

TECHNICAL SPECIFICATIONS & CONSTRUCTION STANDARDS

for

ROY WATER CONSERVANCY DISTRICT

5440 South Freeway Park Drive
Riverdale Utah 84405

Adopted by the Board of Trustees

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Prepared by

WASATCH CIVIL CONSULTING ENGINEERING

1150 South Depot Drive, Suite 225
Ogden, Utah 84404

TABLE OF CONTENTS

for

Technical Specifications & Construction Standards

Roy Water Conservancy District

PART I TECHNICAL SPECIFICATIONS

Section	Page
1	General Development and Subdivision Requirements 2
2	Excavation and Backfill for Pipelines 5
3	Ductile Iron Pipe Fittings..... 8
4	PVC Pressure Pipe 11
5	High Density Polyethylene Pipe 14
6	Secondary Water Service Connections 18
7	Main Line Valves 21
8	Testing of Waterlines 23
9	Construction and Placement of Thrust Blocks 24
10	Casement Pipe..... 25
11	Restoration of Surface Improvements..... 26

PART II CONSTRUCTION STANDARDS

Sheet	
1	New Secondary Water Service Connection Detail
2	Retrofit Secondary Water Service Connection Detail – Upper System
3	Retrofit Secondary Water Service Connection Detail - Lower System
4	New Secondary Water Service Connection Detail (1 ½-inch and 2-inch)
5	New Secondary Water Service Connection Detail (4-inch and 6-inch)
6	Miscellaneous Details
7	Miscellaneous Details
8	Miscellaneous Details

SECTION 1

GENERAL DEVELOPMENT AND SUBDIVISION REQUIREMENTS

- 1.1 **SCOPE:** This section defines the general requirements for improvements to be built by a Contractor who has either been hired by a Subdivider, Developer, Roy Water Conservancy District or other entity to construct improvements to be accepted and maintained by Roy Water Conservancy District, hereinafter referred to as the "District". Any questions with regards to these standards should be directed to the District office at (801) 825-9744.

The required improvements shall include all main lines, valves, air-vac assemblies, drain valves, service connections and other appurtenances associated with the function of the secondary water system. Design must provide for future extension to adjacent developments and be compatible with the District Master Plan. All main lines shall be installed to the boundary lines of the subdivision. Main line sizes shall be determined by the District's Engineer, but in no case shall main lines be less than 6-inches in diameter. If the District determines that a larger main line is needed to meet future demands of the system than is designed by the engineer of the Subdivider, Developer or other entity, the Subdivider, Developer or other entity shall be responsible to direct their Contractor to install the up-sized main line. The District will reimburse the Contractor, Subdivider, Developer or other entity for the costs of materials associated with up-sizing main lines greater than the design by the engineer of the Subdivider, Developer or other entity if it is 8-inches in diameter or larger. The Subdivider or Developer shall direct their Contractor to install such main lines and the Subdivider, Developer or other entity shall submit a request to the District for the difference in cost of materials between the engineered design with a minimum of an 8-inch diameter main line and the main line size required by the District.

The depths of the main lines necessitate the drainage of main lines following the irrigation season. When installing main lines for the District, the Contractor shall insure that all main lines will adequately drain to avoid damage caused by freezing. All main line additions to the system must include adequate drain valves to provide this protection. In locations where a storm drain system is not available to discharge water from the drain valve, a temporary gravel drain shall be constructed by the Contractor.

- 1.2 **PRECONSTRUCTION MEETING:** Before any construction activities begin, a preconstruction meeting shall be held either in conjunction with the preconstruction meeting held by Roy City, Hooper City, West Haven City, Utah Department of Transportation (UDOT), or one held solely by the District.
- 1.3 **CONSTRUCTION DRAWINGS:** One copy of the final plat and improvement drawings shall be submitted to the District office for review prior to commencing construction. No secondary water system improvements shall be installed or constructed until plans have been checked and approved by the District.

- 1.4 **STANDARDS FOR CONSTRUCTION DRAWINGS:** Construction drawings shall conform to the standards defined in the Technical Specifications and Construction Standard drawings hereinafter outlined.
- 1.5 **INSPECTION:** All construction work involving the installation of improvements related to the secondary water system in a subdivision or project shall be subject to inspection by the District. It shall be the responsibility of the Contractor to ensure that inspections take place where and when required. Inspections will be required as follows:
- A. Verification of construction survey staking will be required before commencement of any work.
 - B. District personnel must perform inspections prior to backfilling main lines, service lines or connections. The Contractor is responsible to contact the District to insure compliance with the District's specifications. Final inspection by the District and testing as necessary by the Contractor shall be required before final acceptance of the following:
 - Main line and valve installation
 - Service line installation
 - Individual service installation
 - Air-vac assembly installation
 - Drain valve installation
- 1.6 **REQUESTS FOR INSPECTION:** Requests for inspections shall be made to the District by the person responsible for construction. Requests for inspection on work requiring continuous inspection shall be made 3 working days prior to commencement of the work. Notice shall be given 48 hours in advance of the commencement of work requiring periodic inspection, unless specific approval is given otherwise by the District.
- 1.7 **CONSTRUCTION COMPLETION INSPECTION:** An inspection shall be made by the District after all construction work is completed. Any faulty or defective work shall be corrected by the persons responsible for the work within a period of 30-days of the date of the District's Inspection Report defining the faulty or defective work.
- 1.8 **CONSTRUCTION TESTING:** All in-place density testing shall be performed and paid for by the Subdivider, Developer, Contractor, or other entity. Any tests failing to meet the Standards set forth in Section 2 will be retested and the Subdivider, Developer, Contractor, or other entity will pay for the cost of the retest. The cost of obtaining necessary soil proctors, gradations, asphalt extractions, Marshall asphalt densities, or concrete test cylinders shall be provided and paid for directly by the Subdivider, Developer, Contractor, or other entity.
- 1.9 **DRAWINGS:** All references within these specifications to "The Drawings" shall mean the District approved construction drawings or the Roy Water Conservancy

District Construction Standards and Specifications as applicable.

