

## **DIVISION 1**

### **GENERAL REQUIREMENTS**

#### **1.01 SCOPE OF THE WORK:**

The scope of work is to furnish all materials labor, tools, and equipment for proper construction of the pressurized irrigation pipelines, valves, services and appurtenances in the locations shown on the approved development drawings.

#### **1.02 PRE-CONSTRUCTION CONFERENCE:**

Prior to commencement of work at the site, the Contractor shall meet with the Engineer and the Owner in a pre-construction meeting at the Owner's office, or in conjunction with the City's pre-construction meeting for the approved development.

#### **1.03 TEMPORARY SERVICES:**

Any temporary services and utilities such as telephone, electrical, water, toilet, etc., shall be the responsibility of the Contractor.

#### **1.04 CODES AND STANDARDS:**

Where codes and standards are referred to, they shall be current, approved copies. It shall be the duty of the supplier of any material on this work to submit evidence that its material is in compliance with applicable codes and standards.

#### **1.05 STATE AND LOCAL LAWS:**

The Contractor shall conform to all applicable state and local laws in carrying out its obligations on this project.

#### **1.07 APPROACH TO WORK:**

The work on this project must proceed in a systematic way with a minimum of inconvenience to the public. The Contractor will confine its operations to as small a length of work per crew as feasible. Multiple crews, if necessary, will be acceptable on condition that they coordinate with each other to ensure mutual

**DIVISION 1**  
**GENERAL PROJECT REQUIREMENTS**

understanding of the project and maintain proper traffic control allowing access to all properties.

If the Contractor is required to work in existing City streets, the following requirements will be strictly enforced:

- A.** Excavation shall be not more than two hundred feet (200') ahead of the newly installed pipe.
- B.** All backfill and compaction shall be completed within a maximum distance of two hundred feet (200') behind the end of newly installed pipe.
- C.** Removal of all excess material, sub-base placement and temporary (or final) surface placement shall be completed within a maximum distance of two hundred feet (200') behind the compacted backfill.
- D.** The maximum distance behind the temporary surface placement for permanent surface placement shall be two thousand five hundred feet (2,500') total for all crews. Permanent surface placement shall be placed within 14 days of trench excavation. No intersection shall have the temporary surfacing removed overnight.
- E.** Each new pipeline must be flushed, tested, and ready to be placed into service within fourteen (14) days following its installation. Excavation for installation of additional mainline pipe will not be allowed if this requirement is not met. Each pipeline must be flushed and pressure tested. The Contractor will coordinate all flushing and testing of new pipelines with the Engineer and in accordance with Contractor's submitted schedule. Contractor may wish to test earlier than fourteen days. This is acceptable. Note: If asphalt has been patched back and there is a problem of any kind with new pipeline, or damage to existing utilities due to construction, the Contractor will be responsible to make necessary repairs and patch back the asphalt at Contractor's expense per the project specifications.

**DIVISION 1  
GENERAL PROJECT REQUIREMENTS**

- F.** Final clean-up, removal of equipment, barricades and similar items, and restoration of all surfaces to the final condition will have been completed concurrent with the completion of the trench surface restoration. This includes any restoration of property owners' landscaping, fencing, drive approaches, gravel replacement, etc.
- G.** Should construction be halted because of inclement weather conditions, the Contractor will completely clean up all areas and maintain all streets in good condition during the shut-down period. No excavation in paved streets will be allowed if weather conditions do not permit repaving of the pipeline trench within contract specifications. The Contractor shall be required to provide written documentation of shut-down due to weather conditions and/or any other circumstances halting work and show hours and personnel. There will be no damages for delays due to inclement weather.
- H.** Access to private property shall not be interrupted for longer than 8 hours. The Contractor shall be responsible to see that the property owner is notified of the work schedule. A minimum of 48 hours prior written notice shall be given property owners before access is restricted. If written notification has not been given to property owners, Engineer and/or Owner shall have authority to halt work at Contractors expense until proper written notification has been given.

**1.08 COMPLIANCE WITH GOVERNMENTAL REGULATIONS:**

The Contractor's personnel, equipment, and operations shall comply fully with all applicable standards, regulations, and requirements of existing Federal, State, and local governmental agencies. This shall include, but not be limited to, the following:

- A. United States Occupational Safety and Health Administration Regulations:**

**DIVISION 1  
GENERAL PROJECT REQUIREMENTS**

Title 29 of the Code of Federal Regulations, Part 1926 (29 CFR Part 1926), Safety and Health Regulations for Construction.

**B. Utah State Industrial Commission Regulations:**

The Utah Occupational Safety and Health Act (1973) and Employer-Employee Safe Practices for Excavations and Trenching Operations (Jan. 1, 1974), as published by the Utah State Industrial Commission, including any and all amendments or revisions effective prior to performance of the work.

**C. City Ordinances:**

The Contractor shall be required to comply with all local ordinances. **The Contractor will be required to obtain any necessary permits from the local entity where the work is being performed.**

**D. UDOT Requirements:**

When crossing or working within Utah Department of Transportation (UDOT) rights-of-way the Contractor shall be responsible to comply with all appropriate UDOT regulations.

**E. Permits:**

The Contractor shall be subject to the conditions of all permits and agreements between the Owner and the permitting agencies.

**1.09 FEDERAL, STATE, AND LOCAL INSPECTING AGENCIES:**

The site of construction is to be open at all reasonable times and places for periodic observation by accredited representatives of the Federal, State, and local agencies who have regulatory or

**DIVISION 1  
GENERAL PROJECT REQUIREMENTS**

supervisory authority over any part of the work proposed or regulated thereto.

**1.10 PUBLIC SAFETY AND CONVENIENCE:**

The convenience of the general public and the protection of persons and property are of prime importance and shall be provided for by the Contractor during this project at all times.

The Contractor shall use every reasonable and/or precaution to safeguard persons and property. Failure of the Owner or the Engineer to notify the Contractor of any deficiencies in providing for public safety and convenience shall not relieve the Contractor from its responsibility.

**A. Compliance with Rules and Regulations:**

The Contractor shall comply with all rules and regulations of the City, County, and State authorities regarding the closing of public streets, or highways, to the use of public traffic.

The Contractor shall give written notification to all local and State emergency departments of any road closures and/or lane restrictions prior to work beginning and shall update these agencies on a daily, weekly, or as required basis.

**B. Protection of the Traveling Public:**

The Contractor shall, at all times, conduct its work so as to ensure the least possible obstruction to traffic and normal commercial pursuits. Signs, barricades, and lights shall protect all obstructions within traveled roadways where necessary for the safety of the traveling public. All barricades and obstructions shall be protected at night by signal lights, which shall be

**DIVISION 1  
GENERAL PROJECT REQUIREMENTS**

suitably distributed across the roadway and kept operational from sunset to sunrise. Barricades shall be of substantial construction. Failure of the Owner and/or the Engineer to notify the Contractor to maintain barricades, barriers, lights, flares, danger signals, or guards shall not relieve the Contractor from his responsibility.

Contractor shall coordinate with the City to accommodate and maintain traffic flow and submit a traffic control plan if required. Special community events that may increase traffic flow within or through the project must be coordinated with the City.

**C. Hazardous Conditions:**

Whenever the Contractor's operations create a hazardous condition, it shall furnish flaggers and guards to give adequate warning to the public of any dangerous conditions to be encountered. The Contractor shall furnish, erect, and maintain fences, barricades, signs, lights, and other devices that may be necessary to prevent injury and damage to persons and property. Flaggers and guards shall be UDOT-trained and shall hold current certification and shall be equipped with signs, flags, etc., as required by UDOT regulations.

**D. Dust, Dirt, Mud and Debris Control:**

The Contractor shall control dust, dirt, mud and debris that originate in the construction right-of-way or site. Dust, dirt, mud, trash, and other debris shall be controlled on an "as needed" basis by methods that comply with all Federal, State, and local laws and regulations controlling pollution of the environment. The Contractor shall maintain on the project site a water truck with a minimum two-thousand (2,000) gallon capacity. The Contractor shall be responsible to secure a source of water and shall obtain the necessary permission for its use. Failure by the Contractor to adequately control dust may result in the Owner

## **GENERAL PROJECT REQUIREMENTS**

initiating dust control measures and deducting the cost from payment due to the Contractor. On streets with curb and gutter the Contractor shall promptly remove all debris from gutters either manually or with a "pick-up" broom.

