1.0 GENERAL

1.1 Scope

1.1.1 This section specifies requirements for constructing sewage force main and appurtenances, to lines, grades and dimensions as directed.

1.2 Related Sections

1.2.1 Section 02315 – Trench Excavation and Backfill

1.2.2 Section 02511 - Watermains

1.2.3 Section 02500 - Supply of Portland Cement Concrete

2.0 PRODUCTS

- Use only those products in the Approved Products List, Product ID:
  - SP – 01: Gate Valves
  - SP – 02: Valve Boxes
  - SP – 03: Combination Sewage Air Valves

2.1 Sewage Force Main

2.1.1 PVC Pipe and Fittings

.1 PVC pipe shall be DR25 Class 100 to cast iron O.D. dimensions Polyvinyl Chloride conforming to CSA B137 Series 13 and AWWA C900 or C905. Joints shall be rubber ring pressure tight joints.

.2 Fittings shall be PVC fittings to CSA B137 Series 13 and AWWA C900 or C905 pipe (cast iron O.D.'s) manufactured in one piece of injection molded PVC compound meeting ASTM D1784. Fittings designed to withstand a minimum of 5200 kPa quick burst pressure at 20°C.

2.1.2 Polyethylene Pipe and Fittings

.1 Sewage force main shall conform to the following specifications:

CSA B137.0 and CSA 137.1
ASTM D3035 and D1248
CGSB 41-GP-25M and AWWA C906

.2 Resins used in manufacture of the pipe shall be Type III High Density PE 3408. Compound for pressure pipe.

.3 Sewage force main shall be minimum DR17 or as specified by the Engineer.

.4 Where directional drilling or other trenchless method is indicated, use a minimum DR 11. The Contractor shall be responsible verify the

wall thickness of the pipe is adequate to withstand pressures exerted on the pipe by the equipment. Submit calculations confirming proposed pipe wall thickness is adequate to withstand pressures exerted by directional drilling equipment.

2.2 Valves

2.2.1 Valves and boxes with lengths to suit for sewage force main and shall be Resilient Seat gate valves to suit pipe ends to AWWA Specification AWWA C500 and C509. Valves shall be epoxy coated and fitted with stainless steel nuts and bolts on the bonnet. Valves for HPDE pipe are to be flanged.

2.2.2 Valve casing shall be adjustable cast iron casing to accommodate a 3 metre cover over the hood, top section with lid and stone disc in accordance with Standard Drawing. The casing must rest on the bonnet of the valve and not on the stuffing box. The extension stem shall be made of 25 mm square mild steel with a bottom socket to fit a 50 mm square valve operating nut and shall extend to within .3 metres of the top of the casing when assembled.

2.3 Combination Sewage Air Valves

2.3.1 Combination sewage air release valve, stainless steel body, mechanism and seat, stainless steel lever pins and float, designed for sewage, rated at 690 KPa. Provide shut-off valve and back flushing facilities including blow-off valves and 3 metre long back flush hose. Equip valve and hose with quick disconnect couplings.

2.4 Sewage Force Main Marker

2.4.1 The sewage force main shall be marked at a minimum of 500 metres interval along the pipeline route. The markers shall be along sewage force main and at road crossings (with a 5 m offset noted on marker).

2.4.2 The markers shall be mounted on 75 mm galvanized steel posts to a height of 1200 mm above grade. The posts shall be a minimum of 900 mm below grade and shall be concrete encased.

2.4.3 The sign shall be 250 x 350 mm 12 gauge sign grade aluminum substrate chemically prepared to accept 3M Retro-reflective background. Panel shall have radius corners (90 mm) and two 9 mm holes.

2.4.4 Lettering to be silk screened on the sign and shall be as detailed on drawings and specifications.

2.4.5 The sign shall be 200 wide by 150 high, aluminium have an orange background and black letters. Sign mock-up shall be forwarded to Engineer for approval.

C A U T I O N

City of Regina

Pressurized
Sewage
Force Main
In Case of Emergency
Call:777-7000

2.5 Pipe Bedding and Backfill Materials

2.5.1 Refer to Section 02315 Trench Excavation and Backfill.

2.6 Detectable Marking Tape

2.6.1 100 mm wide, 0.125 mm (5 mil) overall thickness, aluminum foil core, with printed text: "CAUTION FORCE MAIN BELOW"

2.7 Delivery and Stockpiling Materials

2.7.1 The Contractor shall be responsible for arranging, stockpiling, and protecting the materials from damage and theft.

2.7.2 The Contractor shall be responsible for the delivery of material and the City will not pay for materials ordered by the Contractor and not used in the work, nor pay for shipping charges on the return of such material to the supplier.

3.0 EXECUTION

3.1 Preparation

3.1.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation. Carefully inspect materials for defects. Remove defective materials from site.

3.2 Trenching, Excavation and Backfill

3.2.1 3.2.1 Do trenching and backfill work to Section 02315 Trenching, Excavation and Backfill.

