2.2 **Access Vaults**

.1 Access vaults to Section 02725.

2.3 **Pipe Bedding Materials**

.1 Bedding sand to Section 02221, Item 2.1.3.

2.4 **Pipe Disinfection**

.1 Sodium hypochlorite to AWWA B300-80, to disinfect water mains.

2.5 **Warning Tape**

.1 Refer to Section 02221, Item 2.2.

3.0 **EXECUTION**

3.1 **Preparation**

.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 and Backfill**

.1 Do trenching and backfill work to Section 02221.

.2 Rock excavation to Section 02211.

.3 Trench alignment and depth require Engineer's approval prior to placing bedding material or pipe.

.4 Do not backfill trenches until installed work has been checked by Engineer and hydrostatic and leakage test results are within limits specified.

3.3 **Bedding**

.1 Place bedding materials to details indicated or directed.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.

.3 Compact full width of bed to at least 95% Standard Proctor Density.

.4 Place granular material instead of sand bedding material when directed.

.5 Fill any excavation below level of bottom of specified bedding with approved granular material and compact.

3.4 **Pipe Assembly**

.1 Prepare working area between access vaults and/or flanged connections. Pipe is to be constructed one section at a time unless otherwise approved in writing by the Engineer.

.2 Assemble pipe on surface alongside trench alignment. Ensure that ground is free of sharp grade changes and/or debris or large rocks that may injure the protective jacket on the pipe.

.3 For butt-fusion jointing of polyethylene pipe provide trained personnel and jointing machine approved by pipe manufacturer. Obtain the services of a trained technician from the pipe manufacturer to certify and/or train contractor's personnel on jointing procedures and inspect the jointing machine. Provide a letter from manufacturer certifying that the contractor's representative(s), who will perform the jointing, is qualified and that the jointing equipment has been inspected and is suitable for the pipe supplied.

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

.5 Cut pipes as required for specials, 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.

.6 Align pipes carefully before jointing.

.7 Leave joints and fittings exposed for initial pressure test and hydrostatic and leakage testing.

.8 Utilize barricades or temporary fencing to protect pipe from vehicles (regular or ATV traffic).

3.5 **Initial Pressure Test (Prior to Installation in Trench)**

.1 Conduct initial pressure test of each section of main, prior to installation in the trench and completion of insulation of the joints.

.2 Provide labour, equipment and materials required to perform test.

.3 Install temporary end plugs on sections of main to be tested. Expel air from main slowly, at high end, by filling main with potable water.

.4 Thoroughly examine exposed parts and correct for leakage as necessary.

.5 Apply hydrostatic test pressure of 240 psi (1656 kPa) based on elevation of lowest point in main and corrected to elevation of test gauge, for a period of one hour (maximum three (3) hours).

.6 Examine pipe, joints, fittings, and appurtenances while system is under pressure.

.7 Remove pipe, joints, fittings and appurtenances found defective and replace with new sound material and make water tight.

8 Retest pipe after leaks and/or defective materials are repaired or replaced. **Wait a minimum of eight (8) hours between tests.**

3.6 **Pipe Installation**

1 Upon pipe section passing surface pressure test, excavate full length of trench.

2 Prepare and shape bedding for pipe.

.3 Do not drag pipe over the ground which would damage the jacket and insulation. Damaged insulation is to be repaired with field foam. Damaged jacket is to be repaired with two (2) layers of heat shrink tape extending 150 mm on each side of the damage.

.4 Handle pipe by approved methods. Do not lift pipe by insertion of any object into end of pipe. Ensure that load is distributed evenly over the length of pipe when lifting.

.5 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.

.6 Do not lay pipe on frozen bedding.

.7 Lower pipe onto bedding.

.8 Hand place bedding material in uniform layers, not exceeding 150 mm thick to 300 mm above top of pipe. Dumping of material directly on top of pipe **will not permitted.**

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

.10 Compact each layer to at least 95% Standard Proctor Density.

.11 Install warning tape on top of pipe bedding as shown on the drawings.

.12 When hydrostatic and leakage test results (see Item 3.10) are acceptable to Engineer, surround and cover joints and fittings with granular material placed and compacted as specified herein. Backfill remainder of trench to Section 02221.

.13 At end of day, cover all open ends of pipe with suitable material to prevent foreign objects, dirt, small animals, etc., from entering the pipe.

3.7 Access Vaults

.1 Construct access vaults to Section 02725.

3.8 Connections to Prefabricated Access Vaults

.1 Connect ends of the pipes in trench to the steel pipe ends outside the access vault wall and existing pipes. Perform all excavation, backfilling, pipe cutting, jointing, demolition, repair and other work required. Supply all materials. Unless specifically itemized in Schedule of Prices, include cost of this work in price for mains at no additional cost to the Owner for extra work or materials as indicated on the drawings. The maximum allowable space between the pipe ends shall be 10 mm.

.2 After successful hydrostatic and leakage testing of main in trench (Item 3.10), install preformed mastic coated polyethylene half shells over the connection assembly as indicated on the drawings.

