

PART 1 - GENERAL

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| <u>1.1 Related Sections</u> | .1 | Roadway Embankments - Section 31 24 13. |
| | .2 | Riprap - Section 31 37 00 |
| | .3 | Granular Sub-base - Section 32 11 19 |
| | .4 | Granular Base - Section 32 11 23 |
| | .5 | Hot Mix Asphalt Concrete Paving - Section 32 12 16 |
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<u>1.2 References</u> |
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American Society for Testing and Materials (ASTM). |
| | .2 | ASTM C 14M-95, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe. |
| | .3 | ATM C 117-95, Standard Test Method for Material Finer Than 0.075 mm Sieve in Mineral Aggregates by Washing. |
| | .4 | ASTM C 136-96a, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. |
| | .5 | ASTM C 144-97, Standard Specification for Aggregate for Masonry Mortar. |
| | .6 | ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (600 kN-m/m3). |
| | .7 | Canadian Standards Association (CSA) |
| | .8 | Aluminum Structural Plate to AASHTO M219 and ASTM B746 |
| | .9 | Bolts to ASTM 307 and ASTM A 449 |
| | .10 | CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction. |
| | .11 | CAN/CSA-G30.18-09, Billet-Steel Bars for Concrete Reinforcement |
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<u>1.3 Samples</u> |
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Submit samples in accordance with Section 01 33 00-Submittal Procedures. |
| | .2 | Inform Departmental Representative at least 4 weeks prior to commencing work, of proposed source of bedding materials and provide access for sampling. |

<u>1.4 Material Certification</u>	.1	Submit manufacturer's test data and certification at least four weeks prior to commencing work.
	.2	Certification to be marked on pipe.

<u>1.5 Delivery, Storage and Handling</u>	.1	Contractor to deliver, store and handle materials in accordance with Product Requirements or TPW standards.
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<u>1.6 Waste Management and Disposal</u>	.1	Separate and recycle waste materials as indicated by Departmental Representative.
	.2	Place materials defined as hazardous or toxic waste in designated containers.
	.3	Ensure emptied containers are sealed and stored safely for disposal away from children.

PART 2 - PRODUCTS

<u>2.1 Pipe</u>	.1	Water-tight cut-off collars: as indicated.
	.2	All pipe to be gasketed.
	.3	CSP to Newfoundland Specifications, 2.8mm thickness, Aluminized Type II or double zinc coated.

<u>2.2 Pipe Reliner</u>	.1	The reline pipe shall be a two flange tunnel liner plate fabricated to permit in-place assembly of a continuous liner.
	.2	Plates shall be fabricated from marine grade aluminum alloy 5052.
	.3	Factory punched holes along longitudinal and circumferential plate seams shall permit place assembly to be completed from the inside of the pipe.
	.4	Longitudinal plate lap seams shall be offset by the gauge of the shell plate along its length to allow the cross section of the plate to be continuous across the seam.
	.5	Galvanized connector bolts shall be grade A307 x 15.9 mm (5/8") diameter.

- 2.3 Granular Bedding and Backfill
- .6 Factory installed 50.8 mm (12") diameter threaded grout injection ports shall be welded into select plates to facilitate pumping grout into the annular space between the two pipes.
 - .1 Granular bedding and backfill material to 31 05 17 - Aggregates: General and following requirements:
 - .2 Sub-base.

PART 3 - EXECUTION

3.1 Trenching

- .1 Obtain Departmental Representative's approval of trench line and depth prior to placing bedding material or pipe.

3.2 Bedding

- .1 Dewater excavation, as necessary, to allow placement of culvert bedding in the dry.
- .2 Place minimum thickness of 200 mm of approved granular material on bottom of excavation and compact to minimum 100% maximum density to ASTM D 698.
- .3 Shape bedding to fit lower segment of pipe exterior so that width of at least 25% of pipe diameter is in close contact with bedding and to camber as indicated or as directed by Departmental Representative, free from sags or high points.
- .4 Place bedding in unfrozen condition.