3.2.2 3.2.2 Trench depth to provide a minimum cover of 3.0 m below finished grade or to the grades where deeper as indicated on the drawings.

3.3 Bedding

3.3.1 Bedding shall be sand bedding as per Section 02315 and as detailed on standard drawings.

3.3.2 Shape bed true to grade to provide continuous uniform bearing surface for

pipe exterior. Do not use blocks when bedding pipe.

3.3.3 Shape transverse depressions as required to make joints.

3.3.4 Compact full width of bed to at least 95% of maximum dry density.

3.3.5 Place bedding stone in lieu of sand bedding material when requested.

3.3.6 Fill any excavation below level of specified bedding with bedding stone.

3.4 Pipe Installation for PVC Pipe

3.4.1 Lay and join pipes in accordance with manufacturer's recommendations.

3.4.2 Handle pipe with approved equipment. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.

3.4.3 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

3.4.4 Commence laying and proceed in upstream direction with socket ends of pipe facing upgrade.

3.4.5 Do not exceed permissible deflection at joints recommended by pipe manufacturer unless directed in writing.

3.4.6 Do not allow water to flow through pipe during construction, except as may be permitted to Engineer.

3.4.7 Whenever work is suspended, install a removable watertight bulkhead at open ends of last pipe laid to prevent entry of foreign materials.

3.4.8 Position and join pipes with approved equipment. Do not use excavating equipment to force pipe sections together.

3.4.9 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 is properly positioned.

.3 Align pipes carefully before joining.

.4 Maintain pipe joints free from mud, silt, gravel or 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 Apply sufficient pressure in making joints to assure that joint is complete as outlined in manufacturer's recommendations.

.9 Block pipes when any stoppage of work occurs in such a manner to prevent creep during down time.

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

.11 Upon completion of pipe laying place specified granular material to dimensions indicated or directed.

.12 Hand place granular material in uniform layers of 150 mm thick or less. Dumping of material directly on top of pipe is not permitted.

.13 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

3.4.10 Place tracer wire and pipe marking tape min 600 mm above the crown of the pipe.

3.5 Pipe Installation for Polyethylene Pipe – Open Trench

3.5.1 Lay pipe to manufacturer's standard instructions and specifications. Do not use blocks.

3.5.2 Join pipes butt-fusion welding according to manufacturer's recommendations.

3.5.3 Handle pipe by approved methods. Do not use chains or cables passed through pipe bore so that weight of pipe bears upon pipe ends.

3.5.4 Lay pipes on prepared bed, true to line and grade. Ensure barrel of each pipe is in contact with shaped bed throughout its full length. Take up and replace defective pipe. Correct pipe which is not in true alignment or grade or pipe which shows undue settlement after installation.

3.5.5 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

3.5.6 Protect installed pipes from ingress or dirt and water or other foreign materials. Whenever work is suspended, install a removable watertight bulkhead at open ends of last pipe laid to prevent entry of foreign materials.

3.5.7 Cut pipes as required for fittings in a neat manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave a smooth end at right angles to axis of pipe.

3.5.8 Align pipes carefully before jointing.

3.5.9 Maintain pipe joints clean and free from foreign materials.

3.5.10 Upon completion of pipe laying surround and cover pipes between joints with approved granular material placed to dimensions indicated or directed.

3.5.11 Hand place granular material in uniform layers not exceeding 150 mm thick. Dumping of material directly on top of pipe is not permitted.

3.5.12 Place layers uniformly and simultaneously on each side of pipe to prevent lateral displacement of pipe.

3.5.13 Place tracer wire and pipe marking tape min 600 mm above the crown of the pipe.

3.5.14 Backfill to Section 2315 Trench, Excavation and Backfill

3.6 Reaction Blocking

3.6.1 Do concrete work to Section 2500 Supply of Portland Cement Concrete.

3.6.2 Install thrust blocks or thrust restraints in accordance with the water main standard drawings

3.6.3 Place concrete reaction blocking between changes in pipe diameter and fittings and solid ground as shown on drawings or as directed by Engineer. Reaction blocking for HDPE pipe may be omitted for butt fused joints only.

3.6.4 Do not backfill over concrete for 24 hours after placing.

3.7 Pipe Installation for Polyethylene Pipe – Trenchless

3.7.1 When trenchless methods are indicated, the contractor shall be responsible for the method of installation.

3.7.2 For trenchless installation methods, refer to Section 2315 for Trench Excavation and Backfill.

3.7.3 The Contractor shall provide as-built depths from existing ground surface to the centre of the pipe at a nominal interval of 15 metres along the alignment.

3.8 Valves and Fittings

3.8.1 Buried gate valves shall be installed in accordance with the water main standard drawings.

3.8.2 All buried valves and fittings shall be provided with corrosion protection system in accordance with Section 2511 Watermains.

3.9 Hydrostatic Leakage Testing for High Density Polyethylene (HDPE) Pipe

3.9.1 Hydrostatic testing for leakage shall be in accordance with ASTM F2164 Field Leak Testing of HDPE Pressure Piping Using Hydrostatic Pressure and as follows.

