

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

1. Section 31 23 33 – Excavation Backfilling and Trenching

1.2 REFERENCES

1. American National Standards Institute/American Water Works Association (ANSI/AWWA)
 1. ANSI/AWWA B300-10, Standard for Hypochlorites.
 2. ANSI/AWWA B301-10, Standard for Liquid Chlorine.
 3. ANSI/AWWA B303-10, Standard for Sodium Chlorite.
 4. ANSI/AWWA C104/A21.4-08, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 5. ANSI/AWWA C105/A21.5-10, Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 6. ANSI/AWWA C111/A21.11-07, American National Standard for Rubber-Gasket Joints for Ductile-Iron and Fittings.
 7. ANSI/AWWA C110/A21.10-08, American National Standard for Ductile-Iron and Gray Iron Fittings for Water.
 8. ANSI/AWWA C150/A21.50-08, Standard for Thickness Design of Ductile-Iron Pipe.
 9. ANSI/AWWA C151/A21.51-09, Standard for Ductile-Iron Pipe, Centrifugally Cast.
 10. ANSI/AWWA C153/A21.53-11, Standard for Ductile-Iron Compact Fittings.
 11. ANSI/AWWA C500-09, Standard for Metal-Seated Gate Valves for Water Supply Service.
 12. ANSI/AWWA C600-10, Standard for Installation of Ductile-Iron Water Mains, and Their Appurtenances.
 13. ANSI/AWWA C602-11, Standard for Cement-Mortar Lining of Water Pipelines - 4 Inch (100 mm) and Larger.
 14. ANSI/AWWA C651-05, Standard for Disinfecting Water Mains.
 15. ANSI/AWWA C800-05, Standard for Underground Service Line Valves and Fittings.
 16. ANSI/AWWA C900-07, Standard for Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 Inch through 12 Inch (100 mm - 300 mm), for Water Transmission and Distribution.

2. ASTM International
 1. ASTM B88M-05(2011), Standard Specification for Seamless Copper Water Tube.
 2. ASTM C478M-11, Standard Specification for Precast Reinforced Concrete Manhole Sections.
3. American Water Works Association (AWWA)/Manual of Practice
 1. AWWA M9-2008, Concrete Pressure Pipe.
 2. AWWA M11-2004, Steel Pipe - A Guide for Design and Installation.
 3. AWWA M17-2006, Installation, Field Testing, and Maintenance of Fire Hydrants.
4. Canada Green Building Council (CaGBC)
 1. LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
5. CSA International
 1. CAN/CSA-B137 Series-09, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
 2. CAN/CSA-B137.1-09, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.
 3. CAN/CSA-B137.3-09, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.
6. Underwriters' Laboratories of Canada (ULC)
 1. CAN/ULC-S520-07, Standard for Fire Hydrants.
 2. CAN/ULC-S543-09, Standard for Internal-Lug, Quick Connect Couplings for Fire Hose.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

1. Submit in accordance with Section 01 33 00 – Submittal Procedures.
2. Product Data:
 1. Submit manufacturer's instructions, printed product literature and data sheets for distribution piping materials and include product characteristics, performance criteria, physical size, finish and limitations.
 2. Pipe certification to be on pipe.

1.4 CLOSEOUT SUBMITTALS

1. Submit in accordance with Section 01 33 00 – Submittal Procedures.

2. Submit data to produce record drawings, including directions for operating valves, list of equipment required to operate valves, details of pipe material, location of air and vacuum release valves, hydrant details.
 1. Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.
3. Operation and Maintenance Data: submit operation and maintenance data for pipe, valves, valve boxes, and hydrants for incorporation into manual.

1.5 DELIVERY, STORAGE AND HANDLING

1. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
2. Storage and Handling Requirements:
 1. Store materials in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 2. Store and protect water distribution piping from nicks, scratches, and blemishes.
 3. Replace defective or damaged materials with new.

1.6 SCHEDULING OF WORK

1. Schedule Work to minimize interruptions to existing services.
2. Submit schedule of expected interruptions for approval and adhere to interruption schedule as approved by Consultant.
3. Notify Consultant and building occupants minimum of 24 hours in advance of interruption in service.
4. Do not interrupt water service for more than 3 hours unless otherwise authorized.
5. Notify fire department of planned or accidental interruption of water supply to hydrants.
6. Provide and post "Out of Service" sign on hydrant not in use.
7. Advise local police department of anticipated interference with movement of traffic.

