

1.0 GENERAL

1.1 Section 32 80 00 refers to those portions of the work that are unique to the complete installation of a fully automatic underground irrigation system, including all necessary preparatory work and all electrical, wiring and plumbing connections, and maintenance work during the guarantee period. This section must be referenced and interpreted simultaneously with all sections pertinent to the works described herein.

1.2 **SCOPE OF WORK**

- .1 Supply and installation of sleeves, mainline, lateral lines, control zone valves, dripline, spray heads, root watering systems, controller enclosure, controller, and all related items necessary to provide a properly operating automatic irrigation system to distribute water in a way that adequately maintains the landscape while conserving and protecting water resources.
- .2 Maintenance of irrigation system.

1.3 **REFERENCE STANDARDS**

- .1 ASTM D1248 – High Density Polyethylene (HDPE) Pipe
- .2 ASTM D2241 – Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR)
- .3 ASTM D2564 – Solvent Cement for PVC Pipe and Fittings
- .4 CSA B137.0-12 – Thermoplastic Pressure Piping

1.4 **CODES AND REGULATION**

- .1 All work shall be installed in accordance with the requirements of local and applicable provincial and federal regulations. Any work shown on the drawings or described in the specifications which is at variance with the regulations shall be changed to comply with the requisite authority at no cost to the Owner.
- .2 Workers' Compensation Board regulations shall be followed.

1.5 **PERMITS AND FEES**

- .1 The Contractor shall be responsible for obtaining all permits and licenses applicable to the work to be done and shall include costs for such permits and licenses in the tender price.
- .2 Provide Contract Administrator with signed and approved copies of all required permits, including the following:
 - .1 Backflow test report
 - .2 Inspection reports

1.6 **CONTRACT DRAWINGS**

- .1 Drawings are diagrammatic and indicate the general arrangement of systems and work included in the contract. Do not scale drawings.

1.7 **QUALITY ASSURANCE**

- .1 The trade contractor performing this work shall be a "Certified Irrigation Technician – Level 2" having met the certification standards established by *The Irrigation Industry Association of British Columbia*, and having experienced, trained and insured personnel qualified for the scope of work.

- .2 A written guarantee of the installed irrigation system shall be provided to the Owner covering workmanship and materials for a minimum of one (1) year from the date of substantial completion. The contractor shall warranty maintenance on the system for a minimum of one (1) year, including but not limited to spring start-up, adjustments and maintenance operations as required, and winterization.
- .3 Manufactured products, including but not limited to irrigation heads, quick couplers, controllers, valve boxes and valves, will be warranted as per the manufacturer's standard warranty period or a minimum of one (1) year, whichever is greater.
- .4 The Contractor shall be certified in High Density Polyethylene Butt-Fusion as certified by the *British Columbia Institute of Technology* or approved equivalent when HDPE is specified.

1.8 SUBMITTALS

- .1 The Contractor shall submit evidence of project personnel having certification in High Density Polyethylene Butt-Fusion prior to commencing the work.
- .2 The Contractor shall submit shop drawings, product literature, and specifications for approval by the Owners Representative prior to construction.
- .3 A suitably scaled as-built drawing shall be submitted, preferably in AutoCAD 2008 or newer format along with three (3) printed copies of the as-built. Retain a qualified survey instrument operator to record exact location of all irrigation components installed, including but not limited to the controller cabinet, master valve, mainline, sleeves, control zone valves, main water connection, blow-out fittings, pipe drains, lateral end flush valves, sprinklers and any other similar features and components. Show all other deviations from the irrigation design drawing provided to the Contractor. All components of the irrigation system shall be shown as installed, with clear measurements from an identifiable reference point. Ensure all zones are labelled correctly.
- .4 The as-built drawing shall be submitted prior to issue of Substantial Completion. The Contractor shall maintain the as-built record drawing throughout the maintenance and warranty period and issue a revised As-Built Irrigation Drawing at Final Acceptance if any changes are made. The as-built drawings shall be certified by the irrigation designer as being an accurate record of installation.
- .5 Operation and Maintenance Manuals
 - .1 Prepare and deliver to the Owner prior to substantial completion of construction two (2) copies of the following information in 3-ring binders:
 - .2 Parts sheets on every material and component installed under this Contract.
 - .3 Guarantee statements.
 - .4 Complete operating and maintenance instruction on all major equipment.
 - .5 Winterization and spring start-up procedures.
 - .6 Chart of approximate watering times for peak and shoulder season showing all proposed run times for each zone relative to differing precipitation rates and water requirements.
 - .7 Maintenance materials to be furnished: Two (2) sets of tools required for adjusting each type of sprinkler supplied on this project. One (1) quick coupler key and matching hose swivel for each type of quick coupler installed.

.8 One (1) full sized printed copy of the as-built, two (2) 11" x 17" sized printed copies of the as-built on rip-proof and waterproof paper (dura-copy at Can Cadd Reproductions).

1.9 SITE CONDITIONS

- .1 Verify the existence and location of all underground utilities and services prior to commencement of the work.
- .2 Consult with the Owner's Representative to adjust the design, if necessary, to suit existing site conditions and grades prior commencement of the work.
- .3 Ensure sequencing of this work is carried out in coordination with the work of other trades. It is essential to coordinate the installation of sleeves under hard surfaces and irrigation piping through open tree soil trenches to ensure their installation is completed when the work area accessible.
- .4 Protect from damage existing landscape features, plant material, structures, irrigation work in progress, and the work of other trades.

