

SECTION 32 84 20 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide all materials, labor, equipment and services necessary to furnish and install Irrigation System, accessories and other related items necessary to complete the Project as indicated by the Contract Documents unless specifically excluded. The extent of the underground irrigation system is shown on the drawings. Point of Connection (P.O.C) and controller location are shown on the drawings.

1.2 RELATED WORK SPECIFIED ELSEWHERE

32 90 00 PLANTING

- A. Drawings and general provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections, apply to work of this section.

1.3 CODES AND REGULATIONS

- A. All work and materials shall be in full accordance with the following codes adopted and amended by the authority having jurisdiction. Nothing in these drawings or specifications is to be construed to permit work not conforming to these codes. The specifications shall govern in the event that the drawings or specifications call for material or methods of construction of higher quality or standard than required by these codes.
 1. California Plumbing Code
 2. California Administrative Codes:
 - a. Title 8, Industrial Relations
 - b. Title 19, Public **Safety**
 3. California Electrical Code
 4. Standards and Regulations of other agencies or organizations as listed in this specification relating to products or procedures. For example, American Society for Testing and Materials.

1.4 EXPLANATION OF DRAWINGS

- A. The intent of the drawings and specifications is to indicate and specify a complete and efficient sprinkler irrigation system ready for use in accordance with the manufacturer's recommendations, and all applicable local codes and ordinances. Questions concerning interpretation of irrigation plans and specifications shall be the responsibility of the Landscape Architect. The Contractor shall examine the project documents fully before submitting a project bid.
- B. All plot dimensions are approximate. Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and shall report any variations to the Project Inspector and Landscape Architect.
- C. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, etc., which may be required. The Contractor shall carefully investigate the structural and

finished conditions affecting all 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 in the most direct and workmanlike manner, so that conflicts between sprinkler systems, planting, utilities, and architectural features will be avoided. Contractor shall provide and install any and all material, labor and operations necessary to provide a complete fully functional irrigation system as deemed acceptable by the Owner. No additional compensation will be given to the Contractor for work required by the Owner.

- D. All work called for on the drawings by notes shall be furnished and installed whether or not specifically mentioned in the specifications.
- E. The Contractor shall not willfully install the irrigation facilities as indicated on the drawings when it is obvious in the field that unknown obstructions might not have been considered in the engineering. Such obstructions or differences should be brought to the attention of the Project Inspector.
- F. The Contractor shall examine carefully the site of work contemplated and the proposal, plans, specifications, and all other contract documents. It will be assumed that the Contractor has investigated and is satisfied as to the conditions to be encountered, as to the character, quality, and quantity of work to be performed and materials to be furnished, and as to the requirements of the specifications. The Contractor shall take necessary precautions to protect existing site conditions that are to remain. Should damage be incurred, the Contractor shall make the necessary repair or replacement to bring it back to its original condition at his own expense.
- G. Prior to cutting into the soil, the Contractor shall coordinate with the Project Inspector locate all cables, conduits, sewers, septic tanks, and other such utilities as are commonly encountered underground and he shall take proper precaution not to damage or disturb such improvements. If a conflict exists between such obstacles, notify the Project Inspector who will consider realignment of the proposed work. The Contractor will proceed in the same manner if a rock layer or any other condition encountered underground makes change advisable. Should utilities not shown on the plans be found during excavations, Contractor shall promptly notify the Project Inspector for instructions as to further action. Failure to do so will make Contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown in plans.
- H. The Contractor shall verify the correctness of all finish grades within the work area in order to insure the proper soil coverage (as specified) of the sprinkler system pipes. The Contractor shall verify and be familiar with location and size of the proposed water supply (P.O.C.). He shall make approved type connection and install new work.
- I. The Contractor shall be responsible for notifying the Project Inspector in the event any equipment or methods indicated on the drawings or in the specifications conflict with local codes, are incompatible or an error is apparent prior to installing. In the event the Contractor neglects to do this, he will accept full responsibility for any revisions necessary. No additional compensation will be given to the Contractor for necessary revisions resulting from this event.

1.5 PERMITS AND INSPECTIONS

- A. The Contractor shall obtain and pay required fees to any governmental or public agency. Any permits for the installation or construction of any of the 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. He shall also arrange for and pay all costs in connection with any inspections and examination required by these authorities.
- B. In all cases, where inspection of the irrigation system work is required and/or where portions of the work are specified to be performed under the direction and/or inspection of the Owner authorized Representative the Contractor shall notify the Owner's Authorized Representative, at least 48 hours in advance of the time when such inspection and/or direction is required. Any necessary re-excavation or alterations to the system needed because of failure of the Contractor to have the required inspection, shall be performed at the Contractor's own expense.

1.6 GUARANTEE

- A. Irrigation system shall be guaranteed for one year from date of final acceptance by the Architect.

1.7 OPERATIONS AND MAINTENANCE INSTRUCTIONS/RECORD DOCUMENTS

- A. The Contractor shall prepare and deliver to the Owner Representative within ten (10) calendar days prior to completion of the construction, all required and necessary descriptive material in complete detail and sufficient quantity, properly prepared in two individually bound sets of Operating and Maintenance Manuals.
These manuals shall describe the material installed and shall be in sufficient depth to permit operating personnel to understand, operate and maintain all equipment. Spare part lists and related manufacturer identification shall be included for each installed equipment item. Each complete, bound manual shall contain the following information:
 1. Index sheet stating Contractor's address and telephone number, duration of guarantee period, and list of equipment, with names and addresses of local manufacturer representatives.
 2. The Contractor to issue a "CERTIFICATE OF CONSTRUCTION COMPLIANCE" to the Project Inspector which indicates that all work done, materials and equipment used and installed are in compliance with the approved plans, specifications and all authorized revisions.
 3. Complete operating and maintenance instruction on all major equipment.
 4. Complete set of manufacturer's literature and specifications of material installed, including parts list.
 5. Diagrams for all wiring of controller, controller valves, etc.
 6. Initial electrical data on each control valve.
 - a. Ohmmeter reading for each valve taken at the controller and valve.
 - b. Voltmeter reading for each valve.
- B. The contractor shall furnish one set of bond copy As-Built drawings and one set of Autocad 2004 drawing files on flash drive of As Builts after all As Built information has been transferred to the CAD files.

1. Label first page of each document, or set of documents, "PROJECT RECORD" in neat large printed letters on lower right hand corner. Record information concurrently with construction progress. Prints for this purpose may be obtained from the Project Inspector. This set of drawings shall be kept on the site and shall be used only as a record set. Do not conceal any work until required information is recorded.

These drawings shall also serve as work in progress sheets, and the Contractor shall make neat and legible annotations thereon daily as the work progresses, showing the work as actually installed. These drawings shall be available at all times for inspection and shall be kept in a location designated by the Project Inspector.

2. Drawings: Legibly mark to record actual construction:
 - a. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements. Give sufficient horizontal and vertical dimensions to accurately trace route and invert of each concealed line or item. Accurately locate each capped, plugged or stubbed line.
 - b. Field changes of dimension and detail.
 - c. Changes made by Field Order, by Addenda, or by Change Order.
 - d. Details not on original Contract Drawings.
 3. Deliver all Record Documents (As-Built) to Project Inspector. Accompany submittal with transmittal letter in duplicate, containing:
 - a. Date.
 - b. Project title.
 - c. Contractor's name and address.
 - d. Title and number of each Record Document (As-Built).
 - e. Signature of Contractor or his authorized representative.
- C. The Contractor shall provide one controller chart for each controller installed. The chart will show the area irrigated by the controller and shall be the maximum size the controller door will allow. The chart may be a reduced drawing of the actual plans. The chart shall be colored with a different color for each station. The chart shall be laminated or covered in a watertight envelope.
- D. The Contractor shall provide three (3) copies of laminated, typewritten legible controller programming charts for each individual controller. The chart shall show all stations on controller, run times, start times and program.