.3 Apply two (2) wrappings of specified heat shrinkable tape as indicated on the drawings. The first complete wrapping shall be applied and shrunk down before the second wrapping is applied. The tape shall overlap 50% as it is wrapped around the fitting.

3.9 **Connection to Existing Mains**

.1 Cut main at 90° to axis of pipe at location of tie-in.

.2 Fuse pipe as per Item 3.4.1 and 3.4.3 to 3.4.8 of this Section.

.3 Give 48 hours notice to the PW&S, Engineer, Fire Department and the Hamlet before having water turned off. **PW&S will operate all existing valves as required.** The contractor shall not operate existing valves without permission of the Engineer and the Hamlet. Finish connection in order to restore service in shortest possible time. Prior to service interruption, notify all affected customers. Work continuously until service is restored.

3.10 **Hydrostatic and Leakage Testing**

.1 Provide all labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Pressure test the complete installed watermain and services, prior to connection to the existing system.

.3 Pressure testing of watermains and services shall be performed after runs of main between access vaults and/or flanged fittings have been fused and installed in the trench.

.4 Notify the Engineer at least 24 h in advance of all proposed tests. Perform test in presence of the Engineer.

.5 Test pipeline in sections, unless otherwise authorized by the Engineer.

.6 Before testing, bed and cover pipe between joints to prevent movement or snaking of pipe line when test pressure is applied.

.7 Leave service connections, joints and fittings as well as connections to vaults exposed.

.8 Strut and brace temporary caps, bends, tees and valves to prevent movement when test pressure is applied.

.9 Open valves throughout test section including service valves.

.10 Expel air from main and services by slowly filling main with potable water. Install corporation stops at high points, if required, to expel air. Remove stops after satisfactory completion of the test and seal holes with plugs.

.11 Thoroughly examine exposed parts and correct for leakage as necessary.

.12 Apply hydrostatic test pressure of 1035 kPa (150 psi) based on elevation of lowest point in main and corrected to elevation of test gauge, for a period of three (3) hours. This period is required to accommodate the initial expansion of the pipe. Add sufficient make up water to main, returning the system to the test pressure at one hour intervals.

.13 Upon completion of the initial expansion period, add sufficient make up water to return system to 1035 kPa (150 psi) test pressure, leave system at test pressure for test period of one (1) hour. After one (1) hour test period, measure the amount of make up water required to return system to test pressure. Make up water shall not exceed 6 litres/100 m of pipe for 200 mm mains and 3.7 litres/100 m of pipe for 150 mm mains. Test section should not be under test pressure for a period longer

than eight (8) hours. If testing is not complete, leave test section to relax for an additional eight (8) hour period prior to restarting the test.

.14 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.15 Remove pipe, joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.16 Repeat hydrostatic test until all defects have been corrected. Do not start subsequent tests until at least eight (8) hours has elapsed with the pipe at zero pressure.

.17 Complete insulation of joints, including outer jacket upon satisfactory completion of tests. Do insulation work as per Section 02668.

3.11 **Flushing and Disinfecting**

.1 Flushing and disinfecting operations shall be under direct control of the Engineer. Notify Engineer at least four (4) days in advance of proposed date when disinfecting operations will commence. Flush and disinfect all existing Nuvuk watermains, including return line from MH 94-3 to the pumphouse.

.2 Make arrangements with the Owner for supply of water from existing system at mutually agreed time. Co-ordinate flushing of mains with DPW&S, O&M and the Fire Department personnel. Do not cause loss of fire storage in reservoir at any time.

.3 Flush water mains through available outlets with a sufficient flow to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear.

.4 Flushing flows shall be as follows:

Pipe Size (mm)	Flow (L/s) Minimum
150 and below	27
200	47

.5 Provide connections and pumps as required.

.6 Open and close valves, hydrants and service connections to ensure thorough flushing.

.7 When flushing has been completed to satisfaction of Engineer, introduce a strong solution of chlorine into watermain and ensure that it is distributed throughout entire system.

.8 Chlorine application to be close to point of filling water main and to occur at same time

.9 Operate valves, hydrants, services and appurtenances while main contains chlorine solution.

.10 Take water samples at access vaults, in suitable sequence, to test for chlorine residual. Take all samples in the presence of the Engineer.

.11 After adequate chlorine residual, not less than 50 ppm, has been obtained, leave system charged with chlorine solution for 24 h. Further samples, after the 24 h period, shall then be taken to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

.12 Flush line to remove chlorine solution after 24 h.

.13 Have bacteriological tests performed on water samples taken from main, within 24 h of sampling, after chlorine solution has been flushed out. Take samples from location, specified by the Engineer, daily for a minimum of two days. Repeat disinfecting procedure (should contamination remain or recur during this period). Submit results to the Engineer.

.14 **After** acceptable disinfection of the new installation. Drain all services not connected to houses by draining main to lowest service connection. Close all corporation stops after main is drained. Re-pressurize main to system pressure and ensure all corporation stops are in working order and closed.

END OF SECTION

1.0 GENERAL

1.1 Related Work

.1	Rock Excavation:	Section 02211
.2	Trenching, Backfilling and Compaction:	Section 02221
.3	Service Connections:	Section 02665
.4	Watermains and Fittings	Section 02666
.5	Access Vaults:	Section 02725

1.2 Scheduling of Work

.1 Schedule work to minimize interruptions to existing services.

.2 Submit schedule of expected interruptions for approval by Engineer and adhere to interruption schedule as approved by Engineer.

.3 Notify building occupants a minimum of 24 h in advance of any interruption in service.

.4 Do not interrupt water service for more than 3 h and confine this period between 10:00 and 16:00 h local time unless otherwise authorized.

.5 Notify fire department, Public Works and Services, Hamlet office and the Engineer of any planned or accidental interruption of water supply to hydrants.

1.3 Measurement and Payment

.1 Supply of Insulated HDPE Pipe

Pipe will be measured by the metre supplied to the site and incorporated into the work. Payment will be made at the contract Unit Price per lineal metre for each size and class of pipe which shall be full compensation for supply of pipe, including all transportation and delivery to the site, storage, and all other work and materials necessary or incidental thereto for which separate payment is not elsewhere provided.

.2 Install Sewer mains - Two or More Mains in Common Trench:

Will be measured along the center line of EACH sewer main including the length of fittings, but excluding access vaults. Length shall be horizontal measurement with no allowance for slope. Payment shall be made at the Contract Unit Price per lineal metre for each size and class of pipe, which shall be full compensation for trenching, laying, jointing, warning tape, bedding, backfilling, compaction, flushing, testing and all materials including fittings, plugs, and all other work necessary or incidental thereto for which separate payment is not elsewhere provided.

.3 Install Sewer mains - Single Main:

Will be measured along the center line of the sewer main including the length of fittings but excluding access vaults. Length shall be horizontal measurement with no allowance for slope. Payment shall be made at the Contract Unit Price per lineal metre for each size and class of pipe, which shall be full compensation for trenching, laying, jointing, warning tape, bedding, backfilling, compaction, flushing, testing and all materials including fittings, plugs, and all other work necessary or incidental thereto for which separate payment is not elsewhere provided.

.4 Removal and Disposal of Existing Sewermain

Removal and disposal of existing sewer mains will not be measured; but will be considered incidental to the Work of Section 02667 unless specified otherwise.

.5 Connections to the Existing System

Connections to existing system will be measured in units constructed and shall be paid for at the Contract Unit Price for each connections, which shall be full compensation for trenching, laying, jointing, bedding, backfilling, insulation, compaction, and all labour, materials, equipment and sundry items necessary to complete the work.

2.0 PRODUCTS

2.1 Polyethylene Pipe and Fittings

1 High density polyethylene pipe: to CSA B137.1-M for 50 mm pipe or smaller pipe and ASTM F714 for pipe sizes larger than 50 mm diameter, DR11.

.2 Polyethylene to polyethylene joints: to be thermal butt fusion welded. Connect with steel backing flanges to ASTM A536 with corrosion resistant coating as manufactured by KWH or approved equal, where indicated or required for fittings or specials.

.3 Gaskets for flanged fittings shall be 3 mm full face neoprene gaskets: **red rubber, red rubber sheet stock or heavy cloth insert gaskets shall not be allowed.** The inside and outside diameters of the gaskets shall be within 1.5 mm of the inside and outside diameter of the stub end of the backing flange.

.4 All polyethylene pipe and fittings shall be of the same manufacturer and the same grade of polyethylene. Standard of acceptance shall be KWH Sclairpipe or approved equal.

.5 Polyethylene stub ends for flange joints shall be the same series rating as the pipe and shall be butt fused to the pipe. Back-up rings shall be steel (to ASTM A 536-80) with corrosion resistant coating as manufactured by KWH or approved equal. Metal flanges drilled to ANSI B16.5 bolt circles.

.6 All bolts and nuts for underground use shall be cadmium plated.

.7 Blind flanges for use where indicated on drawings shall be flat faced, cast or malleable iron, 125 lb. standard, ITT Grinnel or equal.

.8 No joints shall be allowed in piping covered with shop applied insulation.

.9 All jacketed pipe and fittings shall have a permanent factory applied marking indicating manufacturer, size and series identification at no greater than one (1) metre intervals along the length.

.10 Mains to be supplied with 75 mm insulation manufactured according to Section 02668.

2.2 Access Vaults

1 Access vaults to Section 02725.

2.3 **Pipe Bedding Materials**

.1 Bedding sand to Section 02221, Item 2.1.3.

2.4 **Warning Tape**

.1 Refer to Section 02221, Item 2.2.

3.0 EXECUTION

3.1 **Preparation**

.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 and Backfill**

.1 Do trenching and backfill work to Section 02221.

