

**SECTION 32 84 00
PLANTING IRRIGATION**

PART 1 - GENERAL

1.1 DESCRIPTION

- A. An automatically-controlled irrigation system, complete, including piping, drip emitters, valves, controls, control wiring, fittings, electrical connections and necessary accessories.
- B. The Design intent of this work includes 2 controllers:
 - 1. Controller A is an existing 48 station controller. The new work as indicated on Drawings shall be integrated with Controller A.
 - 2. Controller B is a new 18 station controller that replaces an existing 12 station controller (indicated on plans).
 - 3. For both controllers A and B, Contractor shall unify control valve programming, incorporating all irrigation valves previously connected to the existing controller, and remaining in operation. Modify the systems as shown on Drawings.

1.2 RELATED WORK

- A. Concrete: Section **32 13 20**, SITE CONCRETE.
- B. Maintenance of Existing Utilities: Section **01 00 00**, GENERAL REQUIREMENTS.
- C. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section **31 20 00**, EARTH MOVING.
- D. Division 26, ELECTRICAL.
- E. Section 32 90 00, PLANTING
- F. Procedures and requirements for managing and disposing construction and demolition waste: Section **01 74 19**, CONSTRUCTION WASTE MANAGEMENT.

1.3 QUALITY ASSURANCE

- A. Criteria:
 - 1. Manufacturer regularly and presently manufactures the item submitted as one of their principal products.
 - 2. There is a permanent service organization, maintained or trained by the manufacturer, which will render satisfactory service within eight hours of receipt of notification that service is requested.
 - 3. Installer, or supplier of a service, has technical qualifications, experience, and trained personnel and facilities to perform the specified work.
- B. Products Criteria:
 - 1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.
 - 2. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
 - a. All components of an assembled unit need not be products of the same manufacturer but component parts which are alike are the product of a single manufacturer.
 - b. Components are compatible with each other and with the total assembly for the intended service.
 - 3. Nameplates: Nameplate bearing manufacturer's name or identification trademark securely affixed in a conspicuous place on equipment, or name or trademark cast

- integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- C. System Requirements:
1. Full and complete coverage is required. Contractor shall, at no additional cost to the Government, make necessary adjustments to layout required to achieve full coverage of irrigated areas.
 2. This system is designed to work at xx psi minimum available pressure. Notify Resident Engineer immediately of any discrepancies.
 3. Layout work as closely as possible to drawings. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown. Lines are to be common trenched wherever possible.
 4. Locations of remote control valves is schematic. Remote control valves shall be grouped wherever possible and aligned at a set dimension back of curb along roads.
 5. Irrigation lines and control wire shall run through designated utility lanes or beside roadways where most appropriate.
 6. Connect new pipe systems to existing mains where shown and specified. Disconnect and abandon existing irrigation system to be abandoned.
 7. Connect existing and new RCV wires to new controllers where shown and as specified as accepted by Resident Engineer.
 8. Contractor is responsible for installing all equipment indicated both on drawings and as recommended by the manufacturer for an operational and functioning drip system. This includes flushing end valves, check valves, and visual pop-up indicators.
- D. Maintenance and Operating Instructions: Prior to final acceptance, verbal instructions, for a period of not less than 8 hours, shall be provided to the operating personnel. Provide two additional years of software support for one hour each month. Provide manuals as specified in Section 01 00 00, GENERAL REQUIREMENTS.
- E. Completely program existing controller and satellites according to approved irrigation schedule. Contractor shall make continuous adjustments to the programming as required from irrigation installation completion to the end of the Maintenance Period, to provide adequate watering of new plant materials. Plants shall not be overwatered resulting in plant health issues, or drainage issues. Bring any irrigation issues immediately to the attention of the Resident Engineer.
- F. Follow manufacturer's instructions for installation.
- G. Manufacturer of Control Systems to certify Control System is complete, including all related components, and totally operational. Submit certificate to Resident Engineer.
- H. As-Built Record Drawings: Maintain a complete set of as-built drawings which shall be corrected daily to show changes in locations of all pipe, valves, pumps and related irrigation equipment. Valves shall be shown with dimensions to reference points.
- I. Controller Chart:
1. Consolidate information from existing system (to remain) with new system.
 2. Prepare a map diagram showing location of all valves, lateral lines, and route of the control wires. Identify all valves as to size, station, number and type of irrigation. "As-built" drawings must be approved before charts are prepared.
 3. Provide one controller chart showing the area covered by controller for each automatic controller supplied at the maximum size controller door will allow. Chart shall be a reduced drawing of the actual "as-built" system. If controller sequence is not legible when the drawing is reduced to door size, the drawing shall be enlarged to a size that is readable and placed folded, in a sealed plastic container, inside the controller door.

4. Chart shall be a blackline print with a different color used to show area of coverage for each station. Charts must be completed and approved prior to final inspection of the irrigation system.

