
TITLE 6



MOUNTAIN REGIONAL WATER DISTRICT

**SPECIAL SERVICE DISTRICT
of Summit County**

Construction Standards and Specifications

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Prepared By
The Administrative Staff of
Mountain Regional Water Special Service District

Mountain Regional Water Special Service District

WATER SYSTEM CONSTRUCTION STANDARDS and SPECIFICATIONS

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MOUNTAIN REGIONAL WATER SPECIAL SERVICE DISTRICT

Water System Construction Standards and Specifications

SECTION 1.0 Culinary Water Improvement Requirements

1.1 General. This document defines the general construction standards and specifications of Mountain Regional Water Special Service District, (the “District”) as required for any culinary improvements to be designed, engineered, built, and inspected by the developer, subdivider, owner, agents, contractor, or the District itself, for all types of construction (to include the servicing of residential, commercial, industrial and professional office). The culinary improvements shall include all piping and appurtenant equipment required for a connection with existing improvements to the boundary of the subdivision nearest the existing improvements and shall include any necessary off-site improvements.

System layout must provide for future extensions to existing or future adjacent development and must be compatible with the contour of the ground for proper drainage. All water lines shall be installed to the boundary lines of the subdivision or development. All water improvements shall comply with the standards and specifications of this document, including all attached standard drawings and details, unless certain criteria or elements are specifically exempted or substituted in writing by the District General Manager or Engineer.

1.2 Drawings. All Detailed Drawings, as attached to this document are hereby incorporated into these Standards and Specifications.

1.3 District Rules and Regulations. All other Rules and Regulations of the District, as adopted and amended from time to time, shall be complied with.

1.4 Other Standards. In addition to these standards, all applicable Rules as promulgated and amended from time to time by the Utah Division of Drinking Water shall be complied with, for all types of improvements regulated therein. These rules for water facility construction are more typically referred to as the Series 500 rules, titled, “Drinking Water Facility Construction Design and Operation”. They are listed as follows:

R309-500	Plan Review, Operation and Maintenance Requirements
R309-505	Minimum Treatment Requirements
R309-510	Minimum Sizing Requirements
R309-511	Hydraulic Modeling Rule
R309-515	Source Development
R309-520	Disinfection
R309-525	Conventional Surface Water Treatment
R309-530	Alternative Surface Water Treatment Methods
R309-535	Miscellaneous Treatment Methods
R309-540	Pump Stations
R309-545	Drinking Water Storage Tanks
R309-550	Transmission and Distribution Pipelines

The Section 550 – Transmission and Distribution Pipelines, above, in its entirety, is re-numbered as Section 5 of this document and is adopted herein due to its relevance to most projects engineered and constructed as per these standards. All other standards in this document are supplementary to the basic requirements of Section 5, and any other appurtenant rules of the Division of Drinking Water. Where any conflict may exist, the Division of Drinking rules take precedence.

SECTION 2.0 General Construction Requirements.

- 2.1 Water Supply.** The developer shall connect the development to the culinary water system including all appurtenances and shall make such water available to each lot within the subdivided area. Adequacy of supply and sizes of water mains shall be established by the District Engineer or their designee. The minimum water line size shall be 8" in diameter.

Workmanship and details of construction shall be in accordance with the District "Construction Standards" and/or other codes or Rules and Regulations adopted by the District. All work in connection with water mains and services shall be installed as directed and under the supervision of the District or their designee.

- 2.2 Traffic Control.** Proper traffic control shall be provided during all phases of work. A traffic control plan shall be submitted to the District prior to any work in accordance with MUTCD.
- 2.3 Construction Safety.** Open pits and trenches left for an overnight period or longer shall be clearly marked with flashing barricades and properly secured.
- 2.4 Culinary Water Work.** In order for work to be performed on any portion of the culinary water system, plans and specifications must be submitted and approved by the District, as per current District Rules and Regulations. Work must be done by a competent, licensed, and insured contractor.

Upon approval, the contractor or developer is given a copy of the signed permit and the signed plans. Time limits may be set by the District; and work can be suspended for non-compliance.

SECTION 3.0 Inspections

- 3.1 All Work Subject to Inspection.** All construction work involving the installation of improvements in or outside of subdivisions shall be subject to inspection by the District. The developer, owner, or contractor shall be responsible to ensure inspection and provide that certified reports are obtained and maintained on record and are provided in the as-built subdivision packet. The records shall include the following inspections:

- A. Compaction of all trenches;
- B. Pressure tests on water mains.
- C. Any pertinent material testing reports, i.e. soil, concrete, or asphalt tests.
- D. Chlorine residual and bacteriological tests.

Certain types of construction shall have continuous inspection while others may have only periodic inspections. It is the responsibility of the developer, owner or contractor to ensure that all contractors give the District appropriate notice to allow proper scheduling of said inspections.

- A. Inspection shall be required on the following types of work:
 - 1. Laying of water pipe, valves, hydrants, and testing.
 - 2. Thrust block or other restraining devices.
 - 3. Trenches for laying pipe, including pipe bedding.

4. Any other equipment such as PRV, metering, pumping, and control stations, etc.

B. See individual sections for specific inspection and testing requirements.

3.2 Inspection & Other Fees. Inspection fees and/or other connection related fees required by the rules and regulations of the District shall be paid and permits required shall be obtained prior to the recording of any final plat.

A. The developer or contractor shall be responsible for all sampling, delivery of samples to a qualified testing agency, testing, and delivery of test results or materials certifications to the District at no charge to the District. Testing and certifications reports shall be approved by the District to ensure conformance to all District Construction Standards prior to final inspection and/or acceptance by the District of any materials or workmanship.

3.3 Acceptance of Improvements. Inspection made by the District to determine compliance with the specifications does not imply acceptance of the work. The District requires completion of all facilities before any are accepted for maintenance. Final acceptance of improvements will be made in writing, after an inspection by the District at the completion of all improvements. All improvements shall be free from defects or damage at the time of inspection. Specifically the following are required:

A. All water valves and hydrants shall be operative.

B. Grades. All grades and cut sheets shall be approved by the District or its designee.

C. Clean up. Where excavations are made in streets, the rock, etc., shall be removed and gravel base placed in the excavation the same day as backfill is placed.

D. All PRV's, SCADA systems, Air-Vacs, Meter Vaults, and related facilities shall be completed and operable.

A final walk-through to inspect the improvements shall be arranged by the developer/owner with the District when said improvements are completed. The improvements final acceptance shall be made by the District Engineer, and will be accepted when the punch list from the final walk-through is completed. Warranties will be for 2 years and shall begin and run in conformance with these standards and the District Rules and Regulations.

3.4 Requests for Inspection. Requests for inspection shall be made to the District only by the person responsible for the construction. Requests for inspection must be made one (1) day – (24 hours) in advance of the starting of any work.

A two (2) hour notice of cancellation is required of all scheduled inspections. If an inspection is scheduled and the contractor is not ready or work is not complete according to the "Standards" each additional re-inspection fee of \$50.00, dollars will be charged to the service connection.

3.5 Construction Completion Inspection. An inspection shall be made by the District or its designee 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 thirty (30) days of the date of the inspection report defining the faulty or defective work.

It is further agreed and understood that the determination for necessity of repairs and maintenance of any work rests solely with the District or its designee. The District's decision upon the matter shall be final and binding upon the developer, and the guarantee hereby stipulated shall extend to and include, but

shall not be limited to all pipes, utilities, equipment, joints, valves, backfill, and compaction as well as the working surface, and other appurtenances that are, or may be affected by the construction operations. Further if in the judgment of the District or its designee, there shall be caused a written notice to be served to the developer, then the developer/owner shall undertake and complete such repairs, maintenance or rebuilding in an expeditious manner. If the developer fails to do so within ten (10) days from the date of the service of such notice the District or its designee shall have such repairs made, and the cost of such repairs shall be promptly paid by the developer/owner together.

3.6 Work Without Inspection. Any work performed without proper inspections, as required above, will require the work to be excavated or exposed to the extent necessary for inspection.

3.7 As-Built Drawings. As-built or record drawings shall be submitted to the District or its designee in a timely manner before final inspection and acceptance by the District.

SECTION 4.0 Prerequisites of Contractors

4.1 Pre-qualification. The contractor shall not commence work in public property, streets, easements, or right-of-ways until he has obtained, as a minimum, the proper permits from Summit County, and the insurance required hereunder, and evidence of such insurance has been submitted to and approved by the District. The submittal of said evidence to the District shall not relieve or decrease the liability of the contractor hereunder.

- A. Workers Compensation and Employers Liability Insurance as required by State law.
- B. Commercial General Liability Insurance - ISO Form CG 00 01 (11/85) or equivalent, occurrence policy, with the following information:
 - 1. Limits of not less than -
 - a. General Aggregate \$2,000,000
 - b. Products - Comp/OPS Aggregate \$2,000,000
 - c. Personal and Advertising Injury \$1,000,000
 - d. Each Occurrence \$1,000,000
 - e. Fire Damage (any one fire) \$ 250,000
 - f. Medical Expense (any one person) \$ 25,000
 - 2. Endorsements attached thereto including the following or their equivalent:
 - a. ISO Form CG 25 03 (11/85), Amendment of Limits of Insurance (Designated Project or Premises), describing the subject contract and specifying limits as shown above.
 - b. ISO Form CG 20 10 (11/85), Additional Insured –the District, Lessees, or Contractors (Form B), naming the District as additional insured and containing the following statement, “This Endorsement Also Constitutes Primary Coverage in the Event of any Occurrence, Claim, or Suit.”
- C. Automobile Liability Insurance, with limits of not less than \$500,000 Combined Single Limit per accident coverage applying to any automobile.

The District and Summit County requires all contractors doing work in or on any public property, street, easement, or right-of-way to obtain all necessary permits from Summit County.

Prior to any construction being completed in or on public property, streets, easements, or right-of-ways, a permit must be obtained and approved. The permit must be completed forty-eight (48) hours prior to construction. A notice must be given to the District or its designee at least twenty-four (24) hours prior to inspections. Failure to obtain a permit or proceeding without notification shall constitute grounds for legal action. The District shall inspect all work. The contractor must make arrangements with the District for all inspections. If work is performed without proper inspections or permits, the improvements may be subject to reinstallation.

