Part 1 General

1.1 RELATED REQUIREMENTS

.1 The list of work sections in this division is indicative and non-exhaustive. It does not exclude the works described in the other specification sections, shown in the drawings or necessary for the execution of the works in keeping with overall intent of the plans.

.2 Section 01 33 00 - Submittal Procedures.

.3 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

.4 Section 31 23 33.01 Excavating, Trenching and Backfilling.

.5 Section 31 05 16 - Aggregate Materials.

.6 Section 03 30 00 - Cast-in-Place Concrete.

1.2 SECTION CONTENT

.1 Materials, equipment and installation methods for sewer network.

1.3 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)

.1 ASTM C14M-99, Standard Specification for Concrete Sewer, Storm Drain and Culvert Pipe (Metric).

.2 ASTM C76M-02, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe (Metric).

.3 ASTM C117-95, Standard Test Method for Material Finer Than 0,075 mm (No. 200) Sieve in Mineral Aggregates by Washing.

.4 ASTM C136-01, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM C428-97(2002), Standard Specification for Asbestos-Cement Nonpressure Sewer Pipe.

.6 ASTM C443M-02, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric).

.7 ASTM D698-00a, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3) (600 kN-m/m3).

.8 ASTM D1056-00, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.

.9 ASTM D1869-95(2000) Standard Specification for Rubber Rings for Asbestos-Cement Pipe.

.2 Bureau de normalisation du Québec (BNQ)

.1 BNQ-1809-300-2004, latest edition.

.3 Ministère des Transports du Québec

.1 Cahier des charges et devis généraux (CCDG) - latest edition.

.4 Canadian Standards Association, (CSA International)

.1 CAN/CSA-A3000-98 (April 2001), Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).

.1 CAN/CSA-A5-F98, Portland Cement.

.2 CAN/CSA-A257 Series-M92(R1998), Standards for Concrete Pipe.

.5 Department of Justice Canada (Jus).Canadian Environmental Protection Act, 1999 (CEPA).

.6 Transport Canada (TC)

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.4 DEFINITION

.1 A pipe section is defined as length of pipe between successive catch basins and/or manholes.

1.5 SUBMITTALS

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

.2 Shop drawings to indicate proposed method for installing carrier pipe for undercrossings.

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

.4 Inform Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.

.5 Submit manufacturer's test data and certification proving pipes meet requirements at least 2 weeks prior to beginning Work.

.6 Pipe certification to be on pipe.

.7 Submit to Departmental Representative one copy of manufacturer's installation instructions.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.7 WORK SCHEDULE

.1 Schedule Work to minimize interruptions to existing services and to maintain existing flow during construction.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule, if necessary.

Part 2 Products

2.1 MATERIALS

.1 Storm sewer pipes reinforced concrete and fittings: in accordance with CAN/CSA-A257, ASTM C76M and NQ 2622-126 standards :

.1 Diameter of 300 mm and under: Class V.

.2 Diameter of 375 mm and more: Class IV.

.2 Storm sewer pipes Polyvinyl chloride (PVC) :

.1 Pipes and fittings of 200 mm to 450 mm: minimal resistance DR-35, minimal rigidity of 320 KPa.

.3 Storm sewer pipes high-density polyethylene (HD-PE) :

.1 Pipes and fittings for storm sewer in high-density polyethylene (HD-PE): Solflo-Max with integrated gasket bell with removable locks from SOLENO INC., corrugated with smooth inner wall bell system with integrated seal fitting with removable locks, minimal rigidity of 320 kPa for 5% deflexion.

.2 Provide accessories , fittings and adapters molded or fabricated, recommended by the supplier, including without limitation, adapters for connection to the manhole having a diameter equivalent to PVC, DR-35 or reinforced concrete (coordinate with the manhole supplier).

.4 Sanitary sewer pipe made of polyvinyl chloride (PVC) :

.1 Pipe and fittings 150 mm and less: minimal resistance DR-28, minimal rigidity 625 KPa.

.2 Color white.

.5 Discharge pipe (Force main line) :

.1 High density polyethylene pipe with fused joints (HDPE)

.1 Supply and install the pipes and pipe fittings in HDPE assembled by butt-fusion jointing : the nominal diameter and the inside diameter shall be of minimum SDR-17 for a pressure pipe.