1.10 SUBSTITUTION

- .1 Where materials are specified by brand name and model number, such specifications shall be deemed to facilitate a description of the materials and material quality and shall establish a standard for performance and quality against which proposed substitutes shall be evaluated.
- .2 Substitution requests shall not be considered unless submitted in writing with sufficient descriptive literature and product samples to permit product comparison.
- .3 All product substitutions shall be of equal or greater performance, value and water efficiency than the original design. All proposed sprinkler substitutions must be accompanied with verifiable water efficiency performance data provided by the manufacturer or an independent industry source such as the *Centre for Irrigation Technology* (CIT), Fresno.
- .4 Alternate materials shall match the specified materials in performance, flow, and pressure loss so as not to compromise the intent of the design.
- .5 The written approval of the Owner's Representative is required to the use of materials that are different from those shown in the design. Materials installed which have not been pre-approved by the Owner's Representative are subject to removal and replacement with approved materials at the Contractor's expense.

1.11 NOTIFICATION OF CONSULTANT

- .1 Report to the Owner's Representative, in writing, any conditions or defects encountered on the site during or prior to construction upon which the work of this section depends and which may adversely affect its performance.

- .2 Notify the Owner's Representative and obtain approvals for inspection and testing of irrigation system as specified in this section. Provide the Owner's Representative and Owner minimum 48-hours' notice prior to required inspections or meetings.

1.12 TESTS AND INSPECTIONS

- .1 System installation inspections shall be held on a regular basis.
- .2 In addition to coordinating the inspection schedule, the irrigation contractor shall, in the presence of the Irrigation Consultant conduct the following tests and inspections:
 - .1 Inspection of mainline and sand bedding prior to burial.
 - .2 Pressure tests of mainline.
 - .3 Layout inspection and operation test of subsurface dripline prior to burial.
 - .4 Coverage and operation tests.
 - .5 HDPE pipe strap test.
 - .6 Vault drainage test.
- .3 Keep work uncovered and accessible until successful completion of inspection or test.

1.13 BACKFLOW PREVENTION ASSEMBLY TEST

- .1 Conduct backflow prevention assembly test as BC Water Works Association standard using qualified personnel.

1.14 MAINLINE PRESSURE TEST

- .1 Perform mainline pressure test to identify potential leaks and ensure mainline *can* operate at design pressure and maintain pressure.
- .2 Conduct mainline pressure test prior to backfilling of mainline.
- .3 Fill mainline with water and expel all air from pipe. Maintain water in pipe as follows:
 - .1 3 hours for PVC mainline
 - .2 3 hours for HDPE mainline (not including set up time)
- .4 Subject mainline to hydrostatic pressure of 150psi or twice the optimum design pressure of the mainline and not to exceed 200psi.
- .5 Stop supply of make-up water to mainline and record hydrostatic pressure in mainline.
- .6 Visually inspect mainline and fittings for leaks.
- .7 Record hydrostatic pressure in mainline 3 hours after supply of make-up water stopped.
- .8 Determine test result based on difference in recorded pressures at beginning and end of test as follows:
 - .1 Passed test: Equal to or less than 5% difference
 - .2 Failed test: Great than 5% difference
- .9 Identify source of leak and replace all defective material and workmanship as necessary to eliminate leak.

.10 Repeat mainline pressure test and make replacements as necessary until a passed result is achieved.

1.15 SYSTEM COVERAGE AND OPERATION TEST

.1 Conduct coverage and operation test after installation of complete irrigation system and prior to issuance of Certificate of Substantial Performance:

- .1 Head spacing does not exceed the distances shown on Contract Drawings
- .2 Where applicable, irrigation piping should be installed to follow the contours of the land to minimize low head drainage situations.
- .3 Heads, boxes, vaults and trenches are at specified elevation relevant to finished grade and not subject to settlement or lifting

.2 Conduct operational tests to verify that:

- .1 Controller can be programmed manually on site and remotely via Owner's Centralus system.
- .2 Controller can send and receive communication with Owner's central control system 10 consecutive times without a missed communication.
- .3 Controller responds to flow sensor.
- .4 Operating pressure is within design parameters.
- .5 Each zone can be operated automatically and in succession via programmed controller.
- .6 Performance provides head to head coverage.
- .7 There is no overspray onto different control zones, hard surfaces or other improvements.
- .8 All components are flush to grade.
- .9 All valves are labelled, and valve installed in valve box with minimum 50mm clearance between bottom of valve and top of drain rock.

1.16 DRIPLINE/EMITTER INSPECTION

.1 Perform inspection and testing of dripline/emitter manifold and lines to identify potential leaks and confirm manifold, driplines and emitters *can* operate at design pressure. Conduct inspection and testing prior to backfilling of manifold, driplines or emitters.

.2 Fill manifold and lines with water at operating pressure and maintain pressure for 1 hour. Visually inspect manifold, driplines and fittings for leaks. Confirm that emitters are functioning correctly. Identify sources of leaks and replace any and all defective materials and workmanship as necessary to eliminate leak.

.3 Repeat inspection and testing and make replacements as necessary until no further leaks are identified.

1.17 HDPE PIPE STRAP TEST

.1 Conduct HDPE pipe strap test at least 1 hour after fusion weld has been made prior to backfilling of HDPE pipe on those fusion welds where, upon visual or tactile inspection, the bead does not roll back properly or is not consistent in height or width.

.2 HDPE pipe strap consists of:

- .1 Cut fusion weld from pipe, allowing 200mm on either side of weld to work with.
- .2 Cut pipe lengthways through fusion weld to create a strap 25mm wide.
- .3 Bend strap back on itself.
- .4 If weld breaks repeat test on another fusion weld, chosen by Contract Administrator.
If second fusion weld fails then all welds become suspect and the HDPE pipe cannot be installed until the reason for the fusion joint failures is determined.
- .5 If fusion weld does not break, then the weld is acceptable and no further testing of similar welds is required.
- .6 Replace or repair tested pipe strap.

1.18 VAULT DRAINAGE TEST

- .1 Conduct vault drainage test when vault is installed and backfilled and prior to installation of backflow prevention device and water supply line in vault.
- .2 Fill point of connection vault with water to a depth of 300mm and leave water to drain.
- .3 Determine test result based on time required for water to drain below finish grade of drain rock in bottom of vault:
 - .1 Passed test: 1 hour or less.
 - .2 Failed test: greater than 1 hour.

1.19 MEASUREMENT FOR PAYMENT

- .1 Supply and installation of irrigation point of connection will be measured as a lump sum. The work includes: Permits and fees, water meter, master valve, flow sensor, backflow prevention assembly, vaults and lids, fittings, pipe, excavation, trenching, sleeves, backfill and restoration, all incidentals necessary for the proper installation of complete water service to the irrigation system.
- .2 Supply and installation of irrigation control system will be measured as a lump sum. The work includes: permits & fees, supply, installation, testing, programming, and adjustment of irrigation system controller, electrical conduits, controller cabinets, vaults, valve boxes, lids, fittings, wire, excavation, trenching, backfill, and restoration, and all incidentals necessary for the proper installation and operation of a complete irrigation control system.
- .3 Supply and installation of pipes, valves, sprinklers and dripline will be measured as a lump sum. The work includes, but is not limited to: supply, installation, testing and adjustment of irrigation pipe, sleeves and conduit, zone control valves, drip control zone kits, electric control wire, common wire, flow sensor wire and spare wires, drain valves, isolation valves, pressure regulators, swing joint assemblies, sprinklers, bubblers, emitters, dripline and root watering systems, air relief valves, flush valves, fittings, vaults, valve boxes and lids, excavation, trenching, backfill and restoration, all incidentals necessary for the proper installation and operation of a complete irrigation system.
- .4 Supply all labour and materials necessary for adjustment of existing systems to meet approval of Contractor Administrator.

- .5 Payment for record drawings and operating manual will be measured as a lump sum.
- .6 Payment for irrigation tests, inspections, maintenance, winterizations, and spring start-ups during warranty period will be incidental to the work under this section.

2.0 PRODUCT

2.1 VAULT AND LID

- .1 Acceptable vaults and matching lids for point of connection equipment are dependent on service size and include the following:
 - .1 $\frac{3}{4}$ ": one (1) Kon Kast 1031 vault, base and Excel 4840-1 lid
 - .2 1" to 2": one (1) Kon Kast 1102 vault, base and Excel 3974-2 lid
 - .3 $2\frac{1}{2}$ " to 3": two (2) Kon Kast 1102 vault, base and Excel 3974-2 lids
- .2 Lids to have recessed hinges and locking hardware.

2.2 VAULT DRAIN

- .1 Perforated Schedule 40 PVC pipe, 100mm diameter with threaded inlet cover having 13mm grated openings.

2.3 BACKFLOW PREVENTION ASSEMBLY

- .1 Acceptable double check valve assemblies are:
 - .1 Watts Series 007 Double Check Valve Assemblies

2.4 WATER SERVICE AND METER

- .1 Unless already installed or otherwise required by the water utility having jurisdiction over the site provide a metered water service, including but not limited to:
 - .1 Backflow prevention assembly
- .2 Supply and install water meter in accordance with requirements of water utility.
- .3 Conform size of water meter to mainline diameter and allow for minimal pressure losses.
- .4 Acceptable water meter assemblies are:
 - .1 $\frac{3}{4}$ " to 1": Sensus iPerl
 - .2 $1\frac{1}{2}$ " +: Sensus Omni Turbo (T2) Water Meter

2.5 FLOW SENSORS

- .1 For use with the Hunter ACC2 series controllers, flow sensors to be impeller type with FCT fittings for pipe installation. FCT to be sized based on flow. Acceptable flow sensors are:
 - .1 Hunter HFS Hunter Flow-Sync sensor, sensor requires FCT fitting for pipe installation.

- .2 For use with the Hunter ICC2 controllers, acceptable flow sensors are:
 - .1 Hunter Flow-Clik sensor with interface module, sensor requires FCT fitting for pipe installation.
- .3 Acceptable wires for flow sensor shall be shielded, direct burial communication cable and includes the following:
 - .1 Belden cable
 - .2 Approved equal

2.6 MASTER VALVE

- .1 Acceptable master valves are as follows:
 - .1 Hunter IBV Series
- .2 Ensure master valve is sized to maximum and minimum flow parameters shown on Contract Drawings.

2.7 PRESSURE REDUCING VALVE

- .1 Acceptable water pressure reducing valves are Watts Series 25AUB-Z3.