A Fugitive Dust Control Plan (R307-309) is required for submission to the Utah Division of Air Quality. Two additional copies of the plan shall be submitted for the Engineer and Owner. Dust Control Plans are required to minimize fugitive dust on-site from pits, yards, storage areas, and areas of operation and to prevent greater than 10% opacity from fugitive dust at the property boundary. A copy of the requirements for the plan may be obtained from the Engineer upon request.

### **1.11 LAND MONUMENTS:**

The Contractor shall preserve existing City, County, State, and Federal land monuments whenever possible. When these monuments cannot be preserved, the Contractor shall notify the Engineer at least two (2) weeks in advance of the proposed construction in order that the Engineer will have ample opportunity to reference these monuments for later replacement.

### **1.12 SOURCE OF MATERIALS:**

All materials furnished or incorporated in this project shall conform to the requirements of these Specifications.

The Contractor shall acquire the necessary rights to take material from aggregate sources, to use properties for plant sites, hauling roads, and other purposes and to pay all costs involved.

It is expected that all suitable native materials will be used to backfill trenches. In the event native materials are deemed unsuitable, Imported Granular Materials shall be used. Trench backfill within the State Highway right-of-way shall comply with the conditions of the Permit issued by UDOT.

**DIVISION 1  
GENERAL PROJECT REQUIREMENTS**

The Contractor may select areas for disposal of surplus materials; however, the Contractor will be responsible for acquiring the necessary permits to use the property for such purpose and pay all costs involved.

**1.13 TEMPORARY UTILITIES:**

The Contractor shall arrange for, secure, and pay for directly, any and all temporary utility supplies it may require for prosecution of its work.

**1.14 INTERFERING STRUCTURES, UTILITIES AND FACILITIES:**

The Contractor shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. An attempt has been made to show these structures and utilities on the Drawings. While the information has been compiled from the best available sources, its completeness and accuracy cannot be guaranteed, and it is presented simply as a guide to possible difficulties. The Contractor shall notify all utility offices concerned at least forty-eight (48) hours in advance of construction operations in which a utility agency's facility may be involved. Notification to blue stakes does not necessarily cover all buried lines. This shall include, but not be limited to, irrigation, water, telephone, electric, sewer, gas, and cable television. The Contractor shall be responsible for any and all changes to, relocation of, or re-connection to public utility facilities encountered or interrupted during the prosecution of the work, and all costs relating thereto shall be at the Contractor's expense. The Contractor shall contract with and pay the appropriate public utility agencies for work required in connection with all utility interference and handle all necessary notifications, scheduling, coordination, and details.

It shall be the responsibility of the Contractor to relocate and expose all existing underground structures and utilities in such a manner as to prevent damage to same. Any structures or utilities damaged by the Work shall be repaired or replaced at the Contractor's expense without additional compensation from the Owner.

If the Contractor encounters existing structures which will prevent construction, it shall notify the Engineer before continuing with the construction in order that the Engineer may make such field revisions as necessary to avoid conflict with the existing structures. Unforeseen obstructions encountered as a



**DIVISION 1  
GENERAL PROJECT REQUIREMENTS**

result of such relocation's will not be subject to claims for additional compensation by the Contractor to any greater extent than would have been the case had the obstruction been encountered along the original location. The cost of waiting ("down" time) during such field revisions shall be born by the Contractor without additional cost to the Owner.

Fences, catch basins, drain pipe, culverts, mailboxes, sign posts, and any other existing item, when removed, will be replaced by the contractor at his own expense. The Contractor will be responsible to protect all power poles from damage.

Failure of the Contractor to expose potential conflicting structures and utilities in advance of the work which results in the removal and replacement of a part of the work shall be performed at the Contractor's expense.

**1.15 SURVEYS:**

The Contractor shall be responsible for surveying to ensure that the system drains according to the Drawings, and to ensure horizontal alignment of the pipe.

**1.16 UNDERGROUND SOIL CONDITIONS:**

The Contractor shall be familiar with existing soil conditions at the site. The Owner accepts no liability for loss or inconvenience to the Contractor as a result of uncertainty of conditions encountered in the Work. Note: It is anticipated that the presence of ground water is an existing condition to be dealt with during construction. Contractor will be responsible for de-watering trenches and bedding pipe properly to accommodate ground water. Ground water depth may vary in throughout project boundaries.

**1.17 AS-BUILT DRAWINGS**

The Contractor shall update a set of plans to clearly mark construction notes showing the actual 'as-built' condition of the project. These as-built drawings are to be given to the Owner at the completion of the project.

These as-built drawings must show actual locations and depths of the pipeline with accompanied dimensions to existing structures, details of connections at all intersections, corrections to existing infrastructure that may improve clarity, changes that

**DIVISION 1**  
**GENERAL PROJECT REQUIREMENTS**

were made in construction that are different than the design, details of existing utility main relocations, and anything else that may be helpful to show for clarification.

## **DIVISION 2**

### **TRENCH EXCAVATION AND BACKFILL**

#### **2.01 GENERAL:**

This section covers the requirements for trenching and backfilling for underground pipelines. Unless otherwise shown or ordered, pipe shall be laid in an open trench. All incidental clearing, preliminary grading, structure removal, and benching shall be considered a part of the trenching operation.

#### **2.02 SHEETING, BRACING AND SHORING OF EXCAVATIONS:**

Excavations shall be sheeted, braced, and shored as required to support the walls of the excavations. These measures shall be taken to protect the workers, the work in progress, existing utilities, structures, and improvements, from damage due to sliding and settling of embankments. All such sheeting, bracing, and shoring shall comply with the regulations of the Utah State Industrial Commission, the Occupational Safety and Health Act (OSHA), and the accident prevention and safety provisions of the Contract.

The Contractor shall be fully responsible for the adequacy of methods and materials used in trench sheeting, bracing, shoring, and other systems provided to protect workers. Injury to or death of workers resulting from inadequate trench safety measures shall be the full and complete responsibility of the Contractor. All damages resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Contractor, and the Contractor shall affect all necessary repairs or reconstruction at its own expense resulting from such damage.

#### **2.03 CONTROL OF GROUNDWATER:**

All trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in all cases where the static groundwater is above the bottom of any trench or bell hole excavation, such groundwater shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress. The discharge from excavation dewatering shall be conducted to natural drainage channels, gutters, drains, or storm sewers. No sanitary sewer shall be used

**DIVISION 2  
TRENCH EXCAVATION AND BACKFILL**

for disposal of trench water. Surface water shall be prevented from entering trenches.

**2.04 LENGTH OF OPEN TRENCH:**

See Division 1, General Project Requirements, paragraph 1.07 for existing City Streets. See Division 19 for requirements on Utah Department of Transportation Roads.

**2.05 TRENCH EXCAVATION:**

Excavation for pipelines shall follow the lines as shown on the Drawings. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

**A. Normal Excavation:**

Except in ledge-rock, cobbles, stones, or water-saturated earth, mechanical excavation of trenches shall not extend below the bottom of the pipe after placement in its final position. All additional excavation necessary for preparation of the trench bottom shall be made manually.

**B. Authorized Over-Excavation:**

Where ledge-rock, cobbles, and stones render the trench unsuitable for pipe placement, a minimum of four (4) inches of material below the grade of the bottom of the pipe shall be removed. Foundation material shall then be placed in accordance with these specifications for "Imported Granular Material" and "Foundation Placement"

Where water-saturated or unstable earth is encountered in the excavation, at the grade of the pipe, a minimum of twelve (12) inches below the grade of the bottom of the pipe shall be removed. Foundation material shall then be placed in accordance with these specifications for "Imported Granular Material" and "Foundation Placement"

**DIVISION 2  
TRENCH EXCAVATION AND BACKFILL**

**C. Trench Width:**

The trench shall be excavated such that the pipe is always centered in the trench. The minimum clear trench width at the horizontal diameter of the pipe must not be less than the outside diameter of the pipe plus twelve inches (12").

Trench width for pipeline structures, valves, or other accessories shall be sufficient to leave at least twelve (12) inches clear between their outer surfaces and the trench. Backfill with earth under structures or valves will not be permitted. Any unauthorized excess excavation below the elevation indicated for foundation of any structures shall be backfilled in accordance with these specifications for "Imported Granular Materials," and "Foundation Placement."