.2 Rock excavation to Section 02211.

.3 Trench alignment and depth require Engineer's approval prior to placing bedding material or pipe.

.4 Do not backfill trenches until installed work has been checked by Engineer.

3.3 **Bedding**

.1 Place bedding materials to details indicated or directed.

.2 Shape bed true to grade to provide continuous uniform bearing surface for pipe exterior. Do not use blocks when bedding pipe.

.3 Compact full width of bed to at least 95% Standard Proctor Density.

.4 Place granular material instead of sand bedding material when directed.

.5 Fill any excavation below level of bottom of specified bedding with approved granular material and compact.

3.4 **Pipe Assembly**

.1 Prepare working area between access vaults and/or flanged connections. Pipe is to be constructed one section at a time unless otherwise approved in writing by the Engineer.

.2 Assemble pipe on surface alongside trench alignment. Ensure that ground is free of sharp grade changes and/or debris or large rocks that may injure the protective jacket on the pipe.

.3 For butt-fusion jointing of polyethylene pipe provide trained personnel and jointing machine approved by pipe manufacturer. Obtain the services of a trained technician from the pipe manufacturer to certify and/or train contractor's personnel on jointing procedures and inspect the jointing machine. Provide a letter from manufacturer certifying that the contractor's representative(s) who will perform the jointing is qualified and that the jointing equipment has been inspected and is suitable for the pipe supplied.

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

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

.6 Align pipes carefully before jointing.

.7 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.8 Utilize barricades or temporary fencing to protect pipe from vehicles (regular traffic or ATV traffic).

3.5 **Initial Pressure Test**

.1 Pressure test of each section of main, prior to installation in the trench and completion of insulation of the joints, shall be performed.

.2 Provide labour, equipment and materials required to perform test.

.3 Install temporary end plugs on sections of main to be tested. Expel air from main slowly, at high end, by filling main with potable water.

.4 Thoroughly examine exposed parts and correct for leakage as necessary.

.5 Apply hydrostatic test pressure of 80 psi (552 kPa) based on elevation of lowest point in main and corrected to elevation of test gauge, for a period of one hour (maximum three (3) hours).

.6 Examine pipe, joints, fittings, and appurtenances while system is under pressure.

.7 Remove pipe, joints, fittings and appurtenances found defective and replace with new sound material and make water tight.

.8 Retest pipe after leaks and/or defective materials are repaired or replaced. Wait a minimum of eight (8) hours between tests.

3.6 **Pipe Installation**

.1 Upon pipe section passing surface pressure test, excavate full length of trench.

.2 Prepare and shape bedding for pipe.

.3 Do not drag pipe over the ground which would damage the jacket and insulation. Damaged insulation is to be repaired with field foam. Damaged jacket is to be repaired with two (2) layers of heat shrink tape extending 150 mm on each side of the damage.

.4 Handle pipe by approved methods. Do not lift pipe by insertion of any object into end of pipe. Ensure that load is distributed evenly over the length of pipe when lifting.

.5 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.

.6 Do not lay pipe on frozen bedding.

.7 Lower pipe onto bedding.

.8 Hand place granular material in uniform layers, not exceeding 150 mm thick to 300 mm above top of pipe. Dumping of material directly on top of **pipe will not be permitted.**

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

.10 Compact each layer to at least 95% Standard Proctor Density.

.11 Install warning tape on top of pipe bedding as shown on the drawings.

.12 When hydrostatic and leakage test results are acceptable to Engineer, surround and cover joints and fittings with granular material placed and compacted as specified herein. Backfill remainder of trench to Section 02221.

3.7 **Access Vaults**

.1 Construct access vaults to Section 02725.

3.8 **Connections to Prefabricated Access Vaults**

.1 Connect ends of the pipes in trench to the steel pipe ends outside the access vault wall and existing pipes. Perform all excavation, backfilling, pipe cutting, jointing, demolition, repair and other work required. Supply all materials. Unless specifically itemized in Schedule of Prices, include cost of this work in price for mains at no additional cost to the Owner for extra work or materials as indicated on the drawings. The maximum allowable space between the pipe ends shall be 10 mm.

.2 After successful hydrostatic and leakage testing of main in trench (Item 3.10), install preformed mastic coated polyethylene half shells over the connection assembly as indicated on the drawings.

.3 Apply two (2) wrappings of specified heat shrinkable tape as indicated on the drawings. The first complete wrapping shall be applied and shrunk down before the second wrapping is applied. The tape shall overlap 50% as it is wrapped around the fitting.

3.9 **Connection to Existing Mains**

.1 Cut main at 90° to axis of pipe at location of tie-in.

.2 Fuse pipe as per Item 3.4.1 and 3.4.3 to 3.4.8 of this Section.

.4 Give 48 hours notice to the PW&S, Engineer, Fire Department and the Hamlet before having water turned off. **PW&S will operate all existing valves as required**. The contractor shall not operate existing valves. Finish connection in order to restore service in shortest possible time. Prior to service interruption, notify all affected customers. Work continuously until service is restored.

3.10 **Hydrostatic and Leakage Testing**

.1 Provide all labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.2 Pressure test the complete installed watermain, prior to connection to the existing system.

3 Pressure testing of watermains shall be performed after runs of main between access vaults and/or flanged fittings have been fused and installed in the trench but before the completion of insulation at the joints.

.4 Notify the Engineer at least 24 h in advance of all proposed tests. Perform test in presence of the Engineer.

.5 Test pipeline in sections, unless otherwise authorized by the Engineer.

.6 Before testing, bed and cover pipe between joints to prevent movement or snaking of pipe line when test pressure is applied.

.7 Leave connections to access vaults, joints that have been fused after the initial pressure tests, as well as service connections and fittings exposed.

.8 Strut and brace temporary caps, bends, tees and valves to prevent movement when test pressure is applied.

.9 Expel air from main by slowly filling main with potable water. Install corporation stops at high points in main where no air-vacuum release valves are installed. Remove stops after satisfactory completion of the test and seal holes with plugs.

.10 Thoroughly examine exposed parts and correct for leakage as necessary.

.11 Apply hydrostatic test pressure of 138 kPa (20 psi) based on elevation of lowest point in main and corrected to elevation of test gauge, for a period of three (3) hours. This period is required to accommodate the initial expansion of the pipe. Add sufficient make up water to main, returning the system to the test pressure at one hour intervals.

.12 Upon completion of the initial expansion period, add sufficient make up water to return system to 138 kPa (20 psi) test pressure, leave system at test pressure for test period of one (1) hour. After one (1) hour test period, measure the amount of make up water required to return system to test pressure. Make up water shall not exceed 1 litres/100 m of pipe for 200 mm mains and 0.5 litres/100 m of pipe for 150 mm mains.

.13 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.14 Remove pipe, joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.15 Repeat hydrostatic test until all defects have been corrected.

.16 Complete insulation of joints, including outer jacket upon satisfactory completion of tests. Do insulation work as per Section 02668.

3.11 **Flushing**

.1 Flushing operations shall be under direct control of the Engineer. Notify Engineer at least four (4) days in advance of proposed date when flushing operations will commence.

.2 Make arrangements with the Owner for supply of water from existing system at mutually agreed time.

3 Flush sewer mains through available outlets with a sufficient flow to produce a velocity of 1.5 m/s, within pipe for 10 min, or until foreign materials have been removed and flushed water is clear.

.4 Flushing flows shall be as follows:

Pipe Size (mm)	Flow (L/s) Minimum
150 and below	27
200	47

.5 Provide connections and pumps as required.

END OF SECTION

1.0 GENERAL

1.1 Related Work

.1	Trenching, Backfilling and Compaction:	Section 02221
.2	Service Connections:	Section 02665
.3	Water Mains:	Section 02666
.4	Sewer Mains:	Section 02667

1.2 Material Specification

.1 At least two (2) weeks prior to commencing work, submit manufacturer's test data and certification that insulation materials meet the requirements of this section. Include manufacturer's drawings, information and shop drawings where pertinent.

1.3 Measurement and Payment

.1 Thermal insulation for underground piping will be considered incidental to work under Sections 02665, 02666 and 02667 and no additional payment will be made.

2.0 PRODUCTS

2.1 Application:

.1 Insulation system for water and sewer mains, including fittings and appurtenances. Intent is for a fully insulated water and sewer system.

2.2 Materials:

.1 Thermal insulation: to be factory applied, rigid, closed-cell polyurethane insulation to a thickness of 75 mm for mains and 50 mm for services, Shaw Pipe Protection "Insul-8" systems or Urecon Ltd. "U.I.P." system meeting the following requirements:

.1 Core density: ASTM D-1622; 35 to 48 kg/m^3.

.2 Compressive strength at 25°C, 10% deflection, ASTM D1621-64; 2.81 kg/cm^2 (275 kPa).

.3 Thermal conductivity @ 25°C, ASTM D-2326-64T; 0.00225 W/cm°C.

.4 Upper thermal limit; 121°C.

.5 Closed Cell content, ASTM D2856; 90% minimum.

.6 Water absorption, ASTM D2842; Max. 12 gm/1000 cc.

.7 Dimensional stability, ASTM D2126, procedure B & E; 3.

.8 Cut-back insulation at each end to permit jointing.

.2 Protective jacketing to be either of the following:

.1 A 1.14 mm thickness of continuously extruded high density polyethylene over a rubber mastic under-adhesive as manufactured by Shaw Pipe Protection, "Insul 8" system.

.2 A 1.27 mm thickness in two layers spirally wrapped high density polyethylene tape, hot applied, counter-wound, overlapped 15% of tape width on each seam, Urecon Ltd. "U.I.P." system.

.3 Half Shells (joint closures, fittings and valves); molded for snug fit using polyurethane meeting same requirements as for pipe. Half shells shall be smoothly contoured with no abrupt diameter changes.