PART 2 - PRODUCTS

2.1 PIPE, JOINTS AND FITTINGS

1. Ductile iron pipe: to ANSI/AWWA C151/A21.51, pressure class 52 cement mortar lined to ANSI/AWWA C104/A21.4.
2. Joints and fittings for ductile iron pipe.
 1. Joints:
 1. Push-on joints: to ANSI/AWWA C111/A21.11.
 2. Rubber gasket for mechanical pipe joints: to ANSI/AWWA C111/A21.11.
 3. Rubber gasket for flange pipe joints 1.6 mm thick: to ANSI/AWWA C111/A21.11.
 4. Bolts, nuts, hex head with washers: to ASTM A307, heavy series.
 5. Anodes required at all fittings and joints.
 2. Fittings:
 1. Mechanical joint cast iron and ductile iron fittings NPS 3 and larger: to ANSI/AWWA C110/A21.10.
 2. Flanged cast iron fittings NPS 3 and larger: to ANSI/AWWA C110/A21.10.
 3. Compact Fittings to ANSI/AWWA C153/A21.53.
3. Polyvinyl chloride pressure pipe: to ANSI/AWWA C900, pressure class 150, DR 14, 1 MPa gasket bell end, cast iron outside diameter.
 1. CAN/CSA-B137.3, PVC series 160, 1.1 MPa elastomeric gasket.

2.2 PIPE PROTECTION

1. Provide means of protection for iron pipe in accordance with ANSI/AWWA C105/A21.5.
2. Provide Zinc Anodes for Ductile iron piping and fittings.

2.3 VALVES AND VALVE BOXES

1. Valves to open clockwise.
2. Gate valves: to ANSI/AWWA C500, standard iron body, brass mounted wedge valves with non-rising stems, suitable for 1 Pa with flanged and/or push-on joints.
3. Cast iron valve boxes: three piece sliding type adjustable over minimum of 450 mm complete with valve operating extension rod, 30 mm diameter, 25 x 25 mm cross section, of such length that when set on valve operating nut, top of rod will not be more than 150 mm below cover.
 1. Base to be large round type with minimum diameter of 300 mm.

2. Top of box to be marked "WATER ".

2.4 SERVICE CONNECTIONS

1. Copper tubing: to ASTM B88M type K, annealed.
2. Ductile iron pipe: to ANSI/AWWA C151/A21.51 pressure class 52 cement mortar lined to ANSI/AWWA C104/A21.4.
3. Polyvinyl chloride pressure pipe: to CAN/CSA-B137.3, type 1120 series 160.
4. Copper tubing joints: compression type suitable for 1 MPa working pressure.
5. PVC joints: solvent welded in accordance with manufacturer's specifications.
6. Joints for ductile iron pipe: push-on joints to ANSI/AWWA C111/A21.11. Rubber gaskets to ANSI/AWWA C111/A21.11. Requirement to maintain electrical conductivity between pipes.
7. Brass corporation stops: compression type having threads to ANSI/AWWA C800.
8. Brass inverted key-type curb stops: red brass to ASTM B62, compression type.
 1. Curb stops to have adjustable cast iron service box with stem to suit depth of bury.
 2. Top of cast iron box marked "WATER ".
9. Service connections for PVC pipe:
 1. Service connections less than 100 mm: corporation stop, tapped to main using AWWA threads, complete with stainless service saddle. Service saddle to consist of circumferential band type complete with side bars and fingers, keeper bar, stud bolts, nuts, washers and gaskets.
 2. Service connections 100 mm and over: use tee fitting.
10. Bronze type service clamps: for PVC pipe service connections.
 1. Service clamps to be of strap-type, with confined "O" ring seal cemented in place.
 2. Clamps to be tapped with threads to ANSI/AWWA C800.

2.5 HYDRANTS

1. Post type hydrants: compression type hydrant, to CAN/ULC-S520, designed for working pressure of 1030 kPa with two 65 mm quick connect hose outlets, one 100 mm quick connect pumper connection, 150 mm riser barrel, 125 mm bottom valve and 150 mm connection for main.
 1. Hydrants to open counter clockwise.
 2. Provide key operated gate valve located 1.5 m from hydrant.
 3. Depth of bury 1.6 m.