- 1.10 GUARANTEE OF WORK: The Subdivider, Developer, Contractor, or other entity shall warrant and guarantee (and post bond or other security) that the improvements provided for hereunder, and every part thereof, will remain in good condition for a period of 2-years, after the Construction Completion Inspection report is approved in writing by the District, and agrees to make all repairs to and maintain the improvements and every part thereof in good condition during that time with no cost to the District. Negligence on the part of the Contractor is not limited to a 2-year period. It is further agreed and understood that the determination for necessity of repairs and maintenance of the work rests with the District. The decision of the District shall be final and binding upon the Subdivider, Developer, Contractor, or other entity and the guarantee is hereby limited to the entire secondary system including all pipes, joints, valves, backfill and compaction as well as the working surface, curbs, gutters, sidewalks, and other accessories that are, in the judgment of the District, in need of repairs, maintenance, or construction. The District shall cause a written notice to be served upon the Subdivider, Developer, Contractor, or other entity and thereupon the Subdivider, Developer, Contractor, or other entity shall undertake and complete such repairs, maintenance and construction. If the Subdivider, Developer, Contractor, or other entity fails to do so within 10-days from the date of the service of such notice, the District shall have such repairs made, and the cost of such repairs shall be paid by the Subdivider, Developer, Contractor, or other entity together with 25% in addition thereto as and for stipulated damages for such failure on the part of the Subdivider, Developer, Contractor, or other entity to make the repair.

SECTION 2

EXCAVATION AND BACKFILL FOR PIPELINES

- 2.1 SCOPE: This section applies to the furnishing of all labor, tools, materials, and equipment to perform all operations associated with the excavation, trenching, and backfill for underground pipelines and appurtenances.
- 2.2 CONTROL OF GROUNDWATER: Trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing, and pipe embedment operations in an adequate and acceptable manner. Where the trench bottom is unstable because of the presence of groundwater, and in all cases where the static groundwater elevation 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 the trench de-watering shall be conducted to natural drainage channels, gutters, or drains and in conformance with water discharge policies adopted by the city in which the work is performed. Surface water shall be prevented from entering the trenches. No discharge will be permitted into the sanitary sewer system. The Subdivider, Developer, Contractor, or other entity shall be responsible for obtaining all permits and SWPPP items that may be applicable to the project.
- 2.3 EXCAVATION FOR PIPELINES: Excavation for pipelines shall follow lines parallel and equidistant from the location of the pipe centerline. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:
- A. Except in ledge rock, cobble-rock, stones, or water-saturated earth, mechanical excavation of trenches shall not extend below an elevation of 4-inches above 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. Excavation shall not be carried below the grade shown on the Drawings. Any unauthorized excavation made below grade for any reason shall be backfilled in accordance with these Specifications.
 - B. Excavation for trenches in ledge rock, cobble-rock, stones, mud, or other material unsatisfactory for pipe foundation shall extend to a depth of at least four (4) inches below the bottom of pipe. Pipe bedding material as specified in Section 4.6 shall be placed and thoroughly compacted to provide a smooth, stable foundation. Foundation material shall consist of suitable earth materials free from roots, sod, organic matter, or other deleterious material. Trench bottoms shall be hand-shaped as specified in paragraph (A) above. Where unstable earth is encountered in the excavation at the grade of the pipe, a minimum of 12-inches below grade will be removed and backfilled with crushed rock or gravel as specified in Section 4.5 to provide a stable subgrade.

- C. The maximum width of trench, measured at the top of the pipe, shall be as narrow as possible.
- D. Excavation for pipelines under existing curb and gutter, concrete slabs or sidewalks shall be open cut. Tunneling will be allowed only under the direction of the District. Backfill of open cut areas shall be restored as specified in Sections 2.7 and 2.9.

2.4 GRAVEL FOUNDATION FOR PIPE: Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load or where water must be drained to maintain a dry trench bottom for pipe installation, the subgrade shall be stabilized in accordance with Section 4.5.

2.5 BLASTING: Blasting will not be allowed except by special permission of the District. When the use of blasting is necessary, the Contractor shall use utmost care not to endanger life or property. The Contractor shall comply with all laws, ordinances, and applicable safety code requirements and regulations relative to the handling, storage, and use of explosives and protection of life and property, and the Contractor shall be fully responsible for all damage attributable to the blasting operations. Signals warning persons of danger shall be given before any blast. Suitable weighted plank covering of timber mats shall be provided to confine all materials lifted by blasting within the limits of the excavation trench.

Excessive blasting or overshooting will not be permitted, and any material outside the authorized cross section which may be shattered or loosened by blasting shall be removed and backfilled at the Contractor's expense. The District shall have authority to order any method of blasting discontinued which leads to overshooting or is dangerous to the public or destructive to property or to natural features.

2.6 SHEETING, BRACING, AND SHORING OF EXCAVATIONS: Excavation shall be sheeted, braced, or shored as required to support the walls of the excavations to eliminate sliding and settling and as may be otherwise required to protect the workmen and existing utilities, structures, and improvements. All such sheeting, bracing, shoring and side slopes shall comply with the requirements of the Utah State Industrial Commission and OSHA.

All damage resulting from lack of adequate sheeting, bracing, shoring, and side slopes shall be the responsibility of the Contractor, and the Contractor shall accomplish all necessary repairs or reconstruction resulting from such damage.