1.4 SUBMITTALS

- A. Submit as one package in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturers' Literature and Data:
 1. Piping.
 2. Jointing materials.
 3. Valves.
 4. Frames and covers.
 5. Strainers
 6. Pressure gauges.
 7. Automatic control equipment.
 8. Irrigation Emitters: Pop-up spray, Bubblers, Drip Emitters, etc
 9. Drip Emitters
 10. Quick couplers.
 11. Valve boxes.
 12. Drip pop-up indicator valve
- C. "As-built" drawings consisting of a hard copy in original scale, an electronic pdf file, and an electronic CAD file in conformance with the VA standards. Name and address of a permanent service organization maintained or trained by the manufacturers that will render satisfactory service within eight hours of receipt of notification that service is requested.
- D. After "as-built" drawings have been approved, submit print of controller chart.
- E. Submit controller timing schedule showing time settings for each automatic control valve.

1.5 REFERENCE, CODES AND STANDARDS

- A. All current International Building Code, state, local, federal, and VA codes, standards, regulations, and ADA requirements shall pertain to this project. These may include but not limited to, architectural, structural, mechanical, electrical, fire and life safety codes. The project shall follow the most stringent and current rules codes, standards, and regulations.
 1. AB1881 State of California Model Water Efficient Landscape Ordinance, California Code of Regulation
 2. Water Use Classification of Landscape Species (WUCOLS)
 3. America Society of Irrigation Consultant (ASIC) Design Guidelines
 4. California Landscape Standards, California Landscape Contractors Association (CLCA), Sacramento, California
 5. CAL-OSHA, Title 8, Subchapter 4-Construction Safety Orders, and Subchapter 7-General Industry Safety Orders
 6. NFPA 70, National Electrical Code (NEC)
 7. California Electrical Code
 8. Uniform Plumbing Code (UPC)
 9. California Plumbing Code (CPC)
 10. National Fire Protection Association (NFPA) 24, Section 10.4 Depth of Cover
 11. Underwriters Laboratories (UL): Electrical wiring, controls, motors and devices, UL listed and so labeled.
 12. American Society of Testing Materials (ASTM)

1.6 **APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society Of Mechanical Engineers (ASME):
B16.18-2012 Cast Copper Alloy Solder Joint Pressure Fittings
B16.22-2012 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
B16.24-2011 Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes
150, 300, 600, 900, 1500 and 2500
B18.2.1-2012 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex,
Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch
Series)
B40.100-2005 Pressure Gauges and Gauge Attachments
- C. American Society Of Sanitary Engineering (ASSE):
1013-2011 Reduced Pressure Principle Backflow Preventers and Reduced
Pressure Principle Fire Protection Backflow Preventers
- D. American Society For Testing And Materials (ASTM):
A536-84 (R2009) Ductile Iron Castings
B32-08 Solder Metal
B61-08 Steam or Valve Bronze Castings
B62-09 Composition Bronze or Ounce Metal Castings
B88/B88M-09 Seamless Copper Water Tube
B813-10 Liquid and Paste Fluxes for Soldering of Copper and Copper
Alloy Tube
D1785-12 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and
120
D2241-09 Poly(Vinyl Chloride) (PVC) Pressure Rated Pipe (SDR Series)
D2464-13 Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings,
Schedule 80
D2466-06 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
D2467-13 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
D2564-12 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping
Systems
D2609-02(2008) Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
D2683-10 Socket-Type Polyethylene Fittings for Outside Diameter-
Controlled Polyethylene Pipe and Tubing
D2855-96(2010) Making Solvent Cemented Joints with Poly (Vinyl Chloride)
(PVC) Pipe and Fittings

- | | |
|-----------------|--|
| D3261-12 | Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing |
| F477-10 | Elastomeric Seals (Gaskets) for Joining Plastic Pipe |
| F656-10 | Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings |
| F771-99(2005) | Polyethylene (PE) Thermoplastic High-Pressure Irrigation Pipeline Systems |
| E. | American Water Works Association (AWWA): |
| C500-09 | Metal-Seated Gate Valve for Water Supply Service |
| C504-10 | Rubber-Seated Butterfly Valves |
| C906-07 | Polyethylene (PE) Pressure Pipe and Fittings, 4 in. (100 mm) Through 63 in. (1600 mm), for Water Distribution and Transmission |
| F. | American Welding Society (AWS): |
| A5.8/A5.8M:2011 | Filler Metals for Brazing and Braze Welding |
| G. | Manufacturers Standardization Society (MSS): |
| SP-70-2011 | Gray Iron Gate Valves, Flanged and Thread Ends |

PART 2 - PRODUCTS

2.1 PIPING

- A. Irrigation Mains: Polyvinyl Chloride, Schedule 40, solvent welded.
- B. Irrigation Laterals: Polyvinyl Chloride, Schedule 40, solvent welded.
- C. Threaded Pipe: Polyvinyl Chloride, ASTM D1785, PVC 1120, Schedule 80, for threaded connections, risers and swing joints.
- D. Above Grade and in Concrete Pit: AWWA C115, flanged joints and fittings working pressure 1025 kPa (150 psi).
- E. Fittings:
 - 1. Irrigation Mains (Ductile Iron and PVC Pipe): Ductile Iron, AWWA C110.
 - 2. Irrigation Laterals: PVC, schedule 40, solvent welded socket type, ASTM D2466.
 - 3. Threaded Pipe: PVC, schedule 80, ASTM D2464.
 - 4. Swing Joints: Threaded fittings with elastomeric seals that allow 360 degree rotation, and designed for minimum 1375 kPa (200 psig) working pressure.
- F. Jointing Materials:
 - 1. Irrigation Laterals: Solvent cement, ASTM D2564.