2. Hydrant paint: exterior enamel to MPI #96. Colour to match HRWC hydrants.

2.6 PIPE BEDDING AND SURROUND MATERIAL

1. Granular material to: Section 31 23 33 – Excavating, Trenching and Backfill.

2.7 BACKFILL MATERIAL

1. As indicated. 31 23 33 - Excavating, Trenching and Backfilling .

2.8 PIPE DISINFECTION

1. Sodium hypochlorite to ANSI/AWWA B300 or liquid chlorine to ANSI/AWWA B301 to disinfect water mains.
2. Disinfect water mains in accordance with Standard Specifications for Municipal Services.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for distribution piping installation in accordance with manufacturer's written instructions.
 1. Visually inspect substrate in presence of Consultant.
 2. Inform Consultant of unacceptable conditions immediately upon discovery.
 3. Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

1. Clean pipes, fittings, valves, hydrants, and appurtenances of accumulated debris and water before installation.
 1. Inspect materials for defects to approval of Consultant.
 2. Remove defective materials from site as directed by Consultant.

3.3 TRENCHING

1. Do trenching work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
2. Ensure trench depth allows coverage over pipe as indicated on drawings.

3.4 GRANULAR BEDDING

1. Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
2. Do not place material in frozen condition.
3. Shape bed true to grade to provide continuous uniform bearing surface for pipe.
4. Shape transverse depressions in bedding as required to suit joints.
5. Compact each layer full width of bed to 95 % maximum dry density to ASTM D698.
6. Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling with compacted bedding material.

3.5 PIPE INSTALLATION

1. Terminate building water service as indicated.
 1. Cap or seal end of pipe and place temporary marker to locate pipe end.
2. Lay pipes to ANSI/AWWA C600 manufacturer's standard instructions and specifications.
 1. Do not use blocks except as specified.
3. Join pipes in accordance with ANSI/AWWA C600 and manufacturer's recommendations.
4. Bevel or taper ends of PVC pipe to match fittings.
5. Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.
6. Lay pipes on prepared bed, true to line and grade.
 1. Ensure barrel of each pipe is in contact with shaped bed throughout its full length.
 2. Take up and replace defective pipe.
 3. Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.
7. Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.
8. Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

9. Keep jointing materials and installed pipe free of dirt and water and other foreign materials.
 1. Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
10. Position and join pipes with equipment and methods approved by Consultant.
11. Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.
12. Align pipes before jointing.
13. Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.
14. Avoid displacing gasket or contaminating with dirt or other foreign material.
 1. Remove disturbed or contaminated gaskets.
 2. Clean, lubricate and replace before jointing is attempted again.
15. Complete each joint before laying next length of pipe.
16. Minimize deflection after joint has been made.
17. Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.
18. Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by Consultant.
19. When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.
20. Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.
21. Do not lay pipe on frozen bedding.
22. Do hydrostatic and leakage test and have results approved by Consultant before surrounding and covering joints and fittings with granular material.
23. Backfill remainder of trench.

3.6 VALVE INSTALLATION

1. Install valves to manufacturer's recommendations at locations as indicated.

2. Support valves located in valve boxes or valve chambers by means of bedding same as adjacent pipe. Valves not to be supported by pipe.

3.7 SERVICE CONNECTIONS

1. Terminate building water service 1.5 m outside building wall opposite point of connection to main.
 1. Install coupling necessary for connection to building plumbing.
 2. If plumbing is already installed, make connection, otherwise cap or seal end of pipe and place temporary marker to locate pipe end.
2. Do not install service connections until satisfactory completion of hydrostatic and leakage tests of water main.
3. Construct service connections at right angles to water main unless otherwise directed. Locate curb stops 300 mm inside roadway allowance.
4. Tappings on ductile iron pipe, may be threaded without service clamps.
 1. Double strap service connections with galvanized malleable iron body and neoprene gasket cemented in place may be used.
5. Employ only competent workmen equipped with suitable tools to carry out tapping of mains, cutting and flaring of pipes.
6. Install single and multiple tap service connections on top half of main, between 45 degrees and 90 degrees measured from apex of pipe.
7. Tap main at 2:00 o'clock or 10:00 o'clock position only; not closer to joint nor closer to adjacent service connections than recommended by manufacturer, or 1 m minimum, whichever is greater.
8. Leave corporation stop valves fully open.
9. In order to relieve strain on connections, install service pipe in "Goose Neck" form "laid over" into horizontal position.
10. Install curb stop with corporation box on services NPS 2 or less in diameter.
 1. Equip larger services with gate valve and cast iron box.
 2. Set box plumb over stop and adjust top flush with final grade elevation.
 3. Leave curb stop valves fully closed.
11. Place temporary location marker at ends of plugged or capped unconnected water lines.
 1. Each marker to consist of 38 x 89 mm stake extending from pipe end at pipe level to 600 mm above grade.
 2. Paint exposed portion of stake red.