.2 When required by the site conditions or as shown on the plans, assemble with flanged joints as supplied by the manufacturer (flange fittings by Sclairpipe)

.3 The connection to a manhole is performed using a polyethylene factory-fused anchoring piece. Build a concrete seal joint as shown on the plans.

.2 Accessories anchoring

.1 Anchor the accessories as per section 10.4.7 (NQ 1809-300) with a service pressure of 1035 kPa.

.6 Roadway foundation drain :

.1 Road foundation drain made of high-density polyethylene: corrugated with smooth inner wall and perforated or equivalent, minimal rigidity of 320 kPa at 5% deflexion.

.1 Accepted products :

.1 Solflo-Max with double bell snap couplers by Soleno.

.2 Materials or products alternative : approved in addendum as specified in the Instructions to bidders.

.2 Geotextile : synthetic fiber nonwoven canvas, made of polypropylene or polyester, meeting section 31 31 19.01 geotextile requirements.

2.2 INSULATION

.1 Insulation to place above the pipes :

.1 Accepted products :

.1 50 mm thick HI-60 sheets from DOW.

.2 Materials or products alternative : approved in addendum as specified in the Instructions to bidders.

2.3 MATERIALS AND SEAT COVER

.1 Granular materials: in accordance with section 31 05 16 – Aggregate materials.

2.4 BACKFILL MATERIAL

.1 As indicated.

.2 Backfill material : in accordance with section 31 23 33.01 – Excavation, trenching and backfilling.

.3 Fill materials dimensionally stabilized: in accordance with section 31 23 33.01 - Excavation, trenching and backfilling.

Part 3 Execution

3.1 PREPARATIONS

.1 Clean pipes and fittings of wastes and water before installation, and remove defective materials from site to approval of Departmental Representative.

3.2 TRENCHING

.1 Perform trenching Work in accordance with Section 31 23 33.01 - Excavating Trenching and Backfilling, as well as CSST requirements.

.2 Do not allow contents of sewer or sewer connection to flow into trenches.

.3 Trench alignment and depth to approval of Departmental Representative prior to placing bedding material and pipe.

3.3 GRANULAR BEDDING

.1 Place bedding in unfrozen condition.

.2 Place granular bedding material according to manhole diameter. Refer to BNQ 1809-300 standardized drawings for bedding thickness. Thickness indicated is after compacting.

.3 Shape bed true to grade so as to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipes.

.4 Shape transverse depressions as required to suit joints.

.5 Compact each layer full width of bed to at least 95 % corrected maximum dry density.

.6 Fill excavation below bottom of specified bedding adjacent to manholes or catch basins with compacted bedding material.

3.4 INSTALLATION

.1 Lay and join pipe in accordance with manufacturer's recommendations and to approval of Departmental Representative.

.2 Handle pipe using methods approved by Departmental Representative.

.1 Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

.3 Lay pipes on prepared bed, true to line and grade with pipe inverts smooth and free of sags or high points.

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.4 Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

.5 Do not exceed maximum joint deflection recommended by pipe manufacturer.

.6 Do not allow water to flow through pipes during construction except as permitted by express authorization from Departmental Representative.

.7 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.1 Concrete pipe :

.1 Install gaskets as recommended by manufacturer.

.2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.3 Carefully align pipes before joining.

.4 Maintain pipe joints free from mud, silt, gravel and other foreign material.

.5 Avoid displacing gasket or contaminating with dirt or other foreign material. Remove disturbed or dirty gaskets; clean, lubricate and replace before joining is attempted.

.6 Complete each joint before laying next length of pipe.

.7 Minimize joint deflection after joint has been made to avoid joint damage.

.8 Apply sufficient pressure when joining pipes to ensure that joint is complete as outlined in manufacturer's recommendations.

.8 When any stoppage of Work occurs, restrain pipes as directed by Departmental Representative, to prevent "creep" during down time.

.9 Plug lifting holes with Departmental Representative-approved prefabricated plugs, set in shrinkage compensating grout.

.10 Cut pipes as required for special inserts, fittings or closure pieces, as recommended by pipe manufacturer, without damaging pipe or its coating so as to leave smooth end at right angles to axis of pipe.

.11 Make watertight connections to manholes and catch basins.

