

328400S01 | Irrigation

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all design, labor, materials, and equipment for the proper installation of an irrigation system to service all lawn and planted areas within the designated project area.
 - 1. The contractor shall provide layout and design coordinated with planting types, locations and shall include water savings products (like EPA Water sense) practices which demonstrate the highest level of performance (water saving features).
 - 2. Smart controllers, high efficiency spray nozzles, pressure regulated heads, and drip line in beds must be incorporated.
 - 3. Under no circumstances shall any turf areas be watered in combination with plant beds. Spacing of all sprinkler heads shall not exceed the manufacturer's recommendations as published.
 - 4. Irrigation contractor shall participate in coordination meetings as required with the owner's representative prior to and during construction.

1.2 SUMMARY

- A. Section Includes:
 - 1. Piping.
 - 2. Valves.
 - 3. Sprinklers.
 - 4. Accessories.
 - 5. Miscellaneous piping specialties.
 - 6. Controls.
 - 7. Wiring
 - 8. Drip irrigation specialties.
 - 9. All materials necessary to properly service all grass and other planting areas.

1.3 PERFORMANCE REQUIREMENTS

- A. Complete design of a fully operational irrigation system for the areas as described by the owner.
- B. Irrigation zone control shall be automatic operation with controller and automatic control valves.
- C. Location of Sprinklers and Specialties: Make minor field adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

1.4 SUBMITTALS

- A. Comply with the requirements of the University General Conditions.
- B. Following shall be submitted prior to installation in one complete package:
 1. Product Data – Manufacturers technical data sheets including pressure rating, rated capacity, settings, and electrical data of selected models for the following:
 - a. Valves, including general-duty, underground, manual and automatic control, and quick-coupler types, and valve boxes.
 - b. Sprinklers, including emitters, drip tubes, and devices.
 - c. Controls, including controller wiring diagrams.
 - d. Wiring.
 2. Irrigation design drawings showing irrigation system design, Owner or their representative has the right to accept the design, mark-up and or reject the design drawing and require resubmission. Refer to sample drawings included in this package. The drawings shall include as a minimum the following information:
 - a. Owner will provide a base plan for the designer to include a plan layout showing locations, types, sizes, capacities, and flow characteristics of irrigation system components. Include water meters, backflow preventers, valves, piping, sprinklers and devices, accessories, controls, and wiring. Show areas of sprinkler spray and overspray. All drawings shall be at a scale of 1" = 30'-0" or larger. Refer to sample drawings included in this package.
 - b. Zoning Chart: Show each irrigation zone and its control valve. Refer to sample drawings included in this package.
 - c. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.
 - d. Wiring Diagrams: For electrical controllers, valves, and devices
 - e. Typical details for installation of all irrigation components
 3. Field quality-control reports.
- C. As built and Record Drawings:
 1. All as-built and record drawings shall provide records of actual installed conditions at a scale equal to the scale of the original construction drawings. Drawings shall be delivered to the owner in pdf, and cad format prior to the application of final payment
 2. Indicate exact location of gate valves, wire locations, sprinkler head layout, automatic valves, quick couplers, all irrigation and drainage piping, etc.
 3. Indicate all utilities encountered including type, location and depth.
 4. At the time of the irrigation mainline test, provide a preliminary set of "Record" drawings to the Owner's Authorized Representative.
- D. Operation and Maintenance Data: For sprinklers, controllers and automatic control valves to include in operation and maintenance manuals.
 1. Provide instructions for operation and maintenance of system and controls, seasonal activation and shutdown, and manufacturer's parts catalog.
 2. Provide a schedule indicating the length of time each valve needs to be operated to provide a predetermined amount of water.
 3. Include complete parts lists with manufacturer's designations for each component.
- E. Loose Equipment to Furnish: The Irrigation Contractor will furnish loose irrigation equipment operating keys and spare parts by in the following quantities:
 1. Two (2) quick coupler keys and matching swivel hose ell for $\frac{3}{4}$ " garden hose.
 2. Two (2) valve keys for gate valves, if a key is required for operation.
 3. Two (2) keys for each controller.

