

PART 1 - GENERAL

1.1 SECTION INCLUDES

- .1 Sanitary sewerage drainage piping, fittings, accessories, and bedding.
- .2 Connection and extension of existing sanitary sewer overflow pipe.

1.2 RELATED SECTIONS

- .1 Section 31 05 16 - Aggregate Materials.
- .2 Section 31 23 25 - Rock and Gravel Fill.
- .3 Section 33 05 13 - Manholes And Catch Basin Structures.
- .4 Section 33 41 00 - Storm Utility Drains.

1.3 REFERENCES

- .1 Codes and standards referenced in this section refer to the latest edition thereof.
- .2 AASHTO T180-09 - Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 inch) Drop.
- .3 American Water Works Association (ANSI/AWWA)
 - .1 AWWA C111/A21.11-07 - Rubber Gaskets Joints For Cast Iron and Ductile Iron Pressure Pipe and Fittings.
- .4 ASTM International:
 - .1 ASTM A74-09 - Cast Iron Soil Pipe and Fittings.

- .2 ASTM A746-09 - Ductile Iron Gravity Sewer Pipe.
- .3 ASTM C12-09 - Standard Practice for Installing Vitrified Clay Pipe Lines.
- .4 ASTM C14M-07 - Concrete Sewer, Storm Drain, and Culvert Pipe, ASTM C14M-07 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- .5 ASTM C76M-10a - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe, ASTM C76-10a - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
- .6 ASTM C425-04(2009) - Compression Joints for Vitrified Clay Pipe and Fittings.
- .7 ASTM C443M-07 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets, ASTM C443-05ae1 - Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
- .8 ASTM C564-09a - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .9 ASTM C700-09 - Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
- .10 ASTM D698-07e1 - Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/cu ft (600 kN-m/cu m)).
- .11 ASTM D1556-07 - Test Method for Density and Weight Unit of Soil in Place by the Sand-Cone Method.
- .12 ASTM D1557-09 - Test Methods for Laboratory Compaction

Characteristics of Soil
Using Modified Effort
(56,000 ft-lbf/cu ft (2,700
kN-m/cu m)).

- .13 ASTM D2321-09 - Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
- .14 ASTM D2729-03 - Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .15 ASTM D2751-05 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- .16 ASTM D3034-08 - Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
- .17 ASTM D6938-10 - Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

- .1 Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.5 SUBMITTALS FOR REVIEW

- .1 Section 01 33 00: Submittal Procedures.
- .2 Product Data: Provide data indicating pipe and pipe accessories.

1.6 SUBMITTALS FOR INFORMATION

- .1 Section 01 33 00: Submittal Procedures.

- .2 Installation Data:
Manufacturer's special
installation requirements.

1.7 CLOSEOUT
SUBMITTALS

- .1 Section 01 78 00: Close Out
Submittals.
- .2 Shop drawings to indicate
proposed method for installing
carrier pipe for undercrossings.
- .3 Inform Departmental
Representative at least 4 weeks
prior to beginning Work, of
proposed source of bedding
materials and provide access for
sampling.
- .4 Submit manufacturer's test data
and certification at least 2
weeks prior to beginning Work.
- .5 Ensure certification is marked on
pipe.
- .6 Record location of pipe runs,
connections, manholes, control
points, outfall, invert
elevations, pipe diameter and
pipe slope.
- .7 Identify, indicate, and describe
unexpected variations to subsoil
conditions or discovery of
uncharted utilities.

1.8 REGULATORY
REQUIREMENTS

- .1 Conform to Newfoundland &
Labrador Municipal Water, Sewer
and Roads Master Construction
Specifications.

1.9 MEASUREMENT FOR
PAYMENT

- .1 Sanitary Sewer piping shall be measured in meters of each size of pipe installed, and shall include all fittings in the unit price.