.4 Heat shrink sleeves: Canusa Heat Shrink Pipe Sleeve, adhesive coated cross-linked polyethylene sleeve to provide a moisture-proof seal at joints.

.5 Heat shrink tape: Raychem Thermoclad adhesive coated heat shrinkable tape in 100mm widths.

.6 Mastic: Flintguard No. 110-14 asphalt mastic vapour barrier.

.7 Portable foam packs for foamed in place insulation, two part polyurethane. Class 1, foam, in portable container.

3.0 EXECUTION

3.1 Clean all surfaces adequately prior to applying adhesives, polyurethane, half shells, mastic, shrink sleeves or tape. Remove and replace any materials where proper bond is not attained. Use shrink sleeves except for where directed by the Engineer to use tape.

3.2 Transport, store and handle insulated components with care to prevent damage to insulation and/or protective jacket.

3.3 Repair damaged insulation with field-applied urethane. Repair damaged protective jacket with heat shrink sleeves or heat shrink tape.

3.4 Do jointing as required. Cut back insulation on pipe or half shells to provide snug fit.

3.5 Coat all exposed surfaces of pipe insulation with mastic. Coat all surfaces of half shells before installation.

3.6 Install half shells. Infill gaps and areas at fittings where pre-formed insulation cannot be achieved with field-applied urethane. Use forms where required. Coat field-applied urethane with mastic after curing.

3.7 Apply 2 layers of heat shrink sleeves. Where the geometry of fittings does not permit use of heat shrink sleeves, install double wrap (counterwound) heat shrink tape with 50% overlap to manufacturer's instructions. Heat shrink to overlap 200 mm past all joints in insulation. Installed sleeves and tape shall have all edges contacted to the pipe with no air gaps.

3.8 Do not backfill over mastic coated surfaces for four (4) hours following mastic application.

3.9 All shrink sleeves and shrink tape installations are to be approved by the Engineer prior to installation. No visible trapped air bubbles will be permitted behind sleeve or tape. **All** exposed edges must show proper seal.

END OF SECTION

1.0 GENERAL

1.1 Related Work

.1 Trenching, Backfilling and Compaction: Section 02221

.2 Water Mains: Section 02666

.3 Sewer Mains: Section 02667

1.2 Shop Drawings

.1 Submit shop drawings in accordance with Section 01300.

1.3 Scheduling of Work

.1 Schedule work to minimize interruptions to existing services or to other parts of the Work.

.2 Submit schedule of expected interruptions for approval and adhere to approved schedule.

1.4 Measurement for Payment

.1 Supply of each vault shall be at the price tendered for each specific vault. The price shall be full compensation for supply of prefabricated access vault complete with all piping, hydrants, ladders, marker posts, bollards and details as indicated on the drawings, including freight, delivery, storage and all other work and materials necessary to ensure delivery to site or incidental thereto for which separate payment is not elsewhere provided.

.2 Installation of access vaults shall be paid for at the price tendered for each vault. The price shall allow for complete installation, including excavation; connections to mains; insulation; granular bedding; compacted backfill; marker posts and bollards and all other materials and work necessary or incidental thereto for which separate payment is not elsewhere provided.

.3 Not Used.

.4 Removal of existing hydrant vaults, valve chambers and sanitary manholes will be measured in units and shall be paid for at the Contract Unit Price per unit, which shall be full compensation to supply materials, excavation, demolition, hauling, plugging of lines to be abandoned, required fill, compaction and all other labour, materials, equipment and sundry items necessary or incidental thereto for which separate payment is not elsewhere provided.

1.5 Inspection Certificates

.1 Written inspection certificates shall be issued to the Contractor for various phases of the Work after the Work has been inspected and approved by the Engineer.

.2 The issuance of an inspection certificate shall not relieve the Contractor from his obligation to maintain the Work or replace Work subsequently found to be faulty.

.3 Inspection certificates for prefabricated access vaults shall be issued for each individual access vault for the following items of Work:

.1 Foundation excavation, prior to placing sand bedding.

.2 Sand bedding, prior to the installation of styrofoam.

.3 Styrofoam insulation sheet prior to the installation of the access vault.

.4 Installation of the access vault.

.5 Granular backfill around the access vault.

.4 No payment shall be made for any item of Work before an inspection certificate has been issued for the completed phase.

.5 Do not proceed with the subsequent phase of Work until an inspection certificate has been issued for the completed phase.

2.0 PRODUCTS

2.1 Materials - General

.1 All materials in this section are indicated on the drawings and/or specified herein. Substitution shall not be made without written approval of the Engineer.