3.9.2 Provide labour, equipment and materials required to perform leakage tests hereinafter described and at no additional cost to the Engineer. All costs for testing shall be included in the unit price bid for installation of the mains.

3.9.3 Cleaning and flushing of pressure mains shall not be conducted when the average ambient air temperature is less than + 10o C.

3.9.4 Notify Engineer at least 24 hours in advance of all proposed tests. Perform tests in presence and under direction of Engineer.

3.9.5 The Contractor shall expel the air from the mains prior to leakage testing by filling the lines with water.

3.9.6 Hydrostatic pressure testing for HDPE pipe shall be completed in two steps:

3.9.6.1 Initial Expansion Phase.

.1 The Initial Expansion Phase consists of adding sufficient makeup water at intervals to the pipeline for four (4) hours, each retaining the pipeline at the Test Pressure.

.2 The Test Pressure shall be equal to 690 kPa (100 psi), unless otherwise specified or directed by the Engineer.

3.9.6.2 Test Period.

.1 The Test Period shall begin after the Expansion Phase is completed. If the test period is not specified, it shall be one hour, but shall not exceed three hours.

.2 After the Test Period is completed, add and measure the amount of make-up water required to return to the test pressure, and compare this to the maximum allowable in the table below.

.3 The test period shall not exceed eight (8) hours at the test pressure.

.4 If re-testing is required, depressurize and allow pipe to relax for at least eight hours before repeating.

Allowable Expansion Under Test Pressure (Litres per 100 meters of pipe)							
Nominal Pipe Size (mm)	**1 Hour**	**2 Hour**	**3 Hour**	**Nominal Pipe Size (mm)**	**1 Hour**	**2 Hour**	**3 Hour**
50	0.9	1.4	1.7	500	32.3	63.4	92.2
75	1.2	1.7	2.9	550	40.4	80.7	121.1
100	1.5	2.9	4.6	600	51.9	102.6	153.3
150	3.5	6.9	10.4	700	63.4	128.0	193.7
200	5.8	11.5	17.3	750	71.5	145.3	220.2

250	8.6	15.0	24.2	800	80.7	164.9	247.9
300	12.7	26.5	39.2	900	103.8	207.5	311.3
350	16.1	32.3	48.4	1050	138.4	276.7	415.1
400	19.6	38.0	57.7	1200	173.0	311.3	495.8
450	25.4	49.6	74.9	1350	207.5	345.9	576.5

.5 An additional leakage allowance is made when testing against closed, metal seated valves. This allowance is 0.0012 litres per hour for each millimetre of nominal valve size.

3.10 Hydrostatic Leakage Testing for PVC Piping

3.10.1 After backfilling is completed, a pressure test shall be carried out on all lines at the maximum pressure of 690 kPa (100 psi), unless otherwise specified or directed by the Engineer.

3.10.2 The pressure shall be maintained for not less than one hour by pumping additional water into the test section from a measuring tank. The test section will not be accepted if the leakage in litres per hour measured by the above method exceeds the quantity determined by the following formula

$$L = \frac{NDP}{130{,}400}$$

Where

L = allowable leakage in litres per hour
N = number of joints in the test section
D = nominal pipe diameter in millimetres
P = square root of the test pressure in kPa

An additional allowance is made when testing against closed, metal seated valves. This allowance is 0.0012 litres per hour for each millimetre of nominal valve size.

3.10.3 If the leakage exceeds the allowable, the Contractor shall locate and repair leaks and defects and repeat the test until the leakage does not exceed the allowable.

3.10.4 The Contractor shall provide all necessary labour, materials and equipment for the test including a suitable pump and measuring tank, pressure hoses and connection plugs, caps, gauges and all other apparatus necessary for filling the main, pumping to the required test pressure and recording the pressure and leakage losses. The Contractor shall provide evidence that the gauges used are accurate. Hydrostatic leakage testing, cleaning and flushing of pressure pipe shall not be conducted when the ambient air temperature is less then + 5oC.

3.10.5 The test section of the pipeline shall be filled slowly, taking care to expel all air from the high points. If air valves, service connections, or other

means of venting are not provided, the Contractor shall, at his own expense, drill and tap small holes for the purpose at high points. He shall also provide a suitable cock to vent air during tests. The hole shall be sealed by means of a tight fitting plug at the conclusion of the test.

3.11 Cleaning, Swabbing and Flushing

3.11.1 After the hydrostatic leakage testing and before flushing has been completed, the forcemain shall be swabbed.

3.11.2 All forcemains shall be cleaned and flushed. Sewage forcemains shall be cleaned by use of a minimum of two (2) foam swabs in order to remove debris which may have entered the forcemain during construction. Swab to be a minimum 100 mm larger than the diameter of the line being swabbed.

3.11.3 Cleaning shall be repeated until consecutive swabs are clean and the discharge water is clear.