**D. Trenches in Embankments:**

Before laying pipes that are to be in fill or embankment areas, the embankment shall first be placed and compacted to the specified density to a depth of not less than two feet (2') above the top of the proposed pipe. After placing and compacting the embankment, the trench for the pipe or conduit shall be excavated through the fill, fine graded, and the pipe installed as specified.

**E. Placement of Excavated Material:**

All excess material shall be hauled away from the construction site and disposed of in an area obtained by the Contractor. The Contractor shall be responsible for all permits, clearances, approvals, rights-of-way, easements, and access associated with the disposal of excess excavated material.

Grading of the area surrounding the trenches, including excavated materials, shall be performed as necessary to prevent surface water from flowing into trenches, or other excavations. This shall be monitored on a daily basis.

**DIVISION 2  
TRENCH EXCAVATION AND BACKFILL**

**F. Fine Grading the Trench Bottom:**

The bottom of the trench shall be accurately graded and prepared to provide uniform bearing and support on undisturbed soil or compacted granular bedding at every point along the entire length of the pipe. Bell holes shall be hand excavated after the trench bottom has been fine graded. Bell holes shall be only large enough to permit making the joints and to assure that the pipe is not supported by any portion of the joint or bell.

**2.06 TRENCH BACKFILL**

When the excavated materials are not satisfactory for foundation, bedding, or backfill, the Contractor shall provide imported granular material. The excavated material shall be considered **not satisfactory** when it does not meet gradation requirements, is porous, wet, frozen, or is not capable of compaction in place.

**A. Imported Granular Material.**

Imported granular material for foundation, bedding, and backfill shall be cleaned crushed rock or gravel, free from sod, vegetation, and other organic or deleterious material. Slag will not be allowed for use as bedding material.

Imported granular material shall conform to the following gradation specifications:

**1. Foundation Material.**

One-hundred percent (100%) passing a one (1) inch sieve and five percent (5%) passing a one-half (1/2) inch sieve.

**2. Bedding Material.**

*Ductile-iron pipe, PVC or polyethylene pipe*

One-hundred percent (100%) passing a one (1) inch sieve and no more than five percent (5%) passing a No. 4 sieve.

**3. Backfill Material.**

**DIVISION 2  
TRENCH EXCAVATION AND BACKFILL**

One-hundred percent (100%) passing a three (3) inch square sieve and no more than fifteen percent (15%) passing a No. 200 sieve.

**B. Foundation Placement:**

Imported foundation material shall be placed to an elevation sufficiently above the bottom of the pipe or structure so that it can be compacted, fine graded and remain true to line and grade. The foundation material shall be deposited over the entire trench width and compacted in layers. The layers shall have a maximum uncompacted thickness of six (6) inches. Each layer shall be compacted to 90% of maximum dry density as determined by AASHTO T-180

**C. Pipe Bedding:**

Pipe bedding is fill material in the pipe zone. The pipe zone is defined as the area from the bottom of the pipe to 12-inches above the top of the pipe, or any area within one-foot of any pipe, pipeline structure or accessory.

Pipe bedding material may be excavated materials consisting of loose earth, sand or gravel having no material larger than one-inch in any dimension for ductile iron pipe and PVC pipe. If the excavated materials are not satisfactory, imported granular material as specified herein shall be used for pipe bedding.

After the pipe is in place, bedding material shall be placed below the mid-point of the pipe simultaneously and uniformly on both sides of the pipe in un-compacted layers not to exceed 6-inches or one-half the diameter of the pipe, whichever is less. Bedding material shall be placed with care to prevent displacement of or damage to the pipe during the bedding process. Material shall be placed alongside the pipe and not dropped into the trench in compact masses. Compaction shall be to 90% maximum dry density as determined by AASHTO T-180.

That section of the pipe zone from the mid-point of the pipe to 12-inches above the top of the pipe shall then be filled

**DIVISION 2  
TRENCH EXCAVATION AND BACKFILL**

with bedding materials and compacted to the density required in these specifications for backfill.

**D. Backfill:**

Backfill shall be from twelve inches (12") above the top of the pipe to the level shown on the Drawings. Excavated materials consisting of fines, sand, and gravel shall be used for backfill. No oil cake, bituminous pavement, or concrete shall be used in the backfill unless these materials are scattered and do not exceed six-inches (6") in any dimension. Perishable or spongy material shall not be used.

Under pavements or other surface improvements, the in-place density shall be a minimum of ninety-six percent (96%) of maximum dry density as determined by AASHTO T-99. In shoulders and other areas the in-place density shall be a minimum of ninety percent (90%) of the maximum dry density as determined by AASHTO T-180.

Backfill material shall be placed at a moisture content and un-compacted lift thickness such that the compactive effort produces the required densities. In no event will the material be placed in lifts, which prior to compaction exceed twelve (12) inches.

Approval of equipment, thickness of layers, moisture content, and compactive effort shall not be deemed to relieve the Contractor of the responsibility for attaining the specified densities. The Contractor, in planning its work, shall allow sufficient time to permit the Owner to make tests for densities.

**2.07 EASEMENTS**

Any disturbance to property caused by the Contractor's activity within easements shall be restored to the satisfaction of the owner of the property. (See Division 10 - Restoration of Surface Improvements, paragraph 10.08). The Contractor shall obtain a release from the property owner in writing stating that the



**DIVISION 2**  
**TRENCH EXCAVATION AND BACKFILL**

repairs have been made to the satisfaction of the owner. A copy of said release shall be delivered to the Owner and become part of the documentation on the project.

**2.08 CONTRACTOR'S RESPONSIBILITY:**

The Contractor will be responsible to see that the backfilling and compaction are properly and adequately done. Settlement of trenches within a period of one (1) year after final acceptance of the project shall be considered incontrovertible evidence of inadequate compaction, and the Contractor shall be responsible for correcting the condition in accordance with the provisions of these Specifications, including the replacement of asphalt, sidewalk, curb and gutter, and other surface materials.

## DIVISION 3

### PRESSURE PIPE

#### 3.01 GENERAL:

This division covers furnishing and installing pressure pipe as shown on the Drawings or established in the field, and all flushing, testing, repairing, as required to ensure adequate and safe operation of the pressure irrigation system.

#### 3.02 PVC PIPE:

##### A. Materials:

Pipe for the transmission and distribution of water shall be manufactured in accordance with AWWA C900. "AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water" or Molecular Oriented Polyvinyl Chloride Pipe (PVCMO) meeting the requirements of AWWA C909, manufactured in accordance with ASTM F-1483 from a rigid PVC compound having a cell classification of 12454-B in conformance with ASTM-1784 or approved equal. The PVC pipe shall have a cast-iron-pipe-equivalent outside diameter. All PVC pipe four (4) inches and larger shall be dimension ratio (DR) 18 with a working pressure of 150 psi. The pipe with sizes 4 inch through 10 inch shall have an integral bell end with an elastomeric gasketed sealing system meeting the requirements of ASTM D3139 or F-477. No faded or "sunburned" pipe will be allowed. The pipe shall be sized as shown on the drawings and be purple in color. If the pipe is inspected by Engineer and/or Owner and found to be "sunburned", it shall not be used and shall be replaced with acceptable material at Contractors expense.

##### B. Joints:

Joints shall be the push-on rubber-gasket type. Lubrication shall be water soluble, non-toxic, non-objectionable in odor, non-supporting of bacteria growth, and have no deteriorating effect on the PVC pipe or rubber gaskets.

##### C. Fittings:

**DIVISION 3  
PRESSURE PIPE**

All fittings to be used with the PVC pipe shall be the same as fittings for ductile iron pipe and shall conform to the provisions of ANSI/AWWA C110/A21.10 or AWWA C153/A21.53.

**D. Magnetic Locator Tape:**

All pipe shall include a three (3) inch magnetic locator tape installed in the pipeline trench approximately twelve (12) inches below the ground surface. This tape shall be prepared with white or black printing on a purple field, color Panatone 512C, having the words:

CAUTION: NONPOTABLE WATER - DO NOT DRINK.  
Note: Any substitution or alternate wording must be approved by Engineer.