2.7 BACKFILLING: Backfill shall be carefully placed around and over pipes and shall not be permitted to fall directly on a pipe from such a height or in such a manner as to cause damage. The process of preparing the trench bottom to receive the pipe and the backfilling on each side of the pipe to a level that is a minimum of 12-inches over the top of the pipe is defined as bedding.

Trench backfilling above the level of the pipe bedding may be accomplished with

native excavated materials if they are found to be suitable. If backfill material is found to be unsuitable, the trench is to be backfilled with approved granular import material as specified in Section 2.10.

The backfill in all trenches shall be compacted according to the requirements of the materials being placed. Under pavements or other surface improvements the in-place density shall be a minimum of 95% of laboratory standard maximum dry density, as determined by AASHTO T-180 (ASTM D-1557). In shoulders and other areas where there are no existing surface improvements, the in-place density shall be a minimum of 92% of laboratory standard maximum dry density, as determined by AASHTO T-180 (ASTM D-1557).

2.8 CONSOLIDATION OF BACKFILL: Consolidation of backfill by water is not allowed.

2.9 COMPACTION OF BACKFILL: Compacted backfill shall be placed by means of mechanical compaction equipment of a size and type approved by the District.

Where compaction methods are used, the material shall be placed at a moisture content such that after compaction the required relative densities will be produced; also, the material shall be placed in lifts which, prior to compaction, shall not exceed 12-inches.

Prior to compaction each layer shall be evenly spread and moistened as approved by the District.

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 minimum relative densities or for any settlement which may occur after the compaction has been approved and completed. The Contractor, in planning his work, shall allow sufficient time for the Contractor to make tests for relative densities. Density testing results shall be submitted to the District for their review and approval.

2.10 IMPORTED BACKFILL MATERIAL: In the event the native excavated materials are determined to be too difficult to compact to the required densities, or are unacceptable as backfill as determined by the District, the Contractor may elect to provide imported granular material. This granular material shall pass a 3-inch square sieve and shall not contain more than 15% of material passing a 200-mesh sieve, and shall be free from sod, vegetation, and other organic or deleterious materials. This material is to be used no closer than 12-inches above the pipe.

SECTION 3

DUCTILE IRON PIPE FITTINGS

- 3.1 SCOPE: This section applies to the furnishing and installation of ductile iron pipe fittings.
- 3.2 DUCTILE IRON FITTINGS: Fittings shall be of the short body design for PVC applications and shall meet the standards of AWWA C-110. They shall have mechanical or push-on rubber gasket type joints. Fittings inside structures or where otherwise noted on the drawings shall be ASA Class 124 flanged design with full face rubber gaskets and shall conform to the dimensions and weights specified in AWWA C-110 and C-111. All bolts are to be stainless steel, zinc plated or xylan 1424 coated high strength, low alloy, corrosion resistant t-bolts and nuts meeting the 1000-hour salt fog test per ASTM B-117.
- 3.3 COATINGS FOR DUCTILE IRON PIPE AND FITTINGS: All exterior surfaces of ductile iron pipe and fittings shall be coated with hot coal tar as specified in the Proposed American Standard Specifications for Coal Tar Dip Coating for Ductile Iron Pipe and Fittings.
- 3.4 HANDLING DUCTILE IRON FITTINGS: Fittings shall be handled in such a manner as to ensure installation in sound, undamaged condition. Care shall be taken not to damage the fitting coating.
- 3.5 All damaged fitting coating shall be repaired prior to installing the fitting or placing the backfill. Repair shall be accomplished by removing all damaged coating, wire-brushing to exposed metal, and applying two coats of coal tar coating of a type and quality equal to that used originally in coating the fitting.
- 3.6 All pipe fittings shall be installed as specified in AWWA C600 "Installation of Ductile-Iron Water Mains and Their Appurtenances," except as modified herein and in special conditions approved by the District.

Tees, elbows, crosses, and reducers shall be used for changes in direction and outlets, unless otherwise specified on the approved drawings.

Anchors, thrust bolts and thrust blocks shall be placed at valves, elbows, tees, etc., as shown on the approved drawings or as directed by the District.

All ductile iron pipe fitting installation shall proceed on a stable foundation, with joints closely and accurately fitted. Joints shall be clean and dry, and a non-toxic joint lubricant, as recommended by the pipe manufacturer, shall be applied uniformly to the mating joint and gasket surfaces to facilitate easy, positive joint closure.

All pipe fittings shall be installed with uniform bearing under the full length. The Contractor shall provide suitable excavations receive each type of fitting as

specified to ensure quality installation and service performance. All fittings shall be protected from lateral displacement and possible damage resulting from impact or unbalanced loading during backfilling operations by being adequately bedded.

Select material shall be compacted around the pipe fittings to firmly bed the fittings into position. If adjustment of position of a fitting, for the purposes of length, is required after being installed, the fitting shall be removed and rejoined as for new installation. In addition to the above requirements, all fitting installation shall comply with the specific requirements of the manufacturer.

As work progresses, the interior of all pipe and fittings shall be cleared of dirt and superfluous materials. Where cleaning after laying is difficult because of small pipe diameter, a suitable swab or drag shall be kept in the pipe and pulled forward past each joint immediately after jointing has occurred. At all times when work is in progress, all open ends of the fittings shall be securely closed to the satisfaction of the District, so that no water, earth, or other substance will enter fittings.

- 3.7 PIPE REPAIRS AND REPAIR FITTINGS: All pipe repairs are to be completed under the direct supervision of District personnel. All pipe repair fittings are to be epoxy coated transition couplers and shall meet ASTM A 536 with stainless steel bolts, zinc plated or xylan 1424 coated high strength, low alloy, corrosion resistant t-bolts and nuts meeting the 1000-hour salt fog test per ASTM B-117.
- 3.8 POLYETHYLENE WRAPPING: If the District determines that cathodic protection is required, ductile iron fittings and valves may be required to be wrapped with a polyethylene wrap. At the direction of the District, pipe shall be wrapped with a polyethylene plastic wrap and shall be installed in accordance with the manufacturer's specifications.

Where polyethylene wrap is specified, all compression couplings, mechanical joints, push-on joints, flanged joints, fittings, and valves exposed to soil shall be wrapped with 8-mil thick polyethylene film and polyethylene adhesive tape equal to Polyken No. 900 or Scotchrap No. 50. The tape shall be installed to adhere securely to both the pipe and polyethylene.

Enough polyethylene wrap shall be used to overlap the adjoining pipe a minimum of 1-foot and the laps shall be secured in place by circumferential bands of polyethylene adhesive tape.

Valves shall be wrapped by bringing the wrap on the adjacent pipe over the mechanical joints or flanges of the valve and sealing with polyethylene adhesive tape. The valve bodies are then wrapped with a flat sheet of the film passed under the valve bottom and brought up around the body to the stem and fastened in place with polyethylene adhesive tape.

All fittings that require concrete thrust blocking shall be completely wrapped prior to pouring the thrust block.

Polyethylene wrap shall be protected from the sun and weathering prior to use. Care shall be exercised during backfilling of the protected area to prevent puncturing the film. The bottom of the trench shall be shaped to give substantially uniform circumferential support of the lower third of each pipe.

All polyethylene wrapped pipe, fittings and valves shall be inspected by a representative of the District before backfilling.

SECTION 4

PVC PRESSURE PIPE

- 4.1 SCOPE: This section applies to the furnishing and installation of PVC plastic pressure pipe. Installation of PVC pressure pipe as covered in this specification only applies to pressure irrigation systems.
- 4.2 PIPE: All PVC plastic pressure pipe with integral bell and spigot joints shall be made from clean, virgin, Type 1, Grade 1, unplasticized polyvinyl chloride (PVC), purple in color and shall meet the requirements of the latest revision of ASTM D-1784, cell class 12454-B, with standard dimension ratio (DR-18) for all pipe, unless otherwise approved. All Pipe shall meet ASTM D 1599 and ASTM D-2444 test standards; integral pipe and bell with fittings shall meet ASTM F 477 requirements and shall be NSF approved.
- 4.3 JOINTS: The bell shall consist of an integral wall section with a solid cross-section rubber ring which meets the requirements of ASTM D-3139. The bell section shall be designed to be at least as strong as the pipe wall.
- 4.4 PIPE LAYING: All PVC pipe installation shall proceed on a stable foundation, with joints closely and accurately fitted. Joints shall be clean and dry, and a non-toxic joint lubricant, as recommended by the pipe supplier, shall be applied uniformly to the mating joint surfaces to facilitate easy, positive joint closure.

Pipe shall be installed with uniform bearing under the full length of the barrel, with suitable excavations being made to receive pipe bells.

Select material shall be compacted around the pipe to firmly bed the pipe in position. If adjustment of position of a pipe length is required after being laid, it shall be removed and re-joined as for a new pipe. When laying is not in progress, the ends of pipe shall be closed with a tight-fitting plug to prevent the entrance of foreign material.

Service lines and laterals must be assembled so that no strain is placed on the pipe during or after backfilling operations. After laying of the pipe is completed, it shall be center loaded with backfill and bedding to prevent arching and whipping under pressure. Center loading should be done carefully so that joints will be completely exposed for examination.

In addition to the above requirements, all pipe installation shall comply with the specific requirements of the pipe manufacturer.

- 4.5 FOUNDATION FOR PIPE: Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, where water must be drained to maintain a dry trench bottom for pipe installation, and at other locations as previously defined, the subgrade shall be excavated to a sufficient depth and replaced with crushed rock or gravel.

Gravel for pipe foundation shall be clean gravel conforming to the following gradation:

Foundation Gravel Gradation	
Screen	% Passing
1-1/2"	100
No. 4	5

Gradation may vary under the direction of the District.

The gravel material shall be deposited over the entire trench width in 6-inch maximum layers; each layer shall be compacted by tamping, rolling, vibrating, spading, slicing, rodding, or by a combination of these methods. In addition, the material shall be graded to produce a uniform and continuous support for the installed pipe.

Once the trench bottom is stable, the pipe shall be bedded in accordance with Section 4.6.

- 4.6 **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.

A groove shall be excavated in the bottom of the trench to receive the bottom quadrant of the pipe. Before preparing the groove, the trench bottom shall be excavated or filled and compacted to an elevation sufficiently above the grade of the pipe so that, when completed, the pipe will be true to line and grade. Bell holes shall be excavated so that only the barrel of the pipe receives bearing from the trench bottom.

Pipe bedding materials placed at any point below the midpoint of the pipe shall be deposited and compacted in layers not to exceed 10-inches in un-compacted depth. Deposition and compaction of bedding materials shall be done simultaneously and uniformly on both sides of the pipe. Compaction shall be

accomplished with hand or mechanical compactors. All bedding materials shall be placed in the trench with hand tools or other approved method in such a manner that they will be scattered alongside the pipe and not dropped into the trench in compacted masses. Bedding materials shall be loose sandy material, free from lumps, or rocks and shall be graded to allow 100% passing a 1-inch screen with all materials free from roots, sod, or other organic material. Bedding shall be placed and compacted as indicated and shall extend 12-inches above the top of the pipe.

- 4.7 TRACER WIRE: All tracer wire shall have HDPE insulation for direct bury and purple in color. In open trench, tracer wire shall be #12 AWG copper clad steel, high strength with minimum 450 pound break load, with minimum 30 mil HDPE insulation thickness. For directional drilling/boring tracer wire shall be #12 AWG copper clad steel, extra high strength with minimum 1,150 pound break load, with minimum 30 mil HDPE insulation thickness.

