

## 1.0 GENERAL

### 1.1 Related Work

- 1.1.1 Section 01300 - Shop Drawings, Production Date/Samples
- 1.1.2 Section 01721 - Project Record Documents
- 1.1.3 Section 02210 - Site Grading – Rough
- 1.1.4 Section 02212 - Planting Soil and Finish
- 1.1.5 Section 02950 - Trees, Shrubs and Ground Covers

### 1.2 Site Conditions

- 1.2.1 The Contractor shall examine the work of other Sections upon which the work of this Section depends and correct any defects.
- 1.2.2 Contractor shall protect the irrigation system from contamination during construction by blocking all open pipe ends.

### 1.3 Laying Out Work and Inspections

- 1.3.1 All work shall be laid out by the Contractor who shall be fully responsible for the accuracy thereof.
- 1.3.2 The Contractor shall stake locations of heads and valves and receive approval from the Consultant prior to excavation and installation.
- 1.3.3 The Contractor shall have all materials inspected and approved by the Consultant prior to installation.
- 1.3.4 The Contractor shall not allow nor cause any of their work to be covered or enclosed until it has been inspected, tested, and approved by the Consultant. Should any of the work be enclosed or covered before such inspection and test, it shall be uncovered at the Contractor's expense; and after it has been inspected, tested and approved, the contractor shall make all repairs with like materials necessary to restore all work and that of other Contractors to its original conditions.
- 1.3.5 The Contractor agrees to supply all necessary materials and equipment for the proper installation of automated systems.
- 1.3.6 The contractor shall notify the Consultant 48 hours in advance of commencing irrigation system installation.

### 1.4 Testing

- 1.4.1 Upon completion of the irrigation system, the Contractor shall notify the Consultant to schedule final testing and balancing of the system at a time when both parties are on site. In the presence of the Consultant, the Contractor shall test all components of the irrigation system. The Consultant shall only indicate acceptance of the system once all

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components (individually and systemically) are operating as intended and all deficiencies have been corrected.

- 1.4.2 Upon completion of the irrigation system all cross connection control equipment must be tested in accordance with “The Regina Water Bylaw – No. 8942.” Upon completion of the cross connection test the test report shall be submitted to the Consultant.
- 1.4.3 The Contractor shall be responsible to hydrostatically test the system for 24 hours at 75 psi. Upon completion of the hydrostatic test all components shall be checked for proper operation and settings.

#### 1.5 Balancing and Adjustments

- 1.5.1 The Contractor shall balance and adjust the various components of the sprinkler system so the overall operation is most efficient and coverage is uniform.
- 1.5.2 The Contractor’s price shall reflect 100% coverage of all irrigated area.

#### 1.6 As-Built Plan

- 1.6.1 The as-built irrigation plan must be updated daily in the field as work progresses. The Contractor shall supply the Consultant with a **final as-built plan in the form of an AutoCAD R14, R2000 or R2004 digital file**, showing the exact location of all components of the system including all irrigation pipe, sprinkler heads, valves, water supply, curb stops, exact trench location for all buried wire and service connection data for all trades. All as-built irrigation plans shall also include irrigation valve & sprinkler tables, controller schedule and design tables and irrigation central control software information tables (see schedule 1.0 for examples).
- 1.6.2 The Contractor shall provide three (3) copies of the parts list and irrigation maintenance manual in a three ring, hard cover, ‘D’ binder and a digital copy in Microsoft Word 97 format or later.
- 1.6.3 Irrigation maintenance manuals shall include:
  - .1 Mechanical System: mechanical drawing, design team information, valve tag directory, description or theory of operation, operating guidelines.
  - .2 Electrical System: Electrical drawing, design team, valve tag directory, panel control and indicators, description or theory on the operation, operating guidelines, equipment software.
  - .3 Components: pumps, backflow, water meters, master valve, water service, control equipment, manual valves, electric valves, purge or filter equipment, flow sensors, pressure switches and gauges, piping, saddles, swing joints, wires, wire connectors, equipment software.

