SECTION 328400  PLANTING IRRIGATION

PART 1- GENERAL

1.1 SUMMARY

A. Scope of Work: Provide all labor, materials, transportation, and services necessary to furnish and install Irrigation Systems as shown on the drawings and described herein.

B. Related Work Specified in Other Sections:
   1. Division 26 - Electrical: Power connection for controller.

1.2 SUBMITTALS

A. Material List:
   1. Complete manufacturer's technical data and installation instructions shall be submitted prior to performing any work. Material list shall include the manufacturer, model number and description of all materials and equipment to be used.

B. Record and As-built Drawings:
   1. The original "as-built" plan shall be submitted to the University’s Representative for approval prior to making the controller chart.
   2. Drawings shall include dimensions from two permanent points of reference, building corners, sidewalks, or road intersections, etc., the location of the following items:
      (a) Connection to existing water lines.
      (b) Connection to existing electrical power and splice locations.
      (c) Relocated existing equipment.
      (d) Gate valves.
      (e) Routing of sprinkler pressure lines (dimension max. 100' along routing).
      (f) Sprinkler control valves.
      (g) Routing of control wiring (dimension max. 100' along routing).
      (h) Quick coupling valves.
      (i) Other related equipment as directed by the University’s Representative.

C. Controller Charts:
   1. As-built drawings shall be submitted for approval by the University’s Representative before controller charts are prepared.
   2. Provide one controller chart for each controller supplied.
   3. The chart shall show the area controlled by the automatic controller and shall be the maximum size which the controller door will allow.
   4. The chart is to be a reduced drawing of the actual as-built system. However, in the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a size that will be readable when reduced.
   5. The chart shall be a black line print and a different color shall be used to indicate the area of coverage for each station.
   6. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 10 mils.
7. These charts shall be completed and approved prior to final inspection of the irrigation system.

D. Operation and Maintenance Manuals:
1. Contractor shall prepare Operation and Maintenance Manuals in accordance with Division 1.
   (a) Index sheet stating Contractor's address and telephone number, list of equipment with name and addresses of local manufacturer's representative.
   (b) Catalog and parts sheets on all material and equipment installed under this contract.
   (c) Guarantee statement.
   (d) Complete operating and maintenance instructions on all major equipment.

E. Equipment to be Furnished:
1. Supply as a part of this contract the following tools:
   (a) Two (2) sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied on this project.
   (b) Two (2) keys for each automatic controller.
   (c) One (1) quick coupler key and matching hose swivel for every five (5) or fraction thereof of each type of quick coupling valve installed.

2. The above mentioned equipment shall be turned over to the University at the conclusion of the project. Before final inspection can occur, evidence that the University has received material must be shown to the University’s Representative.

1.3 QUALITY ASSURANCE
A. Manufacturer's Directions: Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturers of articles used in this contract furnish directions covering points not shown in the drawings and specifications.

B. Explanation of Drawings:
1. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.

1.4 COORDINATION AND SCHEDULING
A. Contractor shall be responsible for notifying the University’s Representative in advance for the following observation meetings, according to the time indicated:
   1. Pre-job conference - 7 days.
   2. Pressure supply line installation and testing - 48 hours.
   3. Automatic controller installation - 48 hours.
   4. Control wire installation - 48 hours.
   5. Lateral line and sprinkler installation - 48 hours.
   6. Coverage test - 48 hours.
   7. Final inspection - 7 days.
PART 2 - PRODUCTS

2.1 GENERAL
A. Use only materials of brands and types noted on drawings, specified herein, or approved equals.

2.2 PIPING MATERIALS
A. PVC Pressure Main Line Pipe and Fittings:
1. Pressure main line piping for sizes 3” and larger shall be PVC Class 200 PSI Ring Tite Plastic Pipe.
2. Pressure main line piping inside sleeves, shall be PVC Class 315.
3. Pressure main line piping for sizes 2-1/2” and smaller shall be PVC Schedule 40 with solvent welded joints.
4. Pipe shall be made from NSF approved Type I, Grade I PVC compound conforming to ASTM resin specification D1785. All pipe must meet requirements as set forth in Federal Specification PS-21-70.
5. PVC solvent-weld fittings shall be Schedule 40, 1-2, II-I NSF approved conforming to ASTM test procedure D2466.
6. Solvent cement and primer for PVC solvent-weld pipe and fittings shall be of type and installation methods prescribed by the manufacturer.
7. All PVC pipe must bear the following markings:
   (a) Manufacturer's name.
   (b) Nominal pipe size.
   (c) Schedule or class.
   (d) Pressure rating in P.S.I.
   (e) NSF (National Sanitation Foundation) approval.
   (f) Date of extrusion.
8. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable I.P.S. schedule and NSF seal of approval.