1.5 QUALITY ASSURANCE

- A. The irrigation system is to be installed by a contractor who specializes in irrigation design and installation and has installed at least 5 projects of equal or comparable size and complexity. Irrigation work shall be performed by a single firm, acceptable to the owner's representative and licensed as a contractor in the state where the project is to be installed.
- B. The system shall be designed by a certified EPA Water Sense partner, as found on the EPA Water Sense website, or must be a member of the Irrigation Association (IA), Fairfax, VA, and hold a C.I.D. (Certified Irrigation Designer) qualification.
- C. Comply with requirements of utility supplying water for prevention of backflow and back-siphonage.
- D. Materials, equipment, and methods of installation shall comply with the following codes and standards:
 - 1. All applicable federal, state, and local governing agency requirements, Kentucky Building Codes and to industry standards.
 - 2. American Society for Testing and Materials (ASTM) latest edition.
 - 3. National Sanitation Foundation (NSF).
- E. The Contractor shall furnish a written warranty to the effect that all materials and work furnished under this section is warranted for at least one year, shall be free from defects and faulty workmanship and that any defective material or work shall be promptly repaired or replaced without additional cost to the Owner.
- F. Requirements of Regulatory Agencies
 - 1. All work and materials shall be in full accordance with the latest rules and regulations of safety orders of Division of Industrial Safety the Kentucky Building Code and other applicable laws or regulations, including any local Plumbing Codes.
 - 2. Should the Contract documents be at variance with the aforementioned rules and regulations, notify the Owner's authorized representative for instructions before proceeding with work affected.
- G. Testing:
 - 1. Preliminary review of completed installation will be made prior to backfilling of trenches and hydrostatic testing.
 - 2. Final review and testing shall be made in conjunction with the final restoration of lawns and shrub/tree beds.
- H. Permits and Inspections
 - 1. Any permits for the installation or construction of any work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the contractor, each at the proper time.
 - 2. The Contractor shall also arrange for and pay all costs in connection with any inspection and examination required by these authorities.
- I. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 by a qualified testing agency, and marked for intended location and application.
- J. Substitutions: No substitutions from the initial plan will be permitted without review and approval by the owner's representative. Requests must be made at least 2 weeks in advance of the project start date. In the event the contractor desires to make substitutions of materials, sufficient descriptive literature, new design, and material samples must be furnished to establish the material as an acceptable substitute, and the design as functional. The proposed material substitution must meet the original design intent as it pertains to water conservation, as must also have definitive reasons why the proposed substitution is going to be a better solution for the

owner.

- K. Approval and Selection of Materials and Work: The selection of all materials and the execution of all operations required under this Performance Specification is subject to the approval of the owner's representative who has the right to reject any and all materials and any and all work which, in their opinion, does not meet the requirements of the contract documents at any stage of the operations. Remove rejected work and or materials from project site and replace promptly.
- L. All materials shall come from a regionally authorized irrigation distributor for the products as specified for warranty purposes.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver irrigation system components in manufacturer's original, undamaged, and unopened containers, with labels intact and legible.
- B. Deliver piping in bundles with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
- D. Store and handle materials to prevent damage and deterioration.
- E. Provide secure, locked storage for valves, sprinkler heads and similar components that cannot be immediately replaced to prevent installation delays.
- F. Contractor is responsible for materials through final acceptance.

1.7 PROJECT CONDITIONS

- A. Owner will provide site survey with private and public utility records. Contractor shall verify existing utility locations and be responsible for notification of Kentucky Underground utility locators or B.U.D. Photograph the existing conditions of the site prior to the start of work. Notify owner of any areas that appear to be damaged prior to beginning of the work in this project. All areas noted as damaged during the final walk through will be contractor responsibility unless identified prior to start of construction. Notify owner in writing of any areas damaged by others during construction within 4 days of the damage.
- B. Contractor shall test identified water source to determine flow rates and quantities are acceptable for the designed system. Any changes in the design of the system required to provide a fully operational system shall be included in the project at no additional cost to the owner.
- C. Contractor shall verify that the identified electrical supply is adequate for the system designed.
- D. The Contractor shall carefully coordinate with the landscape and other site developments, including all new and existing utilities.
- E. The Contractor shall verify the correctness of all finish grades within the work area to ensure the proper soil coverage of the irrigation pipes.
- F. Contractor shall establish exact location of piping, sprinkler heads, valves, and other components in the field at time of installation.
- G. Space sprinkler components as indicated. Do not exceed sprinkler spacing shown on Drawings.
- H. Locate existing utilities in areas of work. If utilities are to remain, provide adequate means of protection during the system installation. Repair utilities damaged during the work to the satisfaction of the Utility Owner and at the Contractor's expense. Notify local Utility Protection

Service three (3) days prior to beginning excavation work.

- I. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, notify the Owner's Authorized Representative immediately for direction as to procedure. Cooperate with the Owner and Utility companies in keeping active services and facilities in operation.
- J. Minor adjustments in system layout will be permitted to clear existing field obstruction. Final system layout shall be acceptable to the Owner's Authorized Representative.
- K. Protect structures, streets, curbs, sidewalks, fences, walls, trees, and other existing features from damage.
- L. Obtain all required permits and pay all fees required at no additional cost to the owner. Any penalties for failure to obtain permits is the responsibility of the contractor.
- M. Contractor shall provide traffic control to protect the public, students and employees of the University during construction. All site safety is the responsibility of the contractor.
- N. Contractor shall protect all existing site improvements and be responsible for any repairs needed to restore any damages. This includes damages from a leaks in the irrigation system.
- O. If concrete walks or drives are removed to install piping sleeves shall be installed prior to the replacement of the concrete pavements.

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate irrigation systems work with existing site.
- B. Irrigation system shall be installed and made operable before any seeding, sodding, and final restorations commence. In all affected areas, the ground should be restored to its original grade as existed just before irrigation installation began.
- C. Provide a complete project schedule including design and installation for review with the University. All closures and utility interruptions must follow University requirements for notification.

