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SECTION 8
CITY OF KENNEWICK
STANDARD SPECIFICATIONS
FOR
IRRIGATION SYSTEMS

8-1 GENERAL

The work covered in this section shall consist of furnishing all materials, labor, tools, equipment and all other incidentals required to execute the work as indicated on the plans and as herein specified and necessary to complete the intent of the project, including, but not limited to the following major items of work:

- A. Irrigation system and related appurtenances
- B. Connections to water and electrical utilities
- C. Excavation and backfill
- D. Record drawing and quantities
- E. Testing requirements
- F. Cleanup

All work shall be done in accordance with the requirements of SWSS Section 8-03 except as herein modified by these specifications.

For projects requiring modifications to an existing irrigation system, the contractor shall salvage any replaced irrigation sprinklers, valves, valve boxes, time clocks or other usable items as determined by the city and deliver to the city. The contractor will be billed for the cost of designated items not salvaged, or salvaged items, damaged by the contractor due to improper handling and not returned to the city in usable condition.

All materials or equipment not specifically identified in this section, that are required for a complete and properly functioning irrigation system, shall be new, first quality of their respective kinds, and shall be subject to the approval of the Engineer.

8-2 FIELD VERIFICATION

The Engineer shall field stake only the irrigation system main supply lines. The Contractor shall be responsible for staking all lateral lines and sprinkler head locations.

When provided, the sprinkler irrigation plan is diagrammatic for bidding purposes and therefore is subject to minor changes. The Contractor shall follow the plans as closely as possible.

Before commencing any trench excavation required for main or lateral line installation, the Contractor shall check and verify existing ground measurements to those which are shown

on the plans. Any discrepancies found shall be brought to the attention of the Engineer as quickly as possible.

The City reserves the right to make any necessary field changes to the project, which result from conflicts with underground utilities or differences between field and plan dimensions. Any changes in line locations, sprinkler heads, valves, and other such related equipment shall be made for the sole purpose of providing a complete and functioning irrigation system which provides proper irrigation coverage of lawn and landscaped planting areas.

8-3 MATERIALS

8-3.01 PIPES, JOINTS AND FITTINGS

- A. Polyvinyl Chloride (PVC) plastic pipe shall be PVC Class 200, Type 1120 or SDR 21 and shall meet the requirements of ASTM D2241.

Pipe sizes from three-quarter (3/4) inch to three (3) inches inside diameter inclusive shall be PVC Class 200 SDR 21 Glue Joint. Fittings shall be Schedule 40 Glue Joint.

Irrigation pipe for any installation other than repair of an existing pipe, shall be not less than one (1") in diameter and shall only be sized in one half (1/2") increments thereafter. Exceptions to this are swing joints.

Pipe sizes four (4) inches and larger shall be integral gasket joint PVC Class 200, SDR 21. The integral bell and spigot joints will have flexible elastomeric compound seal gaskets, meeting the requirements of ASTM D3139. Fittings shall be Schedule 40 ASTM D-2466 Glue Joint.

PVC pipes and pipe fittings shall be approved and certified by the National Sanitation Foundation (NSF) Standard No. 14.

Each length of PVC pipe shall be marked with an identifying extrusion "run" number and the manufacturer's name or trade name plus pipe size, classification SDR number, and ASTM designation number. All installed irrigation pipes shall be laid with the pipe markings facing upward.

PVC solvent cement and primer shall be NSF approved and meet the requirements of ASTM D2564 and ASTM D2855. Primer shall be P-70 as manufactured by Industrial Polychemical Service of Gardena, California, or an approved equal.

When a connection is made between PVC pipe and metal pipe, male PVC adapters shall be used. The male adapter shall be hand tightened, plus one turn with a strap wrench. Pipe thread joint compound shall be nonlead base (teflon paste, tape, or equal).

Locate Wire – For 6-inch and larger PVC Irrigation pipe, a locate wire and marker tape will be installed as specified in section 4-1.05 and 4-1.06 of these specifications.

B. GALVANIZED PIPE

Galvanized pipe, when shown on the plans or stated in the special provisions shall be ASA Schedule 40, mild steel threaded pipe. Galvanized pipe couplings may be merchant coupling. Fittings shall be medium galvanized screwed beaded malleable iron.