2.2 VALVES (EXCEPT REMOTE CONTROL VALVES)

- A. Underground Shut-Off Valves: Provide One of the Following:
 - 1. Gate valves (4 inches (100 mm) and larger): Epoxy-coated, cast iron body with ring-tite connections, resilient wedge disc, stainless steel non-rising stem and cast iron hand wheel, 200 psi (1380 kPa) minimum working pressure. AWWA C500.

2. Gate valves (3 inches (75 mm) and smaller): Bronze body, Screw-in Bonnet, Threaded with Cross Handle non-rising stem turning clockwise to close, 200 psi (1380 kPa) minimum working pressure.
- B. Operations:
 1. Underground: furnish valves with 50 mm (2 inch) nut for T-Handle socket wrench operation.
 2. Above ground and in pits: MSS SP-70, with handwheels.
 3. Ends of valves shall accommodate the type of pipe installed.
- C. Check: Swing.
 1. Smaller than 100 mm (4 inches): Bronze body and bonnet, ASTM B61 or B62, 850 kPa (125 pound) WSP.
 2. One hundred mm (4 inches) and larger: Iron body, bronze trim, vertical or horizontal installation, flange connection, 1375 kPa (200 pound) WOG.
- D. Pressure Reducing Valve: Cast steel body with renewable seats, with stainless steel trim. Flow passages and all parts designed to withstand high velocity applications, flange connected.

2.3 VALVE BOX

- A. Valve boxes shall not be placed in pavement.
- B. Valve boxes to have bolt down lids. Provide tamper proof bolts for all lids.
- C. Gate Valve: When in pavement, valve boxes shall be precast concrete (from Rigid Cast Iron Forms) with compressive strength of the concrete in excess of 30 Mpa (4000 psi). In planter areas, valve boxes shall be HDPE box, black in color. Box shall be of such length to be adapted to depth of cover required over pipe at valve location. Mark box cover to differentiate between lawn irrigation system and domestic water supply system and set flush with finished grade. Provide 2 "T" handle socket wrenches of 15 mm (5/8 inch) round stock with sufficient length to extend 600 mm (2 feet) above top of deepest valve box cover.
- D. Remote Control Valves: When in pavement, valve boxes shall be precast concrete (from Rigid Cast Iron Forms) with compressive strength of the concrete in excess of 30 MPa (4000 psi). In planter areas, valve boxes shall be HDPE structural foam Type A, Class III, black in color. Box shall be minimum 475 mm (19 inches) long by 350 mm (14 inches) deep with key-lockable hinged cast iron cover.
 1. Permanently mark valve box lid with 2" black valve number and controller letter or with numbered metal tag inside box as approved by Resident Engineer.
 2. Furnish 2 750 mm (30 inch) long valve adjustment keys.
- E. Drip zone Lateral Flush Cap Assembly: Round reinforced plastic valve box and lid constructed from HDPE. Opening at top of access box to be 14.5 cm (5-3/4") diameter, minimum. Height of access box to be 23cm (9-1/16"), minimum. Lid to have lift-hole for opening.
- F. Provide and install wire mesh at bottom of valve boxes to prevent gopher intrusion.

2.4 STRAINERS

- A. Basket or "Y" type with brass strainer basket. Body smaller than 70 mm (2-1/2 inch) shall be brass or bronze; 70 mm (2-1/2 inch) and larger shall be cast iron or semi-steel. Strainer cover to be furnished with blow-off connection and shut-off valve to accommodate 20 mm (3/4 inch) diameter hose connection.

2.5 PRESSURE GAUGES:

- A. ANSI B40 .100, 114 mm (4-1/2 inch) diameter, all metal case, bottom connected. Dial shall be either dead black or white lacquered throughout. Provide shut-off cocks. Maximum graduations of 10 kPa (2 psi).

2.6 FLOW METER

- A. Housing to be a Sch 80 polyvinyl chloride tee or bronze tee.
- B. Have a pulsing output which operates at 9VDC and a pulse rate which is proportional to the GPM.
- C. Fully compatible with the internal interface at each field controller.
- D. Powered by the controller.
- E. Replaceable metering insert.
- F. Output wire shall be underground 14 AWG feeder wire.
- G. Flow meter data can be accurately read by the controller up to 2,000 feet.
- H. Fully compatible with the manufacturer of the irrigation controller.
- I. Shall feature a six-bladed design with a proprietary, non-magnetic sensing mechanism.

2.7 RAIN MEASUREMENT DEVICE:

- A. Compatible with Controller, WeatherTRAK Rain Sensor WT-WRS, or approved equal.

2.8 AUTOMATIC CONTROL EQUIPMENT—INDEPENDENT ELECTRIC CONTROLLERS

- A. Model: WeatherTRAK ET Pro3 Smart Water Manager WTPRO2S-C-48-SPH, CIM-5YA Product as manufactured by Hydropoint and conforming to this specification is acceptable.
- B. Overall Control Concept. The electric automatic control system shall consist of one or more independent controllers which operate individual remote control valves in accordance with timing schedules programmed into the independent units. The number of units and location of the installations are shown on the drawings. The system shall have two-way, central Internet management with remote programming; monitoring and real-time notification of field alerts anywhere Internet access can be obtained. Whether data shall be collected from over 40,000 government regulated and privately owned weather stations across the US to combine with local wind, temperature, solar radiation and humidity variables to model a virtual on-site weather station.
- C. The Control System consists of an Independent controller, Flow Meter, master valve and all accessories necessary to operate the irrigation system. All of these components and software shall be a standard package
- D. Independent controller shall have the following characteristics:
 - 1. Each controller shall be programmed automatically, daily over the Internet, based upon an ET micro zone representing approximately one square kilometer that is associated with the controllers exact longitude and latitude coordinates.
 - 2. Station base watering time shall be developed by user selection of various sprinkler, soil, slope, and plant factors. Controller will develop watering station from the input factors. The controller will automatically decide whether to irrigate or not based upon the current day's ET and the depletion of each station independent of one another
 - 3. The stations shall allow for a rapid programming of a block of stations with the same watering time.
 - 4. The controller shall have four programs with seven independent water day patterns and schedules. Each program has to start times with up to 20 cycles, with one water window per program. A second start time shall be available for high ET requirements in "auto mode" only.

5. The controller shall have independent station watering and watering day adjustment from -50% to +25% in 5% increments. Able to communicate with normally closed wired or wireless rain and rain/freeze switches, flow sensors and normally open or normally closed master valves.
6. Continuous flow monitoring and alert notification at the individual station and mainline levels. Preview mode that displays flow data and irrigation schedules for each station.
7. Report menu providing accumulated totals of flow usage and station runtime on a daily, weekly and monthly basis. Valve wire diagnostic circuit that identifies field wiring issues such as valve shorts or valve no-connects.
8. The ability to extend watering to following days when water window maximum has been reached. Coordinate a minimum of two flow monitors and master valves.
9. The controller shall be UL and C-UL approved.
10. Daily up dated ET irrigation schedules with an eight week go forward schedule for observing schedules for low-water use or other deep-rooted plant materials The controller shall have direct compatibility with hand-held remotes by simply connecting to a 32 pin connector.
11. The controller shall monitor the flow rate and be furnished with the following features: main line break flow detection, unscheduled flow detection, station upper limit flow detection, programmable flow check delay from one (1) to six (6) minutes, monitor and display measured flow in GPM, automatic flow learn mode for setting individual station limits or manual entry or semi-automatic monitor/set mode, global percentage adjust to automatically factor upper flow limits for stations, automatic station advancement for station overflow, audible and visual alert for all flow violations, intelligent upper-limit processing for concurrent station operation, automatic closure of normally open master valve on main line breaks or unscheduled overflow.
12. The controller shall be furnished with a feature for tracking water consumption in gallons to pinpoint specific water savings and conservation efforts. The controller shall be furnished with the following:
 - c. Programmable master valve either normally open or normally closed.
 - d. Programmable pump.
 - e. Programmable stacking or no stacking.
 - f. Programmable timer delay.
 - g. Programmable security code.
 - h. Programmable alarm to either enable or disable an audible alarm in the event of a flow violation.
 - i. Programmable flow check delay to set up a delay after any station changes, from one (1) minute to six (6) minutes, during which time no flow limits are checked.
 - j. View and clear accumulated gallons.

2.9 CONTROLLER ENCLOSURE PAD

- A. The controller enclosure mounting pad assembly shall consist of a reinforced plastic support base, a 3/16 inch thick 5052 H 32 Marine grade aluminum mounting pad and stainless steel fastening brackets.

2.10 REMOTE CONTROL VALVES:

- A. Provide Isolation Valve upstream from each group of control valves.DDD pROVE
- B. Each irrigation section shall be automatically operated by a remote control valve installed underground and operated by a 24-volt AC electric solenoid Valves shall be of heavy duty

construction and shall have manual shut-off and flow control adjustment and provide for manual operation. Install valves with union on one side to allow for easy removal. Valves shall have a minimum of 1025 kPa (150 psi) working pressure.

- C. Valve body shall be cast-iron with brass bonnet, trim and renewable seat and have two inlet tappings (furnished with one plugged) to allow installation as either a straight or angle pattern valve.
- D. Valves shall be diaphragm type designed to operate in water containing sand and debris, without the use of scrubbers or filters. To ensure this, the flush rod shall be tapered to vary the size of the port opening as the diaphragm raises and lowers, thus allowing trapped material to escape. Rod to be finished with a serrated surface to help scrub trapped material out. The effective diaphragm working area/valve seating opening ratio must be a minimum of 3 to 1. Valves shall be completely serviceable from the top without removing valve body from the system. Furnish 2 750 mm (30 inch) long adjustment keys. Valves to operate at no more than 50 kPa (7 psi) pressure loss at manufacturers maximum recommended flow rate.

