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## PART II - CONSTRUCTION MATERIALS AND METHODS

### SECTION 40.

#### SPRINKLER IRRIGATION SYSTEMS

##### 40.1. GENERAL

All sprinkler irrigation systems installed as Capital Improvements within the City of Rifle shall conform to approved design plans and these specifications.

The Contractor shall insure and guarantee complete coverage of the areas shown on the drawings to be irrigated. The Contractor shall verify actual job site conditions and available water pressure as needed for the coverage guarantee. It shall be the Contractor's responsibility to report to the Project Manager any deviations between the drawings, specifications and the site. Failure to do so prior to installing the equipment, resulting in replacing and/ or relocating equipment, shall be done at the Contractor's expense. Any inconsistencies shall be noted by the Project Manager and a written copy of the corrections shall be given to the Contractor.

When the Contractor is satisfied that the system is operating properly, that it is balanced and adjusted and that all work and cleanup is completed, he shall notify the Project Manager for final inspection with date and time given, at least seventy-two hours in advance.

##### 40.2. DRAWINGS

The specifications and drawings are intended to specify an efficient and complete sprinkler irrigation system. Use of the sprinkler irrigation system will follow the manufacturer's recommendations and meet the Owner's approval without further cost to the Owner.

All plot dimensions are approximate. Before beginning any phase of work, the Contractor shall check all dimensions on the drawings, verify the accuracy of each dimension and notify the Owner of any discrepancies between the drawings and the site.

All work noted on the drawings or details shall be furnished and installed by the Contractor whether or not the work is mentioned in the specifications.

Omissions from the specifications or drawings or any misdescription of detail work which is absolutely necessary to carry out the intentions of the drawings or specifications shall not relieve the Contractor from performing such omitted detail work. The detail work shall be executed by the Contractor as if fully set forth and described in the specifications and drawings.

The Owner will supply the Contractor with four sets of drawings and specifications. The drawings and specifications will indicate the work related to this contract. The Contractor shall record all changes in the work which constitutes departures from the original contract drawings, on one set called the Record Drawings. These Record Drawings (or As-Built Drawings) will become the property of the Owner at the time of acceptance. Contractor shall supply to the Project Manager four 8.5" x 11" drawings of the as-built and a C.D. Rom disc file of the final as-built drawings. The Contractor will provide two 24" x 36" hard copy drawing sets to the City.

The Contractor shall dimension from two permanent reference points (such as sidewalks, road intersections, manholes, abutment walls, etc.) the location of the following items:

- (a) Connections to existing water lines.
- (b) Public Service electric supply connections.
- (c) Sprinkler control valves.

The Contractor shall deliver, on or before the date of final inspection, the corrected and completed Record Drawings to the Owner or Project Manager. Delivery of the Record Drawings will not relieve the Contractor's responsibility to provide location information during the one year guarantee period.

#### **40.3. 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.

#### **40.4. DEMOLITION**

- A. Remove existing sprinklers, valves, automatic controllers, and other existing irrigation components indicated on the drawings. Remove items in a manner that minimizes damage to the components. Deliver only salvageable items to Owner's Representative. 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, Special Conditions and the Environmental Protection Agency rules and regulations.

#### **40.5. 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 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 120 PSI for two hours. Test with mainline components installed.
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 all isolation gate valves and sprinkler lateral isolation gate valves on mainline for tests. Backfill trenches with enough material 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 to quick coupling valve between mainline isolation gate valves in the test section is acceptable.
4. Subject mainline pipe to the anticipated operating pressure of 120 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.

G. Operational Test:

1. Activate each remote control valve in sequence from controller. 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. Cementing 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. Control System Acceptance Test:

1. Upon completion of construction, a System Acceptance Test must be passed.
  2. Following construction completion and a Review by the Engineer, an evaluation period will begin. After 30 days of continuous service without major system problems, the system will be accepted and the guarantee/warranty period will begin. If at any time during the 30-day evaluation period, a major system problem occurs, the source of the problem will be determined and corrected and the 30-day evaluation period will start again. Equipment will not be accepted until such time as the System Acceptance Test is passed.
  3. If successful completion of the System Acceptance Test is not attained within 90 days following commencement of the evaluation period, the Owner's Representative has the option to request replacement of equipment, terminate the order, or portions thereof, or continue with the System Acceptance Test. These options will remain in effect until such time as a successful completion of the System Acceptance Test.
  4. Final payment will be made after successful completion of the System Acceptance Test.
- I. Control System Grounding:
1. Test for proper grounding 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.