C. COPPER PIPE

Copper pipe, when shown on the plans or stated in the special provisions, shall be Type "K" sweat soldered pipe.

D. BRASS PIPE

Brass pipe, when shown on the plans or stated in the Special Provisions, shall be red brass screwed pipe conforming to the requirements of Federal Specification No. WW-P-351. Fittings shall be red brass conforming to the requirements of Federal Specifications No. WW-P-460.

E. PVC SLEEVES

The Contractor shall install all irrigation lateral and main lines within a PVC sleeve where such lines are to be installed under asphaltic concrete pavement or concrete structures. The PVC sleeves shall be Class 200 in accordance with the requirements of ASTM D-1784. The PVC pipe sleeve shall have a minimum diameter of two-inches (2") greater than the irrigation line it carries. The sleeves shall extend a minimum of eighteen inches (18") outside the limits of the asphalt or concrete structures and shall be capped and/or water tight sealed with silicone sealant.

Irrigation sleeves shall be twice the diameter up to an 8" sleeve for a 4" irrigation pipe. For any irrigation piping larger than 4", the sleeve shall be a minimum of 2" greater diameter than the irrigation line it carries. Irrigation control wires shall be sleeved in all the same locations as required for irrigation pipe. Control wires may be run in the same sleeve with the irrigation pipe, provided there is adequate room, otherwise the contractor shall be required to place a separate PVC sleeve, sized adequately to carry the number of irrigation control wires to be installed.

8-3.02 TRENCH EXCAVATION AND BACKFILL

Trench excavation and backfill for irrigation distribution lines shall be done before placing and spreading any topsoil material and it shall be done in accordance with SWSS Section 8-03 and as herein modified.

- A. All main lines shall be a minimum of twenty-four (24) inches below finished grade measured from the bottom of the pipe.
- B. Lateral or section lines shall be a minimum of eighteen (18) inches below finished grade, measured from the bottom of the pipe.
- C. In the event that rock or utility conflicts are encountered, the minimum depth may be reduced with the approval of the Engineer.
- D. Backfill material shall be free from rocks, stones, and any other objectionable materials, which could damage the pipe.
- E. All pipes two inches (2") and larger shall be bedded two inches (2") over and under with rock free sands or soils. All pipes under two-inches (2") shall be bedded a minimum one-inch (1") over and under with rock free sands or soils.
- F. Compaction of all trenches shall be done in such a manner as to preclude future settlement.
- G. The Contractor shall remove and dispose of any excess rocks, sod, soil, and trench materials at a disposal site secured by the Contractor.
- H. Trenches shall be wide enough to allow a minimum of six inches between parallel pipe lines.
- I. Contractor shall furnish, erect, and maintain all warning signs, shoring, barricades, and required public warning devices during the course of the project until such a time as directed by the Engineer.

8-3.03 INSTALLATION

PVC plastic pipe couplings and fittings shall be handled and installed in accordance with the manufacturer's recommendations. PVC pipe field cuts shall be made square and true and shall be well reamed inside and out to remove all burrs and rough edges before being inserted into any pipe fitting or coupling.

Pipes less than four (4) inches and all fittings shall be jointed by solvent welding per the manufacturer's recommendations. Slip fitting socket tapers shall be sized so that a dry unsoftened pipe end can be inserted no more than halfway into the socket. Plastic saddle and flange fittings will not be permitted. Only Schedule 80 pipe may be threaded. Pipe four inches (4") and larger shall be gasket joint and installed per the manufacturer's recommendations. All fittings for pipe 4 inches and larger shall have concrete thrust blocks poured, sized as specified in Section 4-8.02 F of these specifications.

8-3.04 MEASUREMENT AND PAYMENT

The unit contract price for "Pipe and Fittings," per linear foot, for each size and type of pipe as shown on the proposal, shall be full compensation for furnishing all labor, equipment, tools, and materials necessary to excavate trenches, install sleeves, place and join all pipe and fittings, thrust blocks, pipe bedding, connect to supply lines and irrigation control valves, together with flushing, testing, balancing and adjusting the completed system, providing mylar reproducible "as-built" drawings, site security, safety signs, backfilling and compaction of trenches, site cleanup, and all other incidentals required to install and connect all main and lateral irrigation lines to the supply source and related control valves and equipment in accordance with the plans and specifications or as directed by the Engineer.