All mainline tracer wires must be interconnected in intersections, at mainline tees and mainline crosses. At tee, the three wires shall be joined using a single 3-way lockable connector. At crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative. Direct bury wire connectors shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground tracer wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner so as to prevent any uninsulated wire exposure. Non locking friction fit, twist on or taped connectors are prohibited.

All tracer wire shall terminate inside of a valve box with a required minimum of two feet of excess/slack wire after meeting final elevation. For laterals, tracer wire shall terminate inside of the meter box or inside of the Tyler 89-A curb valve box.

Tracer wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512 Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal cause by multiple wires being installed in close proximity to one another. Tracer wire must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

- 4.8 LOCATOR TAPE: All locator tape shall be purple in color and marked either Non-Potable Water or Irrigation, 3-inch or 2-inch in width, at least 5 mil in overall

thickness with a 0.35 mil solid aluminum foil core, and have a tensile strength at break of 35 lbs/in (15,000 psi). In open trench, locator tape shall be placed twelve (12) inches above the mainline pipe.

SECTION 5

HIGH DENSITY POLYETHYLENE PIPE

- 5.1 SCOPE: This section covers the furnishing and installation of high-density polyethylene (HDPE) pressure pipe.
- 5.2 PIPE: High density polyethylene pipe for pressure pipe applications shall be IPS sized pipe and have a minimum pressure rating of 200 psi and a DR of 11. The use of DIPS pipe is not permitted.

Materials used for the manufacture of polyethylene pipe and fittings shall be PE 3608 (formerly PE 3408) high density polyethylene meeting cell classification 345464C for black or 345464E for stripes per ASTM D 3350; and shall be Listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermoplastic Pipe and Fittings Compounds, with a standard grade HDB rating of 1600 psi at 73°F. The Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.

Polyethylene pipe shall be manufactured in accordance with AWWA C901-02 for sizes 1-1/4-inches thru 3-inches IPS diameters and to the requirements of ASTM D3035. Pipe 4-inches and above shall be manufactured to the requirements of ASTM F714 and AWWA C906-07.

Pipe shall have Service Identification Stripes: Permanent identification of the piping service shall be provided by co-extruding color stripes into the pipe outside surface. The striping material shall be the same material as the pipe material except for color. Stripes printed on the pipe outside surface shall not be acceptable. IPS sized pipes shall have four equally spaced, longitudinal color stripes.

Pipe shall be stored on clean level ground to prevent undue scratching or gouging. Sections of pipe with deep cuts or gouges shall be removed and ends of pipes rejoined. Handling of the joined pipe shall be in such a manner that the pipe is not damaged by dragging over sharp or cutting objects.

Lifting of joined pipe sections shall preclude concentration of bending stresses at joints and shall be done in a manner which evenly distributes lifting stresses along the full length of the pipe.

Pipe shall be stored in a shaded area or covered to avoid temperature extremes which may cause the pipe to bow or warp.

- 5.3 PIPE FITTINGS: Molded fittings shall be manufactured and tested in accordance with ASTM D 3261 and shall be so marked.

Fabricated fittings shall be made by heat fusion joining specially machined shapes cut from pipe, polyethylene sheet stock, or molded fittings. Fabricated fittings shall be rated for internal pressure service at least equal to the full service pressure rating of the mating pipe.

Flange adapters shall be made with sufficient through-bore length to be clamped in a butt fusion-joining machine without the use of a stub-end holder. The sealing surface of the flange adapter shall be machined with a series of small v-shaped grooves (serrations) to promote gasketless sealing, or restrain the gasket against blowout. Flange adapters shall be fitted with back-up rings pressure rated equal to or greater than the mating pipe. The back-up ring bore shall be chamfered or radiused to provide clearance to the flange adapter radius. Flange bolts and nuts shall be Grade 2 or higher.

MJ Adapters 4-inch thru 16-inch may be provided with optional stainless steel stiffener upon request. MJ Adapters 14-inch and above shall be provided with Heavy Duty Backup Ring Kits. All MJ adapters above 18-inch must be provided with stainless steel stiffeners.

- 5.4 JOINING:

Heat fusion joining between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle fusion. The butt fusion and saddle fusion procedures used shall be procedures that are in accordance with ASTM F2620. The Contractor shall ensure that persons making heat fusion joints have received training in the recommended procedure. External and internal beads shall not be removed.

Butt Fusion of Unlike Wall Thickness: Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, DR 11 to DR 17. Transitions between unlike wall thickness greater than one DR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion.

Joining by Other Means: Polyethylene pipe and fittings may be joined together

or to other materials by means of the following:

- A. Flanged connections with flange adapters and back-up rings;
- B. Mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material;
- C. MJ Adapters;
- D. Electrofusion;

A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where PE pipe is connected to the socket of a mechanical joint pipe, fitting or appurtenance except where an MJ Adapter is used.

Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe.

Mechanical joint and flange connections shall be installed in accordance with the Manufacturer's recommended procedure. MJ Adapters and flanges shall be centered and aligned to the mating component before assembling and tightening bolts. In no case shall MJ gland or flange bolts be used to draw the connection into alignment. Bolt threads shall be lubricated, and flat washers should be used under the nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the Manufacturer. At least 1-hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the Manufacturer. The final tightening torque shall be as recommended by the Manufacturer.

3.4 TESTING

Fusion Quality: The Contractor shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the Contractor's fusion operator while on site. Upon request by the District, the Contractor shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps shall be cut out and bent strap tested in accordance with ASTM F2620. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The Contractor at his expense shall make all necessary corrections to equipment, set-

up, operation and fusion procedure, and shall re-make the rejected fusions. Testing of large diameter fusion (>12-inches) may require special equipment and safety precautions.