.1 Use shrinkage compensating grout when suitable gaskets are not available.

.12 Use prefabricated saddles or approved field connections for connecting pipes to existing sewer pipes.

.1 Joint to be structurally sound and watertight.

.13 Temporarily plug open upstream ends of pipes with removable watertight concrete, steel or plastic bulkheads.

3.5 BLOCK SEALS FOR PIPE CONNECTIONS

.1 Construct block seals for connections to the sewer lines, as shown on the plans.

.2 Place pipes at the same level. Install a « Tridon » coupling or approved equivalent before pouring the block seal on any pipe of 300 mm diameter or less. Replace the « Tridon »

coupling with a polythene strip exceeding 300 mm each sides of the joint for pipes with a diameter above 300 mm.

.3 Pour the concrete of minimal resistance of 25 MPa. Sealing of the block must be perfect.

3.6 PIPE DECOMMISION

.1 Perform pipe decommission in accordance with article 10.6 (NQ 1809-300).

.1 When existing pipes are inside the limit of the trench, Contractor must remove and dispose in a site for this purpose.

.2 When existing pipes are outside the trench limits, Contractor must proceed to decommission of the pipes by injecting a fluid-sand concrete type.

3.7 INSULATION

.1 Install insulation when minimum cover is not reached in areas designated by the engineer, as shown on the insulation drawing on the plans.

.2 Place insulation above pipes or connections on a sufficient length to cover the entire section where soil cover is less than 2.15 mètres.

.3 Consider as a minimum, type 1 insulation as shown on the plans. Increase insulation according the depth of burry, as shown on the plans.

3.8 PIPE SURROUND

.1 Place surround material in unfrozen condition.

.2 Place layers uniformly and simultaneously on each side of pipe.

.3 Compact each layer from pipe invert to mid height of pipe to at least 95 % corrected maximum dry density, in layers no more than 300 mm thick.

.4 Compact each layer from mid height of pipe to underside of backfill to at least 90 % maximum modified density per layer, no more than 300 mm thick or to Departmental Representative’s approval.

3.9 BACKFILL

.1 Place unshrinkable backfill in accordance with Section 31 23 33.01 - Excavating, Trenching and Backfilling.

3.10 FIELD TESTS

.1 Perform testing true to the BNQ 1809-300/R2007, most recent edition. Also, refer to the table at the end of this section.

.2 Repair or replace pipe, pipe joint or bedding found defective.

.3 Remove foreign material from sewers and related appurtenances by flushing with water.

.4 Seal tests (article 11.2.2 of BNQ 1809-300/R2007) :

.1 Perform tests at the same pace as the work is performed. In the presence of negative trials , make repairs and retest until specified criteria are met.

.2 Provide tight plugs on connections when the private section is nonexistent. When private section is existing, submit work method. In the case where it is decided to use a lateral and a pipe's end up to the road level to insert the plugs during testing (NQ 1809-300, figure 63), remove this piece of pipe at the end of the tests all the way to the lateral and seal it with a sealing plug.

.3 No mortar or any other coating or product can not be applied to the works before testing. No product can be added to the water during soaking and leak testing.

.4 Since the stormsewer network can be occasionally flowing under pressure, leak tests similar to sanitary sewer pipes must be performed on the storm sewer pipes whose crown elevation is below the overflow level of the retention basin (85.750)

.5 Video inspection or additional testing :

.1 The Departmental representative reserves the right to make, at any time since the end of the work until final acceptance, any television inspection or additional testing, at the expense of the Contractor.

.6 Audits conducted by video camera systems or cameras. The Contractor shall inspect sewer lines in place by video camera systems , cameras or other devices of its kind.

.1 Inspection results must be submitted in three (3) copies to the Departmental representative. The latter will perform quality control.

.2 Perform tests in accordance with BNQ 1809-300/R2007, most recent edition.

3.11 LEAK TEST BY EXFILTRATION OF THE RETENTION BASIN AND CALIBRATION OF THE FLOW CONTROL REGULATOR

.1 Before provisionnally receiving the retention basin, the Contractor must perform a leak test by exfiltration to confirm that there is not leak inside the basin and regulation chamber.