8-4 IRRIGATION SYSTEM CONTROL APPURTENANCES

8-4.01 GENERAL

Where shown on the plans or required by the Special Provisions, the Contractor shall install such system control equipment such as drain valves, vacuum breakers, pressure reducing valves, flow control valves, air relief valves in accordance with the requirements of the appropriate subsections of SWSS Section 9-15.

8-4.02 VALVE BOXES

Valve boxes shall be MSBCF1324-12 with a ductile iron lid without flip readers. Manufacturer is Mid States Plastics, Inc., Molded Access Division, or approved equal. Gate Valves and all other manually operated valves shall be provided with a valve box. All valve boxes shall be installed flush with the finished ground surface. Blocks or bricks shall be placed on the corners of the valve box to prevent settlement and contact between the valve box and the irrigation pipe. Lids with lettering other than "irrigation" stamped on top; shall have the lettering ground off prior to placement. Knockouts shall be cut accordingly to provide a clear gap of one inch (1") all around the irrigation pipe. The cost for valve boxes shall be included in the unit costs for the valves being installed see Section 8-4.06.

8-4.03 BALL / GATE VALVES

Manual operated valves shall be installed where shown on the plans and shall meet the requirements as follows.

Ball valves shall be used and sized the same as the pipes on which they are placed for all pipe sizes up to four (4") inches in diameter. Unions are required to be installed on each side of the ball valve and shall be provided with a valve box in accordance with the requirements of Section 8 of these specifications, unless otherwise stated in the special provisions or directed by the Engineer. Ball valves may be either p.v.c. or brass.

Gate valves where shown on the plans shall meet the requirements of City Standard Specification Section 4-8.02B unless otherwise specified in the contract special provisions, except that gate valves shall only be placed on pipe sizes larger than four (4") inches in diameter. Gate valves shall be provided with a valve box in accordance with the requirements of Section 8-4.02 of these specifications unless otherwise stated in the special provisions or directed by the Engineer.

8-4.04 CORPORATION STOP VALVES

Where shown on the plans, the Contractor shall install ball valve curb stops. The curb stops shall be the size shown on the plans and shall be similar and equal to the type as manufactured by Ford Meter Box Company of Wabash, Indiana, and shall be provided with a valve box in accordance with the requirements of Section 8-4.02 of these specifications.

Valve access boxes shall be installed on a free draining gravel base of at least six inches (6"). All valve boxes shall be provided with the proper length and size of valve box extensions to properly bring the top of the valve box flush with walks, turf, curbs, header boards and finished pavement elevations unless otherwise specified.

8-4.05 QUICK COUPLING VALVES

Quick coupling valves, when shown on the plans or stated in the special provisions, shall be of the type and manufacture specified or an approved equal. Each quick coupler shall have a molded vinyl locking cover.

Upon completion of the project and prior to final acceptance, the Contractor shall supply to the City quick coupler keys and hose ells of the quantity called for on the plans. The quick coupler keys and hose ells shall be of the same manufacture as the coupling valve.

8-4.06 MEASUREMENT AND PAYMENT

The unit contract price for:

- "Gate Valves", per each
- "Corporation Stop", per each
- "Quick-Coupling Valve", per each
- "Double Check Valve", per each
- "Pressure Vacuum Breaker", per each
- "Atmospheric Vacuum Breaker", per each
- "Flow Control Valve", per each
- "Air Relief Valve", per each
- "Hose Bib", per each
- "Pressure Regulator Valve", per each

shall be full compensation for furnishing all labor, equipment, tools, and materials required to install complete each particular type and size of valve, together with valve box in accordance with the plans and specifications, or as directed by the Engineer. The Contractor's attention is hereby called to the special provisions for other additional requirements, which may apply to each particular valve.

8-5 SPRINKLER HEADS

8-5.01 MATERIALS

Sprinkler heads shall meet the requirements of the type, style and pattern with a radius of throw, pressure, discharge and any other descriptive designations as shown in "The Sprinkler Head Key" on the plans, and shall be manufactured by either Rainbird, or Toro. Substitutions by other manufacturers will not be considered.