Leak Testing: Hydrostatic leak testing shall be conducted in accordance with ASTM F2164. Pneumatic pressure testing is prohibited. The Contractor shall test all piping either in sections or as a unit. The test shall be made by placing temporary bulkheads as needed in the pipe and filling the line slowly with water. Care shall be taken to see that all air vents are open during the filling. After the piping or section thereof has been filled, it shall be allowed to stand under a slight pressure for a sufficient length of time to allow the escape of air from any pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If any leaks are found, corrective measures satisfactory to the District shall be taken. The test shall consist of holding a minimum pressure of 200 psi on the section being tested for a minimum period of 2-hours using either pneumatic or hydraulic means to maintain the pressure. Suitable means shall be provided by the Contractor for determining the quantity of water lost by leakage under the test pressure. The maximum allowable leakage shall be 3.0 gallons / hour per 1,000-feet of pipeline tested at 200 psi.

SECTION 6

SECONDARY WATER SERVICE CONNECTIONS

- 6.1 SCOPE: This section applies to the furnishing and installing of service line connections, materials, and inspection.
- 6.2 SERVICE SADDLES: Connections to main lines shall be made through nylon coated service saddles with double stainless steel straps. Nuts and bolts shall also be stainless steel. No O-ring seals are allowed.
- 6.3 PIPE FOR SERVICE CONNECTIONS: Pipe for water services shall be flexible polyethylene plastic pipe, SDR9-PE3408, manufactured to meet the requirements of ASTM D-2737. Pipe shall be extruded from virgin polyethylene material and shall have a uniform wall thickness. The pipe shall be marked to show the manufacturer's name and trademark, the pipe size, and type classification and shall be either purple or black in color.
- 6.4 CONNECTIONS: All connections shall be made with Mueller 110 compression fittings, or approved equal.
- 6.5 1-INCH SINGLE SERVICE ASSEMBLY: A typical single service shall consist of the specified connection to the mainline, 1-inch Copper Tube Size (SDR 9) polyethylene service line, a 1-inch Mueller Mark II "Oriseal" curb stop (stop and waste not allowed) and valve box located in the park strip, a 1-inch Mueller lock nut by compression 300 Ball Straight Meter Valve with Lock Wing, a 1-inch Sensus iPERL meter with a SmartPoint 520M pit set module, a 1-inch Mueller iron meter yoke, a 1-inch Mueller expansion handwheel, a 1-inch Mueller lock nut by compression straight coupling and a 21-inch x 18-inch HDPE corrugated meter box with a ring and purple cover marked "RWCD IRRIGATION" as approved by the District located in the center of the park strip, a 6-inch minimum brass nipple piece and a 1-inch gate valve set in a valve box 2-feet behind the sidewalk. The gate valve shall be a heavy duty commercial grade gate valve manufactured by MATCO, or approved equal. They shall be constructed in accordance with the District's Construction Standards detail drawings.
- 6.6 1 1/2-INCH DOUBLE SERVICE ASSEMBLY: A typical double service shall consist of the specified connection to the mainline, 1 1/2-inch Copper Tube (SDR 9) polyethylene service line, a 1 1/2-inch Mueller Mark II "Oriseal" curb stop (stop and waste not allowed) and valve box located in the park strip, a 1-inch x 1-inch x 1 1/2-inch brass tee or a 1 1/2-inch brass tee with a 1 1/2-inch x 1-inch brass bushing in the center of the park strip, two 1-inch x 12-inch minimum brass nipple pieces, two

1-inch Mueller lock nut by FIPT 300 Ball Straight Meter Valves with Lock Wing, two 1-inch Sensus iPERL meters with two SmartPoint 520M pit set modules, two 1-inch Mueller Iron meter yokes, two 1-inch Mueller expansion handwheels, two 1-inch Mueller lock nut by compression straight couplings and two 21-inch x 18-inch HDPE corrugated meter boxes with ring and purple cover marked "RWCD IRRIGATION" or as approved by the District and two 1-inch gate valves set in individual valve boxes 2-feet behind the sidewalk. The gate valves shall be a heavy duty commercial grade commercial gate valve manufactured by MATCO, or approved equal. They shall be constructed in accordance with the District's Construction Standards detail drawings.

No repair coupler shall be installed on any service lateral without the prior approval of the District.

- 6.7 METERS: A typical meter shall be a solid state, battery operated electromagnetic flow measurement system with a hermetically sealed, glass covered, electronic register with a programmable 9-digit display. All meters must conform to AWWA Standard C-700 and C-710 as most recently revised with respect to accuracy and pressure loss requirements, or other appropriate AWWA Standard. The meter must be compliant with NSF/ANSI Standard 61 Annex F and G. The register must be an electronic device encapsulated in glass with 9 programmable digits utilizing a liquid crystal display (LCD). It will have indicators for flow direction, empty pipe, battery life and unit of measurement. The register must be hermetically sealed with a heat tempered glass cover and be tamper resistant. The register shall not be removable from the measuring sensor. The register shall utilize a magnetic coupling technology to connect to a touch read, radio read or fixed base meter reading system in a pit set installation. The measuring element shall be made of a noncorrosive, lead-free glass fiber reinforced, composite alloy material. A battery powered magnetic flow sensor utilizing silver/silver chloride electrodes will be utilized to measure the velocity of the water which is linearly proportional to the volume. The measuring element will have no moving parts and will be specific for each size. The register and measuring element will be an integrated unit housed within a thermal plastic external casing. This integrated unit will not be removable from the external housing. The systems shall have the size and direction of water flow through the system imprinted on the external housing. System shall operate up to a working pressure of 200 pounds / square inch without leakage or damage to any parts. The accuracy shall not be affected by variation of pressure up to 200 pounds / square inch. Sensus meters shall include a TR/PL Sensor with a minimum 6-foot cable, a TR/PL Housing Assembly purple in color, and a Sensus Model 520M Pit Set MXU or approved equal.