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- .4 Schedules: E.T. rates, irrigation valve and sprinkler information, irrigation controller schedule design information, Irrigation central control software information (see schedule 1.0 for examples), maintenance schedule.
  - .5 Supplier or Agent and Manufacturer
  - .6 Certification and Warranty: include an equipment list, copy of the cross connection testing and inspection report.
  - .7 Procedures: normal sequence of operation, operating functions, preventative maintenance, winterizing components, software and alarm. Contractor shall also submit any tools necessary for the adjustment or operation of the system.
  - .8 As-built Drawing: include a copy of the as-built drawing folded in a plastic cover in the binder.
  - .9 Safety: any specialized safety equipment or procedures relevant to the project.
- 1.7 Maintenance
- 1.7.1 The Contractor shall test and adjust all equipment upon completion of installation for a smooth trouble-free operation of the irrigation system.
  - 1.7.2 Defects or misalignment of any part of the Work caused by settlement of bedding or backfill material within the warranty period shall be corrected by the Contractor at their expense. Depressions caused by such settlement in excess of specified depths shall be repaired by the Contractor at their expense. Corrections to defective or deficient Work shall be carried out within 48 hours of notification by the Consultant.
  - 1.7.3 Emergency repairs may be required to protect property or permit operation of the irrigation system. The Consultant shall notify the Contractor immediately by telephone upon becoming aware of any problem requiring emergency repairs to protect property or to permit proper operation of the irrigation system. Upon receiving notice, the Contractor shall complete the required repairs within 24 hours. If the repairs are not made within 24 hours, the Consultant will arrange for the emergency repairs to be carried out and the Contractor will be responsible for the costs of the said repairs.
  - 1.7.4 Maintenance not of an emergency nature shall be brought to the attention of the Contractor in writing and the Contractor shall take the necessary action to correct the faulty Work within 72 hours.
  - 1.7.5 The Contractor shall winterize all of the irrigation equipment and material, prior to freeze up in the fall of the year the project is completed, turn off the main supply, open drains and valves and winterize backflow equipment. The contractor shall not use a compressor for winterizing backflow equipment, master valve or meter.

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- 1.7.6 The Contractor shall blow out all irrigation lines and equipment prior to freeze up in the fall of the year the project is completed. The Contractor shall use a compressor that does not exceed 80 psi operating pressure.
  - 1.7.7 The Contractor shall not contaminate the City of Regina water supply system during the winterising process. Any valves or equipment that must stay open to the atmosphere must be plugged or capped to ensure City of Regina water supply is not contaminated.
  - 1.7.8 The Contractor is responsible to reactivate the system in the spring following the construction completion year. The Contractor shall notify and receive approval from the Owner before reactivating the system.
  - 1.7.9 The Contractor shall familiarize the Owner with the operation of the irrigation system and locations of control equipment.
- 1.8 Flushing
- 1.8.1 The Contractor shall flush all lines and valves between the main curb stop and cross connection control equipment.
  - 1.8.2 The Contractor shall flush main lines prior to the installation of valves and sprinklers.
  - 1.8.3 The Contractor shall flush lateral lines before the installation of any sprinklers.
  - 1.8.4 The Contractor shall notify the Consultant 48 hours in advance of flushing any irrigation lines.
- 1.9 Warranty
- 1.9.1 All irrigation system equipment and installation shall be warranted for one full year following the issuance of the substantial performance certificate for the project. Equipment and installation damage due to vandalism is exempt.
  - 1.9.2 Where the manufacturers warranty exceeds the 1 year construction warranty, the Contractor obligation must extend the full manufacturer's warranty to the city.
  - 1.9.3 The Contractor obligation is to repair vandalism during the construction warranty period at the Owners expense. All vandalism repairs must be completed within 48 hours of notification and be approved by the Owner.
- 1.10 Salvage of Existing Irrigation Equipment
- 1.10.1 Contractor shall remove and salvage all existing irrigation equipment before commencing construction.
  - 1.10.2 Any existing material left on the site must be shown on as-built drawings and itemized in the irrigation manuals.