2.2 Valves

.1 Butterfly valves shall be DeZurik 632, Keystone 1020 or equal and conform to the following specifications:

Type of Valves:	Butterfly Valve		
Valve Ends:	Lug Style Body		
Description:	Lug Style body for placement between two 125#FF flanges		
Actuator:	Heavy duty gear operator		
Materials:	Body	-	Cast iron
	Disc	-	Bronze or ductile iron with bronze, nickel or chrome trim
	Seat	-	Buna N

	Other	-	Stainless Steel shaft and exposed parts
Service Conditions:	Size	-	150 mm to 200 mm
	Temperature	-	0°C to 40°C
	Pressure	-	790 kPa CWP, drop tight at 100 psi differential
	Process Fluids	-	Treated water

.2 Butterfly valves shall be fitted with a heavy duty gear operator and handwheel, oriented as shown on the drawings.

.3 Ball valves shall be fitted with lever operator, NPT, galvanized.

.4 Globe valves shall be fitted with lever operation, NPT, galvanized.

2.3 Steel Pipe and Fittings

.1 Steel schedule 80 to ASTM A120-84, 150 psi, epoxy coated to the following specifications:

.1 Apply coatings in plant by manufacturer or specialized applicator.

.2 Sandblast surfaces to white metal prior to coating. Do not sandblast newly cast objects if not contaminated with soil, grease, etc., and if coated within 4 h after casting.

.3 Apply the following coating in strict conformance to coating manufacturer's specifications:

.1 piping larger than 50 mm ø, one coat two component epoxy (50% min solids) primer, followed by two coats two component liquid High Build epoxy (55% min solids), to AWWA C210-84. Minimum film thickness primer, 0.05 mm (2 mils), top coat 0.3 mm (12 mils).

.2 Piping 50 mm ø, or less: hot dip galvanized to CSA requirements.

.4 For epoxy coated pipe, test coating with a wet sponge Holiday detector set at 7 volts. Repair all pinholes and retest. Coating to be pinhole free.

.5 Tees and elbows to be cast iron fittings, to 150 psi, epoxy coated to same requirements as Item 2.3 1 above.

.2 Flanged joints: to ANSI/AWWA C115/A21.15-83, 1 MPa drilled to match ANSI B16.1, Class 860 kPa flange.

.3 Fittings for grooved-end pipes shall be Victaulic grooved-end fittings, suitable to receive Style 07 Zero-flex, Victaulic couplings. Victaulic fittings and couplings shall be hot dipped galvanized inside and out. Victaulic couplings c/w gasket Grade E.

.4 Screwed pipe and fittings shall be galvanized to C.S.A. G164 requirements.

.5 Tees and elbows to be cast iron fitting to 150 psi, epoxy coated to same requirements as Item 2.3.1, this Section.

2.4 **Miscellaneous Fabricated Steel Work**

.1 All bolts, nuts and washers shall be hot dipped galvanized or cadmium plated.

2.5 **Polyurethane Insulation**

.1 Insulation for prefabricated access vaults shall be rigid closed cell polyurethane insulation to the thickness shown on the drawings. Properties of the insulation shall be the same as those specified for pipe under Section 02668.

.2 Styrofoam covering boards for access vault base plate shall be Dow Chemical Company of Canada Ltd. H140 extruded expanded polystyrene conforming to CSGB 51-GP-20M, Type 4 and CSGB 41-GP-14a, Type 4, 410 kPa minimum compressive strength.

2.6 **Granular Materials**

.1 Granular materials for bedding and backfill around the access vaults shall be the same as those specified for pipe bedding under Section 02666.

2.7 **Exterior Pipe Coupling**

.1 Pipe coupling adjacent to the access vaults shall be with forged steel, slip-on flange welded to steel pipe, 1035 kPa, ASA B16.1, sized to suit, flat faced.

2.8 **Hydrants**

.1 The hydrant shall be Crane, McAvity No. M67 (no alternatives), "on-line" hydrant with two (2) 65 mm (2.5 inch) hose nozzles male C.S.A. Standard thread, 5 threads per inch, and one (1) 114 mm (4.5 inch) pumper nozzle male CSA Standard thread to match the existing hydrants in Rankin Inlet, with extension piece mounted to hydrant body flange and on-line type valve chamber mounted under extension piece for installation on 200 mm - 1030 kPa standard flanged steel connections. All nozzles to be complete with threaded caps.

.2 The hydrant shall have a two-piece operating stem and "break away" safety flange.

.3 The hydrant shall be supplied with insulating gaskets and insulating bolt sleeves and washers. All bolts, nuts and washers shall be hot dipped galvanized.

.4 Direction of opening to be counter clockwise and operating nuts to be hexagonal.

.5 The colour of the hydrant body shall be red. The hydrant top and outlet caps shall be red.

3.0 EXECUTION

3.1 Access Vault Prefabrication

.1 Submit shop drawings for steel access vaults in accordance with requirements for shop drawings.

.2 Steel access vaults shall be fully prefabricated, complete with piping and accessories, finished, tested and inspected within the fabrication shop prior to shipment to site.

.3 The Work shall be open to inspection within the prefabrication shop at all times. Advise the Engineer 24 hrs in advance of any required inspections and/or required tests being carried out.

.4 Provide facilities, apparatus and water for all tests specified. Carry out the specified tests and make repairs to obtain satisfactory test results.

