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This is a supplement to the *Standard Specification for Municipal Services* specific to the requirements of HRWC.

PART 1 - GENERAL

1.1 Work Included

- .1 This section specifies requirements for constructing gravity wastewater mains. Work includes supply, installation, and testing of pipe, fittings and service connections.

1.2 Related Sections

- | | | |
|----|---------------------------------------|-----------------------|
| .1 | Concrete | SECTION 03 30 00 |
| .2 | Earthwork | SECTION 31 20 00 |
| .3 | Reinstatement | SECTION 32 98 00 |
| .4 | CCTV Inspection | SECTION 33 01 30 |
| .5 | Manholes, Catch Basins and Structures | SECTION 33 39 00 |
| .6 | Standard Details | HRWC STANDARD DETAILS |

1.3 Reference Standards

- | | | |
|----|---------------|---|
| .1 | ASTM C14M-15a | Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric) |
| .2 | ASTM C76M-16 | Reinforced Concrete Culvert, Storm, Drain, and Sewer Pipe (metric). |
| .3 | ASTM F477-14 | Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe |

.4	ASTM F2736-13e1	Standard Specification for 6 to 30 in. (152 To 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe And Double Wall Pipe.
.5	ASTM F2764-16	Standard Specification for 6 to 60 in. [150 to 1500 mm] Polypropylene (PP) Corrugated Double and Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications.
.6	AWWA C110/A21.10-12	Ductile-Iron and Gray-Iron Fittings.
.7	AWWA C901-08	Polyethylene (PE) Pressure Pipe and Tubing ½” (13 mm) Through 3” (76 mm) for Water Service.
.8	AWWA C906-15	Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100mm) Through 65 in. (1,650mm), for Waterworks.
.9	CAN/CSA A257 Series-14	Standards for Concrete Pipe and Manhole Sections.
.10	CAN/CSA B1800-15	Thermoplastic Nonpressure Piping Compendium, Update No. 1 (2015), Update No. 2 (2015).
.11	CAN/CSA B182.13-15	Profile Polypropylene (PP) Sewer Pipe and Fittings for Leak-Proof Sewer Applications.
.12	NASSCO	National Association of Sewer Service Companies guideline Specifications.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with SECTION 01 10 00 for all pipe, fittings, valves and all other items necessary for a complete Wastewater System installation.

1.5 Certificates

- .1 Submit manufacturer's test data and certification that products and materials meet requirements of this SECTION and are in accordance with SECTION 01 10 00.

1.6 Handling and Storage

- .1 Handle and store pipe, valves and fittings, in such manner as to avoid shock and damage. Do not use chains or cables passing through pipe bore. Do not damage coatings or linings.
- .2 Store gaskets in cool location, out of direct sunlight, and away from petroleum products.

PART 2 - PRODUCTS

2.1 General

- .1 Diameter, material and strength class of pipe and fittings: as indicated.

2.2 Polyvinyl Chloride Pipe and Fittings

- .1 Pipe:
 - .1 Type PSM polyvinyl chloride: to CSA B1800.
- .2 Joints:
 - .1 Bell and spigot with rubber gaskets meeting ASTM F477.
- .3 Fittings:
 - .1 Fittings and connections shall provide a watertight connection according to the requirements of ASTM D3212.

2.3 Concrete Pipe and Fittings

- .1 Pipe and fittings:
 - .1 Reinforced: to ASTM C76M or CAN/CSA A257.2
- .2 Joints: bell and spigot with flexible rubber gaskets to CAN/CSA A257.3.

2.4 Polyethylene Pipe and Fittings

- .1 Pipe:
 - .1 13 mm to 76 mm diameter: to AWWA C901.
 - .2 100 mm diameter and larger: to AWWA C906.

- .2 Joints:
 - .1 Thermal butt fusion
 - .2 Mechanical connections: polyethylene flange end with metal back-up ring.
 - .3 Electrofusion.
- .3 Fittings:
 - .1 Polyethylene: to AWWA C901 or AWWA C906
 - .2 Flanged cast-iron: to AWWA C110.

2.5 Polypropylene Pipe and Fittings

- .1 Pipe:
 - .1 150 mm to 750 mm diameter corrugated single wall pipe and double wall pipe to ASTM F2736 and CSA B182.13
 - .2 150 mm to 1500 mm diameter and larger corrugated double and triple wall pipe and fittings for non-pressure applications to ASTM F2764
- .2 Joints:
 - .1 Watertight joint to ASTM D3212
 - .2 Gasketed integral bell & spigot joints to ASTM F2736 and ASTM F2764
- .3 Fittings:
 - .1 Fitting watertight joint to ASTM D3212
 - .2 Fittings to ASTM F2736 and ASTM F2764.
 - .3 Bell & spigot connections to utilize a spun-on, welded or integral bell and spigot with gaskets to ASTM F477

2.6 Service Saddles

- .1 Concrete or asbestos-cement main: cast-iron or PVC with gasket, stainless steel strap or bolt on, and O-ring in branch end.
- .2 PVC main: PVC strap-on saddle, factory tee or wye, with gasket, all stainless steel strap and O-ring in branch end.