1.8 SUBMITTALS

- A. Contractor shall submit six (6) copies of complete lists of proposed materials to the Landscape Architect, including manufacturer's name and catalog numbers. No substitution will be allowed without prior written approval by the Owner.
- B. Shop drawings shall follow for all equipment, including dimensions, capacities, and other characteristics as listed in product specifications. Materials and equipment shall not be ordered until given written approval by the Owner.
- C. When specific name brands of equipment and materials are used, they are intended as preferred standards only. This does not imply any right upon the part of the Contractor to furnish other materials unless specifically approved in writing as equal in quality and performance by the Owner. Decisions by the Owner shall

govern as to what name brands of equipment and materials are equal to those specified on the plans and his decisions shall be final. It shall be the responsibility of the prospective bidder to furnish proof as to equality of any proposed equipment or material.

- D. Approval of any item, alternate or substitute indicates only that the products apparently meet the requirements of the drawings and specifications on the basis of the information or samples submitted. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.
- E. Provide three (3) keys for each of the irrigation controllers.
- F. Acceptance of any submittals, deliverables, or other work product of the Contractor shall not be construed as assent that contractor has complied, nor in any way relieved the Contractor of, compliances with (i) the applicable standard of care of (ii) applicable statutes, regulations, rules, guidelines, and contract requirements.

1.9 DEFINITIONS

- A. Piping: All pipe fittings, valves, and accessories as required for a complete piping system.
- B. PVC: Polyvinyl Chloride.
- C. Agencies and Organizations:
 1. ASTM- American Society for Testing and Materials
 2. AWWA- American Water Works Association
 3. IAPMO- International Association of Plumbing and Mechanical Officials
 4. CEC - California Electrical Code.
 5. UL - Underwriter's Laboratories

1.10 REJECTION OF MATERIAL OR WORK

- A. The Owner reserves the right to reject any material or work which does not conform to the contract plans, specifications without any written approval from the Landscape Architect. The rejected material or work shall be removed or corrected by the Contractor at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Piping:
 1. Pressure pipe/upstream of control valve:
 - a. PVC SDR 13.5 high impact pipe (ASTM D2241 & ASTM D1784).
 2. Lateral line/downstream of control valve:
 - a. Solvent weld bell end PVC Schedule 40 high Impact pipe (ASTM D1785 & ASTM D2665).
 - b. Class 315 2" and above Schedule 40 2" and down.
 3. Sleeving under paving:

- a. Solvent weld bell end PVC 1120 Schedule 40 high impact pipe (ASTM D1745 & ASTM **D1784**).
 4. All pipe shall be continuously and permanently marked and conform with the following information:
 Manufacturer's name or trademark, nominal pipe size, schedule and type of pipe, pressure rating in PSI and (NSF) seal of approval. Pipe shall be of improved white rigid polyvinyl chloride (PVC) compound manufactured by Lasco Industries or approved equal.
 5. Saddles shall be used for all connections between mainline and electric control valves and quick coupling valves. Saddles shall be coated ductile iron with two (2) stainless steel straps. Romac Industries (800) 426-9341, #202NS or equivalent
 6. For connections between main lines and electric control valves: Schedule 80 **PVC ASTM D2464**.
- B. Fittings:
1. For PVC plastic pipe: white rigid polyvinyl chloride (PVC) Schedule 40 type I and I grade 1, solvent weld socket fittings ASTM D2466 for all lateral line pipe. Harco Deep Bell Ductile Iron gasketed fittings, grade 65-45-12 in accordance with ASTM A-536, deep bell push on joints with gaskets meeting ASTM F-477 manufactured by The Harrington Corporation (804) 845-7094, or approved equivalent, for all mainline pipe. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable (IPS) schedule, and (NSF) seal of approval.
 2. All plastic fittings and connectors shall be injection molded of an improved polyvinyl chloride compound featuring high tensile strength, high chemical resistance and high impact strength in terms of current ASTM standards for such fittings and as manufactured by Lasco Industries or approved equal. Where threads are required in plastic fittings, these shall be injection molded also.
 3. Schedule 80 fittings 2" and up.
- C. Galvanized pipe and fittings:
1. Galvanized Pipe shall be hot dip galvanized continuous welded, seamless steel pipe SCH 40 conforming to applicable current (ASTM) standards.
 2. Galvanized Fittings shall be galvanized malleable iron ground joint SCH 40 conforming to applicable current (ASTM) standards.
- D. Solvent Weld Adhesive:
1. All socket type connections shall be joined with primer and PVC solvent cement which shall meet the District Standards and requirements of ASTM F656 for primer and ASTM D2564, "Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Pipe and Fittings." Solvent cement joints for plastic pipe and fittings will be made as prescribed by manufacturer. The high chemical resistance of the pipe and fitting compounds specified in the foregoing sections makes it mandatory that an aggressive colored primer, which is a true solvent for (PVC) be used in conjunction with a solvent cement designed for the fit of pipe and fittings of each size range specified. A medium bodied solvent cement to be used on pipe joints with interference fits only and not with Schedule 80 fittings. A heavy bodied solvent cement can be used for all classes and schedules of pipe and fittings.
- E. Pipe Thread Sealant:
1. A non-hardening all purpose sealant and lubricant similar to Lasco blue pipe thread sealant which is certified by the manufacturer to be harmless to PVC pipe and fittings. Apply sealant to clean male threads, brushing into grooves and to the first three threads of the female threads. A good quality grade of teflon tape recommended by the manufacturer for use with