**3.03 DUCTILE IRON PIPE:**

**A. Materials:**

Ductile iron pipe shall conform to all requirements of ANSI/AWWA C151/A21.51, "American National Standard for Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined molds, for Water or Other Liquids." Minimum pressure Class will be 200. If thickness class pipe is used, a minimum Class 50 shall be used.

All pipe shall be made of good quality Ductile Cast Iron and of such chemical composition and structure as is required to meet the physical and mechanical property requirements of the standard.

**B. Joints:**

**DIVISION 3  
PRESSURE PIPE**

(1) Mechanical Joints: All mechanical joints shall meet requirements of ANSI/AWWA C111/A21.11. All gasket surfaces shall be smooth and free from imperfections. Gaskets shall conform to tests in accordance with specifications and shall be less than one year old.

(2) Push-on Joints: All push-on joints shall meet the requirements of ANSI/AWWA C111/A21.11. Gaskets shall be free from defects and not over one year old.

Lubricants shall be non-toxic and have no deteriorating effects on gasket materials. It shall not impart taste to water in a pipe. It shall conform in every way to ANSI 21.11.

(3) Flanged Joints: Flanges shall meet the requirements of ANSI/AWWA C110/A21.10, "American National Standard for Ductile Iron and Gray Iron Fittings, 3-inch Through 48-inch for Water and Other Liquids." Flanged joints shall be bolted firmly with machine, stud or cap bolts of proper size. Flange maybe cast integrally with the pipe or may be screwed on threaded pipe. Flanges shall be faced and drilled and of proper dimensions for size and pressure required. Bolts and nuts, unless otherwise specified, shall be made of the best quality refined iron or metal steel and have clean, well-fitting threads. Bolts will be provided with standard hexagonal nuts and standard hexagonal heads. Bolts shall be of the diameter required for each flange and when installed shall be of length so that no more than 3/8-inch nor less than 1/8-inch extends past face of nut. All buried fittings having steel bolts shall be coated with a non-oxide wax and wrapped with polyethylene.

Gaskets shall be rubber, either ring or full face, and are 1/8th-inch thick. A gasket for each flanged joint of proper size as shown on the drawings.

**C. Coatings and Linings for Ductile Iron Pipe:**

**DIVISION 3  
PRESSURE PIPE**

All exterior surfaces of pipe and fittings shall be coated with hot coal tar approximately 1 mil thick, with a standard thickness according to ANSI/AWWA C104/A21.4-80.

**D. Flanges:**

Flanges when required shall conform to ANSI/AWWA C115/A21.15-83.

**E. Fittings:**

Fittings for Ductile Iron Pipe shall conform to the provisions of ANSI/AWWA C110/A21.10-82 or C153/A21.53-58.

**F. Magnetic locator tape:**

All pipe shall include a 3-inch magnetic locator tape installed in the pipeline trench approximately 12-inches below the ground surface. Identification tape shall be furnished with white or black printing on a purple field, color Panatone 512C, having the words:

CAUTION: NONPOTABLE WATER - DO NOT DRINK.

Note: Any substitution or alternate wording must be approved by Engineer.

**3.04 PIPE INSTALLATION:**

**A. Utility Location:**

A Utility Location Crew shall operate in front of the trenching crew to locate utilities where looping may be necessary. A minimum of 48 hours notice shall be given for looping utilities. The Utility location crew shall consist of (as a minimum) the following: one rubber tired backhoe with operator, one dump truck with

**DIVISION 3  
PRESSURE PIPE**

driver, and two laborers. Use of the Utility Location Crew shall not supercede or relieve the CONTRACTOR of his obligation to familiarize himself with existing conditions or identify potential conflicts in advance of the installation of the new pipeline.

**A. Cutting:**

Cutting of pipe for closure pieces or for other reasons shall be done in a neat and workmanlike manner by a method recommended by the manufacturer. After cutting, the pipe shall be beveled and filed to prevent gasket damage in joint assembly.

**B. Dewatering of Trench:**

Where water is encountered in the trench, it shall be removed during pipe-laying operations and until the ends of the pipe are sealed. See "Control of Groundwater" in Division 2 Trench - Excavation and Backfill.

**C. Laying of Pipe:**

The pipe and pipe coating (where applicable) shall be inspected for defects before installation. Any defects shall be repaired or the pipe shall be replaced, whichever is deemed necessary by the Engineer.

All pipe shall be laid and maintained to the required lines with fittings and valves at the required locations, as shown on the Drawings.

All pipe, fittings, and valves shall be moved carefully, either when lowering from the truck, or when placing in the trench. This should be done one piece at a time in order to prevent damage to pipe materials and

**DIVISION 3  
PRESSURE PIPE**

protective coatings and lining. Under no circumstances shall materials be dropped or dumped from the truck or into the trench. Owner and/or Engineer reserve the right to reject pipe unloaded in this manner regardless of size, and Contractor shall be responsible to replace pipe or fittings at his expense.

The Contractor shall take the necessary precautions to ensure that foreign materials do not enter the pipe. No debris, tools, or other materials shall be placed in the pipe during laying operations. When pipe laying is not in progress, the pipe shall be closed with a water-tight plug.

Maximum deflections at pipe joints shall not exceed the joint specifications of AWWA C600 or latest revision, or the recommendations of the pipe manufacturer.

Deflections in PVC pipe shall be made by longitudinal bending of the barrel of the pipe rather than deflecting the pipe joints. Longitudinal bending shall be limited to eighty percent (80%) of the manufacturer's recommendations. (ie. allowable bending radius = 1.25 X manufacturer's minimum bending radius.)

**D. Pipe Bedding:**

All pipes shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

In the event trench materials are not, in the judgment of the Engineer, satisfactory for pipe bedding, imported granular bedding will be required. See Division 2 of these specifications.

**E. Thrust Blocking:**

Thrust blocking shall be applied at all tees, valves, plugs, caps, and at bends that deflect twenty-two and

**DIVISION 3  
PRESSURE PIPE**

one-half ( $22-1/2^\circ$ ) degrees or more. The fitting shall be encased in a protective plastic wrap before the thrust block is poured. Reaction blocking shall be concrete, having a compressive strength of not less than three-thousand (3000) psi at twenty-eight (28) days. Blocking shall be placed between undisturbed soil and the fitting to be anchored. The area of bearing on the pipe and on the ground shall be as shown in the Drawings. The blocking shall be placed so that the pipe and the fittings will be accessible for repair.

**F. Connections to Existing Secondary Water Lines:**

Information on the Drawings regarding existing pressure irrigation lines is taken from "as-constructed" drawings from the city or utility company files and may or may not be accurate as to size, type of material, or location of those lines. The Contractor will be responsible to determine the proper fittings and materials required, obtain the Engineer's approval of the planned connection, and perform the construction in a suitable fashion. No attempt has been made to show all needed fittings or materials.

There are six subdivisions as shown on the plans that have installed a dry-pipe irrigation system for future connections with this project. Some systems remain dry, while other systems are connected for temporary use until this project is completed. It is the Contractor's responsibility to verify and pressure/leak test the existing system for each subdivision prior to connection of this project. Residents within the subdivision must be notified 48 hours prior to the disconnection of any existing temporary system as well as the connection of the new system on this project.

The Contractor shall determine the status of the existing system. If the system is actively charged, then the connection shall be made and the new valve should be shut off to be sure that the flow from the



**DIVISION 3  
PRESSURE PIPE**

existing system does not enter into the new main line installed on this project.

**G. Pipe Location and Depth:**

Pipe location is shown on the plans. For most of the project, the preferred location of the main shall be installed just off the edge of the asphalt. This should reduce the amount of asphalt removal and replacement.

In areas where the main will run directly under the asphalt, refer to the Detail Sheet of the drawings and Division 2 of these Specifications.

The depth of the pipe shall be placed to accommodate a minimum cover of twenty-four inches (24"). The main shall be installed to allow slopes for drainage of the system as shown on the plans. Because the city topography is mostly flat, the pipe slopes may be installed nearly flat as long as the overall system will maintain a positive slope to flow to the drain valves as shown on the plans.