Prior to starting construction, the developer, owner or contractor shall schedule with the District or its designee a pre-construction meeting with all contractors and sub-contractors. Contractors are required to meet with the District or its designee prior to commencing any construction.

- 4.2 Street Excavation Permits.** All work not bonded for under approved subdivisions shall require a Summit County Road Cut/or Road Right of Way excavation permit prior to commencement of work, and such permit must be available for inspection on site.

SECTION 5.0 Facility Design and Operation: Transmission and Distribution Pipelines (Utah Administrative Code R309-550).

5.1 Purpose.

The purpose of this rule is to provide specific requirements for the design and installation of transmission and distribution pipelines within Mountain Regional Water District (District) which deliver drinking water to facilities of public drinking water systems or to consumers. It is intended to be applied in conjunction with State of Utah Administrative rules R309-500 through R309-550. Collectively, these rules govern the design, construction, operation, and maintenance of public drinking water system facilities. These rules are intended to assure that facilities are reliably capable of supplying water in adequate quantities consistently meeting applicable drinking water quality requirements, and not posing a threat to general public health. The State of Utah Administrative rules at the time this standard was created can be found at www.drinkingwater.utah.gov

"Guidance:" is included in the District Standard as recommendations but they are not part of the official standard.

5.2 INTENTIONALLY LEFT BLANK.

5.3 Definitions.

"AF" means acre foot and is the volume of water required to cover an acre to a depth of one foot (one AF is equivalent to 325,851 gallons).

"Air gap" The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet supplying water to a tank, catch basin, plumbing fixture or other device and the flood level rim of the receptacle. This distance shall be two times the diameter of the effective opening for openings greater than one inch in diameter where walls or obstructions are spaced from the nearest inside edge of the pipe opening a distance greater than three times the diameter of the effective openings for a single wall, or a distance greater than four times the diameter of the effective opening for two intersecting walls. This distance shall be three times the diameter of the effective opening where walls or obstructions are closer than the distances indicated above.

"ANSI/NSF" refers to the American National Standards Institute and NSF International. NSF International has prepared at least two health effect standards dealing with treatment chemicals added to drinking water and system components that will come into contact with drinking water, these being Standard 60

and Standard 61. The American National Standards Institute acts as a certifying agency, and determines which laboratories may certify to these standards.

"Approval" unless indicated otherwise, shall be taken to mean a written statement of acceptance from the District Engineer.

"AWWA" refers to the American Water Works Association located at 6666 West Quincy Avenue, Denver, Colorado 80235. Reference within these rules is generally to a particular Standard prepared by AWWA and which has completed the ANSI approval process such as ANSI/AWWA Standard C651-92 (AWWA Standard for Disinfecting Water Mains).

"Backflow" means the undesirable reversal of flow of water or mixtures of water and other liquids, gases, or other substances into the distribution pipes of the potable water supply from any source. Also see backsiphonage, backpressure and cross-connection.

"Backpressure" means the phenomena that occurs when the customer's pressure is higher than the supply pressure, this could be caused by an unprotected cross connection between a drinking water supply and a pressurized irrigation system, a boiler, a pressurized industrial process, elevation differences, air or steam pressure, use of booster pumps or any other source of pressure. Also see backflow, backsiphonage and cross connection.

"Backsiphonage" means a form of backflow due to a reduction in system pressure which causes a sub atmospheric or negative pressure to exist at a site or point in the water system. Also see backflow and cross-connection.

"cfs" means cubic feet per second and is one way of expressing flowrate (one cfs is equivalent to 448.8 gpm).

"Combined distribution system" is the interconnected distribution system consisting of the distribution systems of wholesale systems and of the consecutive systems that receive finished water.

"Contaminant" means any physical, chemical biological, or radiological substance or matter in water.

"Corrosion inhibitor" means a substance capable of reducing the corrosiveness of water toward metal plumbing materials, especially lead and copper, by forming a protective film on the interior surface of those materials.

"Cross-Connection" means any actual or potential connection between a drinking (potable) water system and any other source or system through which it is possible to introduce into the public drinking water system any used water, industrial fluid, gas or substance other than the intended potable water. For example, if you have a pump moving non-potable water and hook into the drinking water system to supply water for the pump seal, a cross-connection or mixing may lead to contamination of the drinking water. Also see backsiphonage, backpressure and backflow.

"Disinfection" means a process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents (see also Primary Disinfection and Secondary Disinfection).

"Distribution System" means the use of any spring or well source, distribution pipelines, appurtenances, and facilities which carry water for potable use to consumers through a public water supply. Systems which chlorinate groundwater are in this discipline.

"Division" means the Utah Division of Drinking Water, who acts as staff to the Director and is also part of the Utah Department of Environmental Quality.

"Drinking Water" means water that is fit for human consumption and meets the quality standards of State of Utah Administrative Rule R309-200. Common usage of terms such as culinary water, potable water or finished water are synonymous with drinking water

"Drinking Water Project" means any work or facility necessary or desirable to provide water for human consumption and other domestic uses which has at least fifteen service connections or serves an average of twenty-five individuals daily for at least sixty days of the year and includes collection, treatment, storage, and distribution facilities under the control of the operator and used primarily with the system and collection, pretreatment or storage facilities used primarily in connection with the system but not under such control.

"Engineer" means a person licensed under the Professional Engineers and Land Surveyors Licensing Act, 58-22 of the Utah Code, as a "professional engineer" as defined therein.

"Equivalent Residential Connection" (ERC) is a term used to evaluate service connections to consumers other than the typical residential domicile. Public water system management is expected to review annual metered drinking water volumes delivered to non-residential connections and estimate the equivalent number of residential connections that these represent based upon the average of annual metered drinking water volumes delivered to true single family residential connections. This information is utilized in evaluation of the system's source and storage capacities (refer to State of Utah Administrative Rule R309-510).

"Finished water" is water that is introduced into the distribution system of a public water system and is intended for distribution and consumption without further treatment, except as treatment necessary to maintain water quality in the distribution system (e.g., booster disinfection, addition of corrosion control chemicals).

"Flowing stream" is a course of running water flowing in a definite channel.

"fps" means feet per second and is one way of expressing the velocity of water.

"Geologist" means a person licensed under the Professional Geologist Licensing Act, 58-76 of the Utah Code, as a "professional geologist" as defined therein.

"gpd" means gallons per day and is one way of expressing average daily water demands experienced by public water systems.

"gpm" means gallons per minute and is one way of expressing flowrate.

"gpm/sf" means gallons per minute per square foot and is one way of expressing flowrate through a surface area.

"Maximum Contaminant Level" (MCL) means the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

"MG" means million gallons and is one way of expressing a volume of water.

"MGD" means million gallons per day and is one way of expressing average daily water demands experienced by public water systems or the capacity of a water treatment plant.

"mg/L" means milligrams per liter and is one way of expressing the concentration of a chemical in water. At small concentrations, mg/L is synonymous with "ppm" (parts per million).

"Nonpoint source" means any diffuse source of contaminants or pollutants not otherwise defined as a point source.

"Peak Day Demand" means the amount of water delivered to consumers by a public water system on the day of highest consumption, generally expressed in gpd or MGD. This peak day will likely occur during a particularly hot spell in the summer. In contrast, some systems associated with the skiing industry may experience their "Peak Day Demand" in the winter.

"Peak Instantaneous Demand" means calculated or estimated highest flowrate that can be expected through any water mains of the distribution network of a public water system at any instant in time, generally expressed in gpm or cfs (refer to section 510-9).

"Plan Approval" means written approval, by the District Engineer, of contract plans and specifications for any public drinking water project which have been submitted for review prior to the start of construction.

"Public Drinking Water Project" means construction, addition to, or modification of any facility of a public water system which may affect the quality or quantity of the drinking water.

"Residual Disinfectant Concentration" ("C" in CT calculations) means the concentration of disinfectant, measured in mg/L, in a representative sample of water.

"scfm/sf" means standard cubic foot per minute per square foot and is one way of expressing flowrate of air at standard density through a filter or duct area.

"Service Connection" means the constructed conveyance by which a dwelling, commercial or industrial establishment, or other water user obtains water from the supplier's distribution system. Multiple dwelling units such as condominiums or apartments, shall be considered to have a single service connection, if fed by a single line, for the purpose of microbiological repeat sampling; but shall be evaluated by the supplier as multiple "equivalent residential connections" for the purpose of source and storage capacities.

"Significant deficiencies" means defects in design, operation, or maintenance, or a failure or defects in design, operation, or maintenance, or a failure or malfunction of the sources, treatment, storage, or distribution system that the Division Director determines to be causing, or have potential for causing, the introduction of contamination into the water delivered to consumers.

"System with a single service connection" means a system which supplies drinking water to consumers via a single service line.

"Water Supplier" means a person who owns or operates a public drinking water system.

"Water System" means all lands, property, rights, rights-of-way, easements and related facilities owned by a single entity, which are deemed necessary or convenient to deliver drinking water from source to the service connection of a consumer(s). This includes all water rights acquired in connection with the system, all means of conserving, controlling and distributing drinking water, including, but not limited to, diversion or collection works, springs, wells, treatment plants, pumps, lift stations, service meters, mains, hydrants, reservoirs, tanks and associated appurtenances within the property or easement boundaries under the control of or controlled by the entity owning the system.

5.4 General.

Transmission and distribution pipelines shall be designed, constructed and operated to convey adequate quantities of water at ample pressure, while maintaining water quality.

5.5 Water Main Design.

1. Distribution System Pressure.

- a. The distribution system shall be designed to maintain minimum pressures as required in State of Utah Administrative Rule R309-105-9 at points of connection, under all conditions of flow.
- b. When static pressure exceeds 150 psi in new distribution water lines, pressure reducing devices shall be provided on mains in the distribution system where service connections exist.

Guidance: The normal working pressure in the distribution system should be between 60 and 100 psi. The requirement for PRV's to be installed when pressures exceed 150 psi only applies to new water pipelines. Systems should implement an operation program to protect water users from excessive pressures.

2. **Design Flow Rates.** Flow rates used when designing or analyzing distribution systems shall meet the minimum requirements in the current version of the State of Utah Administrative Rule R309-510.

3. Hydraulic Analysis.

- a. All water mains shall be sized following a hydraulic analysis based on flow demands and pressure requirements.
- b. Where improvements will upgrade more than 50% of an existing distribution system in a given phase of a specific project, or where a new distribution system is proposed, a hydraulic analysis of the entire system being upgraded or being installed shall be prepared and submitted for review prior to plan approval.
- c. Some projects require a hydraulic model. The District may require submission of a hydraulic modeling report and/ or certification in a format acceptable to the District Engineer, as outlined in State of Utah Administrative Rule R309-511, prior to plan approval.

4. **Minimum Water Main Size.** For water mains not connected to fire hydrants, the minimum line size shall be 4 inches in diameter, unless they serve picnic sites, parks, semi-developed camps, primitive camps or roadway rest-stops. Minimum water main size, serving a fire hydrant lateral, shall be 8 inches in diameter unless a hydraulic analysis indicates that required flow and pressures can be maintained by 6-inch lines.

Guidance: Generally, velocity in water main should not exceed 5 fps for base water system demands and not to exceed 12 fps under peak instantaneous demand or peak day demand with fire flow imposed. Mains should be designed with sufficient excess capacity to provide for anticipated future connections.

5. **Fire Protection.** When a public water system is required to provide water for fireflow by the local fire code official, or if the system has installed fire hydrants on existing distribution mains for that purpose:
 - a. The design of the distribution system shall be consistent with the fire flow requirements as determined by the local fire code official. The fire flow requirement for residential subdivisions is 1500 gpm.

Guidance: The State Fire Marshall's office has stated that "The State adopted fire code recognizes that water mains intended for firefighting need not become subject to retroactive fire flow requirements. As such, an existing system is considered code compliant as long as it is maintained properly and new construction does not alter the fire flow requirement. Water companies are encouraged to make improvements incrementally to avoid a possible moratorium on development due to lack of water, i.e., fire flow."

- b. The location of fire hydrants shall be consistent with the requirements of the State adopted fire code and as determined by the local fire code official.

Guidance: Generally, individual hydrant spacing may range from 200 to 500 feet depending on the area being served. The planning of hydrant locations should be a cooperative effort between the water utility and local fire officials.

- c. The pipe network design shall permit fire flows to be met at fire hydrant representative locations together with "peak day" system demands while minimum pressures as required in State of Utah Administrative Rule R309-105-9 are maintained at all times and at all points in the distribution system.
- d. Fire hydrant laterals shall be a minimum of 6 inches in diameter.

6. **Geologic Considerations.** The character of the soil through which water mains are to be laid shall be considered. Special design and burial techniques shall be employed for Community Water Systems in areas of geologic hazard (e.g., slide zones, fault zones, river crossings, etc.)

Guidance: Water supply conduits and major service lines crossing known fault areas should be either designed to accommodate significant differential movement of the ground, or be valved immediately above and below the points of the fault crossing to allow control of water flow, in case of pipe rupture during an earthquake event.

Guidance: Water systems should be designed to provide alternative flow paths for major conduits in regions of known geologic hazards.

7. **Dead Ends.**

- a. To provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical.
- b. Where dead-end mains occur, they shall be provided with a fire hydrant if flow and pressure are sufficient, or with an approved flushing hydrant or blow-off for flushing purposes. Flushing devices shall be sized to provide flows that will give a velocity of at least 2.5 fps in the water main being flushed. No flushing device shall be directly connected to a sewer.

8. **Isolation Valves.** Sufficient number of valves shall be provided on water mains so that inconvenience and sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500 foot intervals in commercial districts and at not more than one block or 800 foot intervals in other districts. Where systems serve widely scattered customers and where future development is not expected, the valve spacing shall not exceed one mile.

9. **Corrosive Soils and Waters.** Consideration shall be given to the materials to be used when corrosive soils or waters will be encountered.

10. **Special Precautions in Areas of Contamination.** Where distribution systems are installed in areas of contamination:
 - a. pipe and joint materials which are not susceptible to contamination, such as permeation by organic compounds, shall be used; and,
 - b. non-permeable materials shall be used for all portions of the system including water mains, service connections, and hydrant leads.

11. **Water Mains and Other Sources of Contamination.** Caution shall be exercised when locating water mains at or near certain sites such as sewage treatment plants or industrial complexes. Individual septic tanks shall be located and avoided. The District Engineer shall be contacted to establish specific design requirements prior to locating water mains near a source of contamination.

Guidance: It is recommended that utility lines are clearly identified and visually different from one another. Consideration shall be given to providing appropriate separation between water and other utilities for operational and contamination reasons.

5.6 Component Materials and Design.

1. **ANSI/NSF Standard for Health Effects.** All materials that may come in contact with drinking water, including pipes, gaskets, lubricants and O-Rings, shall be ANSI-certified as meeting the requirements of ANSI/NSF Standard 61, Drinking Water System Components - Health Effects. To permit field verification of this certification, all components shall be appropriately stamped with the NSF logo.

2. **Asbestos and Lead.**
 - a. The use of asbestos cement pipe shall not be allowed.
 - b. Pipes and pipe fittings installed shall be "lead free" in accordance with Section 1417 of the Federal Safe Drinking Water Act. They shall be certified as meeting ANSI/NSF 372 or Annex G of ANSI/NSF 61.

Guidance: The Federal Community Fire Safety Act of 2013 exempts fire hydrants from the lead free requirements of Section 1417.

3. **Standards for Mechanical Properties.** Pipe, joints, fittings, valves, and fire hydrants shall conform to ANSI/NSF Standard 61, and applicable sections of AWWA Standards C104-A21.4-08 through C550-05 and C900-07 through C950-07.

4. **Used Materials.** Only materials that have been used previously for conveying drinking water may be reused. Used materials shall meet the above standards, be thoroughly cleaned, and be restored to their original condition.

5. **Fire Hydrants.**
 - a. Hydrant drains shall not be connected to, or located within, 10 feet of sanitary sewers. Where possible, hydrant drains shall not be located within 10 feet of storm drains.
 - b. Auxiliary valves shall be installed in all hydrant leads.
 - c. Hydrant drains shall be installed with a gravel packet or dry well unless the natural soils will provide adequate drainage.

6. **Air Relief Valves and Blow-offs.**
 - a. At high points in water mains where air can accumulate, provisions shall be made to remove air by means of hydrants or air relief valves.

- b. The open end of the air relief vent pipe from automatic valves shall be provided with a #14 mesh, non-corrodible screen and a downward elbow, and where possible, be extended to at least one foot above grade. Alternatively, the open end of the pipe may be extended to as little as one foot above the top of the pipe if the valve's chamber is not subject to flooding, or if it meets the requirements of (7) Chamber Drainage.
- c. Blow-offs or air relief valves shall not be connected directly to a sewer.
- d. Adequate number of hydrants or blow-offs shall be provided to allow periodic flushing and cleaning of water lines.
- e. The air relief valve shall be installed in a manner to prevent from freezing. A shut-off valve shall be provided to permit servicing of an air relief valve.

7. Chamber Drainage.

- a. Chambers, pits, or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system, shall not be connected directly to a storm drain or sanitary sewer.
- b. Chambers shall be provided with a drain to daylight, if possible. Where this is not possible, underground gravel-filled absorption pits may be used if the site is not subject to flooding and conditions will assure adequate drainage.

8. Control Valve Stations.

- a. Pressure Reducing Valves (PRV's)
 - i. Isolation Valves shall be installed on both sides of the pressure reducing valve.
 - ii. Where variable flow conditions will be encountered, consideration shall be given to providing parallel PRV lines to accommodate low and high flow conditions.
- b. Backflow Devices. Installation of Backflow devices shall conform to the State-adopted plumbing code.
- c. Meters. Meter installation shall conform to the State-adopted plumbing code and local Jurisdictional standards.

5.7 Separation of Water Mains and Transmission Lines from Sewers.

1. Basic Separation Standards.

- a. The horizontal distance between water lines and sanitary sewer lines shall be at least 10 feet. Where a water main and a sewer line must cross, the water main shall be at least 18 inches above the sewer line. Separation distances shall be measured edge-to-edge (i.e., from the nearest edges of the facilities).
- b. Water mains and sewer lines shall not be installed in the same trench.
- c. Where local conditions make it impossible to install water or sewer lines at separation distances required by subsection (a), the sewer pipes are in good condition, and there is not high groundwater in the area, it may be acceptable if the design includes a minimum horizontal separation of 6 feet and a minimum vertical clearance of 18 inches with the waterline being above. In order to determine whether the design is acceptable, the following information shall be submitted as part of the plans for review:
 - i. Reason for not meeting the minimum separation standard;
 - ii. Location where the water and sewer line separation is not being met;
 - iii. Horizontal and vertical clearance that will be achieved;
 - iv. Sewer line information including pipe material, condition, size, age, type of joints, thickness or pressure class, whether the pipe is pressurized or not, etc.;
 - v. Water line information including pipe material, condition, size, age, type of joints, thickness or pressure class, etc.;
 - vi. Ground water and soil conditions; and,
 - vii. Any mitigation efforts.

- d. If the basic separation standards as outlined in subsections (a) through (c) above cannot be met, an exception to the rule can be applied for with additional mitigation measures to protect public health, in accordance with State of Utah Administrative Rule R309-105-6(2)(b).

2. Special Provisions. The following special provisions apply to all situations:

- a. The basic separation standards are applicable under normal conditions for sewage collection lines and water distribution mains. More stringent requirements may be necessary if conditions such as high groundwater exist.
- b. All water transmission lines that may become unpressurized shall not be installed within 20 feet of sewer lines.
- c. In the installation of water mains or sewer lines, measures shall be taken to prevent or minimize disturbances of the existing line.
- d. Special consideration shall be given to the selection of pipe materials if corrosive conditions are likely to exist or where the minimum separation distances cannot be met. These conditions may be due to soil type, groundwater, and/or the nature of the fluid conveyed in the conduit, such as a septic sewage which produces corrosive hydrogen sulfide.
- e. Sewer Force Mains
 - i. When a new sewer force main crosses under an existing water main, all portions of the sewer force main within 10 feet (horizontally) of the water main shall be enclosed in a continuous sleeve.
 - ii. When a new water main crosses over an existing sewer force main, the water main shall be constructed of pipe materials with a minimum rated working pressure of 200 psi or equivalent pressure rating.