PART 2 - PRODUCTS

2.1 PIPE MATERIALS

- .1 Smooth wall polyvinyl pipe and fittings to ASTM D3034-80 and ASTM F679. Plastic pipe and fittings: to CAN/CSA B182.1-M92 for 100/125/150 mm sizes, CAN/CSA B-182.2-M90 for 200 mm to 675 mm sizes. Standard Dimensional Ratio (SDR): 35 for mains and SDR 28 for service pipe, unless otherwise indicated on the contract drawings, with locked-in gasket and integral bell system. Nominal lengths: 4 and 6 m.

2.2 PIPE ACCESSORIES

- .1 Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, clean-outs, reducers, traps and other configurations required.

2.3 BEDDING MATERIALS

- .1 Bedding material, Fill Type 1, to: Section 31 23 25 - Rock and Gravel Fill and following requirements;
- .1 Type 1 bedding: clean, hard durable crushed gravel or stone, free from shale clay, friable materials, organic matter and other deleterious substances and graded within the following limits when

tested to ASTM C136-84a and ASTM C117-87 and giving a smooth curve without sharp breaks when plotted on a semi-log chart:

<u>ASTM sieve designation</u>	<u>% passing</u>
25.000 mm	100
19.000 mm	75 - 100
12.500 mm	-
9.500 mm	50 - 100
4.750 mm	30 - 70
2.000 mm	20 - 45
0.425 mm	10 - 25
0.180 mm	-
0.075 mm	3 - 8

- .2 Rock fill underbedding shall be a well graded 100mm minus material.
- .3 Concrete required for cradles, encasement, supports, thrust blocks and cut-off walls all to Section 03 30 00, strength 25 MPa.

PART 3 - EXECUTION

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that trench cut and excavation base is ready to receive work and excavations, dimensions, and elevations are as indicated on construction drawings.

3.2 PREPARATION

- .1 Clean and dry pipes and fittings before installation.
- .2 Obtain approval of pipes and fittings from Departmental Representative prior to installation.

3.3 TRENCHING

- .1 Do trenching Work in accordance with Section 31 23 25 - Rock and Gravel Fill.
- .2 Do not allow contents of any sewer or sewer connection to flow into trench.
- .3 Trench alignment and depth require approval of Departmental Representative prior to placing bedding material and pipe.
- .4 Do not backfill trenches until pipe grade and alignment have been checked and accepted and infiltration and exfiltration test results are within the limits specified. If the pipe is backfilled for any reason prior to testing, accept responsibility to meet the tests or to re-excavate and repair the line and pay all costs.

3.4 CONCRETE BEDDING
AND ENCASEMENT

- .1 Do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete. Place concrete to details as directed by Departmental Representative.
- .2 Position pipe on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is

placed.

- .3 Do not backfill over concrete within 24 hours after placing.

3.5 GRANULAR BEDDING

- .1 Place granular bedding materials in accordance with details specified or directed.
- .2 Place bedding in unfrozen condition.
- .3 Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth indicated.
- .4 Shape bed true to grade and to provide continuous, uniform bearing surface for pipe. Do not use blocks when bedding pipe.
- .5 Shape transverse depressions as required to suit joints.
- .6 Compact each layer full width of bed to at least 95 % maximum density to ASTM D698.
- .7 Fill excavation below bottom of specified bedding adjacent to manholes or structures with compacted bedding material.

3.6 INSTALLATION

- .1 Lay and join pipes in accordance with manufacturer's recommendations and to approval of Departmental Representative.
- .2 Handle pipe using methods approved by Departmental Representative. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.

- .3 Use laser-type instrument to control line and grade for sewers unless otherwise approved by the Departmental Representative.
- .4 Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Tolerances: 3mm in 3 m.
- .5 Commence laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.
- .6 Do not exceed maximum joint deflection recommended by pipe manufacturer.
- .7 Do not allow water to flow through pipe during construction, except as may be permitted by Departmental Representative.
- .8 Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
- .9 Install plastic pipe and fittings in accordance with CSA B182.11.
- .10 Pipe jointing:
 - .1 Install gaskets in accordance with manufacturer's recommendations.
 - .2 Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket

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- is properly positioned.
 - .3 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. Gaskets so disturbed shall be removed, cleaned and lubricated and replaced 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 At rigid structures, install pipe joints not more than 1.2 m from side of structure.
 - .9 Apply sufficient pressure in making joints to ensure that joint is complete as outlined in manufacturer's recommendations.
 - .11 When stoppage of Work occurs, block pipes as directed by Departmental Representative to prevent creep during down time.
 - .12 Plug lifting holes with pre-fabricated plugs approved by Departmental Representative, set in shrinkage compensating grout.
 - .13 Cut pipes as required for special inserts, fittings or closure pieces as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
 - .14 Make watertight connections to

manholes or other structures. Provide details of proposed method of installing pipe stubs in structure walls to ensure a watertight joint. In the case of precast manhole bases an integral joint gasket may be cast in the manhole wall to receive the pipe stub. In the case of cast-in-place manholes bases the exterior pipe surface in contact with the structure wall shall be roughened or treated to provide a bond with the concrete. Any grout used to be non-shrink type.

- .15 Use prefabricated saddles or field connections approved by Departmental Representative, for connecting pipes to existing sewer pipes. Joints to be structurally sound and watertight.
- .16 Leave joints and fittings exposed for ex-filtration testing. Provide protection when required. If it is necessary to backfill sections of the sewer prior to testing, take full responsibility and bear all costs for any additional excavation and backfill to expose pipe, fittings or joints that may be necessary.
- .17 When infiltration and ex-filtration test results are acceptable to Departmental Representative, backfill remainder of trench in accordance with Section 31 23 25 - Rock and Gravel Fill.

3.7 PIPE SURROUND

- .1 Place surround material in unfrozen condition.
- .2 Upon completion of pipe laying,

and after Departmental Representative has inspected pipe joints, surround and cover pipes as indicated. Leave joints and fittings exposed until field testing is completed.

- .3 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated. Do not dump material within 1.0 m of pipe.
- .4 Place layers uniformly and simultaneously on each side of pipe.
- .5 Compact each layer from pipe invert to mid height of pipe to at least 95 % maximum density to ASTM D698.
- .6 Compact each layer from mid height of pipe to underside of backfill to at least 90 % corrected maximum density to ASTM D698.
- .7 When field test results are acceptable to Departmental Representative, place surround material at pipe joints.

3.8 BACKFILL

- .1 Place backfill material in unfrozen condition.
- .2 Place backfill material, above pipe surround in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
- .3 Under paving and walks, compact backfill to at least 100% maximum density to ASTM D698. In other areas, compact to at least 90 %

maximum density to ASTM D698.

3.9 SERVICE CONNECTION

- .1 Install pipe to CSA B182.11 and manufacturer's instructions and specifications.
- .2 Maintain grade for sewers at 1 vertical to 100 horizontal unless directed otherwise by Departmental Representative.
- .3 Service connection pipe: not to extend into interior of main sewer.
- .4 Make up required horizontal and vertical bends from 45 degrees bends or less, separated by straight section of pipe with minimum length of four pipe diameters.
 - .1 Use long sweep bends where applicable.

3.10 FIELD TESTING

- .1 Repair or replace pipe, pipe joint or bedding found defective.
- .2 Remove foreign material from sewers and related appurtenances by flushing with water.
- .3 Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
- .4 Do infiltration and exfiltration testing as specified herein and as directed by Departmental Representative. Perform tests in presence of Departmental Representative. Notify Departmental Representative 24 h in advance of proposed tests.

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- .5 Carry out tests on each section of sewer between successive manholes including service connections.
 - .6 Install watertight bulkheads in suitable manner to isolate test section from rest of pipeline.
 - .7 Exfiltration test:
 - .1 Fill test section with water to displace air in line. Maintain under nominal head for 24 hours to ensure absorption in pipe wall is complete before test measurements are begun.
 - .2 Immediately prior to test period add water to pipeline until there is head of 1 m over interior crown of pipe measured at highest point of test section or water in manhole is 1 m above static ground water level, whichever is greater.
 - .3 Duration of exfiltration test: 2 hours.
 - .4 Water loss at end of test period: not to exceed maximum allowable exfiltration over any section of pipe between manholes.
 - .8 Infiltration test:
 - .1 Conduct infiltration test in lieu of exfiltration test where static ground water level is 750 mm or more above top of pipe measured at highest point in line to be used.
 - .2 Do not interpolate a head greater than 750 mm to