In areas where culvert crossings are encountered, the depth of the mains may vary. The plans show most of the crossings that are easily visible with an approximate culvert size and depth of cover of proposed irrigation piping. It is the Contractor's responsibility to locate and verify all culvert crossings including ones that may not be shown on the plans. The plans have noted whether the main shall be installed above or below the culvert crossing. It is the Contractor's responsibility to determine the best way to cross each culvert without damaging or blocking the culvert while carefully maintaining a slope on the pipe that would allow drainage of the system.

**3.05 TESTING AND FLUSHING:**

**DIVISION 3  
PRESSURE PIPE**

All newly laid pipe and service connections, or any valved section thereof, and all existing pressure irrigation lines shall be subjected to a hydrostatic pressure test of at least 1.5 times the working pressure at the point of testing. A leakage test shall be conducted concurrently with the pressure test. All new lines, and extensions therefrom, shall be flushed thoroughly before being placed into service. Testing and flushing shall be monitored from start to finish by the Engineer in order for a test to be approved.

**A. Pressure Test:**

If the pipe section being tested includes concrete thrust blocking, the concrete shall be allowed at least twenty-four (24) hours to set before any testing is conducted.

**1. Test Pressure Restrictions:**

Test pressures shall:

- a) Be at least 1.5 times the working pressure at the highest point along the test section, but not less than 120 psi.
- b) Not exceed the pressure rating of the pipe.
- c) Be of at least 2-hour hold duration.
- d) Not vary by more than plus or minus five (+ 5) psi for the duration of the test.
- e) Not exceed twice the rated pressure of the valves or hydrants when the pressure boundary of the test section includes closed gate valves or hydrants.
- f) Not exceed the rated pressure of the valves when the test boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

**2. Pressurization:**

**DIVISION 3  
PRESSURE PIPE**

Each valved section of pipe shall be filled slowly with water to the specified test pressure. Pressurization of the pipe shall be based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gage. Pressure shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer.

**3. Air Removal:**

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged.

**4. Examination:**

All exposed pipe, fittings, valves, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants that are discovered during the pressure test shall be repaired or replaced with sound materials and the test shall be repeated. Repairs or replacements to the pipeline and subsequent pressure testing shall be repeated as necessary for the pipeline to pass the pressure test.

**B. Leakage Test:**

A leakage test shall be conducted concurrently with the pressure test. The Contractor shall notify the Engineer prior to any pressure or leak test and inform which section of pipe is to be tested and which valves have been shut-off to perform this test. The Engineer will be notified when test is ready and hold time to begin and at the end of two

**DIVISION 3  
PRESSURE PIPE**

(2) hour hold. Engineer will be notified to witness test Gauge and section tested. The Contractor shall be responsible to report the results of the leakage and pressure test to the Engineer prior to acceptance in writing.

**1. Leakage defined:**

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.

**2. Allowable leakage:**

No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD(P)^{0.5}}{133,200}$$

in which L is the allowable leakage, in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe, in inches; and P is the average test pressure (gage) during the leakage test, in pounds per square inch.

a) Allowable leakage at various pressures is shown in Table 1.

b) When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gal/hr/in. of nominal valve size shall be allowed.

**TABLE 1 - Allowable Leakage per 1000 ft of Pipeline - gph**

Avg. Test Pressure psi (Bar)	Nominal Pipe Diameter --in.
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**DIVISION 3  
PRESSURE PIPE**

	3	4	6	8	10	12	14	16	18	20	24	30	36	42	48	54
450 (31)	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82	4.78	5.73	6.69	7.64	8.60
400 (28)	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60	4.50	5.41	6.31	7.21	8.11
350 (24)	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37	4.21	5.06	5.90	6.74	7.58
300 (21)	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12	3.90	4.68	5.46	6.24	7.02
275 (19)	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99	3.73	4.48	5.23	5.98	6.72
250 (17)	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85	3.56	4.27	4.99	5.70	6.41
225 (16)	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70	3.38	4.05	4.73	5.41	6.03
200 (14)	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55	3.19	3.82	4.46	5.09	5.73
175 (12)	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38	2.98	3.58	4.17	4.77	5.36
150 (10)	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21	2.76	3.31	3.86	4.41	4.97
125 (9)	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01	2.52	3.02	3.53	4.03	4.53
100 (7)	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80	2.25	2.70	3.15	3.60	4.05

\* If the pipeline under test contains sections of various diameters, the allowable leakage will be the sum of the computed leakage for each size.

\*\* To obtain leakage in liters/hour, multiply the values in the table by 3.785.

**3. Acceptance of Installation:**

Acceptance shall be determined on the basis of allowable leakage. If any test of pipe laid discloses leakage greater than specified, the Contractor shall, at its own expense, locate and repair the defective material until the leakage is within the specified allowance.

All visible leaks are to be repaired regardless of the amount of leakage.

**4. Existing Systems**

Contractor shall be responsible to pressure and leak test the existing systems in the six subdivisions as stated in Section 3.04F. The Contractor shall report the results of the tests for each subdivision to the Engineer in writing. The Contractor shall not be responsible to repair any parts of the existing system that was not installed by the Contractor. If repairs to the existing system are necessary, the Owner reserves the right to determine who will make the repair and how it will be done.

**DIVISION 3  
PRESSURE PIPE**

**C. Flushing:**

Flushing shall be accomplished through temporary flushing valves, or end of line blowoff assemblies at a minimum flushing velocity of two and one-half feet per second (2.5 fps).

FLOW RATE AND OPENINGS TO FLUSH PIPELINES  
(40 psi Residual Pressure)

Pipe Size in.	Flow Required to Produce 2.5 fps Velocity (gpm)
4	100
6	220
8	390
10	610
12	880
14	1,200
16	1,565
18	1,980
20	2,450
24	3,525

## DIVISION 3A

### HIGH DENSITY POLYETHYLENE PIPE, FITTINGS AND SERVICES

#### 3.01 GENERAL:

This section defines the requirements for furnishing and installing High Density Polyethylene (HDPE) pipe, fittings and service taps. HDPE shall be used as main lines only where a "looped" condition will prevent the pipeline from adequately draining.

#### 3.02 HIGH DENSITY POLYETHYLENE (HDPE) PIPE:

High density polyethylene pipe shall be manufactured from resins exhibiting a cell classification of PE 345434C as defined in ASTM D3350 with an established hydrostatic design basis of 1600 psi for water at 73° F. HDPE pipe shall conform to ASTM F714. HDPE pipe shall also conform in every way to AWWA C-906-90, "AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 inch through 63 inch for Water Distribution." The HDPE pipe shall have an iron pipe equivalent outside diameter. All HDPE pipe shall be Dimension Ratio (DR) 17.

#### 3.03 INSTALLATION OF HDPE PIPE:

High Density Polyethylene (HDPE) pipe shall be installed in areas where looping underneath culverts are necessary. These areas shall have a minimum cover of thirty-six inches (36") from the existing grade to the top of the pipe. Details included with the drawings reflect the installation of HDPE pipe and the connection to either PVC or ductile iron pipe.

#### 3.04 JOINTS

HDPE pipe shall be joined by thermal butt fusion or flange assemblies. If flange assemblies are used, stainless steel bolts will be required.

Thermal butt fusion shall be conducted only by persons who have been adequately trained by the pipe or equipment supplier or a trained technician provided by the pipe or equipment supplier.

HDPE pipe shall not be joined by solvent cements, adhesives (such as epoxies) or threaded connections. All joining methods shall be capable of conveying water at a minimum of 2.0 times the working pressure rating of the pipe.

## **HIGH DENSITY POLYETHYLENE PIPE, FITTINGS AND SERVICES**

### **3.05 FITTINGS**

HDPE fittings shall be manufactured from the same resin source as the HDPE pipe. Fittings shall be joined by thermal butt fusion or flange assemblies. Fittings shall not reduce the working pressure rating of the system. This may require the use of fittings fabricated from lower dimension ratio (DR) materials. All HDPE fittings to be used with polyethylene pipe shall comply with the provisions of AWWA C906-90. Ductile iron fittings shall conform with ANSI/AWWA C110/A21.10. Use of flange assemblies will require stainless steel bolts. Flange assemblies will be required on the branch of all tees unless it can be demonstrated to the satisfaction of the Engineer that fusion (on the branch of the tee) can be accomplished without excessive time delay due to over-excavation, excessive effort to place fusion equipment or damage to materials. Fused flange ring, mechanical joint adapter, or restraint ring with stainless steel stiffener will be required where in-line valves and ductile iron fittings are to be installed. In cul-de-sacs, or locations where the pressure irrigation main is permanently terminated, a fused cap will be required. At locations where the pressure irrigation main is temporarily dead-ended, a fused flange and blind flange will be required.