2.11 IRRIGATION EMITTERS

- A. Shall be of make, type and performance as indicated on drawings. The entire internal assembly including filter screen, to be capable of removal from the top without removing the sprinkler case from the riser.
- B. Rotator Pop-up Sprays: Rotator to have multi-trajectory rotating stream delivery system. Body shall be pressure compensating at 40 psi and constructed of corrosion and UV resistant heavy-duty ABS. Body to have factory installed drain check valve capable of checking up to 14 feet in elevation change. Nozzles are shall have fully adjustable arcs and radius reduction up to 25%. Nozzle distances shall reign from 8 to 30 feet with corner, side strips and corner side strips. Precipitation rate to be low below 0.5 in./hr. at head-to-head coverage.
- C. Shrub Spray Heads: Bodies to have an internal flow regulation in the pop-up stems at 30 PSI. The pop-up stem to have a shutoff device restricting water loss by 99% if the nozzle is removed or damaged. The body shall include a check valve to prevent low head drainage up to 10 feet in elevation change. The nozzles shall have a precipitation rate of 1 in./hr. or less. The nozzles to include a wide variety of arcs including 60°, 120°, 150°, 210°, 240°, side strip, left and right corner strips. The nozzles shall be match precipitation rate within each size and with other sizes. The nozzles shall be capable of achieving a minimum of 70% DU at standard head-to-head spacing. The sprinkler body, stem, nozzle and screen shall be constructed of heavy-duty, ultraviolet resistant plastic. It shall have a heavy duty stainless steel retract spring and a ratcheting system for alignment of the pattern. The sprinkler shall have a soft elastomer pressure-activated comolded wiper seal for cleaning debris from the pop-up stem.
- D. Sub Surface Drip Emitters:
 - 1. Drip emitters shall be of the pressure compensating, permanently assembled type. Emitters shall evenly spaced inside of tubing, and be capable of providing 1gph at inlet pressures between 15 and 50 psi.
 - 2. Drip line tubing shall be made of UV resistant material with impregnated emitters. Tubing shall be linear low-density 5/8 inch (16 mm or 17 mm) polyethylene with a minimum wall thickness of 0.045 inch (0.1 mm).
 - 3. Drip line tubing with emitters shall be manufactured with root intrusion technology.
- E. Drip Flush Valve:
 - 1. UV resistant polyethylene materials with a minimum pressure rating of 50
- F. Drip system operation indicator
 - 1. Drip system operation indicator to be a visual pop-up indicator. Install one indicator per drip circuit and per manufacturer's recommendation.

- G. Drip Accessories: Provide a dripline flush valve, air relief valve and operation indicator as required and detailed. Accessories shall be manufactured by the same manufacturer as the drip line tubing.

2.12 QUICK COUPLERS

- A. Shall have all parts contained in a two-piece unit and shall consist of a coupler water seal valve assembly and a removable upper body to allow the spring and key track to be serviced without shut down of the main.
- B. Metal parts shall be brass.
- C. Lids shall be lockable vinyl covered and have springs for positive closure on key removal.
- D. Furnish 2 hose swivels and operating keys for each size coupler to the Resident Engineer.

2.13 LOW VOLTAGE CONTROL VALVE WIRE

- A. Wire: Solid copper wire, Underwriters Laboratories Inc. approved for direct burial in ground. Size of wire shall be in accordance with manufacturer's recommendations, but in no case less than No. 14.
- B. Multi-strand cable, Underwriters Laboratories Inc. approved for direct burial in ground. Size and type of wire shall be in accordance with manufacturer's recommendations.
- C. Provide the following colors:
 - 1. Common ground wire - white
 - 2. Control wire - red
 - 3. Spare wires - yellow (provide 3 spares)
 - 4. Master valve control wire - blue
 - 5. Flow sensor - orange / black
 - 6. Rain sensor - 18 gauge, 2-conductor direct burial wire, black in color
 - 7. Where there is more than one controller, provide a different color control wire for each controller.

2.14 SPLICING MATERIALS:

- A. Epoxy waterproof sealing packet. Low voltage controller cable

2.15 SLEEVE MATERIAL

- A. PVC-1120-5DR 17, Schedule 40.
- B. White color pipe for water.
- C. Grey color pipe for wires.

2.16 WARNING TAPE

- A. Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, **detectable** blue with black letters and imprinted with "CAUTION BURIED IRRIGATION WATER LINE BELOW".
- B. TRACER WIRES
 - 1. No. 14, Green, Type TW plastic-coated copper tracer wire shall be installed with non-metallic irrigation main lines.

PART 3 - EXECUTION

3.1 PIPE LAYING - GENERAL

- A. Do not lay pipe on unstable material, in wet trench or when, in the opinion of Resident Engineer, trench or weather conditions are unsuitable for the work.
- B. Allow a minimum of 80 mm (3 inches) between parallel pipes in the same trench.
- C. Hold pipe securely in place while joint is being made.
- D. Do not work over, or walk on, pipe in trenches until covered by layers of earth well tamped in place to a depth of 300 mm (12 inches) over pipe.
- E. Full length of each section of pipe shall rest upon the pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipe on wood blocking.
- F. Install sprinkler lines to avoid heating trenches, electric ducts, storm and sanitary sewer lines, and existing water and gas mains, all of which have right of way.
- G. Clean interior of pipe of foreign matter before installation. Keep pipe clean during laying operations by means of plugs or other methods. When work is not in progress, securely close open ends of pipe and fittings to prevent water, earth, or other substances from entering.
- H. Minimum cover over water mains shall be 18 inches. Control valves shall never be less than 3 inches below finished grade. Cover laterals to minimum depth of 12 inches.
- I. Existing sidewalks and curbs shall not be cut during trenching and installation of pipe. Install pipe under sidewalks and curbs by jacking, auger boring, or by tunneling. Repair or replace any concrete that cracks, due to settling, during the warranty period.
- J. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.
- K. Warning tape shall be continuously placed 300 mm (12 inches) above sprinkler system water mains and laterals.