3. Water Service Laterals Crossing Sewer Mains and Laterals. Water service laterals shall conform to all requirements given herein for the separation of water and sewer lines.

5.8 Installation of Water Mains.

1. Standards. The specifications shall incorporate the provisions of the manufacturer's recommended installation procedures or the following applicable standards:

- a. For ductile iron pipe, AWWA Standard C600-10, Installation of Ductile Iron Water Mains and Their Appurtenances;
- b. For PVC pipe, ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping and PVC Pipe and AWWA Manual of Practice M23, 2003;
- c. For HDPE pipe, ASTM D2774, Recommended Practice for Underground Installation of Thermoplastic Pressure Piping and AWWA Manual of Practice M55, 2006; and
- d. For Steel pipe, AWWA Standard C604-11, Installation of Buried Steel Water Pipe- 4 inch and Larger.

2. Bedding. A continuous and uniform bedding shall be provided in the trench for all buried pipe. Stones larger than the backfill materials described below shall be removed for a depth of at least 6 inches below the bottom of the pipe.

3. Backfill. Backfill material shall be tamped in layers around the pipe and to a sufficient height above the pipe to adequately support and protect the pipe. The material and backfill zones shall be as specified by the standards referenced in Subsection (1), above. As a minimum:

- a. For plastic pipe, backfill material with a maximum particle size of 3/4 inch shall be used to surround the pipe; and
- b. For ductile iron pipe, backfill material shall contain no stones larger than 2 inches.

4. **Dropping Pipe into Trench.** Under no circumstances shall the pipe or accessories be dropped into the trench.
5. **Burial Cover.** All water mains shall be covered with sufficient earth or other insulation to prevent freezing, unless they are part of a non-community system that can be shut-down and drained during winter months when temperatures are below freezing. The minimum burial depth for the projects in the District is 6' below 7,000' and 7' at or above 7,000' and the maximum burial depth is 10'. Burial depths greater than 10' would require approval from the District Engineer.
6. **Thrust Blocking.** All tees, bends, plugs, and hydrants shall be provided with thrust blocking, anchoring, tie rods, or restraint joints designed to prevent movement. Restraints shall be sized to withstand the forces experienced.
7. **Pressure and Leakage Testing.** All types of installed pipe shall be pressure tested and leakage tested in accordance with AWWA Standard C600-10.
8. **Surface Water Crossings.** *Guidance: Surface water crossings, whether over or under water, present special problems. The Division should be consulted before final plans are prepared.*
 - a. Above Water Crossings. The pipe shall be adequately supported and anchored, protected from damage and freezing, and accessible for repair or replacement.
 - b. Underwater Crossings:
 - i. A minimum cover of 2 feet or greater, as local conditions may dictate, shall be provided over the pipe.
 - ii. When crossing water courses that are greater than 15 feet in width, the following shall be provided:
 - A. Pipe with joints shall be of special construction, having restrained joints for joints within the surface water course and flexible restrained joints at both edges of the water course.
 - B. Isolation valves shall be provided on both sides of the water crossing at locations not subject to high ground water or flooding, so that the section can be isolated for testing or repair.
 - C. A means shall be provided, such as a sampling tap, not subject to flooding, to allow for representative water quality testing on the upstream and downstream sides of the crossing.
 - D. A means shall be provided to pressure test the underground water crossing pipe.
9. **Sealing Pipe Ends During Construction.** The open ends of all pipelines under construction shall be covered and effectively sealed at the end of the day's work.
10. **Disinfecting Water Lines.** All new water mains or appurtenances shall be disinfected in accordance with AWWA Standard C651-05. The specifications shall include detailed procedures for the adequate flushing, disinfection, and microbiological testing of all water mains. On all new and extensive distribution system construction, evidence of satisfactory disinfection shall be provided to the District Engineer. Samples for coliform analyses shall be collected after disinfection is complete and the system is refilled with drinking water. A standard heterotrophic plate count is advisable. The use of water for public drinking water purposes shall not commence until the bacteriologic tests indicate the water is free from contamination.

5.9 Cross Connections and Interconnections.

1. **Physical Cross Connections.** There shall be no physical cross connections between the distribution system and pipe, pumps, hydrants, or tanks that may be contaminated from any source, including pressurized irrigation.
2. **Recycled Water.** Neither steam condensate nor cooling water from engine jackets or other heat exchange devices shall be returned to the drinking water supply.
3. **System Interconnects.** The interconnections between different drinking water systems shall be reviewed and approved by the Director.

Guidance: In some situations, hydraulic modeling or capacity development calculations may be required when proposing a system interconnect.

5.10 Water Hauling.

1. **Community Water Systems.** Water hauling is not an acceptable permanent source for drinking water distribution in Community Water Systems.
2. **Non-community Systems.** The Director may allow water hauling for Non-Community Public Water Systems by special approval if:
 - a. Consumers can not otherwise be supplied with good quality drinking water; or,
 - b. The nature of the development, or ground conditions, are such that the placement of a pipe distribution system is not justified. Proposals for water hauling shall be submitted to, and approved by, the Division Director.
3. **Emergencies.** Water hauling may be a temporary means of providing drinking water in an emergency. Water systems shall notify the Division as soon as possible of such emergencies.

Guidance: The guidelines for water hauling are contained in the bulletin entitled "Recommended Procedures for Hauling Culinary Water" available from the Division.

5.11 Service Connections and Plumbing.

1. **Service Taps.** Service taps shall not jeopardize the quality of the system's water.
2. **Plumbing.**
 - a. Water services and plumbing shall conform to the State-adopted Plumbing Code.
 - b. Pipes and pipe fittings installed, shall be "lead-free" in accordance with Section 1417 of the federal Safe Drinking Water Act. They shall be certified meeting the ANSI/NSF 372 or Annex G of ANSI/NSF 61.
3. **Individual Home Booster Pumps.** Individual booster pumps shall not be allowed for individual service from the public water supply mains. Exceptions to the rule may be granted by the Director of Drinking Water if it can be shown that the granting of such an exception will not jeopardize the public health.
4. **Service Lines.**
 - a. Service lines shall be capped until connected for service.
 - b. The portion of the service line under the control of the water system is considered to be part of the distribution system.

5. **Service Meters and Building Service Line.** Connections between the service meter and the home shall be in accordance with the State adopted Plumbing Code.

5.12 Transmission Lines.

1. **Unpressurized Flows.** Transmission lines shall conform to all applicable requirements in this rule. Transmission line design shall minimize unpressurized flows.
2. **Proximity to Concentrated Sources of Pollution.** A water system shall not install an unpressurized transmission line less than 50 feet from a concentrated source of pollution (e.g., septic tanks and drain fields, garbage dumps, pit privies, sewer lines, feed lots, etc.). Furthermore, unpressurized transmission lines shall not be placed in boggy areas or areas subject to the ponding of water.

5.13 Operation and Maintenance.

1. **Disinfection After Line Repair.** The disinfection procedures of Section 4.7, AWWA Standard C651-05 shall be followed if a water main is cut or repaired.
2. **Cross Connections.** The water system shall not allow a connection that may jeopardize water quality. Cross connections shall be eliminated by physical separation, an air gap, or an approved and properly operating backflow prevention assembly. The water system shall have an ongoing cross connection control program in compliance with R309-105-12.
3. **ANSI/NSF Standards.** All pipe and fittings used in routine operation and maintenance shall be ANSI-certified as meeting NSF Standard 61 or Standard 14.
4. **Seasonal Operation.** Water systems *or any portion thereof* operated seasonally shall be disinfected and flushed according to AWWA Standard C651-05 for pipelines and AWWA Standard C652-11 for storage facilities prior to each season's use. A satisfactory bacteriologic sample shall be obtained prior to use. During the non-use period, care shall be taken to close all openings into the system.

Guidance: Water systems are encouraged to develop contingency plans for obtaining pipe and appurtenances in an emergency. The stockpiling of material shall be considered.

SECTION 6.0 Excavation and Backfill for Trenches

- 6.1 **General.** These specifications cover excavation and backfill of trenches for the installation of water lines located in or out of roadways, and are supplemental to the standards of Section 5.0 above.
- 6.2 **Trench Safety.** All construction shall be done in accordance with the provisions of the Utah State Industrial Commission and OSHA regulations. No trenches shall be left open at any time unless guarded with adequate barricades, warning lamps and signs.

When required, excavation shall be braced and shored to support the walls of the excavation to eliminate sliding and settling and as may be required to protect the workers, the work in progress, and existing utilities and improvements. All such sheeting, bracing, and shoring shall comply with the requirements of the Utah State Industrial Commission and OSHA.

Any injury or damage resulting from lack of adequate bracing and shoring shall be the responsibility of the developer/contractor and the developer/contractor shall, at his/her own expense, affect all necessary

repairs or reconstruction resulting from such damage. No inspections will be done in unsafe trenches and will be the cause for immediate shutdown of the project.

6.3 Dewatering Excavation Area. All seepage or storm water that may occur or accumulate in the excavation during the progress of the work shall be removed. In areas where the nature of the soil and the hydrostatic pressures are of such a character as to develop a quick condition in the earth mass of the trench, the DEWATERING operation shall be conducted so that the hydrostatic pressure will be reduced to or near zero in the immediate vicinity of the trench. All excavations shall be kept entirely free of water at all times during the construction of the work or until otherwise directed by the District or its designee. If this water is pumped into the gutter, the contractor is responsible for all downstream clean-up to the satisfaction of the District Superintendent. No water may be pumped into the sanitary sewer system. Any State of Utah, Division of Water Quality discharge permits required for the dewatering operation is the sole responsibility of the contractor or developer to obtain prior to said operation.