2.7 Marker Stakes

- .1 Timber marker stake – 40 mm x 90 mm painted red. Marker stake must be installed as location marker for end of the Wastewater Service Connection at property line.

2.8 Grout

- .1 Non-shrink: to SECTION 03 30 00.

2.9 Service Pipe

- .1 Service Pipe:
 - .1 125 mm and smaller PSM PVC DR28 (white) to CAN/CSA B1800.
 - .2 150 mm and larger PSM PVC DR35 (white) to CAN/CSA B1800.
 - .3 Pressurized Service Connections see SECTION 33 34 00.

PART 3 - EXECUTION

3.1 Preparation

- .1 Inspect products for defects and remove defective products from site.
- .2 Confirm pipe and fittings are clean before installation.

3.2 Excavation, Bedding and Backfilling

- .1 Perform excavation, bedding and backfilling to SECTION 31 20 00.

3.3 Pipe Installation

- .1 Lay and join pipe and fittings as specified herein and according to manufacturer's published instructions.
- .2 Lay pipe and fittings on prepared bed, true to line and grade indicated, within following tolerances:
 - .1 Horizontal alignment: 50 mm.
 - .2 Vertical alignment: the lesser of 13 mm or one half the rise per pipe length.
- .3 Commence laying at outlet and proceed in upstream direction with bell ends of pipe facing upgrade.
- .4 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.
- .5 Install gaskets in accordance with manufacturer's published instructions. During cold weather store gaskets in heated area to promote flexibility.
- .6 Install plastic pipe in accordance with CSA B1800.
- .7 Align pipe before joining.
- .8 Support pipes as required to assure concentricity until joint is properly completed.

- .9 Keep pipe joints free from mud, silt, gravel or other foreign material.
- .10 Join polyethylene pipe in accordance with pipe manufacturer's written instructions.
- .11 Avoid displacing gasket or contaminating with dirt, petroleum products, or other foreign material. Remove, clean, reinstall and lubricate gaskets so disturbed.
- .12 Complete each joint before laying next length of pipe.
- .13 Where deflection at joints is permitted, deflect only after joint is completed. Do not exceed maximum joint deflection recommended by manufacturer.
- .14 Where a flexible joint is not integral to the structure, provide flexible joint not more than one (1) metre from outside face of structure.
- .15 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer.
- .16 Make watertight connections to manholes. Do not use non-shrink grout unless approved by the HRWC.

3.4 Undercrossing

- .1 Provide shop drawings showing proposed method of installation for pipe in undercrossing.
- .2 Excavate working pit according to reviewed shop drawings.
- .3 Dewater area of excavation and undercrossing.
- .4 Place jacking, boring or tunneling equipment in working pit to approved line and grade of the proposed pipe.
- .5 Install encasing pipe to proposed line and grade as indicated.
- .6 Use mechanical or welded type joints for encasing pipe.
- .7 After encasing pipe has been installed, check line and grade for approval.
- .8 Remove any soil that remains in the casing pipe.
- .9 Insert pipe into encasement pipe, starting from the working pit.

- .10 Place pipe one (1) length at time outside encasement pipe. Maneuver pipe into position.
- .11 Use approved blocking method to guide pipe in true alignment.

3.5 Service Connections

- .1 Extend the Wastewater Service Connection at least 1.5 metres inside the property line.
- .2 Break the rock 3.0 metres beyond the plugged end of the Wastewater Service Connections.
- .3 Lay and join pipe and fittings to manufacturer's published instructions.
- .4 Maintain minimum 2% grade (Residential). Grade less than 2% as approved by the Engineer.
- .5 Maintain a maximum slope of 8% grade. Where greater slopes are required, obtain HRWC approval.
- .6 Minimum 1.2 metres cover.
- .7 Wastewater Service Connection 200 mm or smaller are to connect to the wastewater main utilizing a factory tee or wye fittings. Saddle Connections utilizing flexible rubber connectors may also be used. Utilize vertical long radius bend of 45° at the wastewater main. Confirm with HRWC.
- .8 Wastewater Service Connection 250 mm or greater connect to the wastewater main utilizing a precast wastewater manhole.
- .9 Wastewater Service Connections are not permitted to be connected to a dead end wastewater manhole. Make connection into the wastewater main or a wastewater manhole downstream of the dead end wastewater manhole.
- .10 One horizontal, long radius 22½° bend is permitted along the length of a Wastewater Service Connection. If more than one bend or a bend greater than 22½° is required, an access type structure is to be installed at each additional bend.