**40.6. 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.

**40.7. 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, ad 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 the 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.

**40.8. MATERIALS**

40.8.1 QUALITY

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

40.8.2. SUBSTITUTIONS:

- A. Acceptable sprinkler equipment manufacturers are Rain Bird, Hunter, Weather-Matic and others indicated on irrigation plans, details, and special conditions. Alternative equipment must be approved in writing 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.

40.8.3. SLEEVING:

- A. Install separate sleeve beneath hardscape areas to route each run of irrigation pipe or wiring bundle.
- B. Sleeving material beneath drives, streets, and pedestrian pavements shall be PVC Class 200 pipe with solvent welded joints.
- C. Sleeving diameter shall be as indicated on the drawings and installation details or equal to a minimum of twice that of the pipe or wiring bundle.

40.8.4. 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 12454-13, 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 D1 784. Use primer approved by the pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.
5. No plowing/pulling of mainline accepted.

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 12454-13, 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 Schedule 40, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1 784 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. For drip irrigation laterals downstream of riser connections, use 3/4-inch UV radiation resistant Netafim Techline polyethylene pipe with self-flushing, pressure-compensating bubblers with the following: 1) shrubs - 1 bubbler; 2) 2" trees - 2 bubblers; 3) trees over 2" - 3-bubblers.

Use Techline 17mm (.057") insert fittings with the Techline drip lateral pipe. Use tubing stakes or landscape fabric staples to hold above-ground pipe in place.

4. No plowing or pulling of lateral lines accepted.

C. Specialized Pipe and Fittings:

1. 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#).

2. Low Density Polyethylene Hose:

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

- b. Use spiral barb fittings compatible with the nominal size of the hose.

3. Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 nipples and PVC Schedule 40 or 80 threaded fittings.

4. Joint sealant: Use only Teflon-type tape or Teflon based paste pipe joint sealant on plastic threads. Use nonhardening, nontoxic pipe joint sealant formulated for use on water-carrying pipes on metal threaded connections.

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.

40.8.5. 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. Master Valve Assembly: as presented in the installation details.
- D. Isolation Gate Valve Assembly with square key: as presented in the installation details. Install a separate valve box over a 3-inch depth of 3/4-inch gravel for each assembly with a 2-inch operator.
- E. Quick Coupling Valve Assembly double swing joint arrangement as presented in the installation details.

40.8.6. SPRINKLER IRRIGATION COMPONENTS

- A. Remote Control Valve (RCV) Assembly for Sprinkler Laterals: Provide Rainbird GB Series brass valves 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: Provide Rainbirdalcon models F4-FC-SS-HS and F4-PC-SS-HS 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.

40.8.7.

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. Combination Pressure Regulator/Filter 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.
- C. 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.
- D. Air/Vacuum Relief Valve Assembly: as presented in the installation details. Install at finish grade at high point of each Techline grid layout.
- E. Line Flushing 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.

40.8.8.

CONTROL SYSTEM COMPONENTS

A. Irrigation Controller Unit

- 1. As presented in the drawing specifications and installation details.
- 2. Lightning protection: Provide 8-foot copper-clad grounding rod at controller location. Use American Wire Gauge No. 6 bare copper wire between the controller and grounding rod assembly.
- 3. Wire markers: Prenumbered or labeled with indelible nonfading ink, made of permanent, nonfading material.
- 4. Switch/Outlet: Use 120 VAC, 15 amp combination switch/GFCI outlet.