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- obtain an increase in allowable infiltration rate.
- .3 Install watertight plug at upstream end of pipeline test section.
 - .4 Discontinue pumping operations for at least 3 days before test measurements are to begin and during this time, keep thoroughly wet at least one third of pipe invert perimeter.
 - .5 Prevent damage to pipe and bedding material due to flotation and erosion.
 - .6 Place 90 degrees V-notch weir, or other measuring device approved by Departmental Representative in invert of sewer at each manhole.
 - .7 Measure rate of flow over minimum of 1 hour, with recorded flows for each 5 min interval.
 - .9 Infiltration and exfiltration not to exceed 4.63 L per hour per 100 m of pipe, including service connections.
 - .10 Repair visible leaks regardless of test results.
 - .11 Carry out any retesting of sewer sections which have previously passed ex-filtration and/or infiltration tests, as directed by the Departmental Representative. If any sewer section passes this initial retest, additional payment will be made for such retest of that section. If any sewer section does not pass this initial retest, repair and retest such

sewer as required until test results are again within limits specified, at no additional cost to the Contract.

.12 Television inspections:

- .1 Television equipment shall consist of a self-contained color camera and a monitoring unit connected by a 3 wire coaxial cable. The camera shall be small enough to ensure passage through a 150 mm sewer, shall be waterproof, and shall have a self-contained remotely controlled lighting system of varying the illumination of the interior of the sewer line for inspection and photographic purposes. Picture quality shall be such as to produce a continuous 600-line resolution picture showing the entire periphery of the pipe. All video tapes must be BHS format, SP mode. An audio description of the inspection must also be provided. The monitor shall be not less than 13 inch color monitor.
- .2 Carry out inspection of installed sewers by television camera.
- .3 If defective work is found by such inspections, repair sewer line and repeat television inspections as required until all defective work has been corrected, at no additional cost to the Departmental Representative.
- .4 All tapes of television inspections are to be

retained by the Departmental Representative as a permanent record. Digital Format only. Tape references shall be in hours and minutes (not counter number).

- .5 Carry out television inspections of sewer sections previously not showing defective work as directed by the Departmental Representative. Additional payment will be allowed for such television inspections for sewer sections still free of defects. If defective work is found by such re-inspection repair sewer line and repeat inspection as required until all defective work has been corrected, at no additional cost to the Contract.

.13 Deflection Test for PVC Pipe

- .1 Carry out a deflection test on all sections of the sewer. The maximum allowable deflection under fully backfilled and compacted trench conditions shall not exceed 5% before 30 days and 7.5% after 30 days.
- .2 Locations with excessive deflection shall be repaired and/or the pipe replaced at the Contractor's expense. The equipment used for the deflection test shall be that as recommended by the manufacturer, and may include an Electronic Deflectometer or a Rigid "Go-No-Go" Device. For the purpose of deflection

measurement, the base inside diameters and the deflection mandrel dimensions are provided in the following table. To ensure accurate testing the lines shall be thoroughly cleaned.

Table for Base Inside Diameters and Deflection Mandrel Dimensions PVC SDR-35 (ASTM D3034)			
Nominal Size	Base Inside Diameter (mm)	5% Deflection Mandrel (mm)	7.5% Deflection Mandrel (mm)
200	194.69	185.0	180.0
250	242.90	230.8	224.6
300	288.57	274.0	266.9
375	353.01	335.4	326.6

.3 For nominal sewer sizes not shown in above table the Mandrel dimensions shall be calculated as follows:

$$\text{Mandrel O.D.} = \frac{(100-Y)}{100} \times \text{Base I.D.}$$

Where Y = Deflection Limit in %

3.11 SCHEDULES

.1 As detailed on Construction Drawings.