B. PVC Non-Pressure Lateral Line Piping:
1. Non-pressure buried lateral line piping shall be PVC schedule 40 with solvent-weld joints.
2. Pipe shall be made from NSF approved, Type I, Grade II PVC compound conforming to ASTM resin specification D1784. All pipe must meet requirements set forth in Federal Specification PS-22-70 with an appropriate standard dimension ratio.
3. Except as noted in paragraphs 1 and 2, all requirements for non-pressure lateral line pipe and fittings shall be the same as for solvent-weld pressure main line pipe and fittings as set forth in these specifications.
4. For all sprinkler head installations use schedule 80 thread nipples and risers, and schedule forty fittings. Acceptable pre-manufactured types: KBI Swing Joint Assembly; Spears Swing Joint Assemblies.

C. Brass Pipe and Fittings:
1. Where indicated on the drawings, use red brass threaded pipe.
2. Fittings shall be red brass conforming to Federal Specification #WW-P-460.
1. Where indicated on the drawings, use galvanized steel pipe ASA Schedule 40 mild steel threaded pipe.
2. Fittings shall be medium galvanized screwed beaded malleable iron. Galvanized couplings may be merchant coupling.
3. All galvanized pipe and fittings installed below grade shall be wrapped with two layers of 10 mil pipe wrap.

2.3 VALVES
   A. Gate Valves:
      1. Gate valves 3" and larger shall be 125 lb. SWP bronze gate valve with screw-in bonnet, non-rising stem, solid wedge disc, threaded ends and a bronze or malleable iron handwheel.
      2. Gate valves 3" and smaller shall be manufactured by Nibco, Aqua, or Matco.
   B. Quick Coupling Valves:
      1. Quick coupling valves shall have a brass two-piece body designed for working pressure of 125 P.S.I. operable with quick coupler.
      2. Key size and type shall be as shown on plans.
      3. Quick coupling valves shall be manufactured by Rainbird (RC33, RC44) Buckner (B33, B44) or equal.
   C. Electrical Remote Control Valves:
      1. Electric control valves shall have a manual flow adjustment.
      2. Provide and install one control valve box for each electric control valve.
      3. Electric Remote Control Valves 3" and smaller shall be manufactured by Rainbird (100PES, 150PES, 200PES, PESB Series, GB Series), Irritrol (100 Series – 1FC, 1-1/2FC, 2FC, 3FC), Toro 220 Series or 220 Brass, or equal.
      4. Pressure Regulating Electric Remote Control Valves 3” and smaller shall be manufactured by Irritrol (103 Series 1 FC, 1-1/2FC, 2 FC, 3FC), Rainbird (100-PE-PRS, 150 PE-PRS, 200-PE-PRS), or equal.
   D. Check Valves:
      1. Swing check valves 2" and smaller shall be 200 pound W.O.G. bronze construction with replaceable composition, neoprene or rubber disc. KBI PVC swing check valve, Watts-WCV-S brass swing check valve, or equal.
   E. Associated Valves:
      1. Y-Strainer brass 80 mesh with brass ball valve to blow-out screen.
      2. Above ground Y-strainers shall be metal.
      3. Y-strainer shall be same size as water supply.
      4. Ball valves shall be brass (3 inch and larger); ball valves to be schedule 80 PVC 2 inch and smaller.
   F. Flow Sensor and Master Valve:
      1. Flow Sensor and Master Valve assemblies shall be by Rain Master. Install both units after brass gate valve at point of water connection. The sizes of Master Valve and Flow Sensors to be line-sized for project and have the capacity to have additional systems added on in the future.
2.4 BACKFLOW PREVENTION UNITS
A. Backflow prevention units shall be of size and type indicated on the irrigation drawings. Install backflow prevention units in accordance with irrigation construction details.

B. Wye strainers at backflow prevention units shall have a bronzed screwed body with 60 mesh stainless steel screen and shall be similar to Febco 870-DC double check valve, or equal.

C. Backflow prevention device are to only be used on University domestic water lines. These devices are not to be installed on utility water lines.

2.5 CONTROL WIRING
A. Copper direct burial sprinkler wire, sized according to length of the run, minimum fourteen gallons (white common, red primary lead, blue for spares). Run extra wires for future valves at the ends of all main line runs (see plans – four wires minimum). All communication wire for controllers and sensors to be installed in electrical conduit not less than three quarter inches on runs less than one hundred feet and one inch on runs greater than one hundred feet.

B. Electrical Dry Connection. Spears DS -400, pre-drilled dri-splice connector with crimp sleeves; or DRYCONN #10222 waterproof connectors by King Innovations (#22 to #12 AWG).