### **3.06 TESTING**

HDPE pipe shall be pressure tested and leak tested in accordance with the pipe manufacturers recommendation.

### **3.06 CONNECTION TO AN EXISTING PVC OR DUCTILE IRON PRESSURE IRRIGATION MAIN:**

Connection to an existing PVC or ductile iron pressure irrigation main shall be completed as shown in the detail drawings. The connection shall include an in-line fused flange anchor encased in a concrete block which has been keyed into the trench wall and floor. Connection to the existing PVC or ductile iron main shall be made using a mechanical joint ductile iron sleeve (long) or reducer or equivalent fitting which complies with the recommendations of the pipe manufacturer for transitioning from HDPE to PVC or ductile iron pipe.



**HIGH DENSITY POLYETHYLENE PIPE,  
FITTINGS AND SERVICES**

**3.07 MAGNETIC LOCATOR TAPE:**

All pipe shall include a three-inch (3") magnetic locator tape installed approximately twelve inches (12") below the ground surface. This tape shall be prepared with white or black printing on a purple field, color Panatone 512C, having the words:

CAUTION: NONPOTABLE WATER - DO NOT DRINK.

Note: Any substitution or alternate wording must be approved by Engineer.

**3.08 SERVICE CONNECTIONS:**

No service connections on HDPE pipe shall be permitted.

## DIVISION 5

### MANHOLES

#### 5.01 GENERAL:

This division covers the requirements for manhole materials and installation. Excavation and backfill activities associated with manholes shall be performed as specified in Division 2 of these Specifications, Trench Excavation and Backfill.

#### 5.02 MATERIALS:

Manholes shall be furnished with reinforced concrete sections and cast iron rings and covers, but without concrete bases. A gravel foundation shall be used instead of a concrete base.

- A. **Foundation:** The base for Combination Air Valves shall consist of a minimum of four-inch(4") thick layer of imported granular foundation material. The base for Local Drain shall consist of a two-foot-thick (2') layer of **washed** imported foundation material.
- B. **Geotextile:** Geotextile shall be used in the Local Drain Sumps to separate the natural backfill from the washed Imported Foundation Material. The geotextile shall be Mirafi 140N, or equal.
- C. **Sections:** All manholes shall be precast, sectional, reinforced concrete pipe. Cylindrical sections shall have an inside diameter of forty-eight inches (48"). The height of manhole walls shall be adjustable by using one, two, three, or four feet-tall (1', 2', 3', 4') sections.

Conical sections shall be a maximum of three feet (3') in height.

All sections shall conform to the requirements of the latest revision of ASTM C-478, Standard Specification for Precast Reinforced Concrete Manhole Sections.

**DIVISION 5  
MANHOLES**

- D. **Rings and Covers:** Manhole rings and covers shall be D&L Supply Model A-1122 (vented), or equal. All gray iron shall conform to the requirements of the latest revision of ASTM A-48 (Class 35B), Standard Specification for Gray Iron Casting. Covers shall be marked "IRRIGATION".
- D. **Concrete Collars:** All manholes located in streets shall be installed as nearly to grade as possible. After the pavement is in place, the manhole rings shall be raised to grade. The surrounding asphalt shall be neatly cut and removed to form a circular opening of one foot six inches (1'-6") beyond the limits of the manhole cover. With the manhole cover centered in the opening, a 12-inch (12") thick concrete collar shall be cast.

## DIVISION 6

### VALVES AND COUPLINGS

#### 6.01 GENERAL:

This division covers distribution valves and couplings to be used in the secondary water system. Valve sizes four-inch (4") through ten-inch (10") shall be of the iron-body, resilient-seated gate-valve variety with non-rising bronze stems. Unless otherwise noted, all valves twelve-inches (12") and larger shall be butterfly valves.

#### 6.02 RESILIENT-SEATED GATE VALVE:

All Resilient Wedge Gate Valves sizes 4" through 10" inclusive shall comply with all requirements of AWWA C509, latest revision, and with the below listed requirements.

- A. All Resilient Wedge Gate Valves shall be designed for 250 PSIG working pressure, shall be factory seat tested at 250 PSIG with no leakage past the seat from either side of the disc, and shall be shell tested at 500 PSIG.
- B. Minimum body and bonnet wall thickness shall be as set forth in Table 2, Section 4.3.1 of AWWA C509. Body and bonnet wall thicknesses less than the minimum thickness as specified in Table 2 shall not be acceptable. Bonnet to body seal shall be effected by a flat neoprene gasket. Bonnet and body flanges shall be fully machined to assure proper sealing of the gasket.
- C. End connections shall be flanged in accordance with Class 125, ANSI B16.1 for above ground installation, and for underground installation shall be mechanical joint in accordance with AWWA C110/111 slip-on for use with Cast Iron OD pipe or as specified on the drawings.
- D. All gate valves shall be of the non-rising stem (N.R.S.) design and shall open left (counter-clockwise). Valves installed above ground shall be furnished with handwheels. All buried valves shall be furnished with 2" square operating nuts.
- E. All gate valves shall have O-Ring sealed stems with one O-Ring located below the thrust collar and with two O-Rings located above the thrust collar. The thrust

**DIVISION 6  
VALVES AND COUPLINGS**

collar area between the two lower O-Rings shall be factory filled with a lubricant to provide permanent lubrication of the thrust collar area.

- F. The Bonnet to body flange shall be sealed by a flat rubber gasket and fastened by bolts and nuts to avoid cold flow of bonnet sealing material.
- G. Gate valve stems shall be of bronze rolled bar stock and shall have a forged thrust collar. The stem material shall provide 70,000 PSI tensile strength with 15% elongation and a yield strength of 30,000 PSI. Cast stems shall not be acceptable. Stems shall have acme form threads for strength and efficiency. An anti-friction thrust washer shall be provided both above and below the thrust collar for ease of operation.
- H. The resilient-seated disc wedge shall be of the resilient wedge fully-supported type. Solid guide lugs shall travel within channels in the body of the valve. The disc and guide lugs shall be fully (100%) encapsulated in SBR (styrene butadiene) rubber.
- I. Disc wedges that are not 100% fully encapsulated shall not be acceptable. Guide caps of an acetal copolymer bearing material shall be provided to protect the rubber-encapsulated solid guide lugs from abrasion for long life and ease of operation.
- J. All internal and external exposed Resilient Wedge Gate Valve ferrous surfaces shall be coated with a liquid, two-part thermosetting epoxy coating conforming to AWWA C550 and certified to NSF 61. Coating shall be non-toxic and shall impart no taste to water. Coating thickness shall be nominal 10 mils.
- K. Resilient Wedge Gate Valves shall be Mueller A-2360 Resilient Wedge Gate Valves or approved equal.

**6.03 BUTTERFLY VALVE:**

**DIVISION 6  
VALVES AND COUPLINGS**

Butterfly valves shall be manufactured to equal or exceed all applicable standards of the latest revision of AWWA C-504, Class 150-B, AWWA Standard for Rubber-seated Butterfly Valves. Butterfly valves must also meet the following specific requirements:

- A. Valve bodies shall be cast iron, ASTM A-126 Class B. Body ends shall be flanged with facing and drilling in accordance with ANSI B16.1, Class 125; or mechanical joint in accordance with AWWA C-111. All mechanical joint end valves shall be furnished complete with joint accessories (bolts, nuts, gaskets, and glands). All valves shall conform with AWWA Standard C-504, Table 3 - Laying Lengths for Flanged and Wafer Valves and Minimum Body Shell Thicknesses for all Body Types.
- B. The valve disc shall be ductile iron ASTM A-536, grade 65-45-12. The valve disc shall be of the offset design providing three-hundred-sixty degree (360°) uninterrupted seating.
- C. The resilient seat shall be natural rubber bonded to an 18-8, Type 304 stainless steel retaining ring secured to the disc by 18-8, Type 304 stainless steel screws. The seat shall be capable of mechanical adjustment in the field and be field replaceable without the need for special tools. Valve body seat shall be 18-8, Type 304 stainless steel.
- D. Valve shafts shall be 18-8, Type 304 stainless steel. Shafts shall be of the two piece stub design and be attached to the disc by means of "O"-ring-sealed taper pins with lock nuts.
- E. The valve assembly shall be furnished with a non-adjustable factory set thrust bearing designed to center the valve disc at all times.
- F. Shaft bearings shall be contained in the integral hubs of the valve body and shall be self-lubricated sleeve type.
- G. The valve-shaft seal shall consist of "O" rings. Where the valve shaft projects through the valve body for

**DIVISION 6  
VALVES AND COUPLINGS**

actuator connection, the "O" ring packing seal shall be field replaceable as a part of a removable bronze cartridge.