2.8 BLOW-OUT ASSEMBLY

- .1 Blowout assembly to be 1" brass ball valve with plug and brass swing joint assembly.

2.9 IRRIGATION CONTROLLER

- .1 Irrigation controller to be compatible with Centralus™ Software unless otherwise specified. Acceptable controllers are:
 - .1 Hunter ICC2
 - .2 Hunter ACC2
 - .3 Hunter ACC2 Decoder
 - .4 Hunter Node-BT
- .2 Controllers to be installed with the following accessories:
 - .1 Hunter A2C-LAN communication module
 - .2 Hunter Roam-XL-R remote receiver unit

2.10 CONTROLLER MEDIA CONVERTER

- .1 If a fiber optic line is installed, the controller will require the following:
 - .1 LBH100A-H-SSC Hardened Media Converter Switch, 10-/100- Mbps Copper to 1310-nm, 40km, SC
 - .2 LHC015a-R2 10-/100-Mbps Autosensing Media Converter, Single-Mode, 1310-nm, 40km, SC
 - .3 Both products are available for purchase at UBCO IT Services, BuyIT.

2.11 WEATHER SENSORS

- .1 Acceptable weather sensors are:

- .1 Hunter Solar Sync
- .2 Hunter Rain Clik
- .3 Or as specified on the contract drawings.

2.12 CONTROLLER TO DECODER COMMUNICATION

- .1 Communication between controller and the field decoders at the electric control valves shall be accomplished using the Hunter IDORG wire.
- .2 Field Decoders (either 1, 2, 4, or 6 station configurations with ability to operate multiple solenoids per station) come pre-addressed.
- .3 Decoder to solenoid: standard pair 18AWG/1 mm to 150ft. (twisted improves surge resistance).
- .4 Programmable decoder station IDs (from controller to panel).

2.13 CONTROL WIRE

- .1 Control wire from irrigation controller to electric control valve to be minimum #14 gauge, direct burial, type TWU-40 wire. Control wire to be any colour other than white, blue, purple or red.
- .2 Common wire from irrigation controller to electric control valve to be minimum #12 gauge direct burial, type TWU-40 wire. Common wire to be white in colour.
- .3 Master valve wire from the controller to valve to be minimum #14 gauge direct burial, type TWU-40 wire. Wire to be red in colour.
- .4 Spare control wire to be blue in colour.
- .5 Spare common wire to be white in colour.
- .6 All connectors to be new, two-step, CSA approved for the watertight applications and assembled according to the manufacturer's recommendations.

2.14 TWO WIRE CONDUCTOR

- .1 Two-wire conductor shall be Hunter ID1ORG.
- .2 Single conductor spare decoder wire shall be direct burial CSA approved #14 AWG Blue.
- .3 All control wire installed shall use a Polyethylene outer jacket.
- .4 All connectors to be new, two-step, CSA approved for the watertight applications and assembled according to the manufacturer's recommendations.

2.15 GROUNDING AND BONDING

- .1 Ground assembly consists of CSA and BC Electrical Code endorsed products per irrigation controller manufacturer's recommendations for grounding.

2.16 ELECTRICAL PRODUCTS

- .1 All electrical products shall be CSA approved and bear the CSA label. Alternatively, where a product does not bear the required CSA label, it shall be approved in writing, by the authority having jurisdiction.
- .2 Wire conduit shall be Grey PVC DB2 non-metallic electric conduit as shown on drawings, minimum 2" diameter.

2.17 POLYVINYL CHLORIDE (PVC) PIPE

- .1 Conform to CSA B137.3-93.
- .2 New condition, extruded from virgin, high impact materials, solvent weldable with belled ends, continually and permanently marked showing manufacturer's name, material, size, pressure rating, and CSA approval.
- .3 PVC pipe to be as follows:
 - .1 Class 200 PVC pipe for pipe sizes $\frac{3}{4}$ " to 3" in diameter.
 - .2 Bell and spigot gasket joint pipe complete with concrete thrust blocking for pipe sizes 4" in diameter and greater.

2.18 LOW DENSITY POLYETHYLENE PIPE

- .1 New condition CSA Series 100, LDPE in new condition, extruded from virgin materials, continually and permanently marked showing manufacturers name, material, size, and pressure rating.

2.19 HIGH DENSITY POLYETHYLENE PIPE

- .1 New condition CSA Approved, extruded from virgin materials, continually and permanently marked showing manufacturer's name, materials, size, and pressure rating.
- .2 Material to be listed by the Canadian Standards Association (CSA) and Plastic Pipe Institute (PPI) as a PE-3408 resin with a hydrostatic design basis (HDB) of 1600psi for water at 23°C. Material to comply with ASTM D-1248 as a Type III Class C, Category 5, Grade P34 material and with ASTM D-3350 as a 345434C cell material.
- .3 Acceptable HDPE pipe is dependent on operating pressure and to have Standard Density Ratios (SDR) as follows:
 - .1 Max. pressure up to 100psi: SDR 17.0
 - .2 Max. pressure exceeding 100psi: SDR 11.0

2.20 SLEEVING

- .1 Schedule 40 PVC for irrigation sleeve in bored hole or under hard surface
- .2 Irrigation sleeve diameter to be minimum 3" or twice the diameter of main or lateral line running through it, whichever is greater.