2.6 AUTOMATIC CONTROLLERS
A. Automatic controllers shall be RainMaster Evolution DX-8-48- SPED/DX- Radio-kit/Ev-ant-FD-kit/DX-flow/PMR-kit with radio & flow sensor boards, separate ground rod kit, and surge arrestor (per manufacturers specifications). Wall mount for inside installations; stainless steel pedestal cabinet for exterior installations (preferred). Include dome antenna within one mile of Grounds Division’s central computer, and use high gain antenna for controllers installed greater than one mile. All controllers should be installed with a radio and the proper UC Davis frequency of 485.075 MHz. If there are more than forty-eight stations on a site, the controllers may be hard wired together and would not need separate radios or antennas.

2.7 MAIN LINE SHUT OFF BOX
A. Install main line shut off valve at point of connection in a Christy concrete G5 traffic box for Main Line Shut Off Valves with “water” labeled lid, or equal.

2.8 CONTROL VALVE BOXES
A. Use 10" x 10-1/4" round box for all gate valves, Carson Industries #910-12B with green bolt down cover, or equal. Extension sleeve shall be PVC-8" minimum size.

B. Use 9 1/2" x 16" x 11" rectangular box for all electrical control valves, Carson Industries 1419-13B with green bolt down cover, or equal.

2.9 SPRINKLER HEADS
A. All sprinkler heads on any one system (zone) shall be of the same size, type, and deliver the same rate of precipitation with the diameter (or radius) of throw, pressure, and discharge as shown on the plans and/or specified in these special provisions.
B. Spray heads shall be pop-up with nozzle, have a screw adjustment and shall be manufactured by Rainbird 1804-PRS-SAM, Hunter INST-04, PGP Hi Pop, or equal.

C. Large rotor heads shall be pop-up, have a screw adjustment and shall be manufactured by Hunter (I-20, I-40, I-60, I-42, I-25), Toro (2001, EZ Adjust Series), Rainbird 8005 or 7005, or equal. Medium turf heads shall be manufactured by Hunter I-20S, ADS-36S, Toro EZ adjust Series Sprinklers, or equal.

D. Shrub heads shall be manufactured by Rainbird 1812-PRS-SAM or 1806-PRS-SAM, with brass or plastic nozzles, Hunter INST-06, INST-12, Hunter I-20-HP, I-20-6P for large areas, or equal.

E. Riser units (double swing) shall be fabricated in accordance with the details shown on the plans.

F. Bubbler heads to be Rainbird 1300A-F with screens, Toro 500 Series, or equal.

G. Riser nipples for all sprinkler heads shall be the same size as the riser opening in the sprinkler body.

2.10 REMOTE CONTROL VALVE IDENTIFICATION TAGS
A. 2-1/4” x 2-3/4” yellow polyurethane with valve number embossed on tag, as manufactured by Christy’s Irrigation I.D. Tags, (714) 771-4142, or equal.

PART 3 - EXECUTION

3.1 INSPECTION
A. Exercise extreme care in excavating and working near existing utilities. Contractor shall be responsible for damages to utilities which are caused by his operations or neglect. Check existing utilities drawings for existing utility locations.

3.2 PREPARATION
A. Physical Layout:
   1. Prior to installation, the Contractor shall stake out all pressure supply lines, routing and location of sprinkler heads.
   2. All piping layout shall be approved by University’s Representative prior to installation.

B. Water Supply:
   1. Point of Connection (P.O.C.): Install Flow Sensor and Master Valve assemblies by Rain Master after brass gate valve. The sizes of Master Valve and Flow Sensors to be line-sized for project and have the capacity to have additional systems added on in the future.

C. Electrical Supply:
   1. Electrical connections for automatic controller shall be made to electrical points of connection as indicated on the drawings.

3.3 INSTALLATION
A. Trenching:
   1. Provide for a minimum of eighteen inches cover for all pressure supply lines.
2. Provide for a minimum cover of twelve inches for all non-pressure lines.
3. Provide for a minimum cover of eighteen inches for all control wiring.

B. Backfilling:
1. A fine granular material backfill will be initially placed on all lines. No foreign matter larger than one-half inch in size will be permitted in the initial backfill. The trenches shall not be backfilled until all required tests are performed. Trenches shall be carefully backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand, or other approved materials, free from large clods of earth or stones. Backfill shall be mechanically compacted landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps or other surface irregularities.

2. Flooding of trenches will be permitted only with approval of the University’s Representative.

3. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn or planting, or other construction are necessary, the Contractor shall make all required adjustments without cost to the University.

C. Trenching and Backfill Under Paving:
1. Trenches located under areas where paving (asphaltic concrete or concrete), will be installed shall be backfilled with sand (a layer six inches below the pipe and three inches above the pipe) and compacted in layers to 95% compaction, using manual or mechanical tamping devices. Trenches for piping shall be compacted to equal the compaction of the existing adjacent undisturbed soil and shall be left in a firm unyielding condition. All trenches shall be left flush with the adjoining grade. The sprinkler Contractor shall set in place, cap and pressure test all piping under paving prior to the paving work.