B. Control Wire:

- 1. Use American Wire Gauge (AWG) No. 14-1 solid copper, Type UF or PE cable, UL approved for direct underground burial for individual control wires and spare wires from the controller unit to each remote control valve or stub-out location. Use American Wire Gauge (AWG) No. 12-1 solid copper, Type UF or PE cable, UL approved for direct underground burial for common ground wire from the controller unit to each remote control valve or stub-out location. Contractor will run electrical power to irrigation controller from the nearest approved power source.
- 2. Contractor will pour concrete pad that provides a minimum collar of concrete around the irrigation controller at least 6 inches wide and set irrigation controller in the center of the concrete pad.
- 3. Color: Wire color shall be continuous over its entire length. Install low voltage wires using the following color coding:

Controller "A" control wires: Red

Controller "A" common wire: White with Red stripe

Controller "B" control wires: Orange  
Controller "B" common wire: White with Orange stripe  
Spare wires from master valve locations to future stub-out locations: Green  
Spare control wires along wire routing from each controller: Yellow  
Spare common wires along wire routing from each controller: Yellow with Blue stripe

Splices: Use wire connector with waterproof sealant. 3M DBY. Contractor will label valve wires.

Valve wires - Red  
Common wires- White  
Spare wires - Yellow  
Master valve wire - Blue  
Flow meter wire - Orange

4. Mark wire routing not located near PVC irrigation pipe with warning tape as described in these specifications. Contractor will hook valve wires to controller. Four spare wires are needed to run from bermaid master valve to controller "B". These four wires need to be two different colors. Contractor must numerically label all valve wires.
5. 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 red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

#### C. Existing Control Wire

1. It is assumed that existing low voltage control wire between existing controller and solenoid valves is in workable condition. Field verify quantity, location and proper operation prior to construction. Any concerns are to be brought to the attention of the Owner' Representative prior to installation of the replacement controller.

#### D. Controller Enclosure

1. As presented conceptually in the installation details or noted in the special conditions.
2. Constructed of stainless steel with free-flow ventilation. The key system is to be common to all enclosures made part of this project.
3. Prepare shop drawings to show the exact placement of all components housed in the enclosure.
4. Electrical conduit: Use PVC Schedule 40 conforming to the dimensions and tolerances established by ASTM Standard D-1 785.  
  
Fittings for PVC conduit shall be Schedule 40, Type 1, PVC solvent-weld sweep fittings, ASTM Standards D2466 and D1784.
5. Lightning protection: Provide 8-foot copper-clad grounding rod at each controller location.
6. Wire markers: Prenumbered or labeled with indelible nonfading ink, made of permanent, nonfading material.

E. Power Wire:

1. Electric wire from the power source to controller 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: UL approved 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 red, and imprinted with "CAUTION: BURIED ELECTRIC LINE BELOW."

40.8.9. OTHER COMPONENTS AND MATERIALS

- A. Tools and Spare Parts: Provide operating keys, servicing tools, test equipment, spare parts and other items indicated in the General Notes of the drawings.
- B. Sod and Fertilizer: Provide sod and fertilizer as required by the City of Rifle and as described in these specifications.
- 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.

**40.9. EXECUTION**

40.9.1. INSPECTIONS AND REVIEWS:

- A. Site Inspections:
  1. Verify construction site conditions and note irregularities affecting work of this section. Report irregularities to the Owners Representative prior to beginning work.
  2. Beginning work of this section implies acceptance of existing conditions.
- B. Utility Locates ("Call Before You Dig")
  1. Coordinate with Parks Representatives, and all appropriate local authorities to arrange for the location and marking of all underground utilities.
  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 of sprinkler head locations and Techline grid alignments have 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.

40.9.2. LAYOUT OF WORK:

- A. Stake out the irrigation system. Items staked include: sprinklers, Techline grid alignment, sleeving, mainline and lateral line pipes, control valves, line flushing valves, air/vacuum relief valves, controllers, and isolation valves.
- B. Install all mainline pipe and mainline components inside of project property lines.

