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SECTION 5 – WATER DESIGN & CONSTRUCTION STANDARDS

5.1 ENGINEERING

5.1.1 Introduction

This section outlines design and construction requirements for all public water system improvements. These provisions and technical specifications set forth the requirements of the City of Independence for constructing water system improvements. Interpretations of such provisions and their application in specific circumstances shall be made by the Public Works Department authorized representative. Refer to Chapter 1 of the "Public Works Standards" for general provisions and requirements.

5.1.2 Extension of Public Water Systems

Except as otherwise provided, the extension or upsizing of the public water systems to serve any parcel or tract of land shall be done by, and at the expense of, the property owner or permit applicant. New water systems shall extend to the far side of the property to allow for future extensions beyond present development and be consistent with the Water Master Plan. Distribution mains shall be looped at all possible locations.

5.1.3 Water Plans

- A. It is the design engineer's responsibility to ensure that engineering plans are sufficiently clear and concise to construct the project in proper sequence, using specified methods and materials, with sufficient dimensions to fulfill the intent of these design standards.
- B. All elevations on design plans and record drawings shall be based on the applicable NAVD 88 Datum to match the FEMA flood map elevations.
- C. Existing conditions and facilities on design plans and record drawings shall be shown in light, gray print. Proposed conditions and facilities on design plans and record drawings shall be shown in bold, black print.
- D. All engineering water plans shall be stamped by a Professional Engineer registered in the State of Oregon. At a minimum, water plans shall contain the following:
 - 1. At least one sheet shall show a plan view of the entire project site. If the project site is sufficiently large that detailed water plans on any given sheet do not encompass the entire project site, then a sheet showing the plan view of the entire site must serve as an index to subsequent detailed plan sheets.
 - 2. A topographic map showing existing conditions for the site, including the following:
 - a) Existing topography for the site. Plan views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City Engineer.
 - b) Adjacent streets, trails, multi-use paths, and rail lