

**CITY OF EVANS  
IRRIGATION SPECIFICATIONS**

**TABLE OF CONTENTS**

**SECTION 02810-IRRIGATION**

**PART 1: GENERAL**

1.01	<u>SCOPE:</u>	2
1.02	<u>RELATED WORK:</u>	2
1.03	<u>SUBMITTALS:</u>	3
1.04	<u>RULES AND REGULATIONS:</u>	3
1.05	<u>DEMOLITION:</u>	4
1.06	<u>TESTING:</u>	4
1.07	<u>CONSTRUCTION REVIEW:</u>	6
1.08	<u>GUARANTEE/WARRANTY AND REPLACEMENT:</u>	6

**PART 2: MATERIALS**

2.01	<u>QUALITY:</u>	6
2.02	<u>SUBSTITUTIONS:</u>	7
2.03	<u>IRRIGATION TAP AND WATER METER</u>	7
2.04	<u>SLEEVING:</u>	7
2.05	<u>PIPE AND FITTINGS:</u>	7
2.06	<u>MAINLINE COMPONENTS:</u>	10
2.07	<u>SPRINKLER IRRIGATION COMPONENTS:</u>	10
2.08	<u>DRIP IRRIGATION COMPONENTS:</u>	11
2.09	<u>CONTROL SYSTEM COMPONENTS:</u>	11
2.10	<u>OTHER COMPONENTS:</u>	13

**PART 3: EXECUTION**

3.01	<u>INSPECTIONS AND REVIEWS:</u>	13
3.02	<u>LAYOUT OF WORK:</u>	14
3.03	<u>EXCAVATION, TRENCHING, AND BACKFILLING:</u>	14
3.04	<u>IRRIGATION TAP AND WATER METER:</u>	15
3.05	<u>SLEEVING AND BORING:</u>	15
3.06	<u>ASSEMBLING PIPE AND FITTINGS:</u>	16
3.07	<u>INSTALLATION OF MAINLINE COMPONENTS:</u>	19
3.08	<u>INSTALLATION OF SPRINKLER IRRIGATION COMPONENTS:</u>	19
3.09	<u>INSTALLATION OF DRIP IRRIGATION COMPONENTS:</u>	20
3.10	<u>INSTALLATION OF CONTROL SYSTEM COMPONENTS:</u>	21
3.11	<u>INSTALLATION OF OTHER COMPONENTS:</u>	24
3.12	<u>PROJECT RECORD (AS-BUILT) DRAWINGS:</u>	25
3.13	<u>WINTERIZATION AND SPRING START-UP:</u>	25
3.14	<u>MAINTENANCE:</u>	25
3.15	<u>CLEANUP:</u>	26

**DIVISION 2-SITE WORK**

## SECTION 02810-IRRIGATION

### PART 1: GENERAL

#### 1.01 SCOPE:

Furnish all labor, materials, supplies, equipment, tools, and transportation, and perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system, and guarantee/warranty as shown on the drawings, the installation details, and as specified herein. Items of work specifically included are:

- A. Procurement of all applicable licenses, permits, and fees including payment of all development, plant investment, or any other fees and permits associated with the purchase and installation of the tap.
- B. Coordination of Utility Locates ("Call Before You Dig"). Call 1-800-922-1987 in Colorado.
- C. Excavation, installation, and backfill of tap into municipal water line or non-potable water line.
- D. Excavation, installation, and backfill of water meter and vault.
- E. Provision and connection of electrical power supply to the irrigation control system.
- F. Installation of pumping plant for irrigation system.
- G. Installation of signage for non-potable irrigation system.
- H. Sleeving for irrigation pipe and wire.
- I. Maintenance period.

#### 1.02 RELATED WORK:

##### A. Division 0-Bidding and Contract Requirements:

- 1. Section \_\_\_\_\_.
- 2. Section \_\_\_\_\_.

##### B. Division 1-General Requirements:

- 1. Section 01300 - Submittals.
- 2. Section 01700 - Contract Closeout, Project Record Documents.
- 3. Section \_\_\_\_\_.

- C. Division 2-Site Work:
1. Section 02930 – Lawn and Grass Specification.
  2. Section \_\_\_\_\_.
  3. Section \_\_\_\_\_.
  4. Section \_\_\_\_\_.

1.03 SUBMITTALS:

- A. Submit samples under provisions of Section 01300-Submittals. Deliver four (4) copies of all submittals to the Owner's Representative within 10 working days from the date of Notice to Proceed. Provide information in a 3-ring binder with table of contents and index sheet. Provide sections that are indexed for different components and labeled with the specification section number and the name of the component. Submittals must be made for all the components on the material list. Indicate which items are being supplied on the catalog cut sheets when multiple items are shown on one sheet. Submittal package must be complete prior to being reviewed by the Owner's Representative. Incomplete submittals will be returned without review.
- B. Materials List: Include sleeving, pipe, fittings, mainline components, sprinkler and bubbler components, drip irrigation components, control system components, shop drawings and all other components shown on the drawings and installation details or described herein. Components such as pipe sealant, wire, wire connectors, ID tags, etc. must be included. Quantities of materials need not be included.
- C. Manufacturers' Data: Submit manufacturers' catalog cuts, specifications, and operating instructions for equipment shown on the materials list.
- D. Shop Drawings: Submit shop drawings called for in the installation details. Show products required for proper installation, their relative locations, and critical dimensions. Note modifications to the installation detail.

1.04 RULES AND REGULATIONS:

- A. Work and materials shall be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code as published by the Western Plumbing Officials Association, and applicable laws and regulations of the governing authorities.
- B. When the contract documents call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, provide the quality and size required by the contract documents.
- C. If quantities are provided either in these specifications or on the drawings, these quantities are provided for information only. It is the Contractor's responsibility to determine the actual quantities of all material, equipment, and supplies required

by the project and to complete an independent estimate of quantities and wastage.

1.05 DEMOLITION:

- A. Remove existing sprinklers, valves, automatic controllers, and other irrigation components as indicated. Remove items in a manner that minimizes damage to the components. Deliver only salvageable items to the City of Evans. All other items shall be disposed of by the Contractor.
- B. Existing pipelines shall be abandoned in place. If an existing pipeline is encountered during the installation of a new pipeline, a section of the existing pipeline shall be cut and removed. Remove two (2) feet of the existing pipeline on either side of the new pipeline.
- C. Removal and disposal of existing asbestos-concrete (transite) pipelines shall be in accordance with the General Conditions, Specifications Section 01000 and the Environmental Protection Agency rules and regulations.

1.06 TESTING:

- A. Notify the Owner's Representative three days in advance of testing.
- B. Pipelines jointed with rubber gaskets or threaded connections may be subjected to a pressure test at any time after partial completion of backfill. Pipelines jointed with solvent-welded PVC joints shall be allowed to cure at least 24 hours before testing.
- C. Subsections of mainline pipe may be tested independently, subject to the review of the Engineer/Landscape Architect/Owner's Representative.
- D. Furnish clean, clear water, pumps, labor, fittings, and equipment necessary to conduct tests or retests.
- E. Hydrostatic Pressure Test:
  - 1. Subject mainline pipe to a hydrostatic pressure equal to the anticipated operating pressure of 90 PSI for two hours. Test with mainline components installed and thrust blocks exposed.
  - 2. Backfill to prevent pipe from moving under pressure. Expose couplings and fittings.
  - 3. Leakage will be detected by visual inspection. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat the test until the pipe passes test.
  - 4. Cement or caulking to seal leaks is prohibited.

F. Hydrostatic Pressure Test (Gasketed Pipe):

1. Close tightly isolation gate valves and sprinkler lateral isolation gate valves on mainline for tests. Backfill to prevent pipe from moving under pressure.
2. Test each section of pipe between isolation gates valves on the mainline pipe separately.
3. Purge all air from the pipeline before test. Attach pressure gauge to pipeline in test section. Attaching pressure gauge immediately downstream of one sprinkler lateral isolation gate in the test section is acceptable.
4. Subject mainline pipe to the anticipated operating pressure of 90 PSI for two hours. Observe pressure loss on pressure gauge. If pressure loss is greater than 2 PSI, identify reason for pressure loss. Replace defective pipe, fitting, joint, valve, or appurtenance. Repeat the test until the pressure loss is equal to or less than 2 PSI.
5. Cement or caulking to seal leaks is prohibited.
6. If Hydrostatic Pressure Test can not be passed, test pipe using Volumetric Leakage Test.

G. Operational Test:

1. Activate each remote control valve in sequence from controller or remote. The Owner's Representative will visually observe operation, water application patterns, and leakage.
2. Replace defective remote control valve, solenoid, wiring, or appurtenance to correct operational deficiencies.
3. Replace, adjust, or move water emission devices to correct operational or coverage deficiencies.
4. Replace defective pipe, fitting, joint, valve, sprinkler, or appurtenance to correct leakage problems. Cement or caulking to seal leaks is prohibited.
5. Repeat test(s) until each lateral passes all tests. Repeat tests, replace components, and correct deficiencies at no additional cost to the Owner.

H. Communication Cable:

1. Test for leaks to ground per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
2. Replace defective wire, underground splices, or appurtenances. Repeat the test until the manufacturer's guidelines are met.

I. Control System Grounding:

1. Test for proper grounding of control system per manufacturer's recommendations. Test results must meet or exceed manufacturer's guidelines for acceptance.
2. Replace defective wire, grounding rod, or appurtenances. Repeat the test until the manufacturer's guidelines are met.

1.07 CONSTRUCTION REVIEW:

The purpose of on-site reviews by the Owner's Representative is to periodically observe the work in progress, the Contractor's interpretation of the construction documents, and to address questions with regard to the installation.

- A. Scheduled reviews such as those for irrigation system layout or testing must be scheduled with the Owner's Representative as required by these specifications.
- B. Impromptu reviews may occur at any time during the project.
- C. A review will occur at the completion of the irrigation system installation and Project Record (As-Built) Drawing submittal.

1.08 GUARANTEE/WARRANTY AND REPLACEMENT:

The purpose of this guarantee/warranty is to insure that the Owner receives irrigation materials of prime quality, installed and maintained in a thorough and careful manner.