- .11 Wastewater Service Connections smaller than 200 mm and an overall length greater than 25.0 metres require an access type structure every 25.0 metres. Place a 300 mm x 300 mm x 6 mm steel plate above the structure 150 mm below the ground surface to allow for detection by a metal detector.
- .12 Wastewater Service Connections 200 mm or greater require manholes for changes in direction and maximum spacing of 100 metres.
- .13 Wastewater Service Connections are not permitted to decrease in size from the building connection to the main.
- .14 Minimum 300 mm horizontal and vertical separation distance from a Water Service Connection.
- .15 Minimum 450 mm vertical separation when crossing below a Water Service Connection.
- .16 Minimum 3.0 metres horizontal separation from an outdoor fuel tank and septic tank.
- .17 Minimum 2.0 metres horizontal separation from gas lines, underground electrical / telephone conduit, steam or hot water piping, transformer pads, utility poles or other utilities.
- .18 Locate the public portion of Wastewater Service Connections (residential) 1.5 metres from driveways.
- .19 Plug service connections with watertight caps or plugs at termination points. Paint stub ends and caps **RED**.
- .20 Place temporary marker stakes at end of each plugged or capped service connection, extending from pipe end at pipe level to 600 mm above grade. Paint exposed portion of stake **RED** with designation “SAN” in **BLACK**.
- .21 For Pressurized Service Connections, see Section 33 34 00.

3.6 Leak Testing

- .1 Notify HWRC at least 24 hours in advance of all proposed tests. Perform tests in presence of HRWC.
- .2 Flush mains and related appurtenances to remove foreign materials.

- .3 Provide labour, equipment and materials required to perform testing.
- .4 If water used for flushing is obtained from a potable water supply, the potable water supply is to be continuously separated from the service being flushed or tested by an air gap or a level or protection equal to or greater than that provided by a double check valve backflow prevention device.
- .5 Test each section of main. A section is the length of pipe between successive manholes or termination points, including service connections to the street line or termination point.
- .6 Locate and repair defects if test fails. Re-test. Have repair method reviewed by the HRWC prior to retesting.
- .7 Repair visible leaks regardless of test results.
- .8 Place and compact base lift of gravels prior to pressure and leakage testing.
- .9 Low Pressure Air Testing:
 - .1 Locate and repair defects if test fails. Re-test. Have repair method reviewed by HRWC prior to retesting.
 - .2 Repair visible leaks regardless of test results.
 - .3 **Caution:** For safety of personnel and public, observe proper precautions during air testing. Use test equipment designed to operate above ground. Do not permit personnel in trench during testing. Do not air test pipe with diameter greater than 600 mm. Consult the Engineer for acceptable testing methods of mains greater than 600 mm
 - .4 Provide air testing equipment meeting the following requirements:
 - .1 Air blower: 14 litres/sec, maximum pressure 70 kPa continuous.
 - .2 Pressure relief valve: sized to relieve full blower capacity at maximum blower pressure. Range 20 kPa - 70 kPa, adjustable.
 - .3 Pressure gauges: range 0 to 70 kPa with accuracy +/- 0.25 kPa.
 - .5 Provide plugs at each end of section, with one plug equipped for air inlet connection.

- .6 Fill test section slowly until a constant pressure of 28 kPa is reached. If ground water is above section being tested, HRWC may recommend increase in air pressure.
- .7 Allow minimum two (2) minutes for air temperature to stabilize, adding only amount of air required to maintain pressure.
- .8 After two (2) minute period, shut off air supply.
- .9 Decrease pressure to 24 kPa. Measure time required for pressure to reach 17 kPa. Minimum time allowed for pressure drop is as follows:

Pipe Diameter (mm)	Minimum Time (mm:ss)
100	1:53
150	2:50
200	3:47
250	4:43
300	5:40
375	7:05
450	8:30
525	9:55
600	11:20

3.7 Deflection Testing

- .1 Measure deflections by pulling a deflection gauge through each pipe from manhole to manhole after backfilling.
- .2 Provide deflection gauges to measure a 5% and 7.5% deflection. Gauges to be a "go-no-go" device to HWSD-1532.
- .3 Within thirty days after installation, pull a deflection gauge measuring 5% deflection through the installed section of pipeline. If this test fails proceed with 7.5% deflection test. If 7.5% deflection test fails, locate defect and repair. Re-test using same methodology.
- .4 Thirty days prior to completion of warranty period, pull a deflection gauge measuring 7.5% deflection through the installed section of pipeline. If 7.5% deflection test fails, locate defect and repair. Re-test using same methodology.

- .5 Provide deflection test report with closed circuit television (CCTV) inspection specified in PART 3.8 herein and include the following:
- Project Name
 - Developer
 - Consultant
 - Date of test(s)
 - Size of deflection gauge (5% or 7.5%)
 - Size and material of pipe
 - Manhole span location (from MH# – to MH#)
 - Street name
 - Certification by consultant that deflection test(s) were witnessed and passed
 - Summary of any deficiencies, including location and repair measures required

3.8 Closed Circuit Television Inspection

Provide CCTV inspection as per 33 01 30 CCTV Inspection.