6.4 Pipe Foundation.

6.4.1 Gravel Foundation for Pipe. When the sub-grade material does not afford a sufficiently solid foundation to support the pipe and superimposed load; and where water must be drained to maintain a dry bottom for pipe installation and at other locations as previously defined, the sub-grade shall be excavated to the specified depth and replaced with crushed rock or gravel conforming to the following gradation:

SCREEN	% PASSING
2"	100
1"	5

The gravel material shall be deposited over the entire trench width in eight (8) inch maximum layers, with each layer compacted by tamping, rolling, vibrating, spading, slicing, rodding or by a combination of one or more of these methods. In addition the material shall be graded to produce a uniform and continuous support for the installed pipe.

When groundwater is encountered or in areas where there is seasonal groundwater flows, clay dikes shall be installed unless otherwise directed by the District Engineer from the bottom of the trench to the top of the pipe zone. The dike shall be a minimum of 1 foot thick at the top of dike.

6.4.2 Backfill for Pipe on Hard Foundations. In no case shall pipe be laid directly on rock, hard clay, shale or other hard material. Where foundations are of this nature, the contractor shall excavate a space below the pipe and backfill it with bedding material. Under these circumstances the depth of the bedding material shall not be less than one-half inch (1/2") per foot of height of fill above the pipe with a minimum allowable thickness of six (6) inches.

6.5 Trench Backfill.

6.5.1 Backfilling Within Pipe Zone (Pipe Bedding). 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. In these specifications the process of preparing the trench bottom to receive the pipe and the backfilling on each side of the pipe to a level over the top of the pipe is defined as bedding. Bedding requirements shall follow the pipe manufacturer's recommendations or as defined below, whichever is more strict, to protect the pipe from damage.

A. Backfill Around Ductile Iron and Steel Pipe. Under no circumstances shall the granular material around the pipe exceed two (2) inches in diameter. It shall be placed at least six (6) inches below the pipe and to the center of the pipe and compacted to a minimum of ninety percent (90%) of the maximum density as per AASHTO T-180 method C. Then backfill will be placed in horizontal

layers not to exceed six (6) inches or as approved in writing by the District or its designee. The pipe shall be covered with the same material up to twelve (12) inches above the top of the pipe.

- B. Backfill Around Corrugated Steel, Plastic, Polyethylene or Other Fragile Materials. Backfill around these types of pipe shall be minus three-quarter (3/4) inch granular material. It shall be placed at least six (6) inches below the pipe and to the center of the pipe and compacted to a minimum of ninety percent (90%) of the maximum density as per AASHTO T-180 method C. Then backfill will be placed in horizontal layers not to exceed six (6) inches or as approved in writing by the District or its designee. The pipe shall be covered with the same material up to twelve (12) inches above the top of the pipe.

6.5.2 Backfilling Above Pipe Zone. After pipes are protected by select pipe bedding material, trenches may be backfilled with suitable material by approved means that will not damage or displace the pipe. Trench backfilling above the level of the pipe bedding, in an out-of-roadway location, shall normally be accomplished with native excavated materials, unless such material cannot be properly compacted, and shall be free from rocks larger than six (6) inches in diameter and any organic material or debris. Backfilling an in-roadway location shall be accomplished with three-quarter (3/4) inch minus material and be free of any organic material or debris.

6.5.3 Compaction and Consolidation of Backfill. The backfill in all trenches shall be either compacted or consolidated according to the requirements of the materials being placed. Under pavements, or other surface improvements the in place density shall be a minimum of ninety-five percent (95%) of laboratory standard maximum dry density as determined by AASHTO T-180, method C or the modified proctor test ASTM D-1557 and shall conform to all Summit County standards. 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 the same laboratory method.

- A. Compaction of Backfill. Backfill shall be compacted by means of sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers of a size and type approved by the District or its designee. During compaction, 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 the compaction, shall not exceed six (6) inches for an in-roadway location, twelve (12) inches for an out-of-roadway location, or as approved in writing by the District or its designee. Prior to compaction each layer shall be evenly spread, moistened, and worked by disk harrowing, or other means approved by the District or its designee. If the required relative density is not attained, test sections will be required to determine any adjustments in compacting equipment, thickness of layers, moisture content and compaction effort necessary to attain the specified minimum relative density.

Approval of equipment, thickness of layers, moisture content and compaction effort shall not be deemed to relieve the contractor of the responsibility for attaining the specified minimum relative densities. The contractor in planning his/her work shall allow sufficient time to perform the work connected with the test sections and to permit the District or its designee to make tests for relative densities.

- B. Consolidation of Backfill. When authorized by the District or its designee, consolidation of backfill shall be accomplished by those methods in which water is used as the essential agent to produce the desired condition of density and stability, if allowed by the performed geotechnical report. Water shall be applied by jetting unless flooding is specifically authorized by the District or its designee. Said authorization to use any consolidation method does not relieve the contractor of his/her responsibility to meet the specified density requirements. Water for consolidation shall be furnished by the contractor at his/her own expense. During the jetting procedure, the jets shall be inserted at not more than four-foot intervals (staggered) throughout the length of the

backfilled area and shall be slowly forced down to the bottom of the trench or top of previously jetted lift and held until the trench backfill is completely saturated with water. Depth of jetted lift shall not exceed 5 feet.

- C. Imported Backfill Material. In the event the native excavated material is not satisfactory for backfilling, as determined by the District or its designee, the contractor shall provide imported granular material. This granular material shall pass a 4-inch square sieve and shall not contain more than fifteen (15) percent of material passing a 200-mesh sieve, and shall be free from sod, vegetation and any other organic or deleterious materials.
- D. Compaction Tests. Compaction tests on trenches shall be conducted at a minimum of each 150 linear feet of trench, around manholes, valve boxes, and each lateral per lift. A minimum of two tests per road crossing shall be conducted.

6.6 Foam Board Frost Barrier Installation. Two (2) inch foam board shall be installed at the pipe bedding and backfill interface for pipe sections that meet any of the following conditions:

- A. Installation falls within roadway or under any other surface where snow removal is performed and is in an area where lack of regular water use could lead to a freezing condition (ex. cul de sac)
- B. Installation falls above or below a storm drain crossing or any other condition which reduces the effective cover over the pipe
- C. Portions of laterals that fall within roadway or under any other surface where snow removal is performed

The foam board shall match the length of trench and at a minimum, the width of trench, for the full extent that the condition(s) above are met.

6.7 Disposal of Materials. All excavated material, that is not needed or is unsuitable for backfill, shall be immediately removed from the area and not obstruct streets, sidewalks and driveways. Gutters and irrigation ditches shall be kept clean of all excavated materials.

6.8 Cutting of Asphalt. Where the excavation is made in a paved street, the asphalt surface shall be cut on each side of the trench prior to excavation to provide a vertical joint in the surface. Cutting of the asphalt will be made with an asphalt saw. Summit County permits will be required for all cutting within a County road or right-of-way.

6.9 Sidewalk, Curb, and Gutter.

- A. Sidewalk, Curb, and Gutter. Where sidewalk, curb, and gutter exists, excavation may be made by tunneling, provided the following requirements are met. Excavation shall be vertical and as near to the curb or sidewalk as possible. The length of the tunnel shall not exceed the width of the sidewalk, curb, and gutter. Where a separate sidewalk and curb exist, an excavation shall be made between the sidewalk and the curb. At least three feet of undisturbed earth shall be left under the sidewalk. Where the excavation does not meet these requirements, a section of sidewalk from joint to joint shall be removed and replaced.
- B. Backfill of Sidewalk Tunnels. Where the sidewalk has been tunneled, the hole shall be filled from each end with earth compacted by mechanical tampers to ninety-five percent (95%) of AASHTO T-180, Method C. A 3'-0" section of trench on each side of the tunnel and any space between the sidewalk and curb shall be backfilled with mechanically compacted earth as specified.

- C. Other Methods. Water Lines may be jacked, augured or jetted under sidewalk, curb, and gutter provided the resulting hole diameter does not exceed one (1) inch plus the outside diameter of the pipe installed.

6.10 Blasting. Blasting will not be allowed except by permission from Summit County and all other pertinent Authorities. 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. He/she shall be fully responsible for all damage attributable to his/her blasting operations. Excessive blasting or overshooting will not be permitted. Any material outside the authorized cross section which may be shattered or loosened by blasting shall be removed by the contractor.

SECTION 7.0 Supplemental Water Transmission and Distribution Line Standards

7.1 General. These specifications cover the detailed installation of culinary water lines, and are supplemental to the standards of Section 5.0 above. Special and unusual piping and plumbing for equipment or structures are treated as separate items and are not included in this item.

- A. Inspection. All pipe used shall be carefully inspected prior to installation. Any or all defective pipe shall be rejected.
- B. Care and Handling of Pipe. Adequate precautions shall be taken to prevent damage to piping and protective coatings. Proper implements, tools, and facilities shall be provided and used for safe and convenient prosecution of the work. Pipe placed in trenches shall be lowered in place piece by piece by means of ropes, booms, or any type of power equipment sufficient to handle each piece separately. In no case shall pipe be allowed to fall freely from the top to the bottom of the trench.
- C. Pipe Cleanliness. All foreign matter or dirt shall be removed from the inside of the pipe before it is placed and it shall be kept clean during and after laying.
- D. Minimum Cover. All water mains and service laterals shall have a minimum cover above the pipe as follows:
- six (6) feet up to elevations of 7,000 feet
 - seven (7) feet above elevations of 7,000 feet.

7.2 Culinary Water Pipe. Ductile Iron pipe is to be used for main lines. High Density Polyethylene Pipe will be used only with the prior approval and permission from the District. Pressures, water hammer, surges, and other dynamic water characteristics shall be taken into consideration during the design and construction of the water system. The required pipe class shall be determined based upon characteristics.

7.3 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 250 for pipes larger than 12-inch diameter. Pipes of 12-inch diameter and smaller shall be pressure Class 350. 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 and wrapped with polywrap as per AWWA C105.
- B. Joints.

1. Mechanical Joints. All mechanical joints will utilize Mega-Lugs and 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 or ANSI/AWWA C115/A 21.15, "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 may be 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 shall have 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 or 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 to be 1/8th-inch thick. A gasket is needed for each flanged joint of proper size as shown on the drawings.
 4. Restrained Joints. Restrained joints shall be "Flex-Ring" or "Lok-Ring" restrained joints as manufactured by American Ductile Iron Pipe or pre-approved equal. Field-adaptable restraint shall be provided through the use of "Fast-Grip" or "Field Flex-Ring" as manufactured by American Ductile Iron Pipe or other pre-approved and boltless, push-on restrained devices. When restrained joints require factory welding, the MANUFACTURER shall qualify all welding procedures and welders used to produce per the requirements of a documented assurance system based on ANSI/AWS D11.2. Unless otherwise specified, gasket material shall be standard styrene butadiene copolymer (SBR). Restrained joints and restrained joint pipe shall be rated for the minimum pressure shown in the table from the manufacturer or the specified pressure rating of the pipe, whichever is less. The MANUFACTURER shall furnish test results showing that restrained joints in the sizes specified have been successfully tested to at least twice the specified pressure rating of the joint without leakage or failure. Tests shall be performed on pipe with nominal metal thickness less than or equal to that specified for the project. Torque-activated restrained joint devices that rely on threaded bolts or set-screws for joint restraint shall not be used.
- C. Coatings and Linings for Ductile Iron Pipe. All exterior surfaces of pipe and fittings shall be coated with hot coal tar approximately 1 mil thick. All interior surfaces shall be cement mortar lined with a standard thickness according to ANSI/AWWA C104/A21.4.
- D. Flanges. Flanges when required shall conform to ANSI/AWWA C115/A21.15.
- E. Fittings. Fittings for Ductile Iron Pipe shall conform to the provisions of ANSI/AWWA C110/A21.10 and C153/A21.53.
- F. Corrosion Protection. Ductile iron pipe underground shall be protected against external corrosion by loose 8 mil polyethylene sleeves in accordance with AWWA C 105. Cut polyethylene

tubing about two feet longer than the pipe length. Gather the polyethylene tube on the spigot end of the pipe being assembled. Using shallow holes to accommodate the wrapped bell hold the gathered tubing over the bell and fix it in place with tape, band or string. Take up the slack in the tubing along the top of the pipe barrel and secure in place with tap. Overlap the tubing from the next pipe length and secure in similar fashion. All holes or tears shall be repaired with an additional wrap.

7.4 High Density Polyethylene Pipe – HDPE. High Density Polyethylene (HDPE) pipe may be used only with the prior approval and permission from the District. When HDPE pipe is approved, it shall be installed in accordance to the following:

- A. Materials. Materials used for the manufacture of high density polyethylene pipe and fittings shall comply with all requirements of ASTM D3350, have a minimum cell classification of PE 445474C, and have a PPI recommended designation of PE4710. Manufacturer shall be a member in good standing of the Plastics Pipe Institute. In addition, materials used for the manufacture of the HDPE pipe and fittings shall meet the following physical property requirements.

Physical Properties of PE 4710

Property/Value	Unit	Specification	Nominal Value
Material Designation	PPI/ASTM	---	PE 4710
Cell Classification	---	ASTM D 3350	445474C
Density	g/cm ³	ASTM D 1505	0.947-955
Melt Index	gm/ 10 min	ASTM D 1238	<.15
Flexural Modulus	psi	ASTM D 790	110,000-160,000
Tensile Strength	psi	ASTM D 638	3500-4000
Slow Crack Growth	---	---	---
ESCR	hours in 100% igepal	ASTM D 1693	>5,000
PENT	hours	ASTM F 1473	>500
HDB @73 deg F	psi	ASTM D 2837	1,600
UV Stabilizer	%C	ASTM D 1603	2 to 2.5%

The density provided is without carbon black. Typical PE 4710 HDPE pipe has a density of 0.956 to .964 with carbon black. To be called PE 4710, the pipe and resin has substantiation at 50 years.

- B. Pressure Class Designation. The piping system must be designed to accommodate maximum possible pressure surges. Pressure surges commonly fall into two groups: recurring and occasional. The allowable total pressure during recurring surge conditions shall be 1.5 times the pipe’s pressure class. Recurring pressure surges are those that occur frequently and are inherent in the design and operation of the system such as normal pump startup or shutdown and normal valve opening or closure. The allowable total pressure during occasional surge conditions shall be 2.0 times the pipe’s pressure class. Occasional pressure surges are those that occur infrequently and are usually the result of a malfunction such as pump seize-up, valve-stem failure and pressure relief valve failure. Thus, the piping system shall be designed to accommodate the occasional surge pressure unless supporting evidence for an alternative is provided to and approved by the District. The following table summarizes the commonly used Dimension Ratios (DR) and their respective pressure allowances:

Pressure Characteristics of PE 4710 at 80 °F

DR	Pressure Class (psi)	Allowable Total Pressure During Recurring Surge (psi)	Allowable Total Pressure During Occasional Surge (psi)
7	336	504	672
7.3	320	480	640
9	252	378	504
11	202	303	404
13.5	161	242	322
15.5	139	209	278
17	126	189	252
21	101	152	202
26	81	122	162
32.5	64	96	128

The Pressure Class provided in the table above is the expected static pressure of the system. When the magnitude of the occasional surge pressure cannot be modeled or predicted, the DR rating shall be chosen such that the Pressure Class is greater or equal to the highest expected static pressure of the system.

C. Pipe and Fittings.

1. Pipe and fittings shall be manufactured from material meeting the requirements of Section 7.4.A.
2. Pipe and fittings shall be selected such that the system pressures do not exceed the occasional surge pressures allowed per the table provided in Section 7.4.B.
3. All pipe and fittings shall meet the testing requirements of the most current version of AWWA C901 (1/2" through 3") or C906 (4" through 63"). Test data shall be furnished by the manufacturer upon request.
4. All fittings shall be pressure rated to match the system piping to which they are joined. At the point of fusion, the outside diameter and minimum wall thickness of the fitting shall meet the outside diameter and minimum wall thickness specifications of AWWA C901 or AWWA C906 for the same size of pipe. All fabricated fittings shall be properly rated according to manufacturer's written recommendations, and clearly labeled on the fitting as such. Manufacturer shall have a written specification for all standard fabricated fittings with established Quality Control criteria and tolerances. The manufacturer of the pipe shall be the manufacturer of the fabricated fittings. Molded fittings shall be made from PE4710 HDPE and have fusion compatibility with the pipe. Pipe manufacturer must certify that they produced the pipe, fabricated the fitting, and provide the warranty.
5. The pipe shall have product traceability. This shall be accomplished by the inclusion of a product code into the printline of all pipe products. This shall notate the manufacturer, the date of manufacture, the lot and supplier of raw material, the location of manufacture, and the production shift on which the product was produced. The printline shall also include such other markings as are required by the current version of AWWA C901 or C906. Printline shall be made permanent by using heat indentation. The use of industrial ink as the only method will be cause for rejection at the job site.

6. Upon the prior authorization of the District pipe and fittings shall be joined by either thermal fusion, electrofusion, flange assemblies or mechanical methods as described in AWWA C901 and C906.

D. Specific Standards and Third Party Certification.

1. The performance requirements of the pipe and fittings shall be as stated in AWWA Standard C901 (1/2" through 3") OR C906 (4" through 63"). The manufacturer shall comply with NSF Standard 14 by certifying in writing to the District or its designee and marking the pipe with the NSF logo in the printline. The manufacturer shall comply with AWWA Standard C901 or C906 by certifying in writing to the District or its designee and marking the pipe with the appropriate AWWA standard in the printline.

E. Approved Manufacturer According to Specification

1. Manufacturer shall supply six copies of this specification as a submittal to the District or its designee. It is understood that independent laboratory analysis at the District or its designee discretion may be used to validate the manufacturer's certification. Pipe and fittings not meeting the specification may be rejected and removal shall be at the manufacturer's expense.
2. Product shall carry a standard warranty of one year from date of purchase and a copy shall be submitted from the manufacturer covering their standard Terms and Conditions of Sale.

7.6 Pipe Installation (Other Standards).

- A. Magnetic Locator Tape and Wires. All pipe types shall include a 3-inch magnetic locator tape installed in the pipeline trench approximately 24 inches above the pipe surface. A sixteen (16) gauge tracer wire shall be installed with the pipe and looped to all water meters.
- B. Color. All PE pipe used for potable water mains shall include a blue stripe or other acceptable marking designating the pipe as potable. All PE pipe used for irrigation water mains shall include a purple stripe or other acceptable marking designating the pipe as non-potable.
- C. 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, metal pipe shall be beveled and filed to prevent gasket damage in joint assembly.
- D. Dewatering of Trench. Where water is encountered in the trench, it shall be removed during pipe laying operations and the trench so maintained until the ends of the pipe are sealed.
- E. 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 District or its designee. All pipe shall be laid and maintained to the required lines and grades with fittings and valves at the required locations. The contractor shall be responsible to establish offset hubs parallel to the line of the pipe and to transfer alignment and grade from the hubs set by the District or its designee. All pipe, fittings and valves shall be carefully lowered from the truck when unloading or when installing into the trench. This should be done one piece at a time in order to prevent damage to pipe materials and protective coatings and linings. Under no circumstances shall materials be dropped or dumped from the truck or into the trench. The contractor shall take the necessary precautions such that foreign

materials do not enter into the pipe. No debris, tools, or other materials shall be placed in the pipe during laying operations. When laying of pipe is not in progress, the pipe shall be closed by a water-tight plug. Maximum deflections at pipe joints shall not exceed the joint specifications of AWWA C600 of latest revision, or the recommendations of the pipe manufacturer. Longitudinal bending shall be limited to eighty percent (80%) of the manufacturer's recommended minimum bending radius.

- F. 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 District or its designee, satisfactory for pipe bedding, imported granular bedding will be required.

