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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 force mains. Work includes supply and installation of pipe and fittings.

1.2 Related Sections

- | | | |
|----|---------------------------------------|-----------------------|
| .1 | Concrete | SECTION 03 30 00 |
| .2 | Metal Fabrications | SECTION 05 50 00 |
| .3 | Earthwork | SECTION 31 20 00 |
| .4 | Reinstatement | SECTION 32 98 00 |
| .5 | Manholes, Catch Basins and Structures | SECTION 33 39 00 |
| .6 | Standard Details | HRWC STANDARD DETAILS |

1.3 Reference Standards

- | | | |
|----|---------------------|--|
| .1 | ASME B16.1-15 | Gray Iron Flanges and Standards Flanged Fittings, Class 25, 125 and 250. |
| .2 | AWWA C104/A21.4-16 | Cement Mortar Lining for Ductile Iron Pipe and Fittings for Water. |
| .3 | AWWA C110/A21.10-12 | Ductile-Iron and Gray-Iron Fittings. |
| .4 | AWWA C111/A21.11-17 | Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings. |
| .5 | AWWA C151/A21.51-17 | Ductile-Iron Pipe, Centrifugally Cast, |

		for Water.
.6	AWWA C153/A21.53-11	Ductile Iron Compact Fittings.
.7	AWWA C301-14	Prestressed Concrete Pressure Pipe, Steel-Cylinder Type.
.8	AWWA C303-17	Concrete Pressure Pipe, Bar-Wrapped, Steel-Cylinder Type.
.9	AWWA C509-15	Resilient-Seated Gate Valves for Water-Supply Service.
.10	AWWA C515-15	Reduced-Wall, Resilient Seated Gate Valves, for Water and Sewerage Systems.
.11	AWWA C900-16	Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 60 in. (100 mm Through 1500 mm).
.12	AWWA C901-08	Polyethylene (PE) Pressure Pipe and Tubing, ½ in. (13mm) Through 3 in. (76mm), for Water Service.
.13	AWWA C906-15	Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100mm) Through 65 in. (1,650mm), for Waterworks.
.14	AWWA C909-16	Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe 4” and Larger.
.15	CSA B137 Series-17	Thermoplastic Pressure Piping Compendium.
.16	ULC 701-11	Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

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 in accordance with SECTION 01 10 00.
- .2 For fusion butt jointing for polyethylene pipe provide certification that personnel are trained by manufacturer in current methods and use of equipment.

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 and joints:
 - .1 Polyvinyl chloride DR18: to CSA B137.3 or B137.3.1, AWWA C900, AWWA C905, or AWWA 909.
- .2 Fittings:
 - .1 PVC: to CAN/CSA B137.
- .3 Fusible PVC pipe and joints:
 - .1 100mm diameter and larger: to CSA B137.3, AWWA C900 or AWWA C905.
 - .2 Joints: thermal butt fusion.
 - .3 Have fusion services performed by a qualified and certified fusible PVC technician.

2.3 Polyethylene Pipe and Fittings

- .1 Pipe:
 - .1 13 to 76mm diameter: to AWWA C901.
 - .2 100mm 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 and AWWA C906.
 - .2 Flanged cast-iron: to AWWA C110.

2.4 Gate Valves

- .1 Gate buried valve: to AWWA C509 and AWWA C515 minimum design working pressure of 1380 kPa up to and including 300 mm and as follows:
 - .1 Body: cast iron (AWWA C509) / ductile iron (AWWA C515) with mechanical joint ends.
 - .2 Mechanism: solid resilient wedge, epoxy coated bonnet, ss. packing gland nuts and bolts, non-rising spindle, and O-ring seals.
 - .3 Direction to close:
 - .1 All serviced areas within the former City of Halifax: counterclockwise.
 - .2 All other areas: clockwise.

For further clarification refer to HRWC STANDARD DETAILS.

 - .4 Operating nut: 50 mm square.
 - .5 Acceptable products to AWWA C509:
 - .1 Clow 2640, F-6100 resilient wedge valve.
 - .2 Mueller A-2360-23 resilient wedge valve.
 - .6 Acceptable products to AWWA C515:
 - .1 Clow 2638, F-6100 resilient wedge valve.
 - .2 Mueller A-2361-23 resilient wedge valve.
- .2 Gate chamber valve: to AWWA C509 and AWWA C515 minimum design working pressure of 1380 kPa up to and including 300 mm and as follows:
 - .1 Body: cast iron (AWWA C509) / ductile iron (AWWA C515) with Class 125 flanged ends to ASME B16.1.
 - .2 Mechanism: solid resilient wedge gates, O.S. & Y., rising stem, and hand wheel.
 - .3 Direction to close: clockwise.
 - .4 Acceptable products to AWWA C509:
 - .1 Clow/Kennedy 8068A resilient wedge valve.