- A. For a period of one year from commencement of the formal maintenance period, guarantee/warranty irrigation materials, equipment, and workmanship against defects. Fill and repair depressions. Restore landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repair damage to the premises caused by a defective item. Make repairs within seven days of notification from the Owner's Representative.
- B. Contract documents govern replacements identically as with new work. Make replacements at no additional cost to the contract price.
- C. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period.

PART 2: MATERIALS

2.01 QUALITY:

Use materials which are new and without flaws or defects of any type, and which are the best of their class and kind.

## 2.02 SUBSTITUTIONS:

- A. Acceptable equipment manufacturers are **Rain Bird** or approved equal. Alternative equipment must be approved by the Engineer prior to bidding. The Contractor is responsible for making any changes to the design to accommodate alternative equipment.
- B. Pipe sizes referenced in the construction documents are minimum sizes, and may be increased at the option of the Contractor.

## 2.03 IRRIGATION TAP AND WATER METER

- A. Provide materials required by local codes for installation of the municipal water tap and associated piping.
- B. Provide materials required by local code for installation of the water meter and vault and associated piping.

## 2.04 SLEEVING:

- A. Install separate sleeve beneath paved areas to route each run of irrigation pipe or wiring bundle.
- B. Sleeving material beneath pedestrian pavements shall be PVC Class 200 pipe with solvent welded joints.
- C. Sleeving beneath drives and streets shall be PVC Class 200 pipe with solvent welded joints.
- D. Sleeving diameter: equal to twice that of the pipe or wiring bundle.

## 2.05 PIPE AND FITTINGS:

### A. Mainline Pipe and Fittings:

- 1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end.
- 2. Use Class 200, SDR-21, rated at 200 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241. Use PVC pipe rated at higher pressures than Class 200 in the case of small nominal diameters which are not manufactured in Class 200.
- 3. Use rubber-gasketed pipe equipped with factory installed reinforced gaskets for mainline pipe with a nominal diameter greater than or equal to 3-inches. Gasketed pipe joints must conform to the "Laboratory Qualifying Tests" section of ASTM D3139. Gasket material must conform to ASTM F477. Use rubber-gasketed deep bell ductile iron fittings

conforming to ASTM A-536 and ASTM F-477. Use lubricant approved by the pipe manufacturer.

4. Use solvent weld pipe for mainline pipe with a nominal diameter less than 3-inches or where a pipe connection occurs in a sleeve. Use Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.

B. Lateral Pipe and Fittings:

1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end suitable for solvent welding.
2. Use Class 160, SDR-26, rated at 160 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241.

Use solvent weld pipe for lateral pipe. Use UV radiation resistant Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 for PVC pipe. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564, of a type approved by the pipe manufacturer.

3. Flexible polyethylene (PE) pipe is an alternate to rigid PVC pipe for spray sprinkler laterals.

Use SDR-11.5, PE23, rated at 100 PSI, that is National Sanitation Foundation (NSF) approved, conforming to ASTM Standard D2239.

Use Type 1, PVC insert fittings conforming to ASTM Standard D2609 designed for use with flexible polyethylene (PE) pipe. Use stainless steel wormgear clamps (including stainless steel screw) to join pipe and fittings.

4. For drip irrigation laterals downstream of zone control valves, use UV radiation resistant polyethylene pipe manufactured from Prime Union Carbide G-resin 7510 Natural 7 manufactured by Union Carbide or a Union Carbide Licensee with a minimum of 2% carbon black.

Use PVC/compression line fittings compatible with the drip lateral pipe. Use tubing stakes or landscape fabric staples to hold above-ground pipe in place.

C. Specialized Pipe and Fittings:

1. Copper pipe: Use Type "K" rigid conforming to ASTM Standard B88.



Use wrought copper or cast bronze fittings, soldered or threaded per the installation details. Use a 95% tin and 5% antimony solder.

2. Galvanized steel pipe: Use Schedule 40 conforming to ASTM Standard A53.

Use galvanized, threaded, standard weight, malleable iron fittings.

3. Ductile iron pipe: Use Class 50 conforming to ANSI A21.51 (AWWA C151). Use a minimum of Class 53 thickness pipe for flanged piping.

Use mechanical joints conforming to ANSI A 21.10 (AWWA C110) and ANSI A21.11 (AWWA C111) or flanged fittings conforming to ANSI/AWWA C110 and ANSI B16.1 (125#).

4. Use a dielectric union wherever a copper-based metal (copper, brass, bronze) is joined to an iron-based metal (iron, galvanized steel, stainless steel).

5. Low Density Polyethylene Hose:

- a. Use pipe specifically intended for use as a flexible swing joint.  
Inside diameter:  $0.490 \pm 0.010$  inch.  
Wall thickness:  $0.100 \pm 0.010$  inch.  
Color: Black.

- b. Use spiral barb fittings supplied by the same manufacturer as the hose.

6. Assemblies calling for flanged connections shall utilize stainless steel studs and nuts and rubber gaskets.

7. Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 nipples and PVC Schedule 80 threaded fittings.

8. Joint sealant: Use nonhardening, nontoxic pipe thread sealant formulated for use on threaded connections and approved by the pipe fitting manufacturer.

D. Thrust Blocks:

1. Use thrust blocks for fittings on pipe greater than or equal to 3-inch diameter or any diameter rubber gasketed pipe.
2. Use 3,000 PSI concrete.
3. Use 2 mil plastic.
4. Use No. 4 Rebar wrapped or painted with asphalt tar based mastic coating.