plastics may also be used. Minimum width of tape to be used is 3/4". A minimum of two wraps and a maximum of three wraps to be used.

2.2 VALVES

- A** Electric Control Valves: Globe valves operated by low-power solenoid, normally closed, manual flow adjustment. Sizes and types as shown on drawings.
- B** Control Wire: Paige single solid core with polyethylene jacket, AWG-UF type UL approved for direct burial, minimum size #14 to be ran in 1" Electrical Conduit schedule 40.
- C** Control Wire Connectors: 3M DBR/Y #6 Direct Bury splice kit, or equivalent.
- D** Mainline valve: Nibco cast iron resilient wedge with operating nut or equivalent. Conforming to AWWA C509 Standards.
- E** Quick Coupling Valve: Two piece quick coupling valve as shown on plan.
- F** Control Wire Marking: Christy wire marker or equivalent.
- G** Mainline and Quick Coupler valve boxes: Carson 910 green valve box with green locking lid or equivalent.
- H** Control Valve Boxes: Carson 1419 green valve box and locking lid or equivalent.
- I** Control valve box marking: Heat imprint on top of lid with 2" high letters showing controller letter and station number.

2.3 IRRIGATION HEADS

- A** Spray Head: Molded plastic body with plastic nozzles. Refer to schedule on drawings. Manufacturer's numbers are listed with description.
- B** Rotor Head: Molded plastic and stainless steel construction, Gear driven with memory arc balanced nozzle sets. Refer to schedule on drawings. Manufacturer's numbers are listed with description.
- C** Dripline: Polyethylene tubing with inline emitter. Pre-emergent herbicide impregnated self-cleaning emitter welded to dripline wall. Refer to schedule on drawings. Manufacturer's numbers are listed with description.

2.4 CONTROLLER

- A** Solid state microcomputer controller, completely automatic in operation, which shall electrically start the sprinkler cycle and program and time the individual stations. Controller shall have attached instruction booklet, integral 24V transformer, clock indicating time of day and day of week, 24V master valve circuit and terminal connection strip. Controller shall be universal remote ready with pre-installed connectors.

2.5 OTHER MATERIALS

- A Materials not specifically indicated but necessary for proper execution of this work shall be of first quality as selected by the Contractor subject to the acceptance of Landscape Architect.
- B All materials appearing in the legend and details of the irrigation drawings are part of this job. Contractor is responsible for installation according to plans and details. The system shall efficiently and uniformly irrigate all areas and perform as required by these plans and specifications.

PART 3 - EXECUTION

3.1 SYSTEM DESIGN

- A Design pressure and flow as indicated on drawings.
- B Contractor shall verify design layout and specifications as specified on drawings and inform the Project Inspector and the Landscape Architect of discrepancies, errors or incompatibility in writing prior to installation of irrigation system. Failure to inform the Project Inspector or Landscape Architect of any discrepancy seven working days prior to beginning system installation will institute the responsibility of corrective action to the Contractor at no expense to the Owner.