All sprinkler heads of a particular type of function in the system shall be of the same manufacture, and shall be marked with the manufacturer's name and model number in such a manner that they can be identified in the field after installation without being removed from the system.

All sprinkler heads which are to be installed within the playing areas of athletic fields or where indicated on the plans, shall be provided with a heavy resilient rubber top cover for protection against injury of a player should contact be made with the sprinkler head.

All sprinkler heads shall be vandal resistant and shall have special vandal resistant screws in the top cover to prevent removal of the top cover by ordinary tools. The Contractor shall purchase and turn over to the Engineer two sets of any special tools needed to work on and maintain each type of sprinkler head required on the project.

All sprinkler heads and quick coupling valves shall be provided with a double swing joint adjustable height riser between the supply lateral and the sprinkler head, unless the sprinkler uses 6 gpm or less, in which case, ½" polyethylene (funny pipe) is an acceptable substitute. The swing joint shall be assembled by the use of a minimum of three 90' street elbows and two Schedule 80 PVC nipples of the required diameter and length to properly supply water to the sprinkler head and to adjust it to the finished ground elevation. The tee on the supply lateral shall be Schedule 40 or 80 in accordance with the requirements of Section 8-3.01 of these specifications and shall be sized to the lateral and provided with FIP threads on the outlet side of the tee. All threaded joints shall be sealed with Teflon tape.

8-5.02 INSTALLATION

All sprinkler heads shall be set perpendicular and one-half inch (1/2") to three-quarter inch (3/4") above the finished ground grade unless otherwise specified.

All sprinklers having adjustable pin nozzles shall have the pins adjusted to provide the proper distribution of water over the coverage pattern.

After ground cover has been established and when directed by the Engineer, the Contractor shall readjust the sprinkler head height to be flush with adjacent ground elevation.

All sprinkler heads regardless of type or size shall be connected to the irrigation supply lateral line by the means of a double swing joint riser or polyethylene pipe (funny pipe), which shall be sized to meet the sprinkler head inlet diameter, unless otherwise stated in the special provisions.

The swing joint shall be constructed and installed in accordance with the City of Kennewick Standard Drawing 8-2.

The contractor may be required to add sprinkler stakes to some or all sprinklers installed or relocated to prevent flop over, dependent upon sprinkler stability under pressure. In such cases, as directed by the Engineer, the installation shall be considered incidental to the project and shall be installed at no cost to the city.

8-5.03 MEASUREMENT AND PAYMENT

The unit contract price for:

- "Full Circle Rotary Sprinkler", per each
- "Adjustable Rotary Sprinkler," per each
- "Stream Rotor Sprinkler", per each
- "Pop-up Sprinkler", per each
- "Shrub Spray Sprinkler", per each
- "Bubbler Head Sprinkler", per each

shall be full compensation for furnishing all labor, equipment, tools and materials required to install the particular type of sprinkler head in the system, together with the installation of double swing joints, making adjustments of sprinkler height to finished grade, staking, setting, testing sprinkler pattern to conform to the radius of throw, and arc of coverage to provide for a uniform area of coverage. The cost to install resilient rubber top covers on those sprinkler heads lying in athletic playing areas, shall be considered as incidental. All sprinkler heads shall be installed to provide a complete functional and efficient operating system in accordance with the plans and specifications or as directed by the Engineer.

8-6 LOW VOLTAGE CONTROL WIRING

8-6.01 GENERAL

Wiring used for connecting the automatic irrigation controller to the remote valve(s) shall be either direct burial Type U.S.E./UF, or if placed in conduit, Type THHW. The wire shall be either stranded or solid copper, single conductor; UL Listed and shall meet the National Electric Code requirements for the application in which the wiring is being used and in the sizing of conduit based upon the number of conductors to be installed.

Separate pilot or “hot” conductors shall be run between the automatic controller and each electric control valve. Automatic valves shall be allowed to share a common neutral.

Wire shall be a minimum of AWG No. 14 and meet the requirements of the code for Class II circuits. Each pilot or “hot” wire shall be red in color with the common or neutral wire being white.