E. Joint Restraint Harness:

1. Use a joint restraint harness wherever joints are not positively restrained by flanged fittings, threaded fittings, and/or thrust blocks.
2. Use a joint restraint harness with transition fittings between metal and PVC pipe, where weak trench banks do not allow the use of thrust blocks, or where extra support is required to retain a fitting or joint.
3. Use bolts, nuts, retaining clamps, all-thread, or other joint restraint harness materials which are zinc plated or galvanized.
4. Use on pipe greater than or equal to 3-inch diameter or any diameter rubber gasketed pipe.

2.06 MAINLINE COMPONENTS:

- A. Main System Shutoff Valve: as per local practice and in compliance with local code.
- B. Winterization Assembly: as per local practice and in compliance with local code.
- C. Backflow Prevention Assembly: as presented in the installation details.
- D. Master Valve Assembly: as presented in the installation details.
- E. Flow Sensor Assembly: as presented in the installation details.
- F. Isolation Gate Valve Assembly: as presented in the installation details. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly.
- G. Quick Coupling Valve Assembly: double swing joint arrangement as presented in the installation details.
- H. Manual Drain Valve Assembly: as presented in the installation details. Install a separate sump consisting of three cubic feet of 3/4-inch gravel for each drain valve.

2.07 SPRINKLER IRRIGATION COMPONENTS:

- A. Remote Control Valve (RCV) Assembly for Sprinkler Laterals: as presented in the installation details. Use wire connectors and waterproofing sealant to join control wires to solenoid valves. Use standard Christy I.D. tags with hot-stamped black letters on a yellow background. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly.
- B. Sprinkler Assembly: as presented in the drawings and installation details. Use the sprinkler manufacturer's pressure compensating screens (Rain Bird PCS) to achieve 30 PSI operating conditions on each sprinkler and to control excessive operating pressures.

2.08 DRIP IRRIGATION COMPONENTS:

- A. Remote Control Valve (RCV) Assembly for Drip Laterals: as presented in the installation details. Use wire connectors and waterproofing sealant to join control wires to solenoid valves. Use standard Christy I.D. tags with hot-stamped black letters on a yellow background. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly.
- B. Zone Control Valve Assembly: as presented in the installation details. Install a separate box over a 3-inch depth of 3/4-inch gravel for each assembly.
- C. Drip Emitter Assembly:
1. Barb-mounted, vortex and/or pressure compensating emitter device as presented in the installation details. The device shall be a Rain Bird Xeri-Bug emitter.
  2. Install emitter types and quantities on the following schedule:

<b>Ground cover plant:</b>	1 single outlet emitter each or 1 single outlet emitter per square foot of planting area, whichever is less
<b>Shrub:</b>	2 single outlet emitters each
<b>Tree:</b>	4 single outlet emitters each or 1 multi-outlet emitter each (with 4 outlets open)
  3. Use flexible plastic distribution tubing to direct water from emitter outlet to emission point. Use distribution tubing compatible with the emitters. Length of distribution tubing shall not exceed **five (5) feet**. Secure distribution tubing outlet with tubing stakes.
  4. Install an access sleeve for each multiple-outlet emitter located in a turf area.
- D. Flush Cap Assembly: as presented in the installation details. Locate at the end of each drip irrigation lateral pipe. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly.

2.09 CONTROL SYSTEM COMPONENTS:

- A. Irrigation Controller Unit:
1. Rain Bird ESP controller.
  2. Primary surge protection arrestors:  
  
As recommended by the controller manufacturer.

3. Valve output surge protection arrestors:  
As recommended by the controller manufacturer.
4. Electrical line conditioner:  
As recommended by the controller manufacturer.
5. Lightning protection: Provide 8-foot copper-clad grounding rod at controller location. Use American Wire Gauge No. 8 bare copper wire between the controller and grounding rod.
6. Wire markers: Prenumbered or labeled with indelible nonfading ink, made of permanent, nonfading material.
7. Switch/Outlet: Use 120 VAC, 15 amp combination switch/GFCI outlet.

B. Control Wire:

1. Use American Wire Gauge (AWG) No. 14 solid copper, Type UF or PE cable, UL approved for direct underground burial from the controller unit to each remote control valve.
2. Color: Use white for common ground wire. Use easily distinguished and different colors for other control wires. Spare control wires shall be of a color different from that of the active control wire. Wire color shall be continuous over its entire length.
3. Splices: Use wire connector with waterproof sealant. Wire connector to be of plastic construction consisting of two (2) pieces, one piece that snap locks into the other. A copper crimp sleeve to be provided with connector.
4. Encase wiring not located near PVC irrigation pipe in PVC Schedule 40 electrical conduit.

C. Instrumentation:

1. As presented in the drawings and installation details.
2. Rain Sensor: Mini-Clik II as manufactured by Hunter Products, Inc.

D. Power Wire:

1. Electric wire from the power source to satellite control unit shall be solid or stranded copper, Type UF single conductor cable or multi-conductor with ground cable, UL approved for direct underground burial. Power wires shall be black, white, and green in color. Size as presented in the drawings. The Contractor is responsible for verifying that the power wire sizes shown on the drawings are compatible and adequate for the control system being used.