2.21 VALVE BOXES

- .1 Irrigation valve boxes are to be as follows:
 - .1 Carson 910 Round or equivalent
 - .2 Carson 1419 Standard Regular or equivalent
 - .3 Carson 1730 Super Jumbo Rectangular or equivalent.
- .2 Valve box and matching T Cover Lid and extensions to be commercial grade and green in colour.

2.22 WIRE SPLICE BOXES

- .1 Wire splice box and matching lid and extensions to be commercial grade and grey in colour. Wire splice box to have locking lid with stainless steel bolt locking device and appropriate washers.

2.23 ELECTRIC CONTROL VALVE

- .1 Acceptable electric control valves are:
 - .1 Hunter ICV Series
- .2 Size electric control valve in accordance with valve manufacturer's recommendations for the design flow.
- .3 Include pressure regulating modules as required to provide the optimum operating pressure for each irrigation circuit and head/outlet specification.
- .4 Install ball valve upstream of 1" valves and gate valve on larger valves.

2.24 DRIP ZONE KITS

- .1 Drip zone kit shall be as shown on the drawing.
- .2 Drip zone kits shall include one (1) schedule 40 PVC ball valve and filter.
- .3 The valve box shall contain maximum of two (2) valves per box.
- .4 Drip zone kit shall have two (2) schedule 80 PVC union per drip zone kit.
- .5 Acceptable drip zone kits are as follows:
 - .1 2 to 20 GPM: Hunter ICZ-101-40
 - .2 20 to 60 GPM: Hunter ICZ-151-XL

2.25 FILTERS

- .1 Hunter HY-100
- .2 Hunter HY-151

2.26 QUICK COUPLER VALVE

- .1 Acceptable quick coupler valves are as follows:
 - .1 $\frac{3}{4}$ ": Hunter HQ-33DRC
 - .2 1": Hunter HQ-44RC

2.27 ISOLATION VALVE

- .1 Acceptable isolation valves include the following:
 - .1 Up to 2": Red White #206 or Toyo 206a
 - .2 Over 2": Mueller A-2362 Resilient Wedge Gate Valve

2.28 SWING JOINT ASSEMBLY

- .1 Fabricated with three (3) threaded Schedule 40 PVC elbows and one threaded Schedule 80 PVC nipple.
- .2 Length of nipple shall be such a length to permit installed head or valve to be set as specified.
- .3 Diameter of nipple to match inlet for valve or head shown on Contract Drawings.

2.29 SPRINKLERS – SPRAYHEAD

- .1 Acceptable sprayhead sprinklers are as follows:
 - .1 Hunter Pros-04-PRS30 CV
 - .2 Hunter Pros-04-PRS40 CV

2.30 SPRINKLERS – ROTOR

- .1 Acceptable rotors are as follows:
 - .1 Hunter PGJ-04-V
 - .2 Hunter PGP-ULTRA-04-CV
 - .3 Hunter I-20-04-PRB
 - .4 Hunter I-25-04-SS
 - .5 Hunter I-40-SS

2.31 ROOT ZONE WATERING SYSTEM

- .1 Acceptable root zone watering systems are:
 - .1 Hunter RZWS-18-50-CV
 - .2 Hunter RZWS-36-50-CV
- .2 Each RZWS tube to be installed with Hunter P/N RZWS-SLEEVE

2.32 LANDSCAPE DRIPLINE

- .1 Acceptable driplines include the following:
 - .1 Hunter HDL-09-CV

2.33 DRIP EMITTERS

- .1 Rain Bird Xeri bugs, sized as shown on drawing.

2.34 BUBBLERS

- .1 Acceptable bubblers are Hunter RZWS-CV with fabric sleeve.

2.35 LATERAL FLUSH ASSEMBLY

- .1 Ball valve with street elbow and flexible hose on swing joint assembly complete with 10" round valve box.

2.36 AIR RELIEF VALVES

- .1 Hunter PLD-AVR Air/Vacuum relief valve.

2.37 FITTINGS

- .1 New condition Schedule 40 PVC conforming to ASTM D-2466-97 standards and of the same material as pipe. Fittings to be designed for solvent welding to PVC pipe except where valves and risers require threaded joints.
- .2 Nipples to be threaded Schedule 80 PVC and manufactured from same material as pipe.
- .3 At the point where the supply source changes from metal to PVC pipe, the metal end of the pipe must be an FIPT (female) adapter and the PVC fitting a MIPT (male) adapter.
- .4 Flange couplers may be used upon approval of Contract Administrator.
- .5 Fittings for LDPE pipe to be PVC insert fittings complete with stainless steel gear clamps.
- .6 Fittings for HDPE pipe to be butt fusion type for end-to-end joints.
- .7 SDR rating of HDPE fittings must match the SDR rating of the HDPE pipe specified.
- .8 HDPE pipe fittings to be molded or fabricated by the pipe manufacturer. HDPE pipe fittings and flange adapters made by contractors or distributors are prohibited.
- .9 Fittings for dripline and drip emitters to be compatible with specified dripline or emitter and as recommended by manufacturer. Acceptable fittings are:
 - .1 Hunter LOC series fittings size to dripline

2.38 PIPE SOLVENT AND PRIMER

- .1 PVC pipe solvent and primer combinations recommended by manufacturer and suitable for use with specified materials and application.
- .2 Use solvent and primer as directed by manufacturer. Use only solvent and primer that meets local codes.
- .3 The use of wet and dry solvent and primer is prohibited.

