .1 Install riprap at both ends of the culvert as detailed on the drawings.
 - .2 Grade and level the slopes to receive the riprap. Lay geotextile material on the slopes anchored at the top.
 - .3 Place riprap in a staggered manner to form a running bond pattern on each layer and between layers. Remove foreign matter from rock surfaces during placement. The riprap face shall appear closely packed and uniform.
- .2 Where required, install a trash rack or bar grate as detailed on the drawings.

3.8 CLEANING

- .1 Cover open ends of box sewer using timber and plywood, or other means approved by the Engineer, before leaving the unfinished work at any time.
- .2 Remove all foreign material from the box sewer and take precautions to prevent debris from the installation of new sewers from entering existing systems.
- .3 Flush box sewer clean using a method approved by the Engineer and dispose of all contaminated water away from existing sewers in accordance with Section 01 35 43 – Environmental Protection.

3.9 INSPECTION

- .1 Carry out television or visual inspection of the completed sewer as described in Section 33 41 00 – Sewer Mains. If a visual inspection is to be performed, all members of the inspection party shall be certified in the entry of these spaces with proof of certification being submitted to the Engineer a minimum of seventy-two (72) hours prior to the inspection.
- .2 Perform inspection after installation of all mains, manholes and service connections has been completed.
- .3 Repair all defects which will impair the structural integrity and the performance of the sewer system including, but not limited to: improper joints; cracked, sheared or excessively deflected pipe; sags and rises which pond water in excess of 35 mm; protruding service connections; and visible leaks.
- .4 Precast box sections shall be rejected if cracks of 0.6mm or wider are found and/or if the box section male or female ends are damaged such that a satisfactory joint cannot be made.

END OF SECTION

REVISION LOG		
DATE	REVISION	COMMENTS
12/09/2020	Adjustment to Section 1.5 Measurement for Payment Clause .1	Clarification to payment clause for box sections.