- .2 Mueller A-2360-6 resilient wedge valve.
- .5 Acceptable products to AWWA C515:
 - .1 Clow/Kennedy 7068A resilient wedge valve.
 - .2 Mueller A-2361-6 resilient wedge valve.

2.5 Air Release, Air/Vacuum & Combination Air Valves

- .1 75 mm diameter and larger to AWWA C512:
 - .1 Heavy duty type of cast-iron body with bronze trim and combination of small orifice and large orifice units. Small orifice size 2 mm. Valves suitable working pressure of 2068 kPa and have flanged ends to ASME B16.1.
 - .2 Independent floating stainless steel buoy balls located in both orifices.
 - .3 Orifices are to be capable of expelling air at a high rate during filling and at a low rate during operation and will admit air while draining the pipeline. Provide replaceable seats..
 - .4 Valves are to have no moving parts except for stainless steel balls which remain in the throat area discharging air without blowing shut or collapsing the balls.
 - .5 Valves are not leak in the closed position when pipe is filled.
 - .1 Acceptable products:
 - .1 G.A. Industries Ltd., Fig 960-C.
 - .2 APCO, Model 147C.
 - .3 Crispin, Model AL30.
 - .4 ARI Bermad D-060-C HF
 - .6 Tee: Flanged to AWWA C110/A21.10 and ASME B16.1, Class 125.
- .2 50 mm diameter to AWWA C512:
 - .1 Heavy duty type body consisting of metal and nylon reinforced glass fibre high impact plastic, with a combination small and large orifice. Small orifice to be stainless steel with a minimum opening of one (1) mm, valve suitable for working pressure of 2068 kPa. Size as indicated.

- .2 Independent floats located in both orifices.
- .3 Orifices to be capable of expelling air at a high rate during filling and at a low rate during operation and will admit air while draining the pipeline. Provide replaceable seats.
- .4 Valves to have no moving parts except for the floats which remain in the throat area discharging air without blowing shut.
- .5 Valves are not leak in the closed position when pipeline is filled.
 - .1 Acceptable products:
 - .1 Bermad, model C30.
 - .2 Valve-Matic, model 202C.
 - .3 APCO, model 145C.
 - .4 Crispin, model AL20.
 - .5 ARI Bermad D-040-C.
- .6 Corporation stop: brass c/w IPS inside and CC outside thread, size as indicated.
 - .1 Acceptable products:
 - .1 Mueller A-218. B 20045N.
 - .2 Cambridge Brass 301NL.
- .7 Service saddle: bronze, double stainless steel strap type.
 - .1 Acceptable products:
 - .1 Mueller BR2 SS.
 - .2 Smith-Blair 325.
 - .3 Ford 202 BS.
 - .4 Robar 2706.
- .8 Stainless steel nipples and ball valve are to be provided between corporation stop and air relief valve.
- .9 Stainless steel gooseneck pipe arrangement to be provided at the threaded outlet for discharge protection.

2.6 Valve Boxes

- .1 Valve boxes: (For new installations or replacements) to AWWA C500 and as follows:
 - .1 Cast iron, slide type, adjustable for depth of pipe below finished grade or; composite valve box with one piece ABS lower and ductile iron upper (minimum length 686 mm). Maintain minimum of 125 mm between the top of the lower and flange of the upper. Lower valve box section minimum length 1.5 metres, refer to HRWC STANDARD DETAILS.
 - .2 For use on Type 2, Type 3 and Type 4 adjustments.
 - .3 Intermediate adjustments are not permitted.
 - .4 Mark covers *Sewer*, as applicable.
 - .5 Lugged to prevent turning and rolling of cover, and cover notched to suit.
 - .6 Bonnet on the bottom section which is capable of enclosing the packing gland section of the gate valve.
 - .7 Acceptable products:
 - .1 IMP model V.1.
 - .2 Mueller MVB 070C-27 composite valve box.
 - .3 Sigma valve box.
- .2 Valve box extensions: (For Type 1 adjustments) to AWWA C500 and as follows:
 - .1 Type 1 valve adjustment is as follows: The supply and installation of adjustable top and cap, excavation and adjustment of adjustable top, setting top to finished grade and reinstatement to match existing grade.
 - .2 Material: ductile iron.
 - .3 Mark covers *Sewer*.
 - .4 Lugged to prevent turning and rolling of cover, and cover notched to suit.
 - .5 Have a minimum inside diameter of 125 mm, a minimum length of 300 mm and a maximum length of 450 mm.