2. Splices: Use 3M DBY connectors.
  3. Conduit: PVC Schedule 40.
  4. Warning tape: Inert plastic film highly resistant to alkalis, acids, or other destructive chemical components likely to be encountered in soils. Three inches wide, colored yellow, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."
- E. Existing Control Wire:
1. It is assumed that existing 24 VAC control wire between existing independent controllers and solenoid valves is in workable condition. Any concerns are to be brought to the attention of the Owner prior to installation of the replacement satellite controller.

#### 2.10 OTHER COMPONENTS:

- A. Signage: Provide signage for non-potable irrigation system at each site in accordance with the City of Evans.
- B. Tools and Spare Parts: Provide operating keys, servicing tools, test equipment, spare parts and other items indicated in the General Notes of the drawings.
- C. Other Materials: Provide other materials or equipment shown on the drawings or installation details which are part of the irrigation system, even though such items may not have been referenced in these specifications.

### PART 3: EXECUTION

#### 3.01 INSPECTIONS AND REVIEWS:

- A. Site Inspections:
  1. Verify construction site conditions and note irregularities affecting work of this section. Report irregularities to the Owner's Representative prior to beginning work.
  2. Beginning work of this section implies acceptance of existing conditions.
- B. Utility Locates ("Call Before You Dig"):
  1. Arrange for and coordinate with local authorities the location of all underground utilities. Call 1-800-922-1987 in Colorado.
  2. Repair any underground utilities damaged during construction. Make repairs at no additional cost to the contract price.
- C. Irrigation System Layout Review: Irrigation system layout review will occur after the staking has been completed. Notify the Owner's Representative one week in

advance of review. Modifications will be identified by the Owner's Representative at this review.

### 3.02 LAYOUT OF WORK:

- A. Stake out the irrigation system. Items staked include: sprinklers, pipe, control valves, manual drains, pumping plant, controller, and isolation valves.
- B. Install all mainline pipe and mainline components inside of project property lines.

### 3.03 EXCAVATION, TRENCHING, AND BACKFILLING:

- A. Excavate to permit the pipes to be laid at the intended elevations and to permit work space for installing connections and fittings.
- B. Minimum cover (distance from top of pipe or control wire to finish grade):
  - 1. 14-inch over mainline pipe and over electrical conduit.
  - 2. 16-inch over control wire.
  - 3. 16-inch over communication cable.
  - 4. 10-inch over lateral pipe to sprinklers and over manifold pipe to drip system zone control valves.
  - 5. 8-inch over drip lateral pipe in turf or paved areas downstream of drip system zone control valves.
  - 6. 3-inch minimum mulch cover over drip lateral pipe in planting beds downstream of drip system zone control valves.
  - 7. PVC UV radiation resistant lateral pipe shall be installed directly on the soil surface.
- C. Maximum cover (distance from top of pipe or control wire to finish grade) is 24-inches on all pipe, conduit, and wire.
- D. Maintain at least 15-foot clearance from the centerline of any tree.
- E. PVC or PE lateral pipes may be pulled into the soil utilizing a vibratory plow device specifically manufactured for pipe pulling. Minimum burial depths equals minimum cover listed above.
- F. Backfill only after lines have been reviewed and tested.
- G. Excavated material is generally satisfactory for backfill. Backfill shall be free from rubbish, vegetable matter, frozen materials, and stones larger than 2-inches in maximum dimension. Remove material not suitable for backfill. Backfill placed next to pipe shall be free of sharp objects that may damage the pipe.

- H. Backfill unsleeved pipe and sleeves in either of the following manners:
  - 1. Backfill and puddle the lower half of the trench. Allow to dry 24 hours. Backfill the remainder of the trench in 6-inch layers. Compact to density of surrounding soil.
  - 2. Backfill the trench by depositing the backfill material equally on both sides of the pipe in 6-inch layers and compacting to the density of surrounding soil.
- I. Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves. Minimum compaction of backfill for sleeves shall be 95% Standard Proctor Density, ASTM D698-78. Conduct one compaction test for each sleeved crossing less than 50 feet long. Conduct two compaction tests for each sleeved crossing greater than 50 feet long. Costs for such testing and any necessary retesting shall be borne by the Contractor. Use of water for compaction around sleeves, "puddling", will not be permitted. Submit compaction test results to Owner's Representative.
- J. Dress backfilled areas to original grade. Either incorporate excess backfill into existing site grades or dispose of excess backfill off site. Confirm with Owner's Representative prior to construction.
- K. Where utilities conflict with irrigation trenching and pipe work, contact the Engineer/Landscape Architect/Owner's Representative for trench depth adjustments.

#### 3.04 IRRIGATION TAP AND WATER METER:

- A. Install the municipal water tap and associated piping materials in conformance with local regulations.
- B. Install the water meter and vault and associated piping in conformance with local regulations.

#### 3.05 SLEEVING AND BORING:

- A. Install sleeving at a depth that permits the encased pipe or wiring to remain at the specified burial depth.
- B. Extend sleeve ends six inches beyond the edge of the paved surface. Cover pipe ends and mark with stakes. Mark concrete with a chiseled "x" at sleeve end locations.
- C. Bore for sleeves under obstructions that cannot be removed. Employ equipment and methods designed for horizontal boring.