1.9 WARRANTY

- A. The Contractor shall furnish a written warranty to the effect that all materials and work furnished under this section is warranted for at least one year, shall be free from defects and faulty workmanship and that any defective material or work shall be promptly repaired or replaced without additional cost to the Owner.
- B. Irrigation Contractor is responsible to insure complete coverage as specified herein of the areas to be irrigated. During the warranty period the Irrigation Contractor shall make any adjustments as necessary to maintain proper coverage.
- C. If, within one year from the date of completion, settlement occurs, and adjustments in pipes, valves and sprinkler heads, lawn areas or paving are necessary to bring the system, grade or paving to the proper level of the permanent grades. The Contractor, as part of the work under his Contract, shall make all adjustments without extra cost to the Owner, including the restoration of all damaged planting, paving or other improvements of any kind.

- D. Should any operational difficulties in connection with the irrigation system develop within the specified guarantee period, which, in the opinion of the Owner's Authorized Representative may be due to inferior material and/or workmanship, said difficulties shall be immediately corrected by the Contractor to the satisfaction of the Owner at no additional cost to the Owner, including any and all other damages caused by such defects.

1.10 OPERATION AND MAINTENANCE – IRRIGATION SYSTEM

- A. The entire irrigation system shall be under fully automatic operation for a period of three (3) days prior to any planting.
- B. It is the Landscape Contractor's responsibility to determine water application rates and controller cycling. The Irrigation Contractor will instruct the Landscape Contractor on the operation and programming of the controller and will assist the Landscape Contractor as necessary in such operations throughout the one-year maintenance period. Any adjustments, repairs, etc., other than programming are the total responsibility of the Irrigation Contractor.
- C. The Irrigation Contractor shall service the system at the request of the Owner's Authorized Representative during the guarantee period and shall be paid for work performed which is not covered by the guarantee. The Irrigation Contractor shall winterize the system the first year as part of this contract, and provide written instructions to the Owner's Authorized Representative for future service and maintenance.
- D. The Irrigation Contractor shall return to the site during the subsequent spring season and demonstrate to the Owner's Authorized Representative the proper procedures for the system start-up, operation and maintenance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of design is a Rain Bird system, all systems shall be rain bird.
- B. The irrigation system shall be designed with components that are compatible with each other and operate as a complete system under one warranty.

2.2 UNAUTHORIZED MATERIALS

- A. Materials and products required for work of this section shall not contain asbestos. Polychlorinated biphenyl (PCB) or other hazardous materials identified by the Owner.

2.3 IRRIGATION SYSTEM MANUFACTURERS

- A. All irrigation system components shall be supplied by regionally authorized distributors to provide single source responsibility for warranty service and operations to conform to specifications in all aspects.

2.4 QUALITY AND SIZE

- A. Material specified by name and / or model number in the Specifications, on the site, or detailed drawings are used for the purpose of identification of materials and to ensure specific use of that material in the construction of the system. No substitutions will be permitted without approval. (See Substitutions).

- B. All materials used in the system must be new and without flaws or defects of any type and be the best quality available. All sprays, rotors and valves shall have a minimum three (3) year warranty against material defects or defective workmanship.

2.5 PIPE AND FITTINGS

- A. All PVC pipe from sizes three (3) inches and above shall be Class 200, SDR 26, unplasticized rigid polyvinylchloride (PVC) pipe with integral bell and rubber ring gasket unless otherwise specified. Pipe from sizes two and one - half (2 1/2) to one and one - quarter (1 1/4) inch shall be Class 200, solvent weld PVC pipe. Pipe sizes one (1) and three - quarters (3/4) inch shall be Class 200, solvent weld PVC pipe. One - half (1/2) inch pipe shall be Class 315 solvent weld PVC pipe. All pipe shall be supplied in standard twenty (20) foot lengths and shall be from one of the following manufacturers: No polyethylene pipe will be accepted unless prior written approval is obtained by the landscape architect.
- B. All pipe that is exposed or not below grade shall be Schedule 80 PVC or HDPE.
- C. All pipe fittings size four (4) inches and greater shall be ductile iron. 3" fittings shall be bell and rubber gasket. Fittings 2-1/2" and under shall be Schedule 40 solvent weld PVC.
- D. Solvent weld PVC pipe, if and when used in construction of this system, shall be rigid PVC pipe and shall be assembled using appropriate PVC pipe cleaner / primer and solvent cement in accordance with the manufacturer's recommendations.
- E. Expansion joints shall be installed every three hundred (300) feet of solvent weld piping.
- F. PVC Pipe Couplings Located Within Sleeves: PVC pipe couplings four (4) inches and smaller shall be solvent weld. PVC pipe couplings six (6) inches and larger shall be mechanical joints. Upon exiting sleeves, pipe solvent weld or integral bell and rubber gasket, as described in Section 2-02-A, must be adhered to.

2.6 RISERS: Provide threaded Schedule 80 PVC risers. All risers above grade shall be either dark gray or black PVC pipe, and shall be supported so as not to cause unnecessary movement while sprinkler is in operation.