3.8 HYDRANTS

1. Install hydrants at locations as indicated.

2. Install hydrants in accordance with AWWA M17.
3. Install 150 mm gate valve and cast iron valve box on hydrant service leads as indicated.
4. Set hydrants plumb, with hose outlets parallel with edge of pavement or curb line, with pumper connection facing roadway and with body flange set at elevation of 50 mm above final grade.
5. Place concrete thrust blocks as indicated and specified ensuring that drain holes are unobstructed.
6. To provide proper draining for each hydrant, excavate pit measuring not less than 1 x 1 x 0.5 m deep and backfill with coarse gravel or crushed stone to level 150 mm above drain holes.
7. Place appropriate sign on installed hydrants indicating whether or not they are in service during construction.

3.9 THRUST BLOCKS AND RESTRAINED JOINTS

1. Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated.
2. Keep joints and couplings free of concrete.
3. Do not backfill over concrete within 24 hours after placing.
4. For restrained joints: only use restrained joints approved by Consultant.

3.10 HYDROSTATIC AND LEAKAGE TESTING

1. Do tests in accordance with Standard Specifications for Municipal Services.
2. Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.
3. Notify Consultant at least 24 hours in advance of proposed tests.
 1. Perform tests in presence of Consultant.
4. Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.
5. Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by Consultant.

6. Upon completion of pipe laying and after Consultant has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.
7. Leave hydrants, valves, joints and fittings exposed.
8. When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.
9. Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

3.11 PIPE SURROUND

1. Upon completion of pipe laying and after Consultant has inspected Work in place, surround and cover pipes as indicated.
2. Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.
3. Place layers uniformly and simultaneously on each side of pipe.
4. Do not place material in frozen condition.
5. Compact each layer from pipe invert to mid height of pipe to at least 95% of corrected maximum dry density.
6. Compact each layer from mid height of pipe to underside of backfill to at least 90% of corrected maximum dry density.

3.12 BACKFILL

1. Place backfill material, above pipe surround, in uniform layers not exceeding 150 mm compacted thickness up to grades as indicated.
2. Do not place backfill in frozen condition.
3. Under paving and walks, compact backfill to at least 95% maximum density to ASTM D698.
 1. In other areas, compact to at least 90 % maximum density to ASTM D698.
4. After installation, paint hydrants to suit HRWC standard.

3.13 FLUSHING AND DISINFECTING

1. Flushing and Disinfection operations as per Standard Specifications for Municipal Services.
2. Flushing and disinfecting operations: witnessed by Consultant and carried out by contractor.
3. Notify Consultant at least 2 days in advance of proposed date when disinfecting operations will begin.

3.14 SURFACE RESTORATION

1. After installing and backfilling over water mains, restore surface to original condition as directed by Consultant.

END

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

1. Section 31 23 33 - Excavating Trenching and Backfill.
2. Standard Specifications for Municipal Services.

1.2 REFERENCES

1. Canada Green Building Council (CaGBC)
 1. LEED Canada-NC-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System for New Construction and Major Renovations 2009.
2. American National Standards Institute/American Water Works Association (ANSI/AWWA)
 1. ANSI/AWWA C111/A21.11-07, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. ASTM International
 1. ASTM D3034-0, Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
4. Canadian General Standards Board (CGSB)
 1. CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.
 2. CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.
5. CSA International
 1. CSA-B182.1-11, Plastic Drain and Sewer Pipe and Pipe Fittings.
 2. CSA-B182.2-11, PSM Type Polyvinylchloride PVC Sewer Pipe and Fittings.