40.9.3. EXCAVATION, TRENCHING, BACKFILLING, AND SOD REPLACEMENT:

- 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. 36" over mainline pipe and over electrical conduit.
  - 2. 36" over control wire.
  - 3. 15" over lateral pipe to sprinklers and over supply header lateral pipe to drip system riser connections.
  - 4. Netafim Techline dripperline grids shall be installed directly on the soil surface and secured to grade with approved stakes.
- C. Backfill only after lines have been reviewed and tested.
- D. Excavated material is generally satisfactory for backfill. Backfill shall be free from rubbish, vegetation matter, frozen materials, and stones larger than 2-inches in maximum dimensions. Remove material not suitable for backfill. Backfill placed next to pipe shall be free of sharp objects which may damage the pipe.
- E. 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.
- F. Enclose pipe and wiring beneath roadways, walks, curbs and other hardscape conditions in sleeves. Minimum compaction of backfill for sleeves shall be 95% Standard Proctor Density, ASTM D698-78. Use of water for compaction around sleeves, "puddling", will not be permitted.
- G. Dress backfilled areas to original grade. Dispose of excess backfill off site.
- H. Where utilities conflict with irrigation trenching and pipe work, contact the Owner's Representative for trench depth adjustments.
- I. Any and all turf grass areas disturbed during the construction process shall be repaired as follows:
  - 1. At any location where it is necessary to cross over a sidewalk or any other concrete or asphalt areas, every effort shall be made to protect said concrete and

or asphalt from damage. In the event that any concrete or asphalt does become damaged it is the responsibility of the Contractor to repair or replace the damage.

2. All affected areas will I have sod removed, with a sod cutter or other appropriate equipment to provide a uniform edge for sod replacement. All stripped sod shall be removed from the site and properly disposed of.
3. Fill soil added to raise the soil level in any area shall be placed in no greater than six inch (6") lifts and then compacted to eliminate future settling.
4. These areas will then be rough graded. Clear the prepared area of clods, stones, wood, rubbish and all debris that will not pass through the tines of a garden rake, final approval by the City of Rifle.
5. The area should then be rolled to reduce future settling.
6. The prepared areas should then be fertilized at the rate of twenty pounds per 1,000 square feet of 5-20-5 fertilizer. Submit manufacturer's analysis.
7. Notify the City of Rifle 24 hours prior to sodding to obtain approval of grade and sod bed prior to sodding. To avoid ponding, no tolerance in sod area grading is permitted. If determined by the City of Rifle to be necessary the area will be regraded, and or fill dirt added to provide a smooth, even, uniform transition from the undisturbed areas to the disturbed areas.
8. Sod shall be Colorado grown, 100% certified blended Kentucky Bluegrass of 3 to 4 types, or a mixture approved by the City of Rifle, complying with applicable Colorado and Federal regulations, having a healthy root system, regularly fertilized, watered, mowed, sprayed, and free from objectionable weeds and/or grasses. Sod strips shall have from 5/8" minimum to 1" maximum thickness of soil adhering to the root system, cut into strips 18" maximum width by 24" minimum length. Sod which has dried out, or sod with adhering soil which breaks, tears, or crumbles away will not be accepted. Sod cut for more than twenty-four (24) hours will not be accepted. Sod rolls shall be kept moist, protected from sun, heat, and wind, and properly protected in transport. The sod source shall be made known to and approved by the City of Rifle after contract signing.
9. Sodding dates must be approved by the City of Rifle.

J. No plowing or pulling of pipe will be allowed.

40.9.4. SLEEVING AND BORING:

- A. Install sleeving at a depth which 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.
- C. Bore for sleeves under obstructions which cannot be removed. Employ equipment and methods designed for horizontal boring. At locations where pavers are installed and set in sand base, remove the pavers and sand for surface trenching of sleeving and conduit crossings. Reset sand and pavers after backfilling sleeve or conduit to original condition as directed by Owner's Representative.

40.9.5.

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.

	RADIUS	OFFSET PER 20' LENGTH
	25'	7'-8"
	25'	7'-8"
	100'	1'-11"
	100'	1'-11"
	100'	1'-11"

B. Mainline 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 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.
3. 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 priver 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. Techline Dripperline Pipe:

- a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
- b. Hold in place with tubing stakes or landscape fabric staples spaced every four feet. Pipe is not to be compressed or crimped by the stake or staple or other construction activity.

4. Fittings: The use of cross type fittings is not permitted.

D. Specialized Pipe and Fittings

1. Ductile Iron Pipe:

- a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.