The control wire between the controller and the remote control valves shall be installed in accordance with the requirements of Local and State codes by people licensed in the trade. Unless the governing code specifies otherwise, the sprinkler contractor may install the low voltage control wire. Splicing of all low voltage conductors will be permitted only at junction boxes or valve boxes. The contractor shall leave a minimum coiled loop of eighteen (18”) inches in each valve box for the wires connected at each valve location. The conductors shall be spliced with a wire nut and watertight connector at any exterior or in-ground location. All exterior or in-ground connections shall require the watertight connector, which shall be a “Connector Kings” part No. SA102 for connector burial and approved for wire sizes 10 ga. – 20 ga. In protected areas, such as buildings, wire nut splices wrapped with electrical tape is acceptable, provided they are enclosed in an approved junction box.

All low voltage control wire shall be run in the same trench with the irrigation main, but shall be placed below the main line as indicated in the City of Kennewick Standard Specifications and Detail.

The contractor shall be responsible for determining the quantity of wiring required to provide power to all electric control valves as indicated on the plans and bidding accordingly.

8-6.02 MEASUREMENT AND PAYMENT

The unit contract price for “DIRECT BURY LOW VOLTAGE CONTROL WIRE”, or “LOW VOLTAGE CONTROL WIRE IN CONDUIT” per lump sum, or per linear feet as provided for in the bid proposal, shall be full compensation for furnishing all labor, equipment, tools, and materials required to provide and install the control wires, or control wires in conduit, from the irrigation controller to each electric irrigation valve,

including splicing, all as indicated on the plans, in accordance with the specifications, or as directed by the Engineer. The contractor's attention is hereby called to the special provisions for other additional requirements, which may be, project specific.

8-7 ELECTRIC IRRIGATION VALVES

8-7.01 GENERAL

All irrigation valves shall be operated by electric solenoid, shall be equipped with flow control, bleed screw and manual on/off internal bleed operation of the valve. Valve sizes shall be as indicated on the plans. See Standard Drawing 8-1 for installation requirements of the electric valves. Valve boxes shall be installed at each electric valve and shall be in accordance with Section 8-4.02. All wire splices at the valves shall be in accordance with Section 8.

8-7.02 BATTERY OPERATED ELECTRIC IRRIGATION VALVES

If an AC power source is unavailable and a battery operated electric irrigation valve system is specified, the Rainbird TBOS system shall be used. The valves and system shall come complete with TBOS Control Module(s) and TBOS Potted Latching Solenoid(s) as required for a complete and operational system installation. It shall be the responsibility of the contractor to verify that electric valves from other manufacturers, that are submitted for use, are compatible with the Rainbird TBOS application and shall include any TBOS Solenoid Adapters as may be required for the valves to operate the TBOS system.

8-7.03 MEASUREMENT AND PAYMENT

The unit contract price for "size as indicated", " _____ INCH ELECTRIC IRRIGATION VALVE" and " _____ INCH BATTERY OPERATED ELECTRIC IRRIGATION VALVE", per each, shall be full compensation for all labor, materials, tools, equipment and other incidentals as may be required to provide and install the new electric valves, and to supply and install the valve boxes and extensions as described herein, as shown on the plans or as directed by the Engineer.

8-8 IRRIGATION CONTROLLERS

8-8.01 GENERAL

Irrigation controllers, when required, shall be either the Toro Sentinel or the Rainbird ESP-LX Plus as noted on the plans. The irrigation controllers, when required, shall be mounted on a galvanized steel pedestal enclosed in the below specified water tight enclosure and as specified in Kennewick Standard Detail Drawing 6-5, including a concrete collar at grade as indicated on the drawing.

When the Toro Sentinel is specified, the contractor shall also provide and install the controller in a contractor provided watertight enclosure. The enclosure shall be NEMA rated,

watertight, lockable and sized as needed to contain the irrigation controller, power supply and terminal strip(s). The contractor shall be responsible for providing 120-volt power to the enclosure, installation of a transformer for the irrigation controller power supply and terminal strip capacity capable of handling all the circuits of the irrigation controller. The contractor shall also be required to provide a disc antenna or a Yagi antenna and coaxial cable for the Sentinel, meeting or exceeding the manufacturer requirements. The disc antenna may be mounted to the top of the irrigation controller enclosure, the Yagi shall be mounted at a location and elevation as noted on the plans and shall be grounded. The contractor shall be responsible for providing as much coaxial cable as needed to make a connection between the Yagi antenna and the Sentinel Controller. The coaxial cable shall be concealed and underground in conduit between the controller and the antenna location.