- .6 Acceptable products:
 - .1 Bibby Ste Croix adjustable top and cap
 - .2 Mueller adjustable top and cap
- .3 Valve boxes: (For Type 2, Type 3 & Type 4 adjustments) to AWWA C500 and as follows:
 - .1 Type 2 valve adjustments is as follows: The excavation and adjustment of upper valve box extension sleeve, setting top to finished grade and reinstatement to match existing grade.
 - .2 Type 3 valve adjustments is as follows: The supply and installation of upper valve box and cap (and intermediate section if required), excavation and adjustment of upper valve box extension sleeve; centering over the valve operating stem, setting top to finished grade and reinstatement to match existing grade.
 - .3 Type 4 valve adjustments is as follows: The supply and installation of both the upper, intermediate and lower valve box sections and cap, excavation, adjustment and replacement of upper valve box extension sleeve. Item also includes the centering of the new valve box sections over the valve operating nut, the setting of the top to finished grade and reinstatement to match existing grade.

2.7 Thrust Restraint

- .1 Thrust blocks and anchors: Use 25 MPa concrete and 15M, grade 400 reinforcing steel where indicated. Refer to HRWC STANDARD DETAILS.
- .2 Joint restraint device: 100 mm to 600 mm joint restraint device to AWWA C111/A21.10 and C153/A21.53 for mechanical or push-on joints with multiple wedge or gripper ring restraining mechanism, minimum working pressure rating 2410 kPa and minimum safety factor of 2:1. Installation is not to require special tools.

- .1 Acceptable products for ductile iron (DI) pipe:
- .1 Ebba Iron Megalug – series 1100DI
 - .2 Ford - RFAD
 - .3 Star – series 3000
 - .4 Mueller Aquagrip.
 - .5 MJ Field Lok – series DI.
 - .6 Tufgrip – series 1000.
 - .7 Smith-Blair 100 series.
 - .8 Sigma One-Lok model SLDE
- .2 Acceptable products for polyvinyl chloride (PVC) pipe:
- .1 Ebba Iron Megalug – Series 2000PV.
 - .2 Ford - RFAP.
 - .3 Star – series 4000G2.
 - .4 Mueller Aquagrip.
 - .5 MJ Field Lok – series PV.
 - .6 Tufgrip – series 2000.
 - .7 Smith-Blair 100 series.
 - .8 Sigma One-Lok model SLCE
- .3 Mechanical joint restraint devices are generally to be used in combination with concrete thrust blocks. Mechanical joint restraint devices alone are permitted on 11.25°, 22.5° and 45° horizontal bends for sizes up to 300 mm diameter. No pipe joints are permitted within the “minimum pipe length”, refer to HRWC STANDARD DETAILS.

2.8 Insulation

- .1 Insulation to ULC 701, type 4, for extruded polystyrene.
- .1 Acceptable products:
 - .1 Styrofoam Highload 40.
 - .2 Formular 400.

PART 3 - EXECUTION

3.1 Preparation

- .1 Inspect products for defects and remove defective products from site.
- .2 Clean all pipe, fittings, valves, hydrants and appurtenances of debris and water before installation.

3.2 Excavation, Bedding and Backfilling

- .1 Perform excavation, bedding and backfilling to SECTION 31 20 00 with the following exceptions:
 - .1 Common selected backfill is defined in SECTION 31 20 00 as follows:
 - .1 Common: excavated soil which is not rock, unsuitable, or topsoil.
 - .2 Selected Backfill: common which is free from stumps, trees, roots, sods, organics, rocks, boulders, and masonry larger than 200 mm in any dimension; and other deleterious materials.
 - .2 Use Type 1 gravel for pipe bedding and protection unless otherwise specified.
 - .3 Place pipe bedding by hand and compacted in 150 mm thick layers.
 - .4 Use clear stone in wet or freezing conditions where specified or in consultation with HRWC prior to the installation.