## 2.0 PRODUCTS

### 2.1 Pipe

- 2.1.1 100 mm and larger pipe shall be series 100 high-density polyethylene pipe conforming to ASTM F714, DR17 min.
- 2.1.2 75 mm pipe shall be series 75 low-density polyethylene pipe conforming to CSA CAN3-B137.1, ASTM D2239.
- 2.1.3 50 mm and smaller low-density polyethylene pipe shall be series 75 conforming to CSA CAN3-B137.1, ASTM D2239.

### 2.2 High and Low Density Pipe Fittings

#### 2.2.1 Fittings shall conform to the following:

- .1 PVC elbows, tees, couplings, bushings, plugs and unions 50 mm and smaller to ASTM D2464 Schedule 80 PVC Type 1 (cell classification 12454-B).
- .2 PVC nipples to ASTM D2609 Schedule 80 PVC Type 1 (cell classification 12454-B).

2.2.2 All fittings larger than 50 mm shall be high density. Requests for PVC fittings may be assessed on a case by case basis and approval provided to the contractor in writing by the Consultant.

2.2.3 Saddles shall be heavy duty and of brass construction. Saddles shall be Bayco, Rainbow or approved equal.

2.2.4 Pipe clamps shall be of stainless steel construction. Pipe clamps shall be Oetiker stepless clamp, minimum 9 mm band; Tridon clamp or approved equal.

### 2.3 High Density Pipe Fittings

2.3.1 Brass saddles shall be used in an assembly consisting of high density polyethylene pipe and swing joints utilizing PVC threaded fittings, or an approved combination of high density polyethylene mainline and low density polyethylene as may be found within a low pressure system (less than 75 PSI operating pressures).

2.3.2 PVC saddles for pipe which is 75 mm and larger, shall be "Cal-Am" No. 4400 Series or approved equal.

2.3.3 All fittings such as tees, reducers, end caps and flange assemblies shall be made from the same type and grade of polyethylene, from the same raw material supplier as the pipe, and shall be butt-fused or electric fused, PE 3408, ASTM 1055, to pipe ends.

2.4 Swing Joints

- 2.4.1 Swing joints shall be constructed per City of Regina standard detail drawings or be a pre-manufactured Spears/Lasco 'O-Ring' swing joint or approved equal.
- 2.4.2 Swing joints shall be Schedule 80 PVC Type 1, cell classification 12454-B.
- 2.4.3 Swing joints on systems with operating pressure exceeding 75 psi or valve and head systems shall be Schedule 80 PVC Type 1, cell classification 12454-B, pre-manufactured O-ring swing joints, 315 psi rating, 12 lay length, B.I.P.T.

2.5 120 Volt Electrical Wiring / Direct Burial Wire

- 2.5.1 All 120 V power supply to the field controllers shall be comprised of a bonded neutral plus a ground wire of one continuous length, buried in a trench and installed with a minimum separation of 300 mm from the 24V supply wires and irrigation wires.
- 2.5.2 The contractor shall provide a ground conductor used for machine grounding only. The ground conductor shall be bonded to the machine within the main control panel enclosure and each auxiliary panel enclosure.
- 2.5.3 The contractor shall provide a common connection point for all grounding conductors.

2.6 Control Wiring

- 2.6.1 Standards for control wire shall meet the Canadian Electrical Code Standards.
- 2.6.2 All 24-volt wire shall be #10, #12 and #14 gauge T.W.U. -40° solid core wire.
- 2.6.3 All 24-volt wires from the master valve to the controller shall be red in colour.
- 2.6.4 All 24-volt wires from the water meter to the controller shall be yellow in colour.
- 2.6.5 All 24-volt tracer wires shall be #12, green in colour.
- 2.6.6 All 24-volt common wires shall be a minimum of #12, white in colour.
- 2.6.7 Colours for all other 24 volt wires shall be any colour other than white, yellow, red and green.