1.3 ADMINISTRATIVE REQUIREMENTS

1. Scheduling:
 1. Schedule Work to minimize interruptions to existing services and maintain existing sewage flows during construction.
 2. Submit schedule of expected interruptions for approval and adhere to approved schedule.
 3. Notify Consultant and building occupants 24 hours minimum in advance of any interruption in service.
- 2.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

1. Submit samples, product data and required submittals for products, including adhesives, sealants, paints, and coatings.
2. Product Data:
 1. Submit manufacturer's instructions, printed product literature and data sheets for pipes and include product characteristics, performance criteria, physical size, finish and limitations.
3. Shop Drawings:
 1. Submit drawings stamped and signed by professional engineer registered or licensed in Province of Nova Scotia, Canada.
4. Certificates:
 1. Certification to be marked on pipe.
5. Test and Evaluation Reports:
 1. Submit manufacturer's test data and certification 2 weeks minimum before beginning Work.
6. Sustainable Design Submittals:
 1. Regional Materials: submit evidence that project incorporates regional materials and products, showing their cost, distance from project to furthest site of extraction or manufacture, and total cost of materials for project.

1.5 DELIVERY, STORAGE AND HANDLING

1. Deliver, store and handle materials in accordance with manufacturer's written instructions.
2. Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
3. Storage and Handling Requirements:
 1. Store materials in accordance with manufacturer's recommendations.
 2. Store and protect pipes from damage.
 3. Replace defective or damaged materials with new.

PART 2 - PRODUCTS

2.1 PLASTIC PIPE

1. Type PSM Polyvinyl Chloride (PVC) for Gravity Laterals: to ASTM D3034
 1. Standard Dimensional Ratio (SDR): 28
 2. Nominal lengths: 6 m.

2. Type High Density Polyethylene (HDPE) for Pressure Lateral.
 1. Standard Dimensional Ratio (SDR): 11

2.2 SERVICE CONNECTIONS

1. Type PSM Poly (Vinyl) Chloride: to CSA-B182.2.

2.3 PIPE BEDDING AND SURROUND MATERIALS

1. Granular material to Section 31 23 33 Excavation, Trenching and Backfill.

2.4 BACKFILL MATERIAL

1. As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for sewer pipe installation in accordance with manufacturer's written instructions.
 1. Visually inspect substrate in presence of Consultant.
 2. Inform Consultant of unacceptable conditions immediately upon discovery.
 3. Proceed with installation only after unacceptable conditions have been remedied.

3.2 PREPARATION

1. Temporary Erosion and Sedimentation Control:
 1. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways,
 2. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
 3. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
2. Clean pipes and fittings of debris and water before installation, and remove defective materials from site to approval of Consultant. Clean and dry pipes and fittings before installation.
3. Obtain Consultant's approval of pipes and fittings prior to installation.

3.3 TRENCHING

1. Do trenching Work in accordance with Section 31 23 33 - Excavating, Trenching and Backfilling.
2. Protect trench from contents of sewer or sewer connection.
3. Trench alignment and depth require approval of Consultant prior to placing bedding material and pipe.

3.4 GRANULAR BEDDING

1. Place bedding in unfrozen condition.
2. Place granular bedding materials in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.
3. Shape bed true to grade and to provide continuous, uniform bearing surface for pipe and lift station.
 1. Do not use blocks when bedding pipe.
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 structures with compacted bedding material.

3.5 INSTALLATION

1. Lay and join pipes to: ASTM C12.
2. Lay and join pipes in accordance with manufacturer's recommendations and to approval of Consultant.
3. Handle pipe using methods approved by Manufacturer.
 1. Do not use chains or cables passed through rigid pipe bore so that weight of pipe bears upon pipe ends.
4. Lay pipes on prepared bed, true to line and grade, with pipe invert smooth and free of sags or high points.
 1. Ensure barrel of each pipe is in contact with shaped bed throughout its full length
5. Begin laying at outlet and proceed in upstream direction with socket ends of pipe facing upgrade.

6. Joint deflection permitted within limits recommended by pipe manufacturer.
7. Whenever Work is suspended, install removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.
8. Install plastic pipe and fittings in accordance with CSA-B182.11.
9. Pipe jointing:
 1. Install gaskets in accordance with manufacturer's written 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 before joining.
 4. Maintain pipe joints free from mud, silt, gravel and foreign material.
 5. Avoid displacing gasket or contaminating with dirt or foreign material. Gaskets so disturbed to 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.
10. When stoppage of Work occurs, block pipes to prevent creep during down time.
11. Plug lifting holes with pre-fabricated plugs approved by Manufacturer set in shrinkage compensating grout.
12. 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.
13. Make watertight connections to manholes.
 1. Use shrinkage compensating grout when suitable gaskets are not available.
14. Install pumping station per manufacturer's installation instructions.
15. Pumping station alarm panel to be mounted at interior of building. See electrical/mechanical drawings for exact location.
16. Alarm panel to be wired to building systems – see electrical/mechanical specifications and drawings for details.