3.3 Pipe Installation

- .1 Provide 24 hours' notice to HRWC prior to commencement of pipe installation.
- .2 Lay and join pipe, fittings, and valves, as specified herein and according to manufacturer's published instructions.
- .3 Do not lay pipe and fittings when the trench bottom is frozen, underwater or the trench or weather conditions are unsuitable.

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- .4 Lay pipe and fittings on prepared bed, true to line and grade indicated, within the following tolerances:
 - .1 Horizontal Alignment: 150 mm.
 - .2 Vertical Alignment: 75 mm.
 - .5 Prevent entry of bedding material, water or other foreign matter into pipe. Use temporary watertight bulkheads when pipe laying is not in progress.
 - .6 Face the bell ends in the direction of installation. On grades of 2% or greater, lay pipe up grade. For grades exceeding 16%, install an appropriately designed gradient thrust restraint.
 - .7 Align pipes before joining.
 - .8 Install gaskets as recommended by the manufacturers. Use only lubricant supplied by manufacturer. During cold weather store gaskets in heated area to promote flexibility.
 - .9 Support pipes as required to assure concentricity until joint is completed.
 - .10 Keep pipe joints free from mud, silt, gravel or other foreign materials.
 - .11 Avoid displacing the gasket or contaminating them with dirt, or other foreign materials. When a gasket is contaminated, remove, clean, re-install and lubricate the gasket. Do not reuse a gasket that has been contaminated with petroleum products.
 - .12 Where a deflection at a joint is permitted by the Engineer, deflect only after the spigot is fully inserted into the bell. Do not exceed maximum joint deflection recommended by the manufacturer.
 - .13 Complete each joint before laying next length of pipe.
 - .14 Provide a flexible joint, at structures, no more than 300 mm from outside face of structure. Support the pipe between the structure wall and the first joint with 20 MPa concrete.
 - .15 Cut pipe as required for fittings or closure pieces, square to centerline, and as recommended by manufacturer. Do not damage pipe lining or coating and leave smooth beveled edge.
 - .16 Provide concrete thrust blocks to undisturbed ground on all tees, bends, plugs and caps or as indicated on Project Documents. Construct as indicated and keep joints and couplings free of concrete.

- .17 Install mechanical joint restraint to AWWA C111/A21.10 and tighten lug nuts until all wedges are in firm contact with pipe surface. Continue to tighten alternating between bolts until lug nuts twist off.
- .18 Wrap all internally mechanical restrained bells with two bands of **RED** adhesive tape.
- .19 Install zinc anodes on all valves, fire hydrants, and copper and ductile iron Water Service Connections to HRWC STANDARD DETAILS.
- .20 Install magnesium anodes to any connections to existing unwrapped ductile or cast iron pipe.
- .21 Install polyethylene encasement on ductile-iron pipe and fittings, to HRWC STANDARD DETAILS. Any damage to the polyethylene must be repaired to the satisfaction of HRWC. Where directed by HRWC, install anti-corrosion petrolatum paste, tape and mastic to valve and hydrant flange nuts and bolts and valve bonnet nuts and bolts for corrosion protection.
- .22 Place marker tape upon bedding surround of plastic pipe.

3.4 Undercrossing

- .1 Excavate working pit to dimensions as indicated.
- .2 Excavate working pit to not less than 0.6 metres below lowest invert of encasing pipe.
- .3 Dewater excavation.
- .4 Dewater area of under-crossing
- .5 Install heavy timber or steel frame backstop.
- .6 Place encasing pipe to exact line and grade as indicated. Encasing pipe to cross under obstruction at angle as indicated.
- .7 Install encasing pipe by jacking, boring or tunneling methods approved by HRWC.
- .8 Encasing pipe not to be in tension.