2.39 THRUST BLOCK

- .1 Thrust blocks to be 20MPa at 28 day strength. Thrust blocks can be either:
 - .1 Poured in place concrete.
 - .2 Pre-cast concrete block.

2.40 BACKFILL MATERIAL

- .1 Native excavated material shall be clean excavated soil, free from organic matter, stones larger than 25mm, building debris, and other foreign substances.
- .2 Sand: pit run sand.
- .3 25mm drain rock.

3.0 EXECUTION

3.1 EXISTING CONDITIONS

- .1 Report existing conditions at variance with Contract Drawings to Contract Administrator.
- .2 Verify locations of underground utilities prior to commencing excavation and conduct work so to prevent interruption and damage to services and utilities. Make good all damages to same at Contractor's cost.
- .3 Verify location of all services in building walls before boring or drilling holes. Make good all damages to same at Contractor's cost.
- .4 Protect existing conditions and completed work from disturbance during Work. Make good all damages to same at Contractor's cost.
- .5 Adjustments to installation of irrigation system to avoid existing conditions, completed work and utilities will be permitted subject to prior approval by Contract Administrator.

3.2 LAYOUT

- .1 Locations of irrigation components shown on plans are schematic in nature. Coordinate actual location of irrigation components with landscaping, building and physical features of site. Confirm proposed changes to location of irrigation components in writing with Contract Administrator prior to installation. Changes that markedly alter the irrigation design in the opinion of the Contract Administrator require submission of Shop Drawings and updated Design Report to the Contract Administrator for their permission to proceed. Record all approved revisions on a marked up set of Contract Drawings.
- .2 Layout and stake irrigation system per Contract Drawings to confirm:
 - .1 Layout is within project boundary and property lines
 - .2 Site grades are consistent with Contract Drawings
 - .3 Damage to root system of existing trees is minimized
 - .4 Installation of irrigation components to be minimum of 1 meter outside the dripline of existing trees.
 - .5 Minimum horizontal and vertical clearances from electrical and other utilities are met.
 - .6 Location of all sleeving, mainlines, pedestals, vaults, valve boxes, splice boxes.

.3 EXCAVATION

- .1 Excavate to ensure depth and bedding requirements are met.
- .2 All excavation is unclassified. Report any material or site condition that cannot be excavated by normal mechanical or normal means or that may affect excavation to required depth to Contract Administrator prior to excavation.
- .3 Identify and recycle all suitable materials recovered during construction.
- .4 Remove and dispose of buried debris exposed during excavation, including decommissioned irrigation materials and underground utilities, which may impede the proper installation and operation of irrigation system.

3.3 VAULT AND LID

- .1 Install vault in location on Contract Drawings or in alternate location approved or directed by Contract Administrator.
- .2 Support and brace point of connection components, piping and valves within vault using adjustable aluminum pipe stands complete with riser, pipe clamps, base plate and galvanized or stainless steel fittings in the quantity per service size indicated as follows:
 - .1 $\frac{3}{4}$ ": 2 supports
 - .2 1" to 2": 3 supports
 - .3 2 $\frac{1}{2}$ " to 3": 3 supports per vault
- .3 Use Schedule 80 fittings for all fittings inside vault.
- .4 Make connections of PVC pipe and metal pipe using male threads on PVC pipe and female threads on metal pipe.
- .5 Install vault drain and connect to drain pit, dry well, manhole or catch basin.

3.4 IRRIGATION CONTROLLER

- .1 Install irrigation controller in cabinet as per Contract Drawings.
- .2 Coordinate controller installation with that of other electrical components.
- .3 Install controller and wiring in accordance with local, provincial and national electrical codes.
- .4 Install communication components per manufacturer's recommendations and establish communication between controller and Owner's Central Control System, including relays or boosters as necessary.
- .5 Prior to issuance of Certificate of Substantial Performance request irrigation program from Contract Administrator and set controller program accordingly.

3.5 WEATHER SENSOR

- .1 The sensor shall be mounted within 200 feet of the irrigation controller.

3.6 CONTROL WIRE

- .1 Install control wire per code by qualified personnel employed by the company holding the electrical permit.
- .2 Bury control wire per applicable code and in no case above the bottom side of parallel pipe.
- .3 Bed control wire in sand with minimum 50mm sand around control wire. Where control wire is in same trench as pipe, place wire beside pipe with horizontal clearance of a minimum of 50mm and in accordance with BC Electrical Code depth.
- .4 Bundle multiple lengths of wire in same trench or conduit with ties at maximum 3.0m intervals.
- .5 Install wire with 600mm length of coiled slack at all changes of direction, in wire splice boxes and at connections to controlled components.
- .6 Identify all control wires entering controller cabinet with permanent label or tag indicating zone number of valves operated by each control wire.
- .7 Maintain consistent wire colour through wire splice box.
- .8 Minimize wire splices. Where wire splices are unavoidable make splice only in wire splice box using specified connector.
- .9 Identify spliced wire with permanent label or tag indicating zone number of spliced control valve.
- .10 Where specified on Contract Drawings, install extra control wire to wire splice box. Provide 600mm length of coiled slack of each wire end in wire splice box. Identify extra control wire as 'extra' wire with permanent label or tag.

3.7 GROUNDING AND BONDING

- .1 Install ground assembly in location shown on Contract Drawings or the revised location approved by the Contract Administrator.
- .2 Use the rod, plate and wire configuration as recommended by the manufacturer of irrigation controller and per BC Electrical Code.