2.7 Automatic Controllers

- 2.7.1 Controllers shall be compatible with the City's Motorola Radio controlled MIR/Moscad irrigation system and with 5 watt radios.

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- 2.7.2 Controllers shall be housed in a weatherproof, vandal resistant pedestal mounted enclosure which is CSA approved and lockable, or shall be wall mounted within an existing building per detail drawings.
  - 2.7.3 Controllers shall have electrical surge protection capacity and proper grounding to protect the controller from electrical shock and lightning.
- 2.8 Sprinkler Heads
- 2.8.1 Sprinkler heads must be new with product manufacturer date stamp within the year of construction.
  - 2.8.2 Spray heads shall have ratcheting riser features on all bodies. Spray heads shall be Toro 570C 4P, 12P; Rainbird 1804, 1812; Hunter Pros 04, Pros 12 or approved equal.
  - 2.8.3 Sprinklers in areas that are less than 12 meters in width, shall be a gear driven head, a minimum of 6 gallons per minute, have stainless steel risers and be adjustable from the top of the sprinkler. Sprinklers must also contain a drain check valve to prevent low head drainage.
  - 2.8.4 Sprinklers in areas that are less than 12 meters shall be Hunter I-20 Ultra, Rainbird 5000 Plus or approved equal.
  - 2.8.5 Sprinklers for turf areas with sprinkler spacing up to 20 meters shall be a gear driven rotor head, a minimum of 12 gallons per minute, have a rubber cover and stainless steel riser and adjustable from the top of the sprinkler. The sprinkler must contain a drain check valve to prevent low head drainage.
  - 2.8.6 Sprinklers in areas with sprinkler spacing up to 20 meters shall be Hunter I-35 Plus, Rainbird 7005, Toro 640 or approved equal.
  - 2.8.7 Sprinklers for athletic areas with spacing up to 20 meters shall be a gear driven head with rubber cover, stainless steel riser and be adjustable from the top of the sprinkler.
- 2.9 Quick Couplers
- 2.9.1 Quick couplers shall be Rainbird Double Slotted 5RC-BSP 25mm or approved equal.
- 2.10 Water Main Connection/Meter
- 2.10.1 Connection shall be installed per City of Regina construction details.
- 2.11 Automatic Electric Valves
- 2.11.1 Automatic electric valves shall work with flows and pressure conditions ranging from 40psi – 75psi.
  - 2.11.2 Automatic electric valves shall be 24 volt AC electric powered, industrial strength, complete with internal manual bleed, flow control, non-rising handle and BSP threads made from material rated at 150 psi or greater.
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- 2.11.3 Automatic electric valves shall be Irritrol 700, Toro Ultra Flow 38mm and 50mm or approved equal.
  - 2.11.4 All automatic electric valves shall have plastic ID tags labelled clearly to match the numbers at the controller.
  - 2.11.5 All automatic electric valve ID tags must be numbered sequentially, be bright yellow, be a minimum 50mm x 50mm, and attached using nylon locking cable ties.
  - 2.11.6 All automatic electric valves used for reclaimed water must have purple ID tags.
  - 2.11.7 All automatic electric valves shall be CSA approved.
  - 2.11.8 Location of valves are as noted on drawings.
- 2.12 Gate Valves
- 2.12.1 Gate valves 50mm and smaller shall be Toyo Red and White, Model 280A 200 W.O.G. or approved equal.