3.2 PIPING INSTALLATION

- A General:
 - 1 Any equipment installed by the Contractor and deemed to be for the use of the Owner in various situations (i.e., control valves, control panels, etc.) shall be so installed to be readily accessible and quickly operable. Equipment deemed by the Owner to be inoperable for its intended purpose shall be reinstalled by the Contractor in an operable position before approval will be given. Any changes made by the Contractor shall be done without any additional cost to the Owner.
 - 2 The Contractor shall be responsible for layout of proposed facilities and any minor adjustments required due to differences between site and drawings. Any such deviations in layout shall be within the intent of the original drawings, and without additional costs to the Owner. The Owner will indicate the proposed precise location of the control panels. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Where head spacing is not noted, Contractor is to install sprinkler heads evenly along the irrigation area's perimeter. Flush all lines prior to installation of heads.
 - 3 Support piping without strain on joints or fittings and allow for piping expansion and contraction. "Snake" pipe into trench in accordance to manufacturer's recommendations to allow for expansion. Lay on solid sub-base, at uniform depth.
- B The Contractor shall examine all other portions of working drawings and plan trenching and pipe lays so that no conflict will arise between irrigation and any other work. Any corrective action will be the Contractors responsibility at no further expense to the Owner.

C. Excavations:

1. Excavations shall be open vertical construction, sufficiently wide to provide free working space around the work installed and to provide ample space for backfilling and tamping.

The use of a vibratory plow or methods other than open vertical trenching will not be allowed without the written approval of the District or the Landscape Architect. To obtain such approval, a field test must be performed, at the proposed site, with the equipment to be used in the presence of the Landscape Architect. The field test is to indicate if the proposed site is favorable to the plowing method. Approval for plowing at one location does not allow the use of plowing at another location. Approval for plowing must be obtained for each location where the use of plowing is proposed. If, at previously approved plowing locations, conditions for plowing become unfavorable as determined by the Project Inspector or Landscape Architect, plowing shall be terminated.

2. Trenches for pipe and equipment shall be cut to required grade lines, and compacted to provide an accurate grade and uniform bearing for the full length of the line.
3. When two pipes are to be placed in the same trench, it is required to maintain a minimum four inch (4") horizontal separation between pipes.
4. Depth of trenches shall be sufficient to provide a minimum cover above the top of the pipe as follows:
 - a. 24-inch over main lines.
 - b. 18-inch minimum over non-pressure (rotary pop-up) lateral lines.
 - c. 12-inch minimum over non-pressure (pop-up spray head) lateral lines.
 - d. 24-inch minimum over lines located out in road surface area of paved streets.
5. Maximum cover above the top of the pipe shall not exceed twelve inches (12") greater than the required minimum cover.

D. Assemblies

1. Routing of pressure supply lines as indicated on drawings is diagrammatic. Install lines (and various assemblies) in such a manner as to conform with details on plans.
2. Install all assemblies specified herein according to the respective detail drawings or specifications pertaining to specific items required to complete the work. Perform work according to best standard practice, with prior approval.
3. Install no multiple assemblies on plastic lines. Provide each assembly with its own outlet.
4. All brass pipe and fittings shall be assembled using an approved teflon tape, or equivalent, applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved teflon tape will be required.
5. All plastic and galvanized steel threaded pipe and fittings shall be assembled using an approved teflon tape applied to the male threads only. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved teflon tape will be required.
6. No elbows, tees or valves are to be located closer than five (5') feet of each other without prior approval of the Project Inspector.

E. Line Clearance

1. All lines shall have a minimum clearance of four inches (4") from each other, and six inches (6") from lines of other trades. Parallel lines shall not be installed directly over one another.

F. Plastic to Steel Connections

1. At all plastic (PVC) pipe connections, the Contractor shall work the steel connections first. Connections shall always be plastic into steel, never steel into plastic. An approved teflon tape shall be used on all threaded (PVC) to steel, never steel into plastic. An approved teflon tape shall be used on all thread (PVC) to steel pipe joints applied to the male threads only, and light wrench pressure is to be applied. A minimum of two (2) wraps and a maximum of three (3) wraps of an approved 3/4" wide teflon tape will be required.
2. A non-hardening sealant and lubricant similar to LASCO blue pipe sealant may be used in lieu of teflon tape. Apply sealant to clean male threads brushing into grooves and to the first three threads of the female threads.