- H. Manual actuators shall be of the traveling-nut design capable of withstanding four-hundred-fifty foot-pounds (450 ft-lb) of input torque against the open and closed stops. All actuators shall have adjustable mechanical stop limits. The closed-position stop shall be externally adjustable. Valves shall be installed with the shaft horizontal unless otherwise directed by the Engineer, and shall be provided with a two-inch-square (2") operating nut for manually operating the valve with a "T"-handle wrench.
- I. All valves shall be coated with epoxy in conformance to AWWA Standard C-550, latest revision. Interior wetted ferrous surfaces shall be coated a nominal ten (10) mils thick for long life. The body exterior shall have a minimum of three (3) to four (4) mils coating thickness in order to provide a superior base for field-applied finish coats.

**6.04 VALVE BOXES:**

All buried valves shall be installed complete with a valve box and drop lid. The valve box shall be: two-piece, cast-iron, slip-type, with a five and one-quarter-inch (5-1/4") shaft with locking lid. The lid shall have the word "Irrigation" cast in the metal and shall be triangular in shape per Drawing DS-1

Valves and valve boxes shall be installed where shown on the Drawings according to the following conditions:

- A. Valves and valve boxes shall be set plumb.
- B. Valve boxes shall be centered directly over the valves.
- C. Valves shall be aligned with property lines where possible.
- D. Earth fill shall be carefully tamped around the valve box to a distance of four feet (4') on all sides of the

**DIVISION 6  
VALVES AND COUPLINGS**

box, or to the undisturbed trench face if less than four feet (4').

- E. Valves shall have their interiors cleaned of all foreign matter before installation.

All valve boxes located in streets shall be installed as nearly to grade as possible. After the pavement is in place, the valve boxes shall be raised to grade. The surrounding asphalt shall be neatly cut and removed to form a circular opening of two feet six inches (2'-6") in diameter by 12-inch (12") deep. With the valve box centered in the opening, cast a 12-inch (12") thick concrete collar around the box. Valve boxes in off-road areas shall be marked with a green metal "T" type fence post.

**6.05 COUPLINGS:**

Couplings shall be equal to the product of Smith-Blair or Dresser with cast iron couplings being used on all cast iron and PVC pipe. Couplings shall be of the straight, transition, or reducing style as required by the specific installation. All steel fittings and bolts shall be coated with a non-oxide coating and wrapped with polyethylene.

**6.06 THRUST RESTRAINING GLANDS**

Mechanical joint thrust restraining glands shall be manufactured of ductile iron conforming to ASTM A536-80. The gland shall be such that it may replace the standardized mechanical joint gland and can be used with the standard mechanical joint bell conforming to ANSI/AWWA A21.11/C111 and ANSI/AWWA A21.53/C153 of latest revision. Twist off nuts shall be used to insure proper actuating of the restraining gland. Restraining glands shall have a pressure rating equal to that of the PVC pipe on which it is used.

**6.07 VALVE STEM EXTENSIONS**

Valve Stem Extensions: In the event that the valve is installed at a depth greater than 5'0", the Contractor shall provide a valve stem extension to accommodate the valve opening and closing with a standard valve key at a reasonable height 1 (one) foot below grade preferred. This extension shall be of a steel



**DIVISION 6  
VALVES AND COUPLINGS**

construction, primed, painted and shall be included in the unit price of the valve.

**DIVISION 12**

**SPECIAL VALVES AND STRUCTURES**

**12.01 GENERAL:**

This section covers all specialized valves including Two (2) inch Air Inlet and Removal Facility, and Two (2) inch Combination Air Valves.

**12.02 TWO (2) INCH AIR INLET AND REMOVAL FACILITY:**

The two (2) inch air inlet and removal facility shall be constructed as detailed and placed at the locations shown on the drawings. The work is to include excavation, gravel foundation, backfill, service saddles, piping, fittings, valves, utility boxes, sod replacement, and appurtenances.

**A. Connection to main:**

The connection to the main for the air inlet and removal facility shall be a bronze service saddle, Mueller Model H-13490 or Ford S-90 for line sizes four (4) inches thru ten (10) inches. For line sizes twelve (12) inches and larger use a direct tap with a CC thread for facilities 1 inch and smaller. For facilities larger than 1 inch on line sizes twelve (12) inches and larger, use Mueller Model BR 2 B or Ford 202 B saddles. Tapping the main through the service clamp will be accomplished with standard tapping equipment before the system is put into service.

**B. Polyethylene Tubing:**

Pipe from main to the utility box shall be Polyethylene CTS tube. Polyethylene CTS tube shall be manufactured in accordance AWWA C-901.

Material designation code: Polyethylene  
PE 3408

Plastic Extrusion Compound: Type III, class C,  
grade 34, as defined  
in ASTM D 1248

Standard pipe dimension ratio CTS (SDR) 9 - 200 psi pressure rating.

**DIVISION 12**  
**SPECIAL VALVES AND STRUCTURES**

**DIVISION 12**  
**SPECIAL VALVES AND STRUCTURES**

**C. Compression Connection:**

MUELLER 110 COMPRESSION COUPLINGS OR FORD C84-44Q (1-INCH) OR FORD C84-77Q (2-INCH) COMPRESSION COUPLINGS ARE TO BE USED ON ALL P.E. PLASTIC PIPE INSTALLATIONS.

- (1) The interior surface of the coupling nut, including threads, shall have a baked on, fluorocarbon coating to reduce assembly friction and prevent the gasket from turning and twisting during tightening. The nut shall bottom on a cast or machined shoulder on the body when properly assembled.
- (2) The sealing gasket shall be of molded synthetic rubber (ASTM D-2000) with molded in place bronze spring (ASTM A-134 Alloy #6) to eliminate the possible cold flow of the gasket between the pipe and fitting. A gripper band of hardened stainless steel (ANSI Type 401) shall be fitted into the gasket. When the gasket is compressed it will cause the gripper ring to distort the pipe giving the fitting a high resistance to pull out. The gripper band shall overlap itself to prevent cold flow of the gasket into the cavity under the band.
- (3) Stainless Steel pipe stiffeners are required to be used to eliminate cold flow of plastic pipe.
- (4) All fittings are to be for CTS Polyethylene pipe.
- (5) The Minimum pull out load for the fitting shall be 500 FT.LBS

**D. Valves:**

Valves shall be Mueller series B20283 two (2) inch brass ball valve or approved equal by Engineer.

**E. Fittings:**

Fittings shall be Type K copper or brass.

**F. Service Box:**

**DIVISION 12  
SPECIAL VALVES AND STRUCTURES**

Service box shall be an 11 3/4-inch by 17-inch standard green fiberglass irrigation box with cover. The word "IRRIGATION" shall be embossed on the cover.

Box shall be Brooks 1419 small box series with recessed lid and shall be provided with waterworks pentagon head locking device or equivalent. Camlock Model #20-A (no cap required)

**G. Fire hose connection:**

The fire hose connection shall be a two (2) inch aluminum "quick connect" style. (Camlock Model #20-A (No cap required.)

**12.03 TWO (2) INCH COMBINATION AIR VALVE:**

The two (2) inch combination air valve shall be constructed as detailed, and placed at the locations shown on the drawings. The work is to include excavation, gravel foundation, backfill, precast concrete manhole cone and sections, cast iron manhole frame and vented cover, piping, fittings, valves, saddles, combination air valve, and appurtenances.

**A. Manholes:**

Manhole materials and installation shall meet the requirements of Division 5.

**B. Piping and Fittings:**

Piping and fittings shall be Type K copper or brass.