  - 2.12.2 All gate valves shall have a plastic ID tag labelled clearly to match the number at the controller.
  - 2.12.3 All gate valve ID tags must be numbered sequentially, be bright yellow, be a minimum 50mm x 50mm, and attached using nylon locking cable ties.
  - 2.12.4 All gate valves used for reclaimed water must have purple ID tags.
  - 2.12.5 All gate valves 50mm and smaller shall be threaded, 200 W.O.G. CSA approved.
  - 2.12.6 All gate valves 75mm and larger shall be flanged and resilient seated. Type of valve to be specified on drawings or by Consultant.
  - 2.12.7 All gate valves 75mm and larger shall have a drain and shall be in full compliance with the latest edition of AWWA509.
  - 2.12.8 Direct buried valves to have a non-rising stem with a 50mm sq. AWWA standard wrench nut and open with a counter clockwise rotation.
  - 2.12.9 Direct buried valves to have stainless steel bolting and exterior asphaltic or fusion bonded epoxy coating suitable for direct bury service.
  - 2.12.10 All bronze or brass components to conform to Section 2, Table 1, Grade A, D or E with stem material of Grade E as published within AWWA C509 latest edition.
- 2.13 Butterfly Valves
- 2.13.1 Shall be resilient seated and flanged; Body: Cast Iron ASTM A126; Seat: EPDM, Stem: Stainless Steel; Disc: 316 Stainless Steel; Pressure Rating: 200psi.
- 2.14 Valve Boxes
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- 2.14.1 Valve boxes shall be prefabricated plastic boxes complete with locking cover.
- 2.14.2 For all valve locations, valve boxes shall be Carson Industries #1324-15B, or approved equal. Maximum 2 valves per box.
- 2.14.3 For electrical splices and quick couplers, Carson Industries #910-12B boxes or approved equal shall be used.
- 2.14.4 Boxes shall be green in colour.
- 2.15 Sleeves
  - 2.15.1 Sleeves shall be 2 dimensional sizes larger than pipe diameter to allow clear passage of all water lines. Sleeve shall extend a minimum of 300 mm beyond the edge of surfaces.
  - 2.15.2 Sleeves in areas subject to vehicular traffic shall be schedule 40 steel or corrugated metal culverts.
  - 2.15.3 All sleeves shall be a continuous length.
  - 2.15.4 Sleeves in areas subject to pedestrian traffic shall be PVC: SDR-35, SDR-28; Polyethylene: 50 mm and under, to CSA B137.1 Series 75; ABS: DB-2 or approved equal.
- 2.16 Main Connection / Water Meter
  - 2.16.1 Meter/Master valves sized 38 mm, 50mm, and 75mm, to be Arad Hydrometer Model BM or approved equal.
  - 2.16.2 Meter reading to be in U.S. gallons
  - 2.16.3 Contractor shall be responsible for all water costs until Final Completion of the project.
- 2.17 Backflow Preventer
  - 2.17.1 Backflow preventer shall be 50mm Wilkins 950XL ball valves c/w test port, 75mm Watts 757 Colt with NRS gate valve, 100mm Watts 709 D.C. with NRS gate valve or approved equal.
- 2.18 Nuts and Bolts
  - 2.18.1 Stainless steel nuts and bolts on direct buried or submerged applications shall conform to ASTM A 193 Grade B8 or B8M.
  - 2.18.2 Exposed service – Carbon steel bolts conforming to ASTM A193 Grade B7. Carbon steel nuts conforming to ASTM A194 Grade 2H, semi-finished hex head. Nuts and bolts to be electroplated with Zinc per ASTM B633 – latest edition, Type 1 coating. Hot dip galvanizing is not acceptable.