- G. Thrust Blocking. Thrust blocking of rigid pipe shall be applied at all tees, valves, plugs, caps and at bends deflecting 11 1/2 degrees or more. Thrust blocking of HDPE shall be applied at all tees, valves, plugs, caps and at bends deflecting greater than 22 1/2. Reaction blocking shall be concrete having a compressive strength of not less than 3,000 pounds per square inch at 28 days. Mechanical restraints may be used only with prior approval and permission from the District or its designee. Concrete blocking shall be placed between undisturbed soil and the fitting to be anchored. The fitting shall be encased in a protective plastic wrap before the thrust block is poured. The area of bearing on the pipe and on the ground shall be as shown in the Drawings. Thrust restraint blocks will be required on vertical bends and under water valves of twelve (12) inch or larger in size. The blocking shall be so placed that the pipe and the fittings will be accessible for repair. Inspection of thrust block form is required by the District or its designee prior to placement of concrete. Inspection of the poured thrust block is required by the District or its designee prior to backfilling.

- H. Connections to Existing Water Lines. Information on the drawings regarding existing water lines is taken from "as-constructed" drawings from the utility company files and may or may not be accurate as to size, type of material or location. The Contractor will be responsible to determine the proper fittings and materials required, obtain the District's or its designee's approval of the planned connection, and perform the construction in a suitable fashion. Where fitting sizes, such as tees and crosses, are shown on the plans, those sizes will be used. However, no attempt has been made to show all needed fittings or materials.

7.7 Valves and Couplings.

- A. Resilient Seated Gate Valves. Valves in sizes 4" through 12" – Waterous, Mueller, or like, shall be of the iron body, non rising bronze stem, resilient seated type, manufactured to equal or exceed all applicable AWWA standards of C-509 latest revision and all specific requirements outlined in these specifications. The District shall approve all valve construction materials and design specifications prior to any construction approvals. Valves will be placed on all sides of all tees or crosses at any intersections. All valves on transmission lines and distribution lines without intersections will be spaced not more than 500 feet in commercial districts and not more than one block or 800 feet in other districts.
 - 1. Valves shall open left and be provided with 2" square operating wrench nuts unless otherwise specified.
 - 2. When valves are Mechanical Joint, they shall be furnished with all necessary glands, followers, and bolts and nuts to complete installation.
 - 3. The disc shall have integrally cast ASTM B-62 bronze stem nut to prevent twisting, binding or angling of the stem. Designs with loose stem nuts are not acceptable.

4. Bronze valve stems shall be interchangeable with stems of the double disc valves of the same size, direction of opening and manufacture.
5. All internal ferrous surfaces shall be coated, holiday free, to a minimum thickness of 4 mils with a two part thermo setting epoxy coating. Said coating shall be non-toxic, impart no taste to the water, formulated from materials deemed acceptable in the Food and Drug Administration Document Title 21 of the Federal Regulations on food additives, Section 121.2514 entitled Resins and Polymeric Coatings. It shall protect all seating and adjacent surfaces from corrosion and prevent build-up of scale or tuberculation.
6. The sealing element shall be secured to the disc with self-locking stainless steel screws, and it shall be field replaceable, and shall be such that it cannot be installed improperly.
7. Stem failure from over torque in either the open or closing position shall occur externally at such a point as to enable the stem to be safely turned by use of a readily available tool after exposure of the valve through excavation.
8. Valve design shall incorporate a positive metal-to-metal stop to prevent over-compression of the sealing element.
9. A full-faced composition gasket placed between machined body and bonnet flanges is required to eliminate cold flow or creep action present with "O" ring gasketed bodies.
10. The exterior of the valves shall be Asphalt Varnish, JAN-P-450. If exterior epoxy is used, all bolts and nuts shall be made of stainless steel to prevent galvanic corrosion of said nuts and bolts due to insulation from the ferrous valve and line.

B. Butterfly Valves. Unless otherwise noted, all valves 12" and larger may be butterfly valves conforming to the latest revision of AWWA Standard C-504, Class 150-B, and shall comply with the following standards. The District shall approve all valve construction materials and design specifications prior to any construction approvals. Valves will be placed on all sides of all tees or crosses at any intersections. All valves on transmission lines and distribution lines without intersections will be spaced not more than 500 feet in commercial districts and not more than one block or 800 feet in other districts.

1. 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 to AWWA Standard C-504, Table 3, Laying Lengths for Flanged Valves and Minimum Body Shell Thickness for all Body Types.
2. Valve disc shall be ductile iron ASTM A-536, grade 65-45-12. Valve disc shall be of the offset design providing 360 degree uninterrupted seating.
3. 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 field replaceable without the need for special tools. Valve body seat shall be 18-8, Type 304 Stainless Steel.
4. Valve shafts shall be 18-8, Type 304 stainless steel. Shafts shall be of the two piece stub design and attached to the disc by means of "O" ring sealed taper pins with lock nuts.

5. The valve assembly shall be furnished with a non-adjustable factory set thrust bearing designed to center the valve disc at all times.
 6. Shaft bearings shall be contained in the integral hubs of the valve body and shall be self-lubricated sleeve type.
 7. Valve shaft seal shall consist of "O" Rings. Where the valve shaft projects through the valve body for actuator connection, the "O" Ring packing seal shall be field replaceable as a part of a removable bronze cartridge.
 8. When manual actuators are required they shall be of the traveling nut design capable of withstanding 450 foot pounds 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 2-inch square operating nut for manually operating the valve with a "T" handle wrench.
 9. 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 10 mils thick for long life; and body exterior shall have a minimum of 3 to 4 mils coating thickness in order to provide superior base for field-applied finish coats.
- C. Valve Boxes. All buried valves shall be installed complete with two-piece, cast iron, slip type, 5-1/4-inch shaft valve box with drop lid. The lid shall have the word "Water" cast in the metal. The lids for valves on fire lines shall have the word "FIRE" cast in the metal. Valves and valve boxes shall be installed where shown on the drawings. Valves and valve boxes shall be set plumb. Valve boxes shall be centered directly over the valve. Earth fill shall be carefully tamped around the valve box to a distance of four (4) feet on all sides of the box, or to the undisturbed trench face if less than four (4) feet. Valves shall have the 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 to form a thirty (30) inch round opening centered around the valve box, and a concrete collar shall be cast around the box. Valve boxes in off-road areas shall extend six (6) inches above grade with six (6) inch minus riprap placed around the valve box to a minimum of 2 feet from the outer edge of the valve box.
- D. Couplings. Couplings shall be equal to the product of Smith-Blair or Dresser with cast iron couplings being used on all cast iron. 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. All coupling installations must be approved by the District prior to any installation.
- E. Pressure regulation valves (PRV's). PRV's, which are required in a development, shall be designed by the developers Engineer and the design shall be submitted to the District or its designee for review and approval prior to starting construction. All PRV's shall be Singer or Cla-Val, unless otherwise specified by the District, with a low flow bypass, placed in a well-drained concrete vault or other approved vault, and shall conform to Districts standard PRV details.

7.8 Fire Hydrants.

- A. Fire hydrants shall be set vertical and held in place by adequate concrete blocking which shall be left in the trench. A gravel filled drip area shall be provided. See Standard Drawings for fire hydrant details. Hydrants shall be set at a height that will allow approximately twelve (12) inches

exposed between the finished ground and the sidewalk flange. All hydrants shall be red in color. Hydrant makes and model number must be approved in advance by the District.

- B. All public fire hydrants shall be under the control of and shall be kept in good repair by the District. No other person shall open or operate any fire hydrant, or attempt to draw water from there without a permit from the District. All water drawn from a fire hydrant for other than fire protection will be approved and sold through an appropriate District rental agreement at the established District water rates.
- C. All fire hydrant locations shall be approved by the District.
- D. Fire hydrants shall be 5 1/2 inch barrel diameter and 6 inch flange connection Mueller - Centurion hydrants, Waterous, or approved other, and conform to Specification C-502-64 of the American Water Works Association, including a 6 inch gate valve and valve box complete for a 7' trench with one 4 1/2 inch streamer nozzle and two (2) two - (2) inch hose nozzles. Foot valves are not allowed on fire hydrants. Hydrants shall open to the left and be frost proof. The threads shall be National Standard Fire Hose Thread. All outlets will have a national standard thread and the hydrant shall be red in color. Spacing of fire hydrants shall be according to the Uniform Fire Code, or Fire District Regulations, whichever are stricter.

7.9 Water Main Locations.

- A. Locations of water mains shall be approved by the District prior to design approval.
- B. Water mains shall be a minimum of eighteen (18") inches vertical above the sewer. Separation between water and sewer mains shall be 10 feet (horizontally) minimum unless authorized in writing by the District or its designee and proper measures are taken.

7.10 Water Meters and Service Lines.

Prior to the installation of the water service line, the location and proposed grade at which the lid is to be set shall be approved by the District prior to the installation thereof.

- A. All water service lines shall start with a corporation stop at the main and shall be of CTS SDR9 200 psi polyethylene as specified by the District. Pipe damaged by scratches, cuts, kinks or buckled areas shall not be installed. Brass fittings and inserts will be required on all joints.
- B. The bottom of trench shall be flat with no hollows, no lumps and no rock and the pipe must be bedded in coarse sand or other approved bedding materials. No rock shall be allowed within six inches of pipe.
- C. Pipe shall be cut with either a wheel or scissor type tubing cutter with a blade specifically designed for plastic. Cuts shall be square and clean. Cutter manufacturer instructions shall be followed when cutting pipe.
- D. There shall be no unnecessary bending of pipe. Taps shall be exactly horizontal to the main line. If bending cannot be avoided maximum bending radius shall be 25 times the pipe diameter. There shall be no bending within 3 feet of a fixed point and no "S" shape curves.
- E. Water service lines shall be a minimum of eighteen (18') inches above the sewer. Separation between water and sewer laterals shall be 10 feet (horizontally) minimum and must meet all applicable State of Utah regulations.