2.7 ELECTRIC WIRING

- A. 120 Volt AC Wiring: 120-volt service to controller shall consist of three wires: one black, one white, and one ground. Electrical service is to be provided by the General Contractor unless otherwise directed by Owner's Representative. It is the Irrigation Contractor's responsibility to coordinate the location of electrical service to be provided for controller.
- B. Splices in controller wiring shall be waterproof direct bury application. Use Rain Bird-DBY Tor R wire connectors. 3M DBY/R-6 are equal. No substitutions will be allowed.
- C. Provide junction box, flush-mounted and gasketed per code as required.
- D. Control Wiring shall be 24-volt solid wire Underwriter's Laboratory (UL) approved for direct burial in ground. Minimum wire size shall be fourteen (14) gauge. All control wiring and wiring connections from the controller to the valves is included in this Contract.

2.8 SPRINKLER HEADS

- A. Fixed Spray Sprinkler Head: Sprinkler shall be of the fixed spray type designed for in - ground installation. Sprinkler shall be capable of covering a maximum of fifteen (15) foot radius at thirty

(30) psi and maximum delivery of 3.7 gpm. Spacing shall not exceed a distance of 15' for U-Series and HE-VAN nozzles.

- B. Pop-Up Rotor Sprinklers shall include a pressure regulating device to prevent high pressure fogging to the nozzle stream. This regulating device shall be an integral part of the pop-up stem and shall regulate the nozzle pressure to 30 PSI or 45 psi (nozzle appropriate) for inlet pressures from 35 to 70 PSI. Spacing on the 5000 series shall not exceed 35'. These units shall be identifiable from the top with "PRS" markings on the cap.
- C. The addition of a check valve feature (SAM) shall be incorporated into the spray body and used in locations throughout the system where low head drainage is possible. In the event that the jobsite is flat, the SAM feature can be eliminated.
- D. Spray Nozzles; High-efficiency nozzles distribution uniformity (DULQ) of 70 % or greater, (as published by the manufacturer) shall be used. The higher efficiency nozzle should result in better than a 1.2 SC, reducing runtime accordingly. All nozzles shall all have a matched precipitation rate with other nozzles on the same zone. Utilize lower precipitation rate rotary nozzles (.6 in/p hour) on hilly areas and/or where infiltration is low and therefor runoff is expected. Rotary Nozzle for shrub or small turf areas. Spacing shall be a minimum of 13' and a maximum of 20'.
 - 1. Utilizing high precipitation high-efficiency nozzles for improved wind resistance will allow for shortened run-times on flat areas or where infiltration rates allow. Provide Rain Bird® HE-VAN-8', 10', 12' or 15' spray nozzles Spacing of 8 to 15 feet (DU of 73% to 78% respectively). Shall have an arc adjustment from 0 to 360 degrees.
 - 2. Dual orifice nozzles may be used in locations requiring superior close-in watering, while maintaining a DULQ of 70% or greater. Spray nozzle for shrub or small turf areas (5-15feet) spacing: maximum 30 psi.
- E. Intermediate Turf Rotors
 - 1. The full or part circle sprinklers shall utilize MPR Nozzle sets. In the event that the jobsite is flat, the SAM feature can be eliminated. Sprinkler shall be a single stream, water lubricated, gear drive type capable of covering the areas between 25 and 35 feet at a minimum base pressure of 45 psi. The part circle sprinkler shall have adjustable arc coverage of 40 to 360 degrees. Sprinkler spacing shall not exceed 35'
 - a. The sprinkler shall include an integral pressure regulator to reduce operating pressure to 45 psi for optimal nozzle performance. The sprinkler shall have a flow shut-off device (5000 Plus PRS only) that is integrated into the flow path of the rotor as well as adjustable arc coverage of 40 to 360 degrees.
 - b. The sprinkler shall have a standard rubber cover, tapered stem for positive flushing, and a strong stainless steel retract spring for positive pop down.
- F. Long Range Rotors: 5505, 6504 (Falcon) 8005 Full or Part Circle Rotors
 - 1. The full- or part-circle sprinkler shall be a single stream, water lubricated, gear drive type capable of covering a radius of 17 to 80 feet at a base pressure of a minimum of 45 pounds per square inch (psi) for the 5505 and a minimum of 50 psi for the 8005 to a maximum of pressure of 90 psi for the 5505 and 8005.
 - 2. The sprinkler shall have a rotating nozzle turret independent of the riser stem. The portion of the riser stem that is in contact with the wiper seal shall be non-rotating. The sprinkler shall have a non-strippable drive mechanism and permit manual rotation of the pop-up stem in any direction. This shall have no effect on either the drive or the set arc. Once the manual rotation is terminated, the sprinkler shall automatically return the water stream to its preset arc.
 - 3. Sprinkler shall be full and part circle operation in a single unit, and when adjusted to the full circle position shall rotate in a single continuous direction.
 - 4. Maximum spacing for the 5505 shall not exceed 45', 6504 Falcon 60', and the 8005 shall not exceed 70'