2. Piping under existing walks shall be done by jacking, boring or hydraulic driving, but where any cutting or breaking of sidewalks and/or concrete is necessary, it shall be done and replaced by the Contractor as a part of the contract cost. Permission to cut or break sidewalks and/or concrete shall be obtained from the University’s Representative. No hydraulic driving will be permitted under concrete paving. Concrete paving shall be replaced back to nearest control joint. See Division 1, cutting, matching, and patching.

3. Provide for a minimum cover of eighteen (18) inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete paving.

D. Assemblies:
1. PVC pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.

2. On PVC to metal connections, the Contractor shall work the metal connections first. Permatex 51, or equal, shall be used on all threaded PVC to PVC, and on all threaded PVC to metal joints. Light wrench pressure is all that is required. Where
threaded PVC connections are required, use threaded PVC adapters into which the pipe may be welded.

E. Line Clearance: All lines shall have a minimum clearance of six inches from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.

F. High Voltage Wiring for Automatic Controller:
   1. Provide 120 volt power connection to the automatic controller.

G. Remote Control Valves:
   1. Install where shown on drawings and details. When grouped together, allow at least twelve inches between valve box edges. Install each remote control valve in a separate valve box.
   2. Each controller and station number shall be labeled at the valve with a 2-1/4" x 2-3/4" yellow polyurethane I.D. tag attached to the control wire of the valve.
   3. Set valve boxes perpendicular to adjacent walls and parallel to one another.

H. Control Wiring:
   1. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible.
   2. Where more than one wire is placed in a trench, the wiring shall be taped together at intervals of ten feet.
   3. An expansion curl shall be provided within three feet of each wire connection. Expansion curl at electric control valves shall be of sufficient length so that in case of repair, the valve bonnet may be brought to the surface without disconnecting the control wires. Control wires shall be laid loosely in trench without stress or stretching of control wire conductors.
   4. All splices shall be made with Spears DS-400, Dryconn 10222, or equal. Use one splice per connector sealing pack.
   5. Field splices between the automatic controller and electrical control valves will not be allowed without prior approval of the University’s Representative.

I. Flushing of System:
   1. After all new sprinkler pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, the control valves shall be opened and full head of water used to flush out the system.
   2. Sprinkler heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the University’s Representative.

3.4 EXISTING TREES
A. Where it is necessary to excavate adjacent to existing trees, the Contractor shall first discuss with the University Representative and get written permission for proposed trench route. Contractor shall use all possible care to avoid injury to trees and tree roots.

3.5 FIELD QUALITY CONTROL
A. Testing of Irrigation System:
1. The Contractor shall request the presence of the University’s Representative in writing at least 48 hours in advance of testing. Testing of pressure mainlines shall occur prior to installation of electric control valves.

2. Test all pressure lines under hydrostatic pressure of 150 pounds per square inch, and prove watertight.

3. All piping under paved areas shall be tested under hydrostatic pressure of 150 pounds per square inch, and proved watertight, prior to paving.

4. Sustain pressure in lines for not less than two hours. If leaks develop, replace joints and repeat test until entire system is proven watertight.

5. All hydrostatic tests shall be made only in the presence of the University’s Representative, or other duly authorized representative of the University. No pipe shall be backfilled until it has been inspected, tested and approved in writing.

6. Furnish necessary force pump and all other test equipment.

7. When the sprinkler irrigation system is completed, perform a coverage test in the presence of the University’s Representative, to determine if the water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate, without bringing this to the attention of the University’s Representative. This test shall be accomplished before any ground cover is planted.

B. Adjustment of the System:

1. The Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible.

2. If it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor shall make such adjustments prior to planting. Adjustments may also include changes in nozzle sizes and degrees of arc as required.

3. All sprinkler heads shall be set perpendicular to finished grades unless otherwise designated on the plans.

3.6 MAINTENANCE

A. The entire sprinkler irrigation system shall be under full automatic operation for a period of two days prior to any planting. The University’s Representative reserves the right to waive or shorten the operation period.

B. The University reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the University shall not relieve the Contractor of his responsibilities under the terms of the guarantee as herein specified.

3.7 CLEAN-UP

A. Clean-up shall be made as each portion of work progresses. Refuse and excess dirt shall be removed from the site, all walks and paving shall be broomed or washed down, and any damage sustained on the work of others shall be repaired to original conditions.
3.8  FINAL OBSERVATION PRIOR TO ACCEPTANCE

A. The Contractor shall operate each system in its entirety for the University’s Representative at time of final observation. Any items deemed not acceptable by the University’s Representative shall be reworked to the complete satisfaction of the University’s Representative.

B. The Contractor shall show evidence to the University’s Representative that the University has received all accessories, charts, record drawings, and equipment as required before final inspection can occur.

END OF SECTION