3.06 ASSEMBLING PIPE AND FITTINGS:

A. General:

1. Keep pipe free from dirt and pipe scale. Cut pipe ends square and debur. Clean pipe ends.
2. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.
3. Trenches may be curved to change direction or avoid obstructions within the limits of the curvature of the pipe. Minimum radius of curvature and offset per 20 foot length of pipe by pipe size are shown in the following table. All curvature results from the bending of the pipe lengths. No deflection will be allowed at a pipe joint.

SIZE	RADIUS	OFFSET PER 20' LENGTH
1 ½"	25'	7'-8"
2"	25'	7'8"
2 ½"	100'	1'-11"
3"	100'	1'-11"
4"	100'	1'-11"
6"	150'	1'-4"
8"	200'	1'-0"
10"	250'	9"
12"	300'	8"

B. Mainline Pipe and Fittings:

1. Use only strap-type friction wrenches for threaded plastic pipe.
2. PVC Rubber-Gasketed Pipe:
  - a. Use pipe lubricant. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
  - b. Ductile iron fittings shall not be struck with a metallic tool. Cushion blows with a wood block or similar shock absorber.



3. PVC Solvent Weld Pipe:
    - a. Use primer and solvent cement. Join pipe in a manner recommended by the manufacturer and in accordance with accepted industry practices.
    - b. Cure for 30 minutes before handling and 24 hours before allowing water in pipe.
    - c. Snake pipe from side to side within the trench.
  4. Fittings: The use of cross type fittings is not permitted.
- C. Lateral Pipe and Fittings:
1. Use only strap-type friction wrenches for threaded plastic pipe.
  2. PVC Solvent Weld Pipe:
    - a. Use primer and solvent cement. Join pipe in the manner recommended by the manufacturer and in accordance with accepted industry practices.
    - b. Cure for 30 minutes before handling and 24 hours before allowing water in the pipe.
    - c. Snake pipe from side to side within the trench.
  3. Polyethylene (PE) Pipe:
    - a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
    - b. Snake pipe from side to side within the trench.
  4. UV Radiation Resistant Polyethylene Pipe:
    - a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
    - b. Snake pipe from side to side within the trench, on the soil surface, and hold in place with tubing stakes or landscape fabric staples spaced every five feet. Pipe is not to be compressed or crimped by the stake or staple or other construction activity.
  5. Fittings: The use of cross type fittings is not permitted.

D. Specialized Pipe and Fittings:

1. Copper Pipe:
  - a. Buff surfaces to be joined to a bright finish. Coat with solder flux.
  - b. Solder so that a continuous bead shows around the joint circumference.
2. Galvanized Steel Pipe:
  - a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
  - b. Use factory-made threads whenever possible. Field-cut threads will be permitted only where absolutely necessary. Cut threads on axis using clean, sharp dies.
  - c. Apply Teflon-type tape or pipe joint compound to the male threads only.
3. Ductile Iron Pipe:
  - a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
4. Insert a dielectric union wherever a copper-based metal (copper, brass, bronze) and an iron-based metal (iron, galvanized steel, stainless steel) are joined.
5. Low Density Polyethylene Hose: Install per manufacturer's recommendations.
6. Flanged connections: Install stainless steel studs and nuts and rubber gaskets per manufacturer's recommendations.
7. PVC Threaded Connections:
  - a. Use only factory-formed threads. Field-cut threads are not permitted.
  - b. Use only nonhardening, nontoxic thread sealant.
  - c. When connection is plastic-to-metal, the plastic component shall have male threads and the metal component shall have female threads.
8. Make metal-to-metal, threaded connections with nonhardening, nontoxic pipe sealant applied to the male threads only.

E. Thrust Blocks:

1. Use cast-in-place concrete bearing against undisturbed soil.
2. Size, orientation and placement shall be as shown on the installation details.
3. Wrap fitting with plastic to protect bolts, joint, and fitting from concrete.
4. Install rebar with mastic coating as shown on the installation details.

F. Joint Restraint Harness:

1. Install harness in the manner recommended by the manufacturer and in accordance with accepted industry practices.

3.07 INSTALLATION OF MAINLINE COMPONENTS:

A. Main System Shut Off Valve: Install where indicated on the drawings.

B. Winterization Assembly: Install where indicated on the drawings.

C. Backflow Prevention Assembly: Install where indicated on the drawings. Install assembly so that its elevation, orientation, access, and drainage conform to the manufacturer's recommendations and applicable health codes.

D. Master Valve Assembly: Install where indicated on the drawings.

E. Flow Sensor Assembly: Install where indicated on the drawings.

F. Isolation Gate Valve Assembly:

1. Install where indicated on the drawings.
2. Locate at least 12-inches from and align with adjacent walls or edges of paved areas.

G. Quick Coupling Valve Assembly: Install where indicated on the drawings.

H. Manual Drain Valve Assembly: Install where indicated on the drawings and at other low points in the mainline piping.

3.08 INSTALLATION OF SPRINKLER IRRIGATION COMPONENTS:

A. Remote Control Valve (RCV) Assembly for Sprinkler Laterals:

1. Flush mainline before installation of RCV assembly.
2. Install where indicated on the drawings. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve

wires. Install connectors and sealant per the manufacturer's recommendations.