2. Low Density Polyethylene Hose: Install per manufacturers recommendations.

3. No galvanized pipe will be allowed.

4. PVC Threaded Connections:

- a. Use only factory-formed threads. Field-cut threads are not permitted.
- b. Use only Teflon-type tape or Teflon based paste.
- c. When connection is plastic-to-metal, the plastic component shall have male threads and the metal component shall have female threads.

5. Make metal-to-metal, threaded connections with Teflon-type tape or pipe joint compound 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.

40.9.6. 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. Master Valve Assembly: Install where indicated on the drawings.
- D. 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.
- E. Quick Coupling Valve Assembly: Install where indicated on the drawings.

40.9.7.

#### 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 manufacturers recommendations.
  - 3. Install a ball valve in front of each valve. 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.
  - 6. Brand all valve box lids with an approved number in a sequence that corresponds to the controller layout.
- 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.

40.9.8.

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.

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

C. Techline Emitter Grid Layout

1. Locate as shown on the drawings and installation details.
2. Flush lateral supply header pipe before installing Techline grid.
3. Use tools and techniques recommended by the manufacturer.

D. Air/Vacuum Relief Valve Assembly: Install at the high point of each Techline grid layout as shown on the installation details.

E. Line Flushing Valve Assembly: Install at the end of each Techline grid layout as shown on the installation details.

40.9.9.

INSTALLATION OF CONTROL SYSTEM COMPONENTS:

A. Irrigation Controller Unit

1. The location of the controller unit as depicted on the drawings is approximate; the Owner's Representative will determine the exact site location upon commencement of contract.
2. Lightning protection: Provide grounding components such as ground rod assembly, grounding wire, etc., in accordance with manufacturer's recommendations. Drive 8-foot copper-clad grounding rod into the soil. If rock prevents driving, bury at least four feet deep. Use one ground rod assembly for each controller. Connect controller to grounding rod with AWG No. 6 solid conductor copper wire. Secure wire to grounding rod with approved Calweld Brand Connectors or approved equal.
3. Install primary surge protection arrestors on incoming power lines.
4. Identifying wire and valve box lids numbering will be in sequential order of our Motorola system furnished by the City and given to the contractor prior to installation. Contractor will pour pad for Motorola controller and strong box for backflow device. Template will be supplied by the City.

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 enclosure.
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. Do not tape wire together where contained within sleeving or conduit.
2. 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 30-inch length of wire within each remote control valve box.
3. Install common ground wire and one control wire for each remote control valve. Multiple valves on a single control wire are not permitted.
4. 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 which contains an irrigation valve assembly, or in a separate 10-inch round valve box. Use same procedure for connection to valves as for in-line splices.
5. Unless noted on plans, install wire parallel with and below PVC mainline pipe.
6. Protect wire not installed with PVC mainline pipe with a continuous run of warning tape placed in the backfill six inches above the wiring.

C. 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 junction box in accordance with local codes. Contractor will set Motorola controller on concrete pad and supply 110 electrical power to controller from the nearest approved (by Public Service and owner) power source.
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. Encase power wire in electrical conduit with a continuous run of warning tape placed in the backfill, 6-inches above the wiring.

40.9.10. INSTALLATION OF OTHER COMPONENTS

A. Tools and Spare Parts:

1. Prior to the Review at completion of construction, supply to the Owner operating keys, servicing tools, spare parts, and any other items indicated in the General Notes on the drawings.

B. Other Materials: Install 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.

40.9.11. 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 (Record Drawings). Keep documents current. Do not permanently cover work until as-built information is recorded.

B. Record pipe and wiring network alterations. Record work which 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 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 \$25 per file. 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 Owner's Representative. Completion of the Record Drawings will be a prerequisite for the Review at the completion of the irrigation system installation.

40.9.12. WINTERIZATION AND SPRING START-UP

A. Winterize the irrigation system in the fall and start-up the irrigation system in the spring of the first year following final approval of construction. 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.

40.9.13. MAINTENANCE:

A. Upon completion of construction and Review by the Owner's Representative, maintain irrigation system for a duration of 30 calendar days. Make periodic examinations and adjustments to irrigation system components so as to achieve the most desirable application of water.

B. 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.

40.9.14. CLEANUP

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