### 3.0 EXECUTION

#### 3.1 Excavation

- 3.1.1 All excavation shall include all materials encountered except materials which cannot be excavated by normal mechanical excavation means. Such exceptions shall be brought to the attention of the Consultant and a price adjustment shall be agreed upon before excavation of these areas proceeds. Such price adjustments and agreement shall include responsibility for disposal of the unsuitable materials removed from the trench and the acquiring of additional backfill material.
- 3.1.2 The depth of cover over 25 mm, 38 mm, 50 mm and solvent welded 75 mm lateral pipes shall be no less than 300 mm, and no more than 450mm. The depth of cover over 75 mm and 100 mm main lines shall be no less than 450 mm, and no more than 600mm. The depth of cover over 150 mm main lines shall be no less than 600mm, and no more than 700mm.
- 3.1.3 Where trenches are over-excavated, they shall be backfilled and tamped to provide compacted bearing for the pipe.
- 3.1.4 Backfill material shall be free from rocks, large stones, and other unsuitable substances, which could damage the pipe or create unusual settling problems. Backfilling shall be done in 150mm lifts and tamped after each lift is put in to prevent excessive settling.
- 3.1.5 Chain trenchers shall be equipped with a “crumber”, or trenches shall be manually cleaned of loose material.
- 3.1.6 Excavated material shall not be left on the turf beside the trench for a period of more than 72 hours.
- 3.1.7 The Contractor shall repair all landscape elements damaged in the course of this contract.
- 3.1.8 The Contractor shall avoid damage to any and all underground utilities and structures. The Contractor shall notify the Owner of all underground utilities including power, gas, telephones, Access Communications and City of Regina utilities and have the locations staked prior to commencing excavations.
- 3.1.9 Sleeves shall be installed where pipes or electrical wires pass under roads or walks.
- 3.1.10 The minimum width of trenches for main pipes shall be 150 mm wider than the O.D. size of the pipe in the trench (i.e. 100 mm pipe requires 250 mm trench width, etc.)
- 3.1.11 Where trenches cross existing turf areas that are to be re-seeded or sodded the backfill trench must be re-compacted and re-seeded using the seed mixture appropriate for that area. After the trench has been backfilled and recompacted, all trenching debris shall be removed from the grass on each side of the trench by hand raking or other suitable means. The Contractor

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shall be responsible for watering the trench area until the turf is established and accepted as per the specification for seeding and shall repair any settling of the trench during the warranty period.

3.1.12 In all cases pipe and heads shall be located 450 mm inside the property lines or perimeter boundaries as indicated on the drawings.

3.1.13 Work shall be scheduled in such a manner that all excavations are back filled at the end of each working day.

### 3.2 Installation of Pipes

3.2.1 Lateral lines may be installed by standard trenching techniques or by "pulling in" pipe. If the pull-in method is used, the pipe "plough" shall be a vibratory type. The "Bullet" which precedes the pipe and is used to form the opening for the pipe, shall not be less than 25 mm larger in diameter than the outside diameter of the pipe.

3.2.2 The ridge created by the vibratory plough shall be eliminated by light mechanical tamping, so that the soil over the pipe is returned to its original grade.

3.2.3 The pipe shall be left uncovered at this stage for inspection by the Consultant and shall not be backfilled until the Consultants approval has been given.

3.2.4 Where gasket repair couplings are used for splicing or joining, the enclosed gap in the pipe shall not exceed 25 mm for pipe sizes 100 mm and smaller.

### 3.3 Sprinkler Heads

3.3.1 Locations for sprinkler heads shall be as noted on the drawings.

3.3.2 All sprinkler heads shall be installed on swing joints as shown on the City of Regina detailed drawings.

3.3.3 The sprinkler heads shall be installed so that the top is at the finished grade level.

3.3.4 The Contractor shall place backfill around the swing joint and sprinkler in 100mm compacted lifts.

3.3.5 The Contractor shall ensure that backfill around the sprinkler is tamped.

### 3.4 Quick-Coupling Valves

3.4.1 All quick-coupling valves shall be installed on swing joints, complete with a 1 meter length of 10M rebar attached with 2 HAS 36 S.S hose clamps for stabilization. See City of Regina detailed drawing.