When the Rainbird ESP-LX Plus is specified, the contractor shall be responsible for providing 120-volt power to the irrigation controller.

The contractor shall be required to terminate all circuits for the irrigation system within the irrigation controller enclosure and shall then test and demonstrate that all circuits function properly before acceptance shall be granted.

8-8.02 MEASUREMENT AND PAYMENT

The unit contract price for "Toro Sentinel Irrigation Controller, Antenna and Power Supply" or "Rainbird ESP-LX Plus Irrigation Controller and Power Supply", per lump sum shall be considered full compensation for all labor, materials, tools, equipment and other incidentals as may be required to provide and install the pedestal mounted irrigation controller as described herein, in accordance with the plans and specifications or as directed by the Engineer.

8-9 CLEANING, TESTING, AND ADJUSTING SYSTEM

8-9.01 GENERAL

The irrigation piping system shall be cleaned, tested, and adjusted in accordance with SWSS Section 8-03.3(7) except that only the main system supply lines shall be required to be pressure tested to a minimum of 100 PSI.

After the system has been successfully cleaned, tested, backfilled, and adjusted, the Contractor shall demonstrate the entire system to the Engineer to show that all sprinkler heads, remote control valves and other various system controls are properly balanced to provide for the proper radius of throw and coverage, and that the installed system is workable, clean and efficient.

8-9.02 WINTERIZATION

When construction, repair, or modification of any city owned irrigation system is being made by the contractor and when full use and operation of the irrigation system has not been assumed by the city prior to cold weather, the contractor shall be fully responsible for winterization of the irrigation system under his control. The contractor shall notify the city in writing, when the irrigation system is deemed, substantially complete and request the city to assume operation of the irrigation system. If agreed to by the city, only then will the city assume liability for winterization. All costs for labor, equipment and materials as required to winterize the irrigation system under the contractor's control, shall be incorporated into the pay items as provided for in the bid proposal.

8-10 AS-BUILT DRAWINGS

8-10.01 GENERAL

The Contractor shall be required to mark and keep record of any changes to the contract plans, which are done during the course of the project. After completion of the work and before final acceptance, the Contractor shall turn over to the Engineer one complete set of the contract drawings showing any and all "as-built" changes.

8.11 OPERATION AND MAINTENANCE MANUALS

8-11.01 GENERAL

The Contractor shall submit four (4) copies of the complete operation and maintenance manuals for all major irrigation equipment installed under this contract. Such equipment includes but is not limited to, automatic controller, all system control valves, and any other equipment, which may be specifically requested by the Engineer.

Each manual shall be complete and individually bound and shall include the following minimum information:

- Index sheet
- Contractor's name, address and telephone number
- List of equipment
- Manufacturer's local representative name, address and telephone number
- Complete operation and maintenance instructions on all major equipment

In addition to the above manuals, the Contractor or equipment supplier shall provide at the conclusion of the project, if requested by the Engineer, the City maintenance personnel with instructions on the proper operation and maintenance of the major components of the irrigation system.

8-12 IRRIGATION GUARANTEE

8-12.01 GENERAL

The entire sprinkler system shall be unconditionally guaranteed by the Contractor as to material and workmanship, including settling of backfilled areas below grade for a period of one year following the date of final acceptance of the work by the Kennewick City Council.

If within one year from the date of final acceptance, settlement occurs and adjustments in pipes, valves and sprinkler heads, sod or paving is necessary to bring the system, sod or paving to the proper level of the permanent grades, the Contractor, as part of the work under this Contract, shall make all adjustments without extra cost to the City, including complete restoration of all damaged planting, paving, or other improvements of any kind.

Should any operational difficulties in connection with the sprinkler system develop within the specified guarantee period, which in the opinion of the Engineer may be due to inferior material or workmanship, said difficulties shall be immediately repaired by the Contractor at no additional cost to the City, including any and all other damage caused by such defects.