2.9 AUTOMATIC CONTROLLER

- A. Systems of 48 zones or less: ESP-LXMEF (conventional wiring)
1. Irrigation controller shall have a modular station capacity, by receiving expansion modules of 4, 8, or 12 stations, to create a controller of up to 48 stations. The controller shall be of a hybrid type, housed in a wall-mountable, weather resistant plastic cabinet with a key-locking cabinet door suitable for outdoor installation. The controller shall have 4 separate and independent programs which can have 8 different start times, start day cycles and station run times. The controller shall have a Cycle+Soak water management feature.
 2. The controller shall incorporate a FloManager feature that shall provide real-time flow, power, and station management. FloWatch shall compare the current real-time flow rate to the learned rates and take user defined actions if problem is detected. FloWatch shall automatically determine the location of the flow problem and isolate the problem by turning off the affected station or master valve.
 3. ESP-LXMEF shall be compatible with a Manager Cartridge that enables weather-based management for the irrigation controller.
 4. The controller shall be compatible with the IQ v2.0 Central Control System utilizing IQ-NCC Network Communication Cartridges providing remote computer control of the controller via a variety of communication options (Direct Connect Cable, Phone, GPRS/Cellular, Ethernet, WiFi, Radio, and IQNet Communication Cable).
 5. Shall include a 3-year trade warranty.
- B. 2 Wire Decoder Commercial Grade ESP-LXD (50 stations, expandable to 200 stations)
1. The controller shall be housed in a wall-mountable, plastic locking cabinet suitable for either indoor or outdoor installation. The controller shall be capable of supporting up to 50 stations and shall have a maximum capacity of up to 200 stations. The controller shall interface to decoders capable of controlling 1, 2, 4 or 6 valves per unit (FD101, 102, 104 and 106). Sensor decoder for flow sensing is SD210. Surge suppression and grounding should follow the manufacturer's recommendation. The controller shall have 4 independent programs with 8 start times each. The controller shall include 2-wire diagnostic tools for diagnosis of field wiring, 2-wire path and solenoid issues.
 2. The controller shall support up to 5 independently managed flow sensors interfaced with sensor decoders. The controller shall support up to five flow zones.
 3. The controller shall incorporate a FloManager feature that shall provide real-time flow, power, and station management. FloWatch shall compare the current real-time flow rate to the learned rates and take user defined actions if problem is detected. FloWatch shall automatically determine the location of the flow problem and isolate the problem by turning off the affected station or master valve.
 4. ESP-LXD shall be compatible with a Manager Cartridge that enables weather-based management for the irrigation controller.
 5. The controller shall be compatible with the IQ v2.0 Central Control System utilizing IQ-NCC Network Communication Cartridges providing remote computer control of the controller via a variety of communication options (Direct Connect Cable, Phone, GPRS/Cellular, Ethernet, WiFi, Radio, and IQNet Communication Cable).
 6. Shall include a 3-year trade warranty.

2.10 AUTOMATIC RAIN / FREEZE SHUT OFF DEVICE

- A. Rain or rain / freeze sensor shall employ an electro-mechanical actuating mechanism designed to cause a circuit interrupt if programmable low temperature or rainfall set points are satisfied.
- B. The device shall be used with 24VAC controllers and shall be of sufficient capacity to be used with a maximum of six 24VAC 7VA solenoids plus an additional master valve or pump start that does not exceed 53VA.

- C. The wireless rain sensor shall incorporate a provision that allows the installer to select from several rainfall or low temperature settings that can be programmed through the use of icons on a controller interface.
- D. A sensor LED shall communicate signal strength during the installation process.

2.11 SMART SENSORS FOR CONTROLLERS - Rain bird is basis of design, other manufacturers meeting these specifications will be acceptable.

- A. Weather base scheduling: (LXME or LXD compatible)
 - 1. ET manager, weather based controls are an integral part of a water efficient system. The ET device shall be either Rain Bird model ETM-LXM or ETMi when used with IQ central software. Rain Bird model ETMRG shall also be used in conjunction with the ETM-LXM or ETMi for recording local rainfall. ET-manager Cartridge is also acceptable when utilized with the ESP-LXM controller.

The contractor is responsible for setting and initial acquisition of the weather signal from the provider network.

Or

- B. Soil moisture sensing: (LXME compatible)
 - 1. The SMRT-Y Soil Moisture Sensor shall be a smart watering control device for use with a standard 24-Volt AC multi-wire (LXME) irrigation controller. In operation, the SMRT-Y Soil Moisture Sensor shall only allow a programmed watering cycle when the soil moisture drops below a set moisture threshold. When the moisture is above that threshold, the SMRT-Y Soil Moisture Sensor shall suspend the normal watering cycle by interrupting the common line to the valve solenoids.
 - 2. User interface shall enable instant readings of soil moisture, temperature and electrical conductivity plus review of 7-cycle watering history.
 - 3. It shall take digital readings every 10 minutes of soil Volumetric Water Content (VWC)utilizing advanced Time Domain Transmissometry (TDT) digital signal processing that delivers accurate readings independent of soil temperature and electrical conductivity.
 - 4. It shall consist of a 304 stainless steel digital Soil Moisture Sensor and a User Interface. Features shall include automatic setting of soil moisture threshold with increase/decrease adjustment as well as bypass mode.