3.4.2 The quick-coupling valve shall be installed so that the top is at finished grade level.

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- 3.4.3 Backfill around the swing joint and quick-coupling valves shall be free of rocks larger than 12 mm in diameter, roots, debris, and other extraneous matter.
  - 3.4.4 All quick-coupling valves shall be installed in a Carson #910 valve box unless otherwise noted.
  - 3.4.5 There shall be a quick-coupling valve installed in a Carson #910 valve box at the ends of all main lines for winterization. All other quick-coupling locations are as shown on the drawings.
- 3.5 Gate Valves
- 3.5.1 Valves shall be installed according to manufacturer's instructions.
  - 3.5.2 Locations for gate valves are as noted on the drawings.
  - 3.5.3 The valve shall be installed in a valve box set plumb and flush with finished grade.
  - 3.5.4 The valve box shall have 150 mm depth of pea gravel below the valve on a stable sub-grade.
  - 3.5.5 The top of the valve cross-handle shall be 100 mm below the bottom of the valve box lid.
  - 3.5.6 The bottom of the valve box shall be supported on pea gravel and compacted soil so that it can support the weight of turf maintenance machinery without movement.
  - 3.5.7 Threaded gate valves shall be installed using Schedule 80 P.V.C. unions on each side.
- 3.6 Butterfly Valves
- 3.6.1 Valves shall be installed according to manufacturer's instructions.
  - 3.6.2 Butterfly valves shall be used only within a building.
  - 3.6.3 Contractor must notify and receive consent in writing from the Owner before using a butterfly valve on any project. (Kits butterfly valves preferred)
  - 3.6.4 The valve shall be installed in a valve box set plumb and flush with finished grade.
  - 3.6.5 The valve box shall have 150 mm depth of pea gravel below the valve on a stable sub-grade.
  - 3.6.6 The valve shall be marked with a stake to prevent damage by equipment.
  - 3.6.7 The top of the valve cross-handle shall be 100 mm below the bottom of the valve box lid.
  - 3.6.8 The bottom of the valve box shall be supported on pea gravel and compacted soil so that it can support the weight of turf maintenance machinery without movement.
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- 3.6.9 All butterfly valves shall be CSA approved.
  - 3.6.10 All butterfly valves 75mm and larger shall be flanged and resilient seated. Type of valve to be specified on drawings or by Consultant.
  - 3.6.11 All gate valves 75mm and larger shall have a drain and shall be in full compliance with the latest edition of AWWA509.
- 3.7 Automatic Valves
- 3.7.1 Valves shall be installed according to manufacturer's instructions.
  - 3.7.2 The valve shall be installed in a valve box set plumb and flush with finished grade.
  - 3.7.3 The valve box shall have 150mm depth of pea gravel below the valve on a stable sub-grade.
  - 3.7.4 The top of the valve cross-handle shall be 100 mm below the bottom of the valve box lid.
  - 3.7.5 The bottom of the valve box shall be supported on pea gravel and compacted soil so that it can support the weight of turf maintenance machinery without movement.
  - 3.7.6 All electric valves shall be installed using Schedule 80 P.V.C. threaded unions on each side.
  - 3.7.7 All electric valves shall be CSA approved.
- 3.8 Electrical Wiring
- 3.8.1 Control wires shall be installed in a neat and orderly fashion and may be installed in the pipe trenches or ploughed in. The wires shall be bundled together and taped every 3 m when placed in trenches.
  - 3.8.2 Splicing shall be minimized.
  - 3.8.3 All electrical wiring shall be installed in accordance with existing codes.
  - 3.8.4 Where wire is installed by ploughing, standard wire ploughing techniques and equipment shall be used (wire chutes and reels). Care must be taken to provide adequate "slack" in the wire as it enters the wire chute. If motorized wire reels are not in use, then an assistant shall walk behind the plough and manually unreel the wire and feed slack into the wire chute.
  - 3.8.5 Contractor shall install electrical services at the entrance to the park. Contractor shall have location approved by consultant prior to installation.
  - 3.8.6 Control wires shall be direct burial CSA approved TWU-40 #14 minimum. Control wire to be of a different colour than the 120 A services to controllers.