- .9 Joints for encasing pipe to be welded to AWWA C206.
- .10 Submit shop drawings showing proposed method of installation of carrier pipe.
- .11 For ductile iron carrier pipe only, install continuous zinc strip sacrificial anode electrically bonded to carrier pipe. Install sacrificial anodes for encasing pipe.
- .12 Insert carrier pipe into encasing pipe, in end with largest open area, after placing levelling pad.
- .13 Use chromated copper arsenate salt treated blocking method or fabricated high density polyethylene casing spaced to maintain carrier pipe in true alignment and uniform separation from encasing pipe.
- .14 Clearance between blocks or casing spacers and encasing pipe to be maximum 15 mm when carrier pipe is in position.
- .15 Join carrier pipe one length at a time outside encasing pipe. Push or pull carrier pipe into position.
- .16 Couplings of carrier pipe not to rest on levelling pad when carrier pipe is in position.
- .17 Place 20 MPa concrete cradle around carrier pipe after it is in position. Cradle to be minimum 225mm and maximum of 300 mm above levelling pad.
- .18 Fill open annular space at each end of encasing pipe with burlap bags filled with 20 MPa concrete.

3.5 Valve Chambers

- .1 Construct valve chambers where indicated in accordance with applicable SECTIONS. Do not allow valve chamber to rest upon pipe.

3.6 Valves and Valve Boxes

- .1 Install valves to manufacturer's recommendations at locations as indicated.
- .2 Install valve boxes on direct buried valves. Make valve box plumb and centered over operating nut, and true to line and grade.

- .3 Install zinc anodes on all valves as specified in HRWC STANDARD DETAILS.
- .4 Place select backfill material, maximum size 50 mm around valve box to subgrade.
- .5 Provide an asphalt apron around valve boxes outside of the paved street right-of-way. Refer to HRWC STANDARD DETAILS.
- .6 Install valves on PVC mains with a 450 mm x 450 mm pre-cast concrete block placed underneath for support. Refer to PVC handbook installation guide.

3.7 Pressure & Leakage Testing

- .1 Perform pressure and leakage testing of ductile iron piping to AWWA C600 and AWWA M41.
- .2 Perform pressure and leakage testing of PVC piping to AWWA C605 and AWWA M23.
- .3 Provide, in writing to HRWC, the plan for pressure testing, flushing, disinfecting, neutralizing, disposing and bacteria testing. The plan will indicate the areas to be tested, the sequence of testing and the sample locations for bacteria tests. The maximum length of water main test is 450 metres.
- .4 All pressure testing, flushing, disinfecting, neutralizing, disposing and bacteria testing to be witness by HRWC and the Applicant's Professional Engineer, or their representative. Provide HRWC 24 hours' notice to schedule the work.
- .5 Isolation of existing HRWC Water System, where required, will be performed by HRWC Water Services. Do not operate any existing HRWC Water System valves.
- .6 Water may be supplied from the existing HRWC Water System. This requires a hydrant or Water Service Connection at the opposite end of the new water main extension being open to release air and prevent backflow into the existing HRWC Water System.
- .7 Include all new Water Service Connections, fire hydrants, valves, mains and other appurtenances in the pressure and leakage testing.
- .8 Place and compact base lift of gravels prior to pressure and leakage testing.

- .9 Provide labour, equipment and materials required to perform pressure and leakage testing. Provide a ¼ inch NPT connection at the appropriate location for the pressure gauge.
- .10 Open all new valves in test section.
- .11 Use chlorinated potable water for all testing.
- .12 Expel air from the new water main and appurtenances by slowly filling with potable water. Install corporation stops at high points where no air vacuum release valves are installed. After testing, remove corporation stops and install plugs.
- .13 Conduct test at a minimum pressure of 1035 kPa or 1.5 times the operating pressure at the lowest point of elevation of the new water main being tested. Test pressure not to exceed 1205 kPa.
- .14 Conduct test over a full two (2) hour period, maintaining a constant test pressure. No leakage is permitted during the test period.
- .15 If any test fails, repair or replace defect and retest section until specified testing requirement is achieved.
- .16 Repair visible leaks regardless of test results.
- .17 Flush the new water main and appurtenances as per 3.8 of this Specification.

3.8 Flushing

- .1 All flushing to be witness by HRWC and the Applicant's Professional Engineer, or their representative. Provide HRWC 24 hours' notice to schedule the work.
- .2 If water is supplied from the existing HRWC Water System, the supply is to be continuously separated from the service being flushed or tested by an air gap or a level of protection equal to or greater than that provided by a double check valve backflow prevention device.
- .3 Flush mains with water through available outlets with sufficient flow to produce minimum velocity in main of 1.5 m/s, for 10 minutes. Flush until foreign materials have been removed and water is clear.
- .4 Slowly open and close valves to confirm thorough flushing.