3.2 LAYING PLASTIC PIPE

- A. Shall be snaked in trench at least 1 meter to 100 meters (1 foot per 100 feet) to allow for thermal construction and expansion and to reduce strain on connections.
- B. Joints
 - 1. Solvent Welded Socket Type: ASTM D2855.
 - 2. Threaded Type: Apply liquid teflon thread lubricant of teflon thread type. After joint is made hand tight (hard), a strap wrench should be used to make up to one half additional full turn.
- C. Lubrication of the joint and rubber gasket shall be done in accordance with the pipe manufacturer's specifications
- D. The spigot and bell shall be aligned and pushed until the reference line on the spigot is flush with the end of the bell or coupling. Pushing shall be done in a smooth, steady motion.
- E. Concrete thrust blocks shall be installed where the irrigation main changes direction at "L" and "T" locations and where the irrigation main terminates.
 - 1. Concrete thrust blocks for supply mains shall be sized and placed in strict accordance with the pipe manufacturer's specifications and shall be of an adequate size and so placed as to take all thrust created by the maximum internal water pressure.
 - 2. Pressure tests shall not be made for a period of 36 hours following the completion of pouring of the thrust blocks.

3.3 INSTALLATION OF SPRAY IRRIGATION AND QUICK COUPLERS

- A. Install irrigation and quick couplers at ground surface as detailed.

- B. Place part circle sprinkler heads minimum 1 inch (25 mm), but not over 2 inches (50 mm) for turf and 6 inches (150 mm) for shrubs from edge of, and flush with top of adjacent walks, header boards, curbs, and mowing aprons, or paved areas at time of installation
- C. Set all sprinkler heads in turf to allow for settlement. Adjust as required after settlement. Hold heads 2 inches clear of pavement edge.
- D. Install all shrub sprays, sprinklers and quick couplers on swing joints as detailed on plans.

3.4 DRIP EMITTER TUBING INSTALLATION

- A. Thoroughly flush all lateral lines before installing drip emitter tubing.
- B. Install as per manufacturer's recommendations.
- C. Install drip emitter tubing with direct-attached emitters 2 to 4 inches (50 to 100 mm) below grade, stake down every four (4) feet and at every fitting. Cover with a minimum 2 inches (50 mm) of mulch.
- D. Install pressure regulators and filter units in control valve boxes
- E. Adaptation from PVC Schedule 40 fittings to flex vinyl hose shall be line size by 3/8 inch (10 mm) insert bushings.
- F. Tape all ends during installation and do not allow dirt or debris to enter tubing.
- G. Use fittings at sharp bends and do not allow dripper line to kink.
- H. Install a minimum two (2)//automatic//manual// flush valves per zone at the low points and ends of the zone.
- I. Use manufacturer recommended fittings for all changes in direction.

3.5 DRIPLINE (IN LINE) TUBING INSTALLATION

- A. Thoroughly flush all lateral lines before installing dripline tubing.
- B. Install as per manufactures recommendations
- C. Install dripline tubing with impregnated emitters 2 to 4 inches (50 to 100 mm) below grade, staked down every four (4) feet and at every fitting. Cover with a minimum 2 inches(50 mm) of mulch.
- D. Install dripline in a grid pattern utilizing the specified spacing. Install per VA standard detail.
- E. Install air relief valves at all high points on the system.
- F. Install a minimum two (2)//automatic//manual// flush valves per zone at the low points and ends of the zone.
- G. Install a minimum two (2) operation indicators at the ends of the zone.
- H. Install pressure regulators and filter units in control valve boxes.
- I. Adaptation from PVC Schedule 40 fittings to drip tubing shall be line size by 3/4 inch (20 mm) hose thread.
- J. Tape all ends during installation and do not allow dirt or debris to enter tubing
- K. Use fittings at sharp bends and do not allow dripper line to kink
- L. Use manufacturer recommended fittings for all changes in direction.

3.6 FLOW SENSOR

- A. Installation shall include sufficient pipe lengths before and after flow sensor to avoid turbulence as per manufactures specifications.
- B. Provide a 1 inch (25 mm) continuous dedicated conduit from the controller to flow sensor
- C. Install a Red and Black field wire in the dedicated conduit.
- D. Flow sensor wires shall be sealed with epoxy seal.

3.7 RAIN SENSOR

- A. Mount sensor on suitable post, pole, gutter, or building. Mount in location where sensor is open to rainfall and out of sprinkler spray. Sensor can be wired or wireless.