.2 The Contractor must follow the procedure describe in this section to quantify the exfiltration volume after the filling of the basin :

.1 The Contractor isolates the connection between the reservoir and the regulation chamber : both entrances to the basin, the westward entrance of the regulation chamber as well as the flow control regulator's outlet pipe are to be isolated using swelling water stoppers or other approved methods.

.2 Quebec City's potable water network will be used to fill the reservoir. The City must be informed one week (minimum) in advance so that the Public Works can install a hose and a valve on the nearest fire hydrant. The Contractor can operate this fire hydrant to fill the reservoir. There is no restriction in using this fire

hydrant to fill the reservoir unless there is a network problem, supply problems at the treatment plant, drought, etc.

.3 The Contractor fills the reservoir with potable water up to the emergency spillway elevation (85750 mm) afterwards the soaking period begins and lasts 72 hours.

.4 After the soaking period, the reservoir is filled anew up to the emergency spillway elevation. The Departmental representative will manually measure the water level relative to the reservoir access or to the regulation chamber. Afterwards the exfiltration period begins.

.5 Following the next 48 hours, 4 series of readings will be taken manually by the Departmental representative. The difference between the last reading and the first reading will be used to calculate the leak in mm during the time lapse and the intermediate readings will be used to confirm the linear rate of leak during the test.

.6 The rate of global leak of the reservoir is determined by using this equation :

$$Leak\ rate\ \left(\frac{m3}{day}\right) = \left(\frac{initial\ level\ (m) - \left(final\ level\ (m)\right) * Area\ of\ the\ reservoir\ (m2)}{time\ elapsed\ between\ the\ first\ and\ last\ readings\ (days)}\right.$$

Notes :

- The area of the reservoir at the elevation of the emergency spillway is 225.6 m^2. The total retention volume is 480 m^3.
- Water lost by evaporation is considered to be negligible since the access will only be opened during readings.

.3 The maximum acceptable leak rate is 0.25% of the accumulated volume by period of 24 hours. For the retention basin, the maximum acceptable volume lost over a period of 24 hours is (480 m3 * 0.0025) = 1.2 m3/day. So over the surface area of the reservoir, the readings difference cannot be greater than (1.2 m3/day * 2 days) / 225.6 m2 = 0.0106 m = 10.6 mm.

.4 Following the leaktest of the reservoir, a leak test for the wall mounted valve will be performed by the Departmental Representative. A visual inspection to see if thee are leaks can be performed starting downstream of the regulation chamber when the retention basin is under pressure.

.5 The Contractor, the supplier/manufacturer, and the Departmental Representative should validate the calibration of the flow control regulator when the reservoir is filling. The supplier/manufacturer must submit a written report of this test before the provisional reception of this work.

.6 The Contractor will be responsible for the coordination of these tests and must warn the Departmental Representative 14 days in advance prior to the tests.

.7 The Contractor is responsible for the security to access in enclosed space.

.8 If the leak rate is not acceptable, then the Contractor must proceed to waterproofing operations by injection or by using approved methods. A new test must be performed afterwards.

.9 The outflow rate of the reservoir cannot be greater than the capacity of the flow control regulator

TABLE
WORK VERIFICATIONS (TESTS)

Period		**Sanitary and pseudo-sanitary network**				**Storm sewer network**			
		Pipes	Connections	Structures on pipes ≤ 900 ø	Structures on pipes > 900 ø	Pipes	Connections	Structures	Catch-basins
Before the provisional reception	- Cleaning ***(11.2.2.1 et 11.4.5)***	√	√	√	√	√	√	√	√
	- TV inspection ***(11.2.2.1 et 11.4.1)***	√		√	√	√		√	
	- Visual inspection ***(11.4.2)***								√
	- Leak test : · Leak test with low air pressure ***(11.2.4)***	√	√			√	√		
	· Leak test by water exfiltration ***(11.2.5)***			√				√	
	· Infiltration check ***(11.2.3)***	√	√	√	√				
	· Retention basin leak test							√	
	- Deformation test at 5% ***(11.5)***	√				√			
Before the final reception	- Cleaning ***(11.5.2)***	√	√	√	√	√			
	- Leak test : · Infiltration check by flow readings[(1)] ***(11.2.1.8)***	√	√	√	√				
	- Deformation test at 7,5%[(2)] ***(11.5)***	√				√			

END OF SECTION