3.8 SLEEVING

- .1 Install irrigation sleeves in locations shown on Contract Drawings.
- .2 Install irrigation sleeve to minimum depth as follows:
 - .1 Mainline Piping
 - .1 24" below walkways
 - .2 36" below driveways, roads and plazas

.2 Lateral Piping

- .1 12" below walkways
- .2 24" below driveways, roads and plazas
- .3 Install sleeves to extend 1.0m past edge of hard surface into soft landscape surface.
- .4 Cap sleeve with removable plug or cover. Maintain plug in sleeve until such time as pipe or wire is ready to be installed.
- .5 Bed sleeve as follows:
 - .1 Under walkways, 100mm of sand placed all around
 - .2 Under driveways, roads, and plazas, compacted base aggregate all around per materials shown on Drawings.
- .6 Bury a piece of detectable metal on top of each end of sleeve to enable location of sleeve end by metal detector after burial.
- .7 Stake location of each end of sleeve prior to backfilling such that top of stake is 300mm above finished grade and maintain. Label exposed end of stake with the word "sleeve".
- .8 Record location of sleeve ends and label size of sleeve on record drawings.
- .9 Remove sleeve stake after submission of Record Drawings.

3.9 VALVE BOXES

- .1 Install manual and electric control valves, control zone kits and quick coupler valves in valve boxes or concrete vault as shown on Drawings.
- .2 Except as shown otherwise on Contract Drawings or approved otherwise by Contract Administrator, locate valve boxes in planting beds and locate for ease of access, maintenance, and testing.
- .3 Install valve box flush with finish grade and arrange in a neat and orderly manner.
- .4 Valve box must have 150mm depth of 25mm drain rock. Wrap valve box in landscape fabric.
- .5 Provide minimum 150mm clearance between valve box and all components within.
- .6 Valve box must not contact irrigation pipe. Use matching valve box extensions as required.

3.10 WIRE SPLICE BOXES

- .1 Locate wire splice box in planting bed where possible and locate for ease of access, maintenance, and testing.
- .2 Install wire splice box per Contract Drawings and arrange in a neat and orderly manner.

- .3 Do not install valves in wire splice box.

3.11 ELECTRIC CONTROL VALVE

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.
- .2 Identify electric control valve with permanent label or tag indicating zone number.
- .3 Ensure 50mm gap between bottom of valve and top of drain rock.

3.12 DRIP ZONE KITS

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.
- .2 Identify electric control valve with permanent label or tag indicating zone number of valve.
- .3 Ensure 2" gap between bottom of valve and top of drain rock.

3.13 QUICK COUPLERS

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.

3.14 ISOLATION VALVE

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.
- .2 Where points of connections are located within a building, install isolation valve immediately downstream of where pipe exits building, installed in rectangular valve box.

3.15 BLOW-OUT ASSEMBLY

- .1 Install blow-out assembly immediately in vault at point of connection. In the case where the point of connection is inside a building, install blow-out connection immediately downstream of isolation valve where mainline pipe exits building.

3.16 FILTERS

- .1 Install filter in same valve box as valve, per manufacturer's recommendations and Contract Drawings.

3.17 SWING JOINT ASSEMBLY

- .1 Fabricate assembly of triple swing joint using three threaded Schedule 40 PVC elbows and one threaded Schedule 80 PVC nipple.
- .2 Install swing joint assembly to rotate counterclockwise when depressed.
- .3 Tape threads of PVC fittings with Teflon tape and make hand tight.

3.18 SPRINKLERS

- .1 Install per manufacturer's recommendations and in location shown on Contract Drawings.

- .2 Location of heads as illustrated on Contract Drawings is intended as a guide to layout of heads. Establish actual head locations in the field to ensure complete and adequate coverage of all areas to be irrigated and no overspray onto adjacent surfaces and improvements. Do not exceed head spacing shown on Contract Drawings.
- .3 Where obstructions or site improvements hinder or block head to head coverage advise Contract Administrator and determine best method to maximize coverage.

3.19 ROOT ZONE WATERING SYSTEM

- .1 Install root zone watering system as follows:
 - .1 Install sock over tube.
 - .2 Position units evenly spaced, adjacent to the root zone and within the canopy of the tree.
 - .3 Fill tube with pea gravel to 2" below bubbler.
 - .4 Connect to lateral pipe.
 - .5 Cover grate with duct tape or landscape fabric to prevent ingress of foreign material during construction. Remove prior to substantial completion.

3.20 LANDSCAPE DRIPLINE

- .1 Do not install driplines or emitters of different flow lengths or spacing on the same zone.
- .2 Place dripline on prepared surface. Surface to be free of sharp rocks or other objects that may damage dripline. Surface to be at grade necessary for dripline to be at specified depth after placement of remainder of topsoil or growing medium.
- .3 Placement of dripline by trenching using hand or mechanical methods permitted only if specified as such on Contract Drawings or upon written approval of Contract Administrator.
- .4 Thoroughly flush each zone after installation and before beginning regular operation of drip zone.
- .5 Stake dripline in beds every 450mm on centre.

3.21 DRIP EMITTERS

- .1 Install per manufacturer's recommendations and as shown on Contract Drawings.