G. Plastic Pipe

1. The Contractor shall exercise care in handling, loading, unloading, and storing plastic pipe and fittings. All plastic pipe and fittings shall be stored under a weatherproof roofed structure before using and shall be transported in a vehicle with a bed long enough to allow the length of pipe to lie flat so as not to be subject to undue bending or concentrated external load at any point.
 - a. All lumber, rubbish, rubble, concrete and rocks shall be removed from the trenches by the Contractor. Pipe shall have a firm uniform bearing for the entire length of each pipe line to prevent uneven settlement. Wedging or blocking under riser tees shall be done only if specified on the plans. Pad trenches with soil as necessary to provide uniform bearing surfaces.
 - b. Where extensive lengths of pipe are installed, snake pipe in trench from side to side to allow for expansion and contraction. One additional foot per one hundred (100) feet of pipe is the minimum allowance for snaking. Never lay pipe when there is water in the trench or when the temperature is 32 degrees F or below.
 - c. All changes in direction of pipe shall be made with fittings, not by bending.
 - d. Make solvent weld joints with a non-synthetic bristle brush in the following sequence:
 - 1) Make sure pipe is cut square and all rough edges and burrs are removed. All connecting surfaces are properly cleaned and dry prior to application of pipe primer.
 - 2) Apply an even coat of colored primer to pipe and fitting prior to application of solvent.
 - 3) Apply an even coat of solvent to the outside of the pipe, making sure that the coated area is equal to the depth of the fitting socket.
 - 4) Apply an even light coat of solvent to the inside of the fitting.
 - 5) Apply a second coat of solvent to the pipe.
 - 6) Insert the pipe quickly into the fitting and turn pipe approximately one-eighth to one-quarter turn to distribute the solvent and remove air bubbles. Hold the joint for approximately fifteen seconds so the fittings do not push off the pipe.
 - 7) Using a clean rag, make sure to wipe off all excess solvent to prevent weakening at joint.
 - 8) Exercise care in going to the next joint so that pipe is not twisted, thereby disturbing the last completed joint.
 - 9) Allow at least fifteen minutes setup time for each welded joint before moving.
 - 10) Repairing plastic pipe when damaged shall be done by replacing the

damaged portion of pipe.

H. Concrete Thrust Blocks:

1. Concrete anchors or thrust blocks shall be provided on main pipelines at abrupt changes in pipeline grade, changes in horizontal alignment (elbows, tees and crosses), reduction in pipe size (reducers, reducing tees or crosses), end-line caps or plugs, and in-line valve to absorb any axial thrust of the pipeline. The pipe manufacturer's recommendation for thrust control shall be followed. Thrust blocks must be formed against solid unexcavated earth (undisturbed). Do not enclose entire joint in concrete. Provide a minimum of three (3) cubic feet of 3,500 PSI concrete for each concrete thrust block.

3.3 SPRINKLER HEAD INSTALLATION

- A. Head spacing on drawings is diagrammatic. Head spacing and patterns shall be adjusted to provide complete and adequate coverage with a minimum spray on non-planted areas. Flush all lines prior to installation of heads.
- B. Rotary and spray pop-up sprinkler heads adjacent to walks or mowstrips shall be set four inches (4") from edge of walk or mowstrips or as noted otherwise on the plans and details.
- C. Upon completion of the installation, the Contractor shall adjust sprinkler heads to properly distribute water flow and shall place entire irrigation system in first-class operating condition.
- D. Adjustable sprinkler heads shall be adjusted by fully opening the sprinkler furthest from the control. Adjust sprinkler heads which spray toward buildings in shrub areas so that water spray does not contact side of buildings.
- E. Install irrigation heads in accordance with details on plans.