3. Install only one RCV to a valve box. Locate valve box at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical. Arrange grouped valve boxes in rectangular patterns. Allow at least 12-inches between valve boxes.
4. Adjust RCV to regulate the downstream operating pressure.
5. Attach ID tag with controller station number to control wiring.

B. Sprinkler Assembly:

1. Flush lateral pipe before installing sprinkler assembly.
2. Install per the installation details at locations shown on the drawings.
3. Locate rotary sprinklers 6-inches from adjacent walls, fences, or edges of paved areas.
4. Locate spray sprinklers 3-inches from adjacent walls, fences, or edges of paved areas.
5. Install sprinklers perpendicular to the finish grade.
6. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.
7. Adjust the radius of throw of each sprinkler for best performance.

3.09 INSTALLATION OF DRIP IRRIGATION COMPONENTS:

A. Remote Control Valve (RCV) Assembly for Drip Laterals:

1. Flush mainline pipe before installing RCV assembly.
2. Locate as shown on the drawings. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve wires. Connectors and sealant shall be installed as per the manufacturer's recommendations.
3. Install only one RCV to valve box. Locate at least 12-inches from and align with nearby walls or edges of paved areas. Group RCV assemblies together where practical.
4. Arrange grouped valve boxes in rectangular patterns. Set RCV assembly discharge pressure to 30 PSI.

B. Zone Control Valve Assembly: Install at locations shown on the drawings.

C. Drip Emitter Assembly:

1. Locate as shown on the drawings and installation details.
2. Flush lateral pipe before installing emitter assembly.
3. Cut emitter outlet distribution tubing square.
4. Install an access sleeve as part of each multiple-outlet emitter assembly for emitters located in turf areas.
5. Use tools and techniques recommended by the manufacturer.

Make openings for barb-mounted emitters with the emitter manufacturer's hole-punching tool.

D. Flush Cap Assembly: Install at the end of each drip irrigation lateral pipe as shown on the installation details.

E. Pressure Adjustment Procedure:

1. Fully open all zone control valves and energize the RCV assembly.
2. Determine which emitter has the least outlet pressure; this is the critical emitter.
3. Identify zone control valve associated with the critical emitter; this is the critical zone control valve.
4. Set discharge pressure of RCV such that the critical pressure compensating emitter has a pressure of 25 PSI  $\pm$  5 PSI. Measure with pressure gauge attached to critical emitter.
5. Identify the critical emitter for remaining zone control valves.
6. Set each zone control valve such that its critical pressure compensating emitter has a pressure of 25 PSI  $\pm$  5 PSI.

3.10 INSTALLATION OF CONTROL SYSTEM COMPONENTS:

A. Irrigation Controller Unit:

1. The location of the controller unit as depicted on the drawings is approximate; Owner's Representative will determine the exact site location during sprinkler layout review.
2. Lightning protection: Drive 8-foot copper-clad grounding rod into the soil. If rock prevents driving, bury at least four feet deep. Use one rod for each controller. Connect controller to grounding rod with AWG No. 10 solid conductor copper wire. Secure wire to grounding rod with brass or bronze clamp. Locate the connection in a separate valve box.

3. Install primary surge protection arrestors on incoming power lines.
4. Install one valve output surge protection arrestor on each control wire and one for the common wire.
5. Attach wire markers to the ends of control wires inside the controller unit housing. Label wires with the identification number (see drawings) of the remote control valve to which the control wire is connected.
6. Install combination switch/GFCI outlet inside the controller pedestal or unit housing.
7. Connect control wires to the corresponding controller terminal.

B. Control Wire:

1. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape spaced at 10-foot intervals.
2. Control wiring may be chiseled into the soil utilizing a vibratory plow device specifically manufactured for pipe pulling and wire installation. Appropriate chisel must be used so that wire is fed into a chute on the chisel, and wire is not subject to pulling tension. Minimum burial depth must equal minimum cover previously listed.
3. Provide a 24-inch excess length of wire in an 8-inch diameter loop at each 90 degree change of direction, at both ends of sleeves, and at 100-foot intervals along continuous runs of wiring. Do not tie wiring loop. Coil 24-inch length of wire within each remote control valve box.
4. Install common ground wire and one control wire for each remote control valve. Multiple valves on a single control wire are not permitted.
5. If a control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per the manufacturer's instructions. Locate splice in a valve box that contains an irrigation valve assembly, or in a separate 12-inch standard valve box.

Use same procedure for connection to valves as for in-line splices.

6. Unless noted on plans, install wire parallel with and below PVC mainline pipe.
7. Encase wire not installed with PVC mainline pipe in electrical conduit.

C. Instrumentation:

1. Install sensors per the installation details and manufacturer's recommendations. Install at locations shown on the drawings.

2. Install electrical connections between central control unit components and sensors per manufacturer's recommendations.