3.8 **AUTOMATIC IRRIGATION - CONTROL SYSTEM INSTALLATION**

- A. Prior to the start of the irrigation installation, the Contractor shall arrange with the irrigation controller manufacturer to provide pre-installation instructions and training on the proper installation and start-up of the irrigation control system.
- B. Install exterior freestanding controller on precast concrete base
- C. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- D. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.9 **INSTALLATION OF CONTROL WIRING**

- A. Wiring from master controllers to satellites and stub-cuts for future extension shall be located in trench with new mains or in separate trench at back of curb, unless cross-country route is shown. Locate in trench with mains when possible on cross-country routes.
- B. Wiring bundles located with piping shall be set with top of the bundle below top of the pipe. No two wires in any bundle shall be of the same color. Wires shall be bundled, and tied or taped at 4.5 m (15 foot) intervals. A numbered tag shall be provided at each end of a wire, i.e., at valve, at field located controllers and at master controller. The number at each end of wire to be the same.
- C. Splicing shall be held to a minimum. A pullbox shall be provided at each splice. No splices will be allowed between field located controllers and remote control valves.
- D. Provide 300 mm (12 inch) expansion loops in wiring at each wire connection or change in wire direction. Provide 600 mm (24 inch) loop at remote control valves.
- E. Power wiring for the operation of irrigation system shall not be run in same conduit as control wiring.

3.10 **TRACER WIRE INSTALLATION**

- A. Tracer wire shall be installed on bottom of trench, adjacent to vertical pipe projections, carefully installed to avoid stress from backfilling, and shall be continuous throughout length of pipe with spliced joints soldered and covered with insulation type tape.
- B. Tracer wire shall follow main line pipe and branch lines and terminate in yard box with gate valve controlling these main irrigation lines. Provide sufficient length of wire to reach finish grade, bend back end of wire to make a loop and attach a Dymo-Tape type plastic label with designation "Tracer Wire."
- C. Record locations of tracer wires and their terminations on project record documents.

3.11 **EXISTING TREES**

- A. Where it is necessary to excavate adjacent to existing trees, the Contractor shall comply with the provision of Section 01 00 00 General Requirements for the protection of existing vegetation.
- B. Excavation in areas where 2 inch (50 mm) or larger roots occur shall be done by hand. All roots 2 inch (50mm) and larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap, to prevent scarring or excessive drying.
- C. Where a ditching machine is run close to trees having roots smaller than 2 inch (50 mm) in diameter, the wall of the trench adjacent to the tree shall be hand trimmed, making clean cuts through.
- D. Where Irrigation is shown within the drip line of existing trees, Contractor shall determine in the field where irrigation can be installed without impacting or damaging existing roots. Contractor shall layout exact proposed trench locations or equipment and review locations with the Arborist and Resident Engineer. Adjust the system as required to avoid damage to tree roots and as directed by the Arborist and Resident Engineer.

- E. Excavation within the drip line shall be done by hand only, with no exceptions unless approved or directed by the Arborist.
- F. The Contractor is responsible for securing the services of a Certified Arborist at no cost to the Resident Engineer.

3.12 SETTING OF VALVES

- A. Install valves where shown on Drawings and group together where practical. Limit one remote control valve per box.
- B. Locate valve boxes 12 inches (300 mm) from and perpendicular to walk edges, buildings, and walls. Provide 12 inches (300 mm) between valve boxes where valves are grouped together.
- C. Thoroughly flush main line before installing valves.
- D. Clean interior of valves of foreign matter before installation.
- E. Install valves in shrub or groundcover areas where possible.
- F. No valves shall be set under roads, pavement or walks. Label control line wire at each valve with a 2-1/4 inch by 2-3/4 inch polyurethane identification tag, indicated identification number of valve (controller and station number). Attach label to control wire.
- G. Place gopher wire mesh under the valve box and wrap up each side a minimum of 6 inches (150 mm). Wire mesh shall be 19 gauge galvanized steel with 1/2 inch (13 mm) mesh.
- H. Install 4 inch (100 mm) layer of pea gravel or 3/4 inch (20 mm) drain rock on top of the wire mesh at the bottom of the valve box.
- I. Set valve box cover flush with finished grade.
- J. Heat brand controller and station number or valve type (gate valve or quick coupler) into the valve box lid.

3.13 SLEEVING

- A. Furnish and install where pipe and control wires pass under walks, paving, walls, and other similar areas.
- B. Sleeving to be twice line size or greater to accommodate retrieval for repair of wiring or piping and shall extend 300 mm (12 inches) beyond edges of paving or construction.
- C. Bed sleeves with a minimum of 100 mm (4 inches) of sand backfill above top of pipe.

3.14 CONSTRUCTION WASTE MANAGEMENT

- A. General: Comply with Contractor's Waste Management Plan and Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

3.15 TEST AND FLUSHING

- A. Coordinate scheduling testing / observations with the Contracting Officer's Representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Observations conducted by persons other than the Contracting Officer's Representative shall not be permitted without prior written authorization of the Contracting Officer's Representative.
- C. No site observations will commence without as-built drawings. In the event the Contractor calls for a site visit without as-builts drawings, without completing previously noted corrections, or without preparing the system for said visit, he shall be responsible for reimbursing the Contracting Officer's Representative at his current bill rates per hour portal

to portal (plus transportation costs) for inconvenience. No further site visits will be scheduled until this charge has been paid and received.