3.4 PIPE DEPTH AND BACKFILL

- A. Backfill shall not be placed until the installed system has been inspected and approved by the Project Inspector.
- B. Backfill material shall be approved soil. Unsuitable material, such as pipe remnants and wire including clods and rocks over two inches (2") in size, shall be removed from the premises and disposed of legally at no cost to the Owner. Backfill for first six inches (6") around mainline pipe and control wires shall be native soil.
- C. All backfilling shall be done carefully and shall be properly tamped. All soil shall be tamped and puddled to eliminate any voids.
- D. Surplus earth remaining after backfilling shall be disposed of as directed by the Project Inspector.
- E. Backfilling for all pipe shall be carried out in two basic stages.
 1. Stage One Backfilling:

This shall be accomplished as soon as possible after the pipe is laid. A bedding of uniform depth with no voids must be provided along the entire length of the pipe. The bedding dirt should be placed in the trench and tamped into the areas under the pipe, using a suitable tool. Joints should be left exposed until hydrostatic tests are completed. Cover only those portions of the pipe necessary to prevent movement or damage.

2. Stage Two Backfilling:

This shall be completed after all hydrostatic tests are completed and the piping system has been thoroughly checked for leaks or other defects. Continue to add backfill soil in four inch (4") layers and hand tamp to achieve density similar to adjacent soil. After twelve inches (12") in main line trenches and eight inches (8") in lateral line trenches of hand tamped soil is in place over the pipe and fittings, backfilling can be continued, using light machinery to place dirt in the trenches in six inch (6") layers and to compact the dirt to conform to adjacent soil. Extreme care should be taken to avoid damage to the pipe from machinery that is too heavy.

All trenches shall then be water jetted to assure uniform settling and compaction. Backfilling operations will not be considered complete until the top surface has been graded to conform to the adjacent soil. All rocks uncovered and not used as backfill must be collected and removed from the site. PVC piping and fittings shall not be backfilled during periods of extreme heat or when a sudden lowering of temperature of the pipe may cause separation of joints or fittings.

3.5 CONTROL WIRE

- A. Install control wires in schedule 40 electrical conduit running alongside of irrigation mainline. Provide six inches (6") minimum separation. Do not tape wires together when encased in sleeves. Minimum cover shall be 24 inches. Seal splice with 3M DBY/R #6 splice kit. Tag all control wires at control valves with approved control wire markers.
- B. Splices are not encouraged but allowed. All splice connections must be provided in a valve box.

3.6 ELECTRIC CONTROL VALVES

- A. Electric control valves shall be adjusted so the most remote heads operate at the pressure recommended by the head manufacturer. Electric control valves shall be adjusted so a uniform distribution of water is applied by the heads to the planting areas for each individual valve system. The Contractor shall make all necessary connections for operation. Where pressure regulating electric control valves are called for the Contractor shall adjust the valve so a uniform distribution of water is applied by the heads.
- B. Valve boxes and lids shall be set to finished grade or as indicated on the Construction Plans. Heat Imprint electric control valve identification numbers on top of valve box with two inch (2") high letters. Not more than one electric control valve may be installed in each box.
- C. Electric control valves shall be connected and aligned to provide the most efficient flow of water to the irrigation heads. Each valve is to be enclosed in the specified valve box. The valve box shall be secured on firm soil clear of valves and wiring connections. Backfill carefully to prevent settlement and subsequent damage.
- D. A valve box must be provided at all underground irrigation control wire splice connections.

3.7 AUTOMATIC CONTROLLER

- A** Contractor shall be required to program and schedule the controller to maximize and utilize the design flow indicated. Programming and scheduling shall be compatible with controller on site. It shall be the complete responsibility of the Contractor to ensure that the interface between the irrigation booster pump and controller provide for a fully functioning, smooth running irrigation system. Contractor shall provide all wiring and rewiring of irrigation controller necessary to accomplish programming and scheduling which utilizes the design flow indicated. Controller Model # EGP-TW-SPED
- B** Install automatic controller chart in laminated or watertight plastic envelope inside controller cover showing which valves are connected to which stations on controller.
- C** Controller Charts:
1. The Contractor shall provide one controller chart for each controller supplied.
 2. The chart shall show the area controlled by the automatic controller and shall be the maximum size that the controller door will allow.
 3. The chart may 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.
 4. The chart shall be colored with a different color for each station.
 5. The chart shall be a permanent bond copy or approved equal and enclosed in a waterproof envelope or laminated.
 6. Provide three (3) copies of laminated, typewritten, legible programming charts for each controller. Charts shall show all stations on the controller, run times, start times for each individual program on the controller.