  - 3.8.7 Control wires shall be individually identified with 3M ScotchCode STD wire markers (or approved equal) inside the controller housing. All valves must have a valve identification tag.
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- 3.8.8 Splices shall be made waterproof with the use of an outdoor waterproof wire connector such as 3M DBY/DBR or approved equal. Field splices shall be looped and located in a Carson Industries #910 junction box.
  - 3.8.9 All wiring shall be bundled together, taped every 3 m and placed at the bottom of the pipe trench. Some slack in the wire shall be allowed for contraction and expansion.
  - 3.8.10 In instances where control wire does not follow the irrigation line and is beneath a hard surface area, the control wire shall be installed in a separate polyethylene or PVC sleeve.
- 3.9 Automatic Controllers
- 3.9.1 Automatic controllers shall be installed according to the manufacturer's recommendations.
  - 3.9.2 Automatic controller location is schematic and shall be specifically located by the Consultant.
  - 3.9.3 The Contractor shall install controller inside buildings at locations generally shown on the drawing. The exact location shall be determined by the Consultant.
  - 3.9.4 All wiring shall be done in a neat, orderly manner and shall be in compliance with local codes and the Canadian electrical codes, including grounding. Provide separate grounding for controllers. All 24-volt control lines shall be run to the outside in an electrical conduit.
  - 3.9.5 The Contractor shall place the two 50 mm PVC pipe sleeves from inside the controller to a point 300 mm outside the concrete base at a depth of 600 mm. These sleeves will be used for the power feed to the controller and for the valve wiring. The radius of the bend will be 6 times the diameter of the conduit.
  - 3.9.6 The initial programming of the controller shall be undertaken prior to take-over by City of Regina maintenance staff.
  - 3.9.7 Contractor shall install a terminal block for wiring and provide a temporary controller until final inspection.
  - 3.9.8 Contractor shall install a set of wires for each valve to the controller.
  - 3.9.9 Contractor shall use a continuous wire run where roll sizes allow.
  - 3.9.10 Contractor shall install an additional 24 volt wire for every 5 valves installed.
  - 3.9.11 Contractor shall tag and ID both ends of the spare wire as spare.
- 3.10 Water Service Connection and Meter Box
- 3.10.1 Water service connection shall be made by the Contractor at the location shown on the plan.
  - 3.10.2 Contractor shall install all water service components and water service box per City of Regina Construction Details.
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- 3.10.3 Any damage to the water connection or meter will be the Contractor's responsibility.
- 3.10.4 Contractor shall maintain accurate records of the water meter installations.
- 3.10.5 Contractor shall complete a Water Meter Installation form for each location as supplied by the City of Regina.
- 3.10.6 Contractor shall be responsible for providing proper information tracking and records for all meter installations to the City.
- 3.10.7 Contractor shall provide the following information:
  - .1 Meter reading and serial number of the installed water meter.
  - .2 Date of installation.
  - .3 Meter reading and serial number of removed water meter if applicable.
  - .4 Other information as applicable.
- 3.10.8 Contractor shall return accumulated data on meter installations to the Consultant on the first day of each week.
- 3.11 115 Volt and Greater Main Power Connection and Meter
  - 3.11.1 Installation, connection and all applications shall be done in accordance with Canadian Electrical Codes.
  - 3.11.2 The contractor shall make application for the power meter on behalf of the Owner.
  - 3.11.3 The Contractor shall assume all costs associated with the power meter and the power until the conditions of Substantial Performance are met.
  - 3.11.4 Contractor shall assume all costs associated with the application and change over of the power billing.
- 3.12 Backflow Preventer
  - 3.12.1 Contractor shall install in accordance with the manufacturers information and the *City of Regina Water Bylaw 8942*.
  - 3.12.2 Contractor shall submit a backflow inspection and testing report to the City of Regina prior to the Owner issuing Substantial Performance.