- D. Contractor shall be responsible for notifying the Contracting Officer's Representative in advance for the following inspections/observation meetings, according to the time indicated:

1. Pressure supply line installation and testing-48 hours
2. Remote control valves (RCV) and lateral lines visual inspection – 48 hours
3. Coverage test-48 hours
4. Final inspection- 7 days

- E. Tests and Inspections:

1. Pressure supply line installation and testing:
 - a. Make hydrostatic tests with risers capped when welded PVC joints have cured at least 24 hours. Center load piping with backfill to prevent pipe from moving under pressure. Keep all couplings and fittings exposed
 - b. Apply the following tests after welded plastic pipe joints have cured for at least 24 hours.
 - i) Ring-Tite Main Line:
Remove all the air from the piping system then test live (constant pressure) and quick coupler valve lines hydrostatically at 125 psi minimum. Lines will be approved if test pressure is maintained for six (6) hours. The lines shall be restored to the original test pressure and the amount of water required to do so shall be measured. Approved tables of allowable loss will be consulted, and the line will be approved or not approved as such results may indicate. The Contractor shall make tests and repairs as necessary until test conditions are met.
 - ii) Solvent Weld Main Line:
Remove all the air from the piping system then test live (constant pressure) and quick coupler valve lines hydrostatically at 125 psi minimum. Lines will be approved if test pressure is maintained for six (6) hours. The Contractor shall make tests and repairs as necessary until test conditions are met.
2. RCV and lateral lines visual inspection:
 - a. Test RCV controlled lateral lines with water at line pressure and visually inspect for leaks. Retest after correcting defects.
3. Coverage Test:
 - a. After electrical circuitry has been energized and final adjustment of the sprinkler heads and drip system have been complete, test each remote control valve with a visual coverage/wetting pattern test in the presence of the Contracting Officer's Representative, to determine if the water coverage for planting areas is complete and adequate. Furnish all material and perform all work required to correct any inadequacies of coverage due to deviation from Drawings. Contractor is responsible to perform all work required correcting any inadequate coverage at his own expense where the system has been willfully installed as indicated on the Drawings and the coverage is obviously inadequate, without bringing this to the attention of the Contracting Officer's Representative.
 - b. This test shall be accomplished prior to the burial of the drip lines and any planting being installed.
4. Final Inspection:

- a. Operate controllers and automatic control valves to demonstrate the complete and successful installation and operation of all equipment.
- b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment. Any irrigation product will be considered defective if it does not pass tests and inspections.

3.16 FINAL INSTRUCTIONS AND DOCUMENTATION

- A. Program controller according to approved irrigation schedule
- B. Manufacturer of Control Systems shall certify control system is complete, including all related components, and operational. Submit certificate to Contracting Officer's Representative.
- C. As-Built Drawings:
 - 1. Maintain and provide a complete set of As-Built drawings, which shall be corrected daily to show changes in locations of all pipe, valves, pumps and related irrigation equipment.
 - 2. Prepare As-Built drawings showing location of all valves, lateral lines, and route of control wires.
 - 3. See 1.7C As-Built Drawings of this Section for the requirements for the drawings.
- D. Controller Chart
 - 1. Provide one controller chart showing the area covered by controller for each automatic controller
 - 2. Use the approved As-Built drawings for the controller chart.
 - 3. See 1.7D Controller Chart of this Section for the requirements for the controller chart.
- E. Maintenance and Operating Instructions and Manuals
 - 1. Prior to final acceptance, verbal instructions, for a period of not less than 8 hours, shall be provided to the operating personnel. Multiple instructions may be required for a total of 8 hours. Instructions shall be conducted to the satisfaction of the Contracting Officer's Representative. Contractor shall be required to repeat the training at Contractor's own expense until the Contracting Officer's Representative has conclude that the training has be conducted satisfactorily.
 - 2. Deliver manuals to the Contracting Officer's Representative, within 10 Calendar Days of completion of work of this Section and as a condition of its acceptance, to the Contracting Officer's Representative
 - 3. See 1.7E Maintenance and Operating Instructions and Manuals of this Section for the requirements for the Operation and Maintenance Manuals

3.17 MAINTENANCE PERIOD

- A. Maintenance period duration to start on the date of the project final acceptance. The irrigation may be installed and final tested prior to the project completion; however, the system remains in the Contractor's possession until the project is certified complete and formally turned over to the government. The Contracting Officer shall provide written documentation to the Contractor stating this date.
- B. Maintain, make minor adjustments, repair and / or replace any breaks, malfunctions or deficiencies of the irrigation system for the full duration of the 90 day maintenance period.
- C. The Contracting Officer's Representative reserves the right to waive or shorten the maintenance period.

3.18 CLEAN UP

- A. Remove all trash, debris, surplus materials and equipment from the project site when the work of this Section has been completed and at such other times as may be directed by the Contracting Officer's Representative.

3.19 WARRANTY

- A. It shall be the responsibility of the Contractor to fill and repair all depressions and replace all necessary lawn, planting and hard surfaces due to the settlement of irrigation trenches, and to replace all necessary lawn and planting impacted by the lack of proper irrigation coverage due to workmanship for one (1) year following completion and acceptance of the job.

--- E N D ---