2.12 FLOW SENSORS (used with LXME or LXD controller's flow manager)

- A. The flow sensor shall be an in line type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part. The electronics housing shall have two, ethylene propylene O-Rings and shall be easily removed from the meter body. The sensor electronics will be potted in an epoxy compound designed for prolonged immersion. Electrical connections shall be 2 single conductor 18 AWG leads 48 inches (1,2 meters) long. Insulation shall be direct burial "UF" type colored red for the positive lead and black for the negative lead. The sensor shall be capable of operating in line pressures up to 400 psi (27,5 bars) and liquid temperatures up to 220° F, and operating in flows of ½ foot per second to 15 feet per second with linearity of ±1%and repeatability of ±1%. The meter body shall be cast 85-5-5-5 bronze, in 1" and 1½", female iron pipe thread sizes. This flow sensor shall be Rain Bird Model FS series (appropriately sized based on flow) or equal.

2.13 METER: Submit product data as required

2.14 BACKFLOW PREVENTER:

- A. To be supplied and installed by the Irrigation Contractor. Backflow preventer shall be a RPZ

reduced pressure backflow assembly type, capable of having an adequate flow rate in gallons per minute (gpm) without excessive pressure loss, and shall be suitable for supply pressure of up to 70 psi. Backflow preventer body shall be bronze with corrosion-resistant interior components and check assemblies shall be tight seating rubber. Working pressure shall be 150psi minimum with a maximum pressure loss of 12 psi through middle 1/3 of flow range. Backflow preventer shall be installed within enclosure with sufficient clearance to permit periodic testing and maintenance. Provide a lockable enclosure on a concrete pad 5" thick with WWF reinforcement, over 6" CA6 base for the backflow preventer. Backflow preventer assembly must include (2) gate valves for isolating unit, and two (2) ball valve test cocks for testing unit to ensure proper operation.

2.15 VALVE BOXES

- A. Control Valves and Quick Coupling Valves shall be Rain Bird VB-10RND or VB-STD for multiple valves.
- B. Valve box body and black lid shall be composed of 100% recycled HDPE. There shall be no pre-punched hole in the valve box lid. The standard rectangular body shall have 14 knock-outs molded into the sides that can be readily removed. The valve box shall have corrugated sides for lateral strength. Lids shall have beveled edges to minimize potential damage from lawn equipment. Lids shall be clearly marked with the words "Irrigation Control Valve" molded onto the top. Lids shall have a marking area measuring 6.0" by 2.0" suitable for branding or other identification. The locking bolt, washer and clip shall be made of stainless steel.

2.16 SLEEVES: Class 200 PVC Pipe Type II20 or 1220 coordinate with and installed by the General Contractor.

2.17 QUICK COUPLING VALVES: One (1) per zone, located adjacent to remote solenoid valve.

- A. Quick Coupling Valves (QCVs) will be used for manual access to the pressurized main line so that a hose can be attached and used for hand watering. QCVs shall be constructed of brass with a spring loaded seal that will keep the valve in a closed position until the key is inserted into the valve.
- B. Two-piece body design for easy servicing (models 33-DRC, 44-LRC, 44-RC, 33-DNP, and 44-NP). QCVs shall be installed on a triple elbow swing joint.
- C. Irrigation Contractor to contact Owner's Representative to determine hose type. Key and swivel shall both be constructed of brass.

2.18 CONTROL VALVES:

- A. Remote Control Zone or Master Valve model PGA or PEB series or approved equal. The valve shall be normally closed globe pattern design. Valve pressure rating shall not be less than 150psi. Shall have both internal and external manual open/close control (internal and external bleed) to manually open and close the valve without electronically energizing the solenoid. Shall be compatible with ESP-LXD-decoders. Shall have a brass flow control stem for accurate manual regulation and/or shut off of outlet flow. Slow closing to prevent water hammer and subsequent system damage. Accepts latching solenoid for use with battery-operated controllers up to 150 psi. Valve can accommodate an optional, field-installed Rain Bird® PRS-D pressure regulating module capable of regulating outlet pressure between 15 and 100 psi (± 3 psi). Operating pressure range of 20 to 200 psi. Operating flow rate of 5 to 200 gpm.
- B. Drip Zone Control Kit (low flow): XCZ-075-PRF [3/4" Low Flow valve and 3/4" PR filter]. Low flow control zone kit assembly for drip zones with flows from 0.2 to 5.0 gpm. Valve body and bonnet constructed of high impact, weather-resistant plastic, stainless steel. Low-power encapsulated solenoid with captured plunger and 90 mesh (200 micron) solenoid filter, Normally-open in-line

pressure regulating device. Operating flow rate of 0.2 to 5.0 GPM. Operating pressure range of 20 to 120 PSI. Regulated pressure of 30 PSI (2,1 bar). Temperature rating to 150° F (66° C). Shall include a 3 -year trade warranty.