- 6.8 METER BOXES AND COVERS: Meter boxes shall be 21-inch diameter, 18-inches

deep, corrugated High Density Polyethylene. Cover shall be DFW Plastics Model DFW12AUT (purple) with 5/8-inch recess and metal detector.

- 6.9 VALVE BOXES: Valve boxes set over the gate valves shall be AMETEK 10-inch circular or approved equal. All valve boxes set over the curb stops or meter valves shall be Tyler model 89-A or approved equal marked "Sprinkler" or "Irrigation".
- 6.10 1 1/2-INCH OR LARGER SINGLE SERVICE ASSEMBLY: Materials and fittings for a service assembly of this size shall be approved by the District and constructed in accordance with the District's Construction Standards detail drawings.

SECTION 7

MAIN LINE VALVES

- 7.1 SCOPE: This section applied to furnishing and installing valves and valve boxes.
- 7.2 GATE VALVES: Gate valves shall conform to AWWA C-509. Valves shall be iron body with fusion epoxy coated interior and exterior surfaces, resilient wedge type, with non-rising stem. Unless otherwise approved, valves shall be flanged or mechanical joint connection design for buried service. Valves located inside structures shall have flanged connections. Valves shall be rated for a working pressure of at least 150 pounds / square inch. Buried valves shall have a 2-inch operating nut and valves in structures shall have hand wheels. Gate valves are to be used on main lines that are less than 10-inches in diameter.
- 7.3 BUTTERFLY VALVES: Butterfly valves shall conform to (AWWA C-504). Valves shall have rubber seats that are securely fastened to the valve body. No metal-to-metal seating surfaces shall be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve disc shall rotate 90 degrees from the full open position to the tight shut position. Valves shall meet the full requirements of AWWA C-504 for Class 150B. Shafts of all valves shall be turned, ground and polished. Valve shafts shall be constructed of 18-8 Type 304 or Type 316 stainless steel. Shaft diameter must meet minimum requirements established by AWWA C-504 for Class 150B. All butterfly valves shall be for underground applications with a 2-inch square operating nut and non-rising stem and shall have mechanical joints unless otherwise noted on the plans or directed by the District. Installation of valves shall be in accordance with the manufacturer's recommendations and shall include a valve box in accordance with Section 7.4. Butterfly valves are to be used on main lines that are 10-inches in diameter or larger, or as approved by the District.
- 7.4 VALVE BOXES: All buried main line or drain valves shall be installed complete with two-piece, cast iron, 5 1/4-inch shaft, slip or screw-type top valve box with a square lid marked as directed by the District. Acceptable valve box tops can be purchased from the District and picked up at the District office after payment is received. Valve boxes shall be adjusted to a minimum of 1/8-inch to 1/4-inch below final grade and shall be surrounded at the surface with a 24-inch square x 12-inch deep concrete collar.
- 7.5 COMBINATION AIR AND VACUUM RELIEF VALVES: Air-vacuum relief valves, shall be constructed at all high points or at locations determined by the District.

They shall be constructed in accordance with the District's Construction Standards detail drawings. Lids associated with the installation of combination or air-vacuum relief valves shall be marked "Sprinkler", "Irrigation" or as directed by the District.

- 7.6 DRAIN VALVES AND FLUSH VALVES: Permanent drain valves, temporary drain valves and flush valves shall be constructed at all low points or at locations determined by the District. They shall be constructed in accordance with the District's Construction Standard detail drawings. Lids associated with the installation of drain valves or flush valves shall be marked "Sprinkler", "Irrigation" or as directed by the District.
- 7.7 VALVE LOCATIONS: At intersections, main line valves shall be bolted to the adjacent tee or bend. At least 2 valves shall be required at all 3-way intersections and 3 valves at 4-way intersections, or as indicated by the District. Drain valves shall be located at low points or as directed by the District.

SECTION 8

TESTING OF WATERLINES

- 8.1 **SCOPE:** This section applies to the flushing and testing of secondary waterlines that are replaced, installed or repaired.
- 8.2 **TESTING:** Tests shall be made upon completion of system replacement, installation or repairs or any portion thereof. Tests shall be performed on both main lines and service laterals up to and including the gate valve. Pressure tests and retests shall be made at the expense of the Contractor and in the presence of a District representative.

All lines shall be slowly filled with water, venting off all air. All main line valves, curb stops, and meter valves shall be in the fully open position during the test while all gate valves shall be in the closed position. All lines shall be pressurized to 200 pounds / square inch. This pressure shall remain steady for a period of 2 hours.

- 8.3 **FLUSHING:** After pressure testing, all waterlines shall be flushed. Flushing shall be accomplished through end of line blow-offs with a minimum of 2-inch diameter or, the Contractor shall install a tap sufficient in size to provide a 2.5 foot / second flushing velocity in the waterline. The following is the flow quantity required to provide a 2.5 foot / second flushing velocity for various pipe diameters:

Pipe Flushing Velocities	
Pipe Diameter (inches)	Gallons Per Minute (gpm)
2	26
4	100
6	220
8	390
10	610
12	880

SECTION 9

CONSTRUCTION AND PLACEMENT OF THRUST BLOCKS

- 9.1 **SCOPE:** This section defines the placement and construction of thrust blocks where required.
- 9.2 **PLACEMENT:** Thrust blocks are required at points where the main line changes direction, or as specified by the District. Thrust blocks are required at all tees, elbows, wyes, caps, valves, reducers, etc. Thrust blocks should be constructed so that the bearing surface is in direct line with the major force created by the main line or fitting. The bearing surface should be undisturbed. Thrust blocks should be constructed in accordance with the District's Construction Standards detail drawings.
- 9.3 **CONCRETE MIX DESIGN:** The concrete mixture shall have a minimum 28-day compressive strength of 2,500 pounds / square inch and shall comply with the requirements of Class C concrete.