3.9 TESTING

- A** General: Unless otherwise directed, tests shall be witnessed by the Project Inspector. Work to be concealed shall not be covered until prescribed tests are made. Should any work be covered before such tests, the Contractor shall, at his expense, uncover, test and repair his work and that of other contractors to original conditions. Leaks and defects shown by tests shall be repaired and entire work re-tested. Tests may be made in sections, however, all connections between sections previously tested and new section must be included in the test.
- B** Piping Upstream of Control Valves (Mainline): Maintain 100 PSI water pressure for a duration of four (4) hours. There shall be no drop in pressure during test except that due to ambient temperature changes (+ 5PSI).

3.10 INSPECTION

- A** Inspection of Work:
1. Installation and operations must be approved by the Project Inspector.
 2. In no event shall the Contractor cover up or otherwise remove from view any work under this contract without prior approval of the Project Inspector. Any work covered prior to inspection shall be opened to view by the Contractor at his expense.

- B. General Inspection: Periodic inspections shall be required for basic operations and installations during progression of the project. Such inspections will include but not necessarily be limited to the following items:
1. Layout and flagging of sprinkler heads and system.
 2. Trenching.
 3. Wire placement.
 4. Partial fill compaction of trenches.
 5. Control valve installation.
 6. Irrigation controller installation and operation.
 7. Mainline sustained pressure check.
- C. Coverage Test: When the irrigation system is completed, the Contractor in the presence of the Project Inspector shall perform a coverage test of water afforded in the planting and turf areas. The Contractor shall furnish all materials and labor required to correct any inadequacies of coverage disclosed. The Contractor shall inform the Project Inspector and the Landscape Architect of any deviation from the plan required due to wind, planting, soil, or site conditions, that bear on proper coverage. If such corrections or additions are required in the irrigation system, the Contractor shall make all adjustments and corrections without any extra cost to the Owner.
- D. Completion: The work will be accepted in writing when the entire project improvements have been completed satisfactorily to the Landscape Architect as stated in Section 32 90 00 Planting Part 3.7. In judging the work, no allowance for deviation from the original plans and specifications will be made unless already approved in writing at proper time. Should it become necessary, due to developed conditions, to occupy any portion of the work before the contract is fully completed, such occupancy shall not constitute acceptance. The Contractor will not be responsible for any damage caused by the Owner's work forces.

3.11 MAINTENANCE

- A. Adjustments: Irrigation system shall be maintained and adjusted as required to provide proper coverage throughout the one calendar year maintenance period. Irrigation system maintenance shall commence upon general inspection following irrigation installation, planting operations and general clean-up. Maintenance shall be continued until final acceptance.
- B. After the system has been completed, the Contractor shall instruct an authorized representative of the Owner in the operations and maintenance of the system and shall set the desired controller irrigation time for each station.

3.12 GUARANTEE

- A. The entire irrigation system shall be guaranteed by the Contractor to give satisfactory service and to the quality of materials equipment and workmanship including settling of backfilled areas below finish grade for a period of one (1) year following the date of the final acceptance of all the work by the Architect. If, within one year from the date of completion and final acceptance of all of the work, any trouble develops resulting from inferior or faulty materials or workmanship or settlement occurs and adjustments in pipes, valves, and heads, sod, or paving to the proper level of the permanent grades, the Contractor, as part of the work under his contract, shall make all adjustments and corrections without extra cost to the Owner, including the complete restoration of all damaged planting, paving, or other improvements of any kind.

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

- C. Should any operational difficulties in connection with the irrigation system develop within the specified guarantee period which in the opinion of the Owner 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 damage caused by such defects.

3.13 DISTRICT CONTROLLER AND REMOTE REQUIREMENTS .

- A. Controller Model # -EGP-TW-SPED
- B. Remote Control Model # PROMAX
- C. 2 wire Controls Model # TW-LA-1 EVERY 600' & TWPROG
- D. Common Parts Model # 118-0483
- E. Common Parts Model # EGP-ETHER
- F. Flow Sensor Model # FS-400

END OF SECTION 32 84 20