.5 Set the water main pipe and fittings, horizontally and vertically, as shown in the access vault detail drawings.

.6 After the shells are prefabricated, but prior to placing the insulation, the shells shall be properly supported above the floor and shall be subjected to a static leakage test by capping the entries and filling with water to the top of the access vault. The access vault shall show no signs of leakage after a period of four (4) hours. The Contractor shall provide a static leakage test report from the manufacturer.

.7 The steel access vaults, including interior and exterior surfaces of welded-in steel pipe, etc. shall be sandblasted and epoxy coated inside and outside after fabrication in accordance with the following:

.1 Surface Preparation: in accordance with the Steel Structures Painting Council specification SSPC #10 near white blast cleaning. All surfaces must be dry before any paint is applied.

.2 Painting: two (2) coats of "Indurall Ruff Stuff 3300 Epoxy" as produced by Phillips Paint Products (1968) Ltd. or equal, each coat achieving 8 mils dry film thickness. The total system shall have a total minimum of 16 mils dry film thickness when tested with a magnetic testing device. The colours shall be grey outside and white inside.

.3 Galvanizing: shall conform to C.S.A. G164 (minimum 610 g/m^2).

.8 Completed water piping shall be subjected to pressure tests by capping external piping stubs and pressurizing to the following requirements:

.1 Water piping shall be water pressure tested at 1380 kPa (200 psi) for a period of two (2) hours.

.2 All piping shall show no signs of leaking during the tests.

.9 Inject polyurethane foam insulation for access vaults from above so as to prevent voids. Injection of polyurethane shall be performed by experienced operators with methods and equipment approved by the Engineer.

3.2 **Access Vault Installation**

.1 Perform excavation as specified under Section 02221. Do not install access vaults until the excavation has been inspected and approved by the Engineer.

.2 Place a 500 mm level layer of approved compacted sand bedding or granular backfill material as directed by the Engineer. If requested, granular material used for access vault bedding will be paid for at Unit Price for granular material.

.3 Place on top of the bedding, a 38 mm thick styrofoam insulation base having dimensions as shown on the drawings. Center the base to match the established position of the access vaults.

.4 Carefully lower and position the prefabricated access vault over the center of the styrofoam insulation base, without any shock to the interior piping. Ensure the installed access vault is level and true to line and grade. Leveling the access vault with wood or concrete will not be allowed.

.5 Place a 38 mm thick piece of styrofoam complete with a 10 mm thick filler piece on top of the base flange, cut to match the exterior wall radius of the vault and the dimensions of the styrofoam base.

.6 Repair, prior to backfill, any damage to the exterior epoxy finish of the access vault below grade by repainting damaged areas with epoxy or application of a 0.8 mm field coat of "Flintkote - Superior" asphalt mastic No. 110-14. Repair damage above grade or the interior surface with epoxy paint.

.7 Do not backfill around the access vault until the installation and connections to the trench piping have been pressure tested as per Section 02666, inspected and approved by the Engineer.

.8 Backfill to 300 mm above the base insulation and the access vault exterior with approved granular bedding materials. Placing of the granular material shall be as specified under Section 02221. Backfill around the access vaults shall be 150 mm above and slope to surrounding ground.

.9 Supply and erect marker signs and bumper posts as detailed on the drawings.

3.3 **Pressure Test of Water Mains**

.1 During the period of the pressure test for the completed water mains as specified under Section 02666, include the vault piping in the test section, and inspect the installed access vaults for leakage in all joints on water main fittings, hydrants, etc.

.2 Joints showing leakage shall be remade or replaced and, if required by the Engineer, the system shall be retested.

END OF SECTION

1.0 GENERAL

1.1 Related Work

.1 Service Connections — Section 02665

1.2 Requirements

.1 To provide a control panel to monitor and annunciate the status of recirculating domestic water system in a residential application.

1.3 Shop Drawings

.1 Provide shop drawings for review with complete wiring diagrams to all associated equipment.

1.4 Payment

.1 No separate payment will be made for work performed to this Section (refer to Section 02665).

2.0 PRODUCTS

2.1 Enclosures

.1 Metal clad, dead front, totally enclosed construction made from code gauge steel to CEMA-1A standards with hinged cover to suit the application. Factory finish in ANSI 61 grey enamel.

2.2 Terminals

.1 Required for all ingoing and outgoing connections, of the disconnecting type.

2.3 Controls in Cover

.1 Push buttons, pilot lights and signal devices, heavy duty oil-tight construction as specified on the drawings.

2.4 Relays

.1 Heavy duty industrial type, rated volts and poles to suit application.

2.5 Grounding

.1 Provide copper ground connection to enclosure.

3.0 EXECUTION

3.1 Prewire panels and factory test before shipments.

3.2 Size panels to suit equipment provided, as shown on drawings.

3.3 Provide engraved lamacoid labels mechanically fastened to front of panel as indicated on the drawings.

END OF SECTION