D. Power Wire:

1. Route power wire as directed on plans. Install with a minimum number of field splices. If a power wire must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate all splices in a separate 12-inch standard valve box. Coil 2 feet of wire in valve box.
2. All power wire shall be laid in trenches. The use of a vibratory plow is not permitted.
3. Green wire shall be used as the common ground wire from power source to all satellites.
4. Carefully backfill around power wire to avoid damage to wire insulation or wire connectors.
5. Unless noted on plans, install wire parallel with and below mainline pipe. Install wire 2-inches below top of PVC mainline pipe.
6. Encase wire not installed with PVC mainline pipe in electrical conduit with a continuous run of warning tape placed in the backfill, 6-inches above the wiring.

E. Communication cable:

1. Route communication cable as directed on plans. Install with a minimum number of field splices.
2. All communication cable shall be laid in trenches and installed in conduit. The use of a vibratory plow is not permitted.
3. Carefully backfill around communication cable to avoid damage to wire insulation or wire connectors.
4. If a communication cable must be spliced, make splice with recommended connector, installed per manufacturer's recommendations. Locate all splices in a housing afforded by other control system components or a separate 12-inch standard valve box. Coil 2 feet of communication cable in valve box.
5. Unless noted on plans, install wire parallel with and below mainline pipe.
6. Encase wire not installed with PVC mainline pipe in electrical conduit.

F. Control Wire:

1. Bundle control wires where two or more are in the same trench. Bundle with pipe wrapping tape spaced at 10-foot intervals.
2. Control wiring may be chiseled into the soil utilizing a vibratory plow device specifically manufactured for pipe pulling and wire installation. Appropriate chisel must be used so that wire is fed into a chute on the chisel, and wire is not subject to pulling tension. Minimum burial depth must equal minimum cover previously listed.
3. Provide a 24-inch excess length of wire in an 8-inch diameter loop at each 90 degree change of direction, at both ends of sleeves, and at 100-foot intervals along continuous runs of wiring. Do not tie wiring loop. Coil 24-inch length of wire within each remote control valve box.
4. Install common ground wire and one control wire for each remote control valve. Multiple valves on a single control wire are not permitted.
5. If a control wire must be spliced, make splice with wire connectors and waterproof sealant, installed per the manufacturer's instructions. Locate splice in a valve box that contains an irrigation valve assembly, or in a separate 12-inch standard valve box. Wire color will be continued through splice to avoid documentation confusion.

Maintain the integrity of the wire color over the entire run of wire, including splices.

Use same procedure for connection to valves as for in-line splices.

6. Unless noted on plans, install wire parallel with and below mainline pipe.
7. Encase wire not installed with PVC mainline pipe in electrical conduit.

3.11 INSTALLATION OF OTHER COMPONENTS:

- A. Signage: Install signage for non-potable irrigation system at each site in accordance with the City of Evans.
- B. Tools and Spare Parts:
  1. Prior to the Review at completion of construction, supply to the Owner operating keys, servicing tools, spare parts, test equipment, and any other items indicated in the General Notes on the drawings.
- C. Other Materials: Install other materials or equipment shown on the drawings or installation details that are part of the irrigation system, even though such items may not have been referenced in these specifications.



### 3.12 PROJECT RECORD (AS-BUILT) DRAWINGS:

- A. The Contractor is responsible for documenting changes to the design. Maintain on-site and separate from documents used for construction, one complete set of contract documents as Project Documents. Keep documents current. Do not permanently cover work until as-built information is recorded.
- B. Record pipe and wiring network alterations. Record work that is installed differently than shown on the construction drawings. Record accurate reference dimensions, measured from at least two permanent reference points, of each irrigation system valve, each backflow prevention device, each controller or control unit, each sleeve end, each stub-out for future pipe or wiring connections, and other irrigation components enclosed within a valve box.
- C. Prior to construction completion, obtain from the Owner's Representative a reproducible mylar copy of the drawings. Mylars or CAD data files compatible with AutoCAD software, can be purchased from the Engineer. Cost of mylar reproducible drawings is \$25 per sheet and the cost of AutoCAD data files on diskette is \$100 per project set. Using technical drafting pen or CAD, duplicate information contained on the project drawings maintained on site. Label each sheet "Record Drawing".
- D. Turn over the "Record Drawings" to the Engineer/Landscape Architect/Owner's Representative. Completion of the Record Drawings will be a prerequisite for the Review at the completion of the irrigation system installation.

### 3.13 WINTERIZATION AND SPRING START-UP:

- A. Winterize the irrigation system in the first fall after installation and start-up the irrigation system in the first spring after installation. Repair any damage caused in improper winterization at no additional cost to the Owner. Coordinate the winterization and start-up with the landscape maintenance personnel.

### 3.14 MAINTENANCE:

- A. Upon completion of construction and Review by the Owner's Representative, maintain irrigation system for a duration of one (1) calendar year (including one winterization and one start-up). Make periodic examinations and adjustments to irrigation system components so as to achieve the most desirable application of water.
- B. Provide training and familiarization of the irrigation system to the City of Evans Parks Department staff.
- C. Following completion of the Contractor's maintenance period, the Owner will be responsible for maintaining the system in working order during the remainder of the guarantee/warranty period, for performing necessary minor maintenance, for trimming around sprinklers, for protecting against vandalism, and for preventing damage after the landscape maintenance operation.

3.15 CLEANUP:

- A. Upon completion of work, remove from the site all machinery, tools, excess materials, and rubbish.

END OF SECTION