3.6 PIPE SURROUND

1. Place surround material in unfrozen condition.
2. Upon completion of pipe laying, and after Consultant has inspected pipe joints, surround and cover pipes as indicated.
 1. 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.
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% corrected maximum dry density.
6. Compact each layer from mid height of pipe to underside of backfill to at least 95% corrected maximum dry density.
7. When field test results are acceptable to Consultant, place surround material at pipe joints.

3.7 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 95% corrected maximum dry density
 1. In other areas, compact to at least 90% corrected maximum dry density.

3.8 FIELD TESTING

1. Field Testing as per Standard Specifications for Municipal Services.
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. Perform infiltration and exfiltration testing as soon as practicable after jointing and bedding are complete, and service connections have been installed.
5. Do infiltration and exfiltration test to Standard Specifications for Municipal Services.

6. Carry out tests on each section of sewer between successive manholes including service connections.
7. Repair and retest sewer line as required, until test results are within limits specified.
8. Repair visible leaks regardless of test results.
9. Television and photographic inspections:
 1. Carry out inspection of installed sewers by video camera, digital camera or by other related means.
 2. Provide means of access to permit Consultant to do inspections.
 3. Payment for inspection services in accordance with Measurement and Payment.

END

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- .1 This section applies to:
 - .1 All seawater piping (SWS & SWR)
 - .2 All underground heat exchange water supply & return piping (HXWS & HXWR) from seater pumphouse to boiler room in Cabot Building.
- .2 Division 01 and Section 23 05 00 – Common Works Results - Mechanical are both part of this Section and shall apply as if repeated here.

1.2 RELATED SECTIONS

- .1 Division 01 – General Requirements.
- .2 Section 01 33 00 Submittal Procedures.
- .3 Section 01 45 00 – Testing and Quality Control.
- .4 Section 01 77 00 - Closeout Procedures.
- .5 Section 01 78 00 - Closeout Submittals.
- .6 Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .7 Section 22 05 00 – Common Work Results for Plumbing.
- .8 Section 23 05 00 – Common Work Results – Mechanical.
- .9 Section 23 05 15 – Common Installation Requirements for HVAC Pipework.
- .10 Section 23 05 53 – Mechanical Identification.

1.3 REFERENCE STANDARDS

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASME B16.1-[98] , Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 ANSI B18.2.1-[96(R2005)] , Square and Hex Bolts and Screws - Inch Series.
 - .3 ANSI B18.2.2-[87(R1999)] , Square and Hex Nuts (Inch Series).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A307-[04] , Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile.
 - .2 ASTM D2774, Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
 - .3 ASTM D3035, Standard specifications for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
 - .4 ASTM D3350, Standard Specifications for Polyethylene Plastic Pipe and Fittings Materials.

- .5 ASTM F2164, Standard Practices for Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure.
- .6 ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
- .3 American Water Works Association (AWWA)
C901, Polyethylene (PE) Pressure Pipe and Fittings 100mm through 1600mm Diameter for Water Distribution and Transmission.
- .4 CSA Group (CSA)
 - .1 CSA-B137 Series-[05] , Thermoplastic Pressure Piping Compendium (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12).
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.4 SHOP DRAWINGS AND PRODUCT DATA

- .1 Submit shop drawings and product data in accordance with Section 01 33 00 – Submittal Procedures and Section 22 05 01 – Common Work Results for Plumbing.

1.5 CLOSEOUT SUBMITTALS

- .1 Submit close out documentation in accordance with in accordance with Section 01 77 00 – Closeout Procedures, 01 78 00 – Closeout Submittals and Section 22 05 00 – Common Work Results for Plumbing.

1.6 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 – Testing and Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 The pipe shall be made from HDPE material having a minimum material designation code of PE4710. The material shall have a minimum cell classification of 445484C1 as defined in ASTM D3350. PE4710 resins shall have a minimum PENT value of 2,000 hours. The Hydrostatic Design Stress (HDS) at 23°C (73.4°F) shall be 6.9MPa(1,000 psi) for resin designated by PE4710 and shall be listed in the name of pip manufacturer in PPI TR-4. In addition, the material shall be listed as meeting NSF/ANSI 61.