Or

- C. Drip Zone Control Kit (medium flow): XCZ-100-PRB-COM [1" PVC ball valve, 1" PESB CV and 1" PRBF filter]. Medium flow control zone kit assembly for drip zones with flows from 3 to 20 gpm, including PVC ball valve, PESB control valve (CV), and quick check pressure-regulating basket filter (PRBF) which combines filtration and pressure regulation in one unit for protection of downstream components of drip irrigation system. Pressure regulating basket filter component specifications include: Standard 200 mesh (75 micron) filter screen constructed of stainless steel. Normally-open in-line pressure regulating device. Operating flow rate of 3 to 20 gpm. Operating pressure range of 15 to 150 psi. Regulated pressure of 40 psi. Temperature rating to 150° F.

Or

- D. Drip Zone Control Kit (high flow): XCZ-150-COM [1 1/2" PESB valve, and two 1" PRB-QKCHK pressure regulating basket filters]. Rain Bird High Flow Commercial Control Zone Kit for dripline zones with flows from 15.0 to 40.0 GPM, including PESB valve and two parallel pressure regulating quick-check basket filters. One-piece solenoid with captured plunger and 90 mesh (200 micron) solenoid filter, external bleed for manual system flushing during start-up, internal bleed for manual zone activation during maintenance operations. Operating flow rate of 15.0 to 40.0 GPM. Inlet pressure rating: 20 to 200 PSI. Regulated pressure of 40 psi. Temperature rating to 150° F. Shall include a 3 -year trade warranty.

2.19 DRIP LINE

- A. Description: XFS Dripline with Copper Shield Technology and pressure-compensating dual-layered inline emitters. XFS for surface and sub-surface application with dripline emitters designed to protect the emitter from root intrusion without chemicals. Emitter spacing and dripline row spacing should be indicated on construction drawings.
- B. Refer to manufacturer's recommendation regarding spacing and precipitation rate base on soil profile. (see catalog)
1. XFS-06-12; 0.6 GPH emitters spaced 12" on-center
 2. XFS-06-18; 0.6 GPH emitters spaced 18" on-center
 3. XFS-09-12; 0.9 GPH emitters spaced 12" on-center
 4. XFS-09-18; 0.9 GPH emitters spaced 18" on-center
- C. Easy Fit compression fittings, XF Dripline insert fittings and 17mm insert fittings. Operating pressure range of 8.5 to 60 psi. Operating emitter flow rates of 0.6 and 0.9 gph. Emitter spacing of 12 or 18 inches. Drip zone operational indicators model# OPERIND are to be installed close to the end of each zone in an inconspicuous location and noted on the as-built drawing. OPERIND is designed to open at 20psi, confirming normal pressure and flow are present. Shall be manufactured by Rain Bird Corporation, Azusa, California.

2.20 SURGE PROTECTION EQUIPMENT

- A. Provide General Electric Lightning Arrestor No. GL 15 CC B 007 for controllers not equipped with primary surge protection.
- B. Irrigation Contractor is responsible for determining whether the above mentioned surge protection equipment is provided in the controller as a "built - in" unit or if it must be supplied and installed separately.

2.21 ISOLATION VALVES

- A. Provide all gate valves for isolation purposes, allowing full diameter opening when in full open position.
- B. Manually operated valves shall be the same size as the line.
- C. Valves three (3) inches or smaller shall be brass construction, threaded, and rated for two hundred (200) psi WOG.
- D. Valves four (4) inches or larger shall be cast iron fitted with a rubber ring, slab - type gasket.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Meet with University personnel to investigate and determine available water supply, water pressure, and flow characteristics.

3.2 PREPARATION

- A. Provide design drawings and data information for owner review, with minimum disturbance of existing landscape plantings.
- B. Lay out work as closely as possible to the drawings. **Any work shown within the drip lines of existing trees shall be reviewed on site with the University arborist prior to installation or disturbance of the ground.**
- C. The Contractor shall be responsible for full and complete coverage of irrigated areas as to spacing and precipitation rates being matched and shall make any necessary adjustments to the system at no additional charge to the Owner. Head spacing as shown on the drawings is predicated on the water pressure being 65 poss. (static) at the point of connection. Head spacing shall not exceed 55 percent of manufacturer's stated diameter. Contractor shall verify existing working pressure before commencing work. Revisions to the irrigation system must be submitted to the engineer in written form for approval.

3.3 EARTHWORK

- A. Prior to any disturbance provide BMP/ erosion control plan showing how storm water runoff will be controlled. All erosion control measures shall be in place prior to disturbance of the site.
- B. Pulling, Excavating, and Trenching
 - 1. Trenching, backfilling, and compacting shall be as per Division 32 "Earthmoving."
 - 2. If trenching, trenches shall be made wide enough to allow a minimum of 6 inches between parallel pipe lines. If pulling, the same lateral distance shall be observed.
- C. Minimum Cover
 - 1. An absolute minimum of 12 inches cover shall be held over laterals, control wires, and mains below finished grade.
- D. Backfill

1. Backfilling shall be done in 6" layers and compacted after each layer to prevent excessive settling.
2. Backfilling of trenches containing plastic pipe shall be done when pipe is cool to avoid excessive contraction in cold weather. Such backfilling can be done in early morning hours or the pipe may be water cooled prior to backfilling procedures.
3. Where pipe is pulled into the ground, slit-domes shall be compacted to original grade after pulling.