3.3 Laying Corrugated Steel Pipe Culverts

- .1 Commence pipe placing at downstream end.
- .2 Ensure bottom of pipe is in contact with shaped bed or compacted fill throughout its length.
- .3 Lay pipe with outside circumferential laps facing upstream and longitudinal laps or seams at side or quarter points.
- .4 Do not allow water to flow through pipes during construction except as permitted by Departmental Representative.

3.4 Joints: Corrugated Steel Culverts

- .1 Corrugated steel pipe: joints/couplings shall be non-corroding, Steel Culverts aluminized Type II or double galvanized Zinc Coated to manufacturer's standards.

- .2 Match corrugations or indentations of coupler with pipe sections before tightening.
 - .1 Tap couplers firmly as they are being tightened, to take up slack and ensure snug fit.
 - .2 Insert and tighten bolts.

3.5 Backfilling

- .1 Place backfill material, approved by Departmental Representative, in 150 mm layers to full width, alternately on each side of culvert, so as not to displace it laterally or vertically.
- .2 Compact each layer to 100% maximum density to ASTM D 698 taking special care to obtain required density under haunches.
- .3 Protect installed culvert with minimum 600 mm cover of compacted fill before heavy equipment is permitted to cross. During construction, width of fill, at its top, to be at least twice diameter or span of pipe and with slopes not steeper than 1:2.

3.6 Culvert Relining

- .1 Plate Assembly
 - .1 All rings to be 500 mm long. Reline pipe invert length = 43.5 m (87 rings).
 - .2 Plates shall be assembled in accordance with Sheet 2 - Plate Assembly Drawing.
 - .3 Start plate assembly at the crown working towards the invert to complete each ring.
 - .4 Swaged end of plate nests inside of adjoining plate.
 - .5 Double swage invert plate nests inside both sides of adjoining plates to close ring.
 - .6 Recommended bolt torque is between 135 & 170 N-m (115-135 foot-pounds).
 - .7 Field trim reline pipe at upstream/downstream ends to match existing pipe bevel.
- .2 Bracing
 - .1 Contractor shall place blocking between the reline pipe sections and the host culvert to maintain a uniform annular space of approximately 71 mm between the two pipes while grouting. Blocking to be used to maintain the proper alignment and grade of the reline pipe as required. Aluminum reline pipe shall not be in direct contact with the existing steel pipe after grouting operations is complete.
 - .2 Any internal shoring of the reline pipe required to hold the design diameter during grouting shall be supplied by the contractor.
 - .3 Critical span and rise dimensions shall be monitored and recorded while pumping grout.
 - .4 The Contractor shall close off inlet and outlet ends of the culvert with bulkheads to retain grout.

- .3 Grouting
 - .1 Grout mixture shall freely flow and consolidate with minimal vibration or tamping.
 - .2 Grout shall be pumped through 50.8 mm (2") diameter grout ports. Contractor shall insert plugs into grout ports after pumping operation is complete.
 - .3 Grout to be placed in a minimum of 3 equal and uniform lifts (pours) along both sides of the pipe while ensuring the design diameter of the reline pipe is held at all times.
 - .4 Maximum difference in grout elevations on opposing sides not to exceed 200 mm.
 - .5 Grout to completely fill annular space between reline pipe and host pipe. Vibrate as required to eliminate air voids in the grout.
 - .6 Each lift of grout shall be adequately cured before placing subsequent lifts.
 - .7 Grout pressure shall not exceed 100 kPa.
 - .8 The non-shrink grout shall have a minimum 28 day compressive strength between 1 and 5 MPa.

3.7 Culvert Cut-Off Walls

- .1 Clay cut-off walls to be constructed at locations shown on drawings. Clay material to be approved by Departmental Representative.
- .3 Concrete cut-off walls at culvert 9+701 to be constructed as per drawings.
 - .1 Concrete 30 MPA - Exposure Class C1
 - .2 Reinforcing Steel - Grade 400, uncoated.