3.22 LATERAL FLUSH ASSEMBLY

- .1 Install flush assembly on swing joint in valve box.
- .2 Coil hose in valve box.

3.23 PIPE AND FITTINGS

- .1 Verify that all pipe, fittings, primer and cements are compatible for proper installation.
- .2 Do not locate open side of trench any closer than 300mm from hard surface or feature.

- .3 Keep inside of pipe and outside of pipe ends always clean. Cap or plug open pipe ends to keep out dirt and debris.
- .4 Cut PVC pipe ends at right angle to pipe length. Clean burrs prior to joining pipe and fittings.
- .5 Immediately prior to joining pipe and fittings wipe contact surfaces clean with primer on clean rag.
- .6 Apply light coat pipe of cement on inside of fitting and heavier coat on outside of pipe. Insert pipe into fitting and give a quarter turn to seat cement. Wipe excess cement from outside of pipe.
- .7 Wrap male threads of threaded fittings with minimum 3 wraps of Teflon tape immediately prior to making connection.
- .8 Flush all irrigation pipe fully to remove accumulation of dirt and debris prior to installation of heads, dripline, emitters and filters. Flush all laterals in a manner approved by the manufacturer to prevent clogging of screens, nozzles and emitters.
- .9 Conduct mainline pressure test and HDPE pipe strap test and obtain approval of Contract Administrator prior to backfilling lines.
- .10 Sidewall fusion of HDPE is not acceptable.
- .11 Set mainlines and laterals on and backfill with sand to clearance limit shown on Drawings.
- .12 Install thrust blocks at all changes in direction of PVC pipe 2 1/2" in diameter or greater, and for any change in direction of gasketed pipe.

3.24 THRUST BLOCK

- .1 Place thrust block to support the pipe joints from separating, not to prevent the pipe from heaving. Do not cover top of pipe with concrete thrust blocking at change from a horizontal alignment to a vertical alignment.
- .2 For thrust blocks installed in disturbed soils increase the thrust block area by 50%.
- .3 Place 2 ply of 6mil polyethylene between pipe and thrust block.
- .4 Allow concrete to set before backfilling trench or pressurizing line.
- .5 Obtain approval from Contract Administrator prior to backfilling thrust block.

3.25 CLEAN UP AND RESTORATION

- .1 Remove all waste and debris resulting from irrigation installation from site.
- .2 Restore all disturbed surfaces to original condition and repair all trench settlement.

3.26 INSTRUCTIONS TO OWNER

- .1 Instruct Owner in complete operating and maintenance procedures for irrigation system, including start-up, winterization, and programming.
- .2 Review Record Drawings and Operating Manual with Owner on site.

3.27 MAINTENANCE - GENERAL

- .1 Inspect, operate, maintain and adjust irrigation system through the Landscape Maintenance Period until issuance of Certificate of Acceptance to ensure it operates as intended, including but not limited to:
 - .1 Adjust irrigation schedule to ensure survival, health and growth of plant material and respond to soil conditions, climate, and seasons of site.
 - .2 Clean sprinkler heads and adjust coverage to eliminate over watering, under watering and overspray onto adjacent surfaces.
 - .3 Monitor and clean filtration equipment.
 - .4 Restore grass areas, planting beds, hard surfaces and improvements affected by trench settlement and erosion.
 - .5 Respond to requests from Contract Administrator for program adjustments, servicing, adjustments and repairs.

3.28 MAINTENANCE – WINTERIZATION

- .1 During Maintenance Period be responsible for winterization of irrigation system at end of growing season and prior to onset of air temperatures below 0° Celsius. Be liable for any damage resulting from late or improper winterization.
- .2 Request presence of Owner at winterization at least 5 days prior to proposed winterization date.
- .3 Winterization includes but is not limited to:
 - .1 Saturation of soil with water to a depth of 300mm to provide deep watering of all lawn areas, planting beds and tree pits.
 - .2 Deactivation of controller
 - .3 Drainage and blow-out assembly of entire irrigation system.

3.29 MAINTENANCE – SPRING START-UP

- .1 During Maintenance Period be responsible for spring start-up of irrigation system at beginning of growing season or within 10 days of request for start-up from Owner. Be liable for any damage resulting from late or improper start-up.

- .2 Ensure Owner is present for spring start-up. Request presence of Owner at least 5 days prior to proposed start-up.
- .3 Spring start-up includes but is not limited to:
 - .1 Checking and testing for leaks
 - .2 Cycling irrigation control program through all zones to ensure proper function and performance
 - .3 Checking and adjusting heads and emitters to achieve even coverage with minimum overspray onto other surfaces.
 - .4 Test backflow prevention assembly. Submit test results to Contract Administrator.
 - .5 Saturation of soil with water to a depth of 300mm to provide deep watering of all lawn areas, planting beds and tree pits

3.30 GUARANTEE

- .1 Submit written guarantee, in approved form, stating that all work showing defects in materials, workmanship or operation will be repaired or replaced at no cost to Owner for a period of one year from date of Substantial Performance.
- .2 Guarantee includes the supply of labour, materials and equipment necessary for the repair and replacement of damaged or defective materials and workmanship. Guarantee also includes spring start-up, winterization, maintenance, necessary testing, program corrections or adjustments and restoration of settled trenches.
- .3 Guarantee will not apply to materials or workmanship damaged after Substantial Performance by causes beyond the Contractor's control, such as vandalism or abuse.

*****END OF SECTION*****