**C. Valves:**

Valves shall be Mueller series B20283 2-inch brass ball valve or approved equal by Engineer.

**D. Saddles:**

Saddles shall be Mueller bronze Series H13490 or approved equal by Engineer.

**E. 2-inch Combination Air Valve:**

**DIVISION 12**  
**SPECIAL VALVES AND STRUCTURES**

Combination Air Valves shall be of the single housing style that combines the operating features of both an Air/Vacuum and Air Release Valve.

The Air/Vacuum portion shall automatically exhaust large quantities of air during the filling of the pipeline and automatically allows air to re-enter the pipeline when the internal pressure of the pipeline approaches a negative value.

The Air Release portion shall automatically release small pockets of air from the pipeline while the pipeline is in operation and under pressure.

The Combination Air Valve shall have 2-inch NPT inlet and outlet connections. The body, cover and baffle shall be of Cast Iron and the float and other trim shall be of Stainless Steel. The valve shall be a Val-Matic Model 202C or approved equal.

## DIVISION 15

### SERVICE CONNECTION

#### 15.01 GENERAL:

This section covers the installation of service connection and components to homeowner's property line.

#### 15.02 SERVICE SADDLE SPECIFICATIONS:

For service connections to C900 PVC main, all service saddles shall be of a "Full encirclement design," and shall be O.D. controlled, which design will eliminate the possibility of pipe crushing due to the over torquing of the nuts upon installation. All service saddles for connections to C900 PVC pipe sizes 4 inch to 10 inch diameter shall be Mueller Model H-13490 Series or Ford S-90.

#### 15.03 CORPORATION STOP:

For service connections to Ductile Iron main on pipe sizes that are 12 inch diameter and larger, corporation stops shall be used to connect to the main. Corporation stops shall be manufactured and tested to ANSI/AWWA C800. The body is to be cast from 85-5-5-5 ASTM B62 brass alloy and be of a straight through design. All corporation stops shall be Mueller 1500 series (or approved equal), with CTS 110 compression outlet. Stainless steel pipe stiffeners are required to be used to eliminate cold flow of plastic pipe and compression fittings.

#### 15.04 POLYETHYLENE TUBING:

Pipe for the transmission of irrigation water from main to utility box and from the utility box at property line shall be Polyethylene CTS tube. Polyethylene CTS tube shall be manufactured in accordance with the standard specification for Polyethylene (PEP plastic tubing as issued by the American Standard for Testing and Materials under ASTM D 2737 and AWWA C-901.

Material designation code: Polyethylene  
PE 3408

Plastic Extrusion Compound: Type III, class C,  
grade 34, as defined

**DIVISION 15**  
**SERVICE CONNECTION**

in ASTM D 1248

The standard pipe dimension ratio is CTS (SDR) 9, which has a 200 psi pressure rating. All tubing for service lines shall be cut and installed in a neat and workmanlike manner by a method recommended by the manufacturer. No joints will be allowed between the main and the service valve. Tubing shall be WESTFLEX PE 3408 Gold Label or equivalent.

**15.05 COMPRESSION CONNECTION:**

MUELLER 110 COMPRESSION COUPLINGS AND FITTINGS OR FORD C84-44Q (1-INCH) OR FORD C84-77Q (2-INCH) COMPRESSION COUPLINGS ARE TO BE USED ON ALL P.E. PLASTIC PIPE INSTALLATIONS.

- (a) The interior surface of the coupling nut, including threads, shall have a baked on, fluorocarbon coating to reduce assembly friction and prevent the gasket from turning and twisting during tightening. The nut shall bottom on a cast or machined shoulder on the body when properly assembled. This design will provide a visual check to assure connection is properly assembled.
- (b) The sealing gasket shall be of molded synthetic rubber (ASTM D-2000) with molded in place bronze spring (ASTM A-134 Alloy #6) to eliminate the possible cold flow of the gasket between the pipe and fitting. A gripper band of hardened stainless steel (ANSI Type 401) shall be fitted into the gasket. When the gasket is compressed it will cause the gripper ring to distort the pipe giving the fitting a high resistance to pull out. The gripper band shall overlap itself to prevent cold flow of the gasket into the cavity under the band.
- (c) When compression fittings are used with P.E. Pipe, Stainless Steel pipe stiffeners are required to be used to eliminate cold flow of plastic pipe.
- (d) All fittings are to be for CTS Polyethylene pipe.
- (e) The Minimum pull out load for the fitting when used with PE plastic pipe shall be as follows for each given size:



**DIVISION 15  
SERVICE CONNECTION**

<u>SIZE</u>	<u>MINIMUM PULL OUT (FT.LBS.)</u>
1"	400
1½"	500
2"	500

**15.06 SERVICE FITTINGS:**

All service fittings such as brass tees, and brass ells shall be Mueller 110 Compression Connections or Ford Q Fittings.

**15.07 MARK II ORI-SEAL VALVE:**

These valves shall be closed bottom design and sealed against external leakage at the top by means of a non-adjustable resilient pressure actuated seal, and shall be provided with a secondary resilient seal disposed above the pressure seal for added protection of the bearing surfaces against ground water infiltration. Shutoff shall be affected by a resilient pressure actuated seal so disposed in the key (or plug) as to completely enclose the inlet body port (flow way), in the closed position. All Curb valves shall be quarter turn valves and the fully open and closed positions shall be controlled by check lugs which are integral parts of the key and body. The maximum pressure rating shall be 175 PSI water at a maximum temperature of 180 degrees Fahrenheit.

All fittings are to be CTS Size, used on CTS (Copper Tube Size) Polyethylene pipe. No IPS polyethylene pipe or fittings are to be used.

Curb stops valves shall be MUELLER H-15172, 110 COMPRESSION by FIP, STOP AND WASTE CONFIGURATION. (no substitution is allowed)

A protective insert plug shall be placed on the open side of the valve (the side where the resident will connect into in the future) in order to prevent dirt and debris from entering the valve.

**15.08 SERVICE BOX:**

Hooper Irrigation Company  
Standard Specifications

July 2003

**DIVISION 15**  
**SERVICE CONNECTION**

Service box shall be an 11 3/4-inch by 17-inch standard green fiberglass irrigation box with cover. Service Box shall be installed over the Ori-Seal valve. A sign shall be attached or embossed to or on the cover indicating as follows: "IRRIGATION" Box shall be Brooks 1419 series utility box with lid recessed and shall be provided with Waterworks Pentagon Head locking device or equivalent.

The location of the service box should be coordinated with each property owner. A double service near a shared property corner is encouraged in order to reduce construction and maintenance costs. Determination of service location shall be provided by Hooper Irrigation Company (Owner) and coordinated with the resident and the Contractor. The location shall be near the property line and away from traffic impact areas. The location shall be marked on the ground with a flag, stake, paint, or other methods chosen by the Owner. The Contractor must coordinate with the Owner and the resident when a service box location may provide conflicts with existing infrastructure or difficulties in construction. Note: Service box must be a minimum of 5'-0" away, either side of culinary water meter. Field notes of the actual installed location of the service box must be shown on the as-built drawings by the Contractor. Contractor shall be required to write in permanent ink Marker on the lid of the service box footage from service box to main. This will serve as another means of locating the main in the roadway and for dewatering pay quantities.

**15.09 SERVICE BORE:**

All services on the opposite side of the street from the main will be bored under the asphalt. No open trenching for services will be permitted unless approved by engineer. All approved open trenching for service installation will require a minimum of 1'-0" (one Foot) trench width in order to achieve the necessary compaction and asphalt replacement. Boring will also be required in areas where construction will cross existing sidewalk, and/or curb and gutter. Sidewalk and/or curb and gutter that is damaged or removed on this project shall be replaced in same or better condition (than before the damage or removal) at no additional cost to the Owner.

**DIVISION 15**  
**SERVICE CONNECTION**

**15.10 FLOW METERS:**

As of March 12, 2018, flow meters shall be installed on all new secondary services per the Hooper Irrigation Company "Typical Service Connections" detail in the standard drawings. Meters shall be of type Sensus iPerl for all services 1" in size and smaller. For services larger than 1", the Hooper Irrigation Company engineer should be consulted for information about meter type and model. Meters shall be located behind the curb and gutter in the park strip area per the standard detail.