- F. Meter setters shall be eighteen (18) inches or taller and shall be braced and meet height specs in a twenty-four (24) inch inside diameter can for three-quarters (¾) inch and one (1) inch meters. The top of the setter shall be at a depth of not less than twenty-four (24") inches and not more than thirty-six (36") inches from the lid of the meter box. Meters larger than one (1) inch shall be placed in vaults and shall be designed by the developer/owner retained Engineer and approved by the District prior to construction.
- G. All meter setters shall have dual check valves (requiring an adequate expansion tank placed in the home or customer premises at customer expense as per the plumbing codes). No meters shall be set in sidewalks or driveways. Meter boxes shall be in good repair and relatively free from obstruction to insure ease in maintenance and reading, (not full of dirt past the base of the meter, having trash present and being badly bent to create a hazard). Damaged boxes shall be replaced. Meter boxes shall be from level to one inch high from the final grade and/or sidewalk and must be properly bedded. See Standard Drawings.
- H. Lids shall have a one and seven-eighths (1 7/8) inch hole in the top for the touch-read sensor.
- I. Water meters will not be placed in driveways or under sidewalks.
- J. All residential water meters shall be purchased from the District. All structures, dwelling units, and establishments using water from the culinary water system must have such number and size of water meters connected to their system as are necessary to meet the requirement of the Utah Plumbing Code. Meter readings shall be taken at regular intervals as determined by the District and shall be submitted to the treasurer for the purpose of making necessary billings for water service.

7.11 Tapping of Water Lines. Tapping valves may only be used when previously approved by the District or its designee. Tapping saddles with an "O" ring may be used if the water main line to be tapped is larger than the new water main line. Where the tap is the same size as the existing main, cast iron or stainless steel tapping sleeves shall be used, which encase the full perimeter of the pipe. The valve shall be a tapping valve with a guide lip on the flanged side. The opposite side of the valve shall have a mechanical joint connection. Service taps shall be a minimum of thirty-six (36) inches apart and shall consist of double strap brass tapping saddles as per the District detailed drawings. No taps will be allowed within thirty-six (36) inches of the end of the pipe. No direct pipe taps will be allowed.

7.12 Testing and Flushing.

- A. A minimum pressure 50% in excess of the maximum line operation pressure shall be maintained on the portion of pipe being tested for a minimum period of two (2) hours, using either pneumatic or hydraulic means to maintain the pressure.
- B. After pressure testing, all pipelines shall be flushed. Flushing shall be accomplished through hydrants or, if a hydrant does not exist at the end of the line, the contractor shall install a tap sufficient in size to provide for 2.5 foot-per-second flushing velocity in the line.
- C. A leakage test shall be conducted concurrently with the pressure test.
 - 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 during the leakage test, in pounds per square inch gage.

- a. 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.
- b. When hydrants are in the test section, the test shall be made against the closed hydrant.

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.

- D. All visible leaks are to be repaired regardless of the amount of leakage. All new water systems or extensions to existing systems shall be thoroughly flushed before being placed in service. Flushing shall be accomplished through hydrants, or end of line blowoff assemblies at a minimum flushing velocity of 2.5 feet-per-second. The following is the flow quantity required to provide a 2.5 foot-per-second flushing velocity.

PIPE SIZE (IN)	FLOW (G.P.M.)
4	100
6	220
8	390
10	610
12	880
16	1567
18	1980
20	2450
24	3525
30	5507

7.13 Disinfection of Water Lines.

- A. Disinfection of water mains shall be done in accordance with the latest edition of AWWA C651.
- B. The pipe shall be clean prior to disinfection. If in the opinion of the District, contamination is such that it cannot be removed by flushing, the pipe shall be cleaned by mechanical means and then swabbed with a one percent (1%) hypochlorite disinfection solution.
- C. The pipeline shall be disinfected as outlined in AWWA C651. The tablet method shall consist of placing calcium hypochlorite tablets at the specified rate in the main during construction at the

upstream end of each section of pipe. The tablet shall be attached with an adhesive, such as Permatex No. 1 or equal. The line shall then be filled slowly (velocities less than 1 ft/sec), expelling all air pockets and maintaining the disinfection solution in the line for at least twenty-four (24) hours, forty-eight (48) hours if the water temperature is less than forty-one degrees (41) F. The disinfection solution shall have a concentration of at least twenty-five (25) mg/l of available chlorine. The continuous feed shall be done exactly as outlined in AWWA C651 and shall have a twenty-five mg/l available Chlorine after twenty-four (24) hours. Under both methods the contractor shall not be allowed to flush the line until the chlorine residual test has been passed by the District.

- D. After the chlorination, the line shall be thoroughly flushed with velocities greater than 2.5 ft/sec with clean water and if necessary re-chlorinated until satisfactory bacteriological testing is obtained. Proper disposal of the chlorinated water is the responsibility of the contractor. If any of the tests fail the contractor shall be responsible for the fees of additional tests. All new lines shall be isolated from existing lines when tested.
- E. Following the approval of the testing and installation of a water main, the entire water line will be flushed through the end of the main via an approved outlet.
- F. The developer shall take bacteria samples at the sites designated by the District or its designee for each job, based on the following criteria:
 - 1. Minimum of 1 sample up to 200 feet. Minimum of 2 samples up to 600 feet. (One in the middle and one on the end). Minimum of 1 more sample for every additional 600 feet. Sampling points to be established during the pre-construction meeting for each project.
 - 2. If any sample point fails on the first test, the line will be flushed and re-tested at all sample points.
 - 3. If any sample point fails a second time the complete line will re-disinfected and re-tested at all sample points.
 - 4. If any samples come back marked "presence", which means coliform bacteria is present, the line will be re-disinfected and re-tested at all sample sites. Water services will not be installed until the District or its designee has approved bacteria sample results.

7.14 Backflow Prevention and Cross Connection Control Rules and Regulations. Backflow prevention and cross connection devices are required and these regulations are contained within the current Mountain Regional Water Special Service District, Water Rules and Regulations.

SECTION 8.0 Energy Conservation Standards

8.1 General. These specifications address the Districts goal of achieving and implementing energy conservation based standards and practices in all newly constructed facilities. The State Division of Drinking Water Energy Program suggestions will be reviewed and addressed in all facility designs where applicable.

- A. Distribution System Design. All piping systems shall be modeled and designed to achieve optimum energy efficiency as well as reducing head losses as much as practical during normal operation. The systems will also be designed to:

1. Minimize the unnecessary pumping of water to high elevations, just to be delivered again to a lower pressure zone(s), and then possibly be re-pumped.
 2. Maximize the utilization of lower cost water (gallons per kwh) before higher cost water is utilized.
 3. Minimize air entrainment in pipelines.
 4. Reduce the possibility of looping or re-pumping of water.
 5. Minimize high distribution system pressures if possible.
 6. Optimize pressure zone and PRV station placements.
 7. Evaluate the connection of key PRV stations to the District SCADA system.
- B. Storage Facilities. Water storage tanks and reservoirs will be optimized and utilized to assist in the energy pumping strategies listed below, providing water quality constraints can be met. Tanks will be provided with adequate mixing equipment if a tank is oversized to allow for energy management purposes in areas with very small initial demands.
- C. Pumping Systems. All wells and pumping plants will be designed with the following energy efficiency guidelines:
1. In any application for new electrical service, consult with the District to ensure that the proper Rocky Mountain Power rate is chosen, rather than the default rates offered.
 2. Pumps will be selected for their highest efficiency and whichever selection of pump or pumps to be utilized for the most period of time(s), will be set to their optimum efficiency points.
 3. All pumps will either be on a soft start or variable frequency drive system, depending on which is the most energy efficient and reliable for the application.
 4. Booster pumping stations will be equipped with at least one small jockey type pump to allow for the pump load factors to be raised to at least an 80 percent utilization.
 5. Multiple and smaller pumps are preferable to one or two large pumps, with peak emergency or build-out pumping conditions achieved through the operation of multiple simultaneous pump scenarios.
 6. Pumping systems will be designed for off-peak pumping abilities where appropriate.
 7. Wells will be designed for line drive pumping systems, rather than submersible motor systems where feasible.
 8. Motor power factors shall be 90 percent or better.
 9. All VFD controlled motors shall be designed for VFD's or inverter rated.
 10. Any adverse harmonics which may be created by VFD systems shall be remediated with properly sized filters, etc.
 11. Any VFD or Soft Start system shall be sized and provided with proper cooling systems applicable to the high altitude of the application.
 12. All VFD or Soft Start equipment shall be provide with MODBUS interconnection to the SCADA system and provide for power and energy data.
 13. All pumps will be provided with proper electrical protection, as well as input and output pressure gauges, switches and/or transducers, flow switches or individual meters, high performance check valves, and air removal systems.
 14. Pumping equipment shall have overhead crane facilities provided and room for vehicular access within the facility for the proper and safe change out any equipment.
 15. Pumping and Well houses shall be constructed with insulated and energy efficient materials and all buried concrete walls shall be insulated on the outside buried portions as per Summit County building codes.
 16. Proper sound attenuation systems shall be provided when the facility is close to any residential or commercial structures (including possible future development encroachments).
 17. Back-up power generation will be provided in key facilities and shall be natural gas powered if possible.

- D. HVAC. All pumping or well facilities shall be provided with energy efficient heating and cooling systems, sized for the construction, and equipment loads. If a facility is near any residential or commercial facilities (or could be in the future), it shall not be ventilated to the outside for cooling or heating. In this event a water cooled fan-coil type system or a geothermal heating and cooling system shall be provided. In these cases, any system which utilizes culinary water as a heat transfer medium, shall be separated from any equipment closed loops (with or without food grade closed loop additives) with an NSF 61 approved heat exchanger. If using a fan coil directly for cooling, all equipment that comes in contact with culinary water shall also have an NSF 61 certification. Resistive heating systems shall be provided with a contactor and remote thermostat control system. Due to their high power demand and energy consumption, resistive systems shall be sized as small as possible for the application. Dehumidification systems shall also be provided in underground or any damp environments or where pipe condensation could be a problem.
- E. Lighting. All lighting shall be LED, with florescent high output T5 units acceptable in certain situations and with special permission. No soft white LED or florescent systems will be allowed. All exterior lighting shall be minimized if possible and if needed or turned on, shall be of an indirect type and only illuminate the ground as much as possible.
- F. SCADA. All facilities shall be designed to be connected to the District SCADA system, and as such will be provided with the ability to deliver energy, power, VAR, volts, amps, and power factor data, among those standard control parameters typically provided in a control system. Facility security measures and indication shall also be provided. Reservoirs and key PRV stations shall also be connected to the SCADA system for level and pressure monitoring and/or control.