- .2 The pipe material shall contain 2% - 3% well dispersed carbon black. Additives which can be conclusively proven not to be detrimental to the pipe may also be used, provided the pipe produced meets the requirements of this specification.

2.2 PIPE

- .1 The pipe shall be manufactured in accordance with ASTM D3035.
- .2 The pipe shall contain no recycled compound except that which is generated in the manufacturer's own plant, from resin of the same specification and from the same raw material supplier.
- .3 Pressure ratings in accordance with PE4710 shall be as follows:
 - .1 Pressure rating: 860KPa (125 Psig)
 - .2 Allowable total pressure during recurring surge: 1300 KPa (188 Psig)
 - .3 Allowable total pressure during occasional surge: 1725 KPa (350 Psig)

2.3 FITTINGS

- .1 HDPE pipe flange assemblies shall meet the following requirements unless otherwise specified by the engineer:
 - .1 Solid HDPE stub ends or flange adapters shall be made from PE4710 and shall be formed using extrusion or molding methods. PE4710 stub ends and flange when used with PE3608 pipe shall have the same DR as the pipe. These components shall meet the requirements of ASTM F2880.
 - .2 Flange rings shall have bolt-holes and bolt-circles conforming to be Class 150, ANSI B16.1/B16.5 or AWWA C207 Class 150 Series B, D or E dimensional standards with exceptions. Flange rings shall be ductile iron (ASTM A536-84). They shall be protected from corrosion by [*Specifier to select .. paint, coal-tar epoxy, galvanization, anodic protection, cathodic protection ... or alternative corrosion resistant material*].
 - .3 Methods for flange assembly, gasket selection and bolt torque application shall be as outlined in PPI Technical Note TN-38.

2.4 JOINTS

- .1 Butt Fusion: The pipe shall be joined by the butt fusion procedure outlined in ASTM F2620 or PPI TR-33, and the pipe manufacturer's recommendations.
- .2 Socket Fusion: Joints between the pipe and socket fitting shall be done in accordance with ASTM F2620, and the fitting manufacturer's recommendations.
- .3 Electrofusion: Electrofusion joining shall be done in accordance with the electrofusion fitting manufacturer's recommendations, and ASTM F1290
- .4 Mechanical: Mechanical connection of HDPE to auxiliary equipment such as valves, pumps, and fittings shall use mechanical joint adapters and other devices as outlined in the PPI Handbook of Polyethylene Pipe (2nd Edition), Chapter 9 and AWWA Manual of Practice M55, Chapter 6.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Fusion technicians, shall be trained in the use of the appropriate procedures and evaluated by the fusion equipment manufacturer, must conduct the fusion joining.
- .2 The critical parameters of each fusion joint, shall be recorded either manually or by an electronic data logging device. All fusion joint data shall be included in the Fusion Technician's joint report. Submit report to Department Representative.
- .3 Install buried pipe on 150mm (6") bed of clean washed sand, shaped to accommodate piping, to line and grade as indicated. Backfill with 150mm (6") of clean washed sand.
- .4 During construction, all open ends of pipe and fittings shall be plugged or capped to keep out debris.
- .5 Align pipe carefully before joining. Do not use excessive force to join pipe sections.
- .6 Support pipes as required to assure concentricity until joint is properly completed.
- .7 Provide flex restraints where indicated on buried piping. Install in accordance with manufactures installation instructions.
- .8 Provide concrete anchors on seawater piping.
- .9 Provide separate Cathodic Protection systems on seawater intake and discharge strainers as indicated on drawings.

3.2 TESTING

- .1 Give Departmental Representative 48 hours' prior notice for witnessing of tests.
- .2 Hydrostatic leakage testing for pressure piping should comply with ASTM F2164 and PPI TN-46.
- .3 Hydrostatic leakage testing for non-pressure piping should be conducted in accordance with ASTM F1417.
- .4 If the test section fails the test, the contractor shall repair or replace all defective materials and/or workmanship at no additional cost to the owner.
- .5 After installation and pressure testing, new water mains should be disinfected according to AWWA C651.
- .6 Do not bury or submerge piping until testing is accepted by Department Representatives.

END