3.4 SLEEVING WORK

- A. Communication wire must be placed in sleeving under pavement, walks, etc.
- B. Sleeving required shall be furnished by this Contractor, unless directed otherwise.

3.5 INSTALLATION

- A. Unless otherwise indicated, comply with requirements of the Local Plumbing Code.
- B. Install piping, valves, controls and sprinklers in accordance with manufacturer's written instructions.
- C. Connection to Main: Connect to building domestic piping in location approved by RAC.
 1. As a minimum, install tee, valve, union and other fittings as needed to provide a complete connection.
- D. Backflow Preventer: Not required RPZ.
- E. Water Hammer Arrester: When necessary, Install between connection to building main and circuit valves, inside building or in valve box.
- F. Circuit Valves: Install in valve box, arranged for easy adjustment and removal.
 1. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- G. Automatic Controllers.
 1. Connect remote control valves to controller in a sequence corresponding with station settings, as denoted on the plan.
 2. Communications Circuitry.
 3. Communication circuitry shall be run, wherever possible, along with the mainline pipe.
 4. A minimum of 12 inches of wire shall be left at each valve to provide slack
- H. Piping: Lay pipe on solid subbase, uniformly sloped without humps or depressions.
 1. At wall penetrations, pack the opening around pipe with non-shrink grout. At exterior face, leave a perimeter slot approximately 1/2" wide by 3/4" deep. Fill this slot with backer rod and an acceptable elastomeric sealant. Repair below grade waterproofing disturbed by this work and make penetration watertight.
 2. Install PVC pipe in dry weather when temperature is above 40 degrees F. (4 degrees C) before testing, unless otherwise recommended by manufacturer.
 3. Pipe may be assembled and welded on the surface.
 4. Plastic pipe and fittings shall be solvent welded using solvents and methods as recommended by manufacturer of the pipe, except where screwed connections are required. Pipe and fittings shall be thoroughly cleaned of dirt, dust and moisture before applying solvent with a non-synthetic bristle brush.
 5. When pipe is pulled into the ground, all PVC pipe shall be solvent welded at least 2 hours before pulling.

6. Make all connections between plastic pipe and metal valves or steel pipe with threaded fittings using plastic male adapters.
 7. Use dielectric fittings at connection where pipes of dissimilar metal are joined.
 8. Lay pipe on solid subbase, uniformly sloped without humps or depressions
 9. Trenches (or pulls) shall be snaked, or the pipe snaked, within the trench to allow for expansion and contraction of pipe.
- I. Sprinkler Heads: Flush circuit lines with full head of water and install heads after hydrostatic test is complete.
1. Install lawn heads at manufacturer's recommended heights.
 2. Install shrubbery heads at heights indicated.
 3. Locate part-circle to maintain a minimum distance of 4" from walls and 2" from other boundaries, unless otherwise indicated.
 4. Use only Teflon tape for sealing heads and riser assemblies when required.
- J. Closing of Pipes and Flushing Lines.
1. Cap or plug openings as soon as lines have been installed to prevent the entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of the installation. Thoroughly flush out water lines and before installing heads, valves, and other hydrants.
 2. Test in accordance with industry standards and pipe ratings.
 3. Upon completion of the testing, the Contractor shall complete assembly and adjust sprinkler heads for proper distribution.

3.6 FIELD QUALITY CONTROL

- A. Testing: Perform hydrostatic testing of piping and valves before backfilling trenches. Piping may be tested in sections to expedite work.
1. Cap and subject the piping system to a static water pressure of 50 psig (345 kPa) above the operating pressure without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
 2. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.

3.7 CLEANING AND ADJUSTING

- A. Flush dirt and debris from piping before installing sprinklers and other devices.
- B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.
- C. Carefully adjust lawn sprinklers so they will be flush with, or not more than ½ inch (13 mm) above, finish grade after completion of landscape work.
- D. Adjust settings of controllers and automatic control valves.

3.8 DEMONSTRATION

- A. Personnel Training
1. Contractor shall be responsible for the training of as many personnel as the Owner shall deem necessary.
 2. Contractor shall be responsible for one closing and one opening of the system during the appropriate times of the year as part of the training of the Owner's personnel.
 3. Contractor training shall include general trouble-shooting and operation of the system with reference to head, valve, and controller operation.

4. Provide 7 day written notice in advance of demonstration.

3.9 RESTORATIONS

- A. Any disturbed areas being restored shall be sodded with an approved sod.
- B. Any concrete walks or pavements shall be replaced with 4000psi concrete of the same thickness as was removed and doweled following Universities standards for concrete placement.
- C. All plantings disturbed by the installation of the irrigation system shall be restored with matching plantings.

3.10 CLEAN UP

- A. Remove debris, resulting from work, from the site.

3.11 ADJUSTMENT

- A. After completion of grading, seeding or sodding, if applicable, contractor shall return to the jobsite to perform any final adjustments to the system which might be deemed necessary.
- B. Maintenance shall include, in addition to initial start-up, one winterization and one spring start-up the following year. Re-setting of heads up to two times, as directed, if necessary, shall be included at no additional cost to the owner.

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