SECTION 10

CASEMENT PIPE

- 10.1 SCOPE: This section applies to the furnishing and installation of steel casement pipe.
- 10.2 PIPE: All casement and carrier pipe shall be straight seam, electric resistance welded ASTM A-53, Grade B, Schedule 20 plain end steel pipe. Spiral welded steel pipe is not allowed.
- 10.3 JOINTS: The casement pipe may be joined by either butt-welding, lap-welding, or welded together using butt straps.
- 10.4 COATING: Protective coatings do not need to be applied to the casement pipe.
- 10.5 INSTALLATION: The casement pipe shall be installed by direct bury, jacking and/or boring to the line and grade shown on the drawings. The casement pipe shall not have a deviation of more than 0.25 feet from its' intended grade and location upon completion of the construction.
- 10.6 CARRIER PIPE INSTALLATION: The carrier pipe shall be installed within the casement pipe by sliding it into the casement pipe on approved polyethylene spacers. Each skid on the spacers shall be of sufficient length to ensure the carrier pipe does not touch the casement pipe.

At a minimum, three spacers shall be installed per 20 lineal foot of pipe. Placement shall be as recommended by the manufacturer or directed by the District. Spacers shall be PSI model PE, or approved equivalent.

No joints are allowed in the carrier pipe or within 3-feet of the exterior of the casement pipe.

- 10.7 END SEALS: After the carrier pipe installation has been approved by the District, both ends of the Casement Pipe shall be sealed using a synthetic rubber end seal. The ends of the casement pipe are to be protected from sediment and water at all times. The ends of the casement pipe shall be sealed within 12-hours of the carrier pipe installation. If there is the possibility of water entering the excavation, the ends of the casement shall be sealed immediately following the installation of the carrier pipe. End seals shall be PSI model S, or approved equivalent.

SECTION 11

RESTORATION OF SURFACE IMPROVEMENTS

11.1 SCOPE: This section applies to the restoration of existing surface improvements.

11.2 GENERAL: The Contractor shall be responsible for the protection and restoration or replacement of any improvements existing on public or private property at the start of work or placed there during the progress of the work.

Existing improvements shall include but are not limited to permanent surfacing, curbs, gutters, sidewalks, planted areas, ditches, driveways, culverts, fences and walls. All improvements shall be reconstructed to equal or better conditions in all respects than the existing improvements removed.

11.3 ROADBASE SURFACE: Where trenches are excavated through roadbase surfaced areas such as roads and shoulders, parking areas, unpaved driveways, etc., the roadbase shall be restored and maintained as follows:

- A. The roadbase shall be placed deep enough to provide a minimum thickness of 6-inches.
- B. The roadbase shall be placed in the trench at the time it is backfilled. The surface shall be maintained by blading, sprinkling, rolling, adding additional roadbase, etc., to maintain a safe, uniform surface satisfactory to the District. Excess materials shall be removed from the premises immediately.
- C. Material for use on roadbase surfaces shall be obtained from sound durable gravel or rock meeting the following requirements for grading:

Roadbase Surface Gradation		
	Ideal	Tolerance
Passing 1-inch Screen	100	0
Passing ½ inch Screen	85	+/-6
Passing No. 4 Screen	55	+/-6
Passing No. 16 Screen	31	+/-4
Passing No. 200 Screen	9	+/-2

- 11.4 BITUMINOUS SURFACE: Where trenches are excavated through bituminous surfaced roads, parking areas, driveways, etc., the surface shall be restored and maintained as follows:
- A. A temporary roadbase surface shall be placed and maintained as required in Paragraph 11.3 above after the required backfill and compaction of the trench has been accomplished.
 - B. The roadbase shall be placed to such depth as to provide 12-inches of thickness below the bottom of the bituminous surface and shall be brought flush with the bituminous surface.
 - C. The area over trenches to be resurfaced shall be graded and rolled to provide a subgrade which is firm and unyielding. Density of the subgrade materials shall meet the requirements of Section 2.9. Mud or other soft material shall be removed and replaced with approved granular material then rolled and compacted in lifts not exceeding 6-inches in thickness.
 - D. Before any permanent resurfacing is placed, the Contractor shall saw-cut the existing bituminous surface to clean, straight lines as nearly parallel to the centerline of the trench as practicable. Said straight lines shall be 30-foot minimum in length and no deviations from such lines shall be made except as specifically permitted by the Roy City, Hooper City, or West Haven City Street Departments, or the Utah Department of Transportation (UDOT) as applicable.
 - E. Existing bituminous surfaces shall be cut back a minimum of 6-inches beyond the limits of any excavation or cave-in along the trench so that the edges of the new paving will rest on a minimum of 6-inches of undisturbed soil or at a distance required by the Roy City, Hooper City, or West Haven City Street Departments, or the Utah Department of Transportation (UDOT) as applicable.
 - F. As soon as is practical, weather permitting, the bituminous surface shall be restored by placing a minimum asphalt thickness of 3-inches or as required by the Roy City, Hooper City, or West Haven City Street Departments, or the Utah Department of Transportation (UDOT) as applicable.
 - G. Bituminous surface restoration shall include rolling plant hot mix asphalt material to the level of the adjacent bituminous surfaces.
- 11.5 CONCRETE SURFACES: All concrete curbs, gutters, sidewalks and driveways

shall be removed and replaced to the next joint or scoring line beyond the damaged or broken sections; or if joints or scoring lines do not exist or are 3-feet or more from the removed or damaged section, the damaged portions shall be removed and reconstructed to a clean "saw cut" vertical plane face. All new concrete shall match, as nearly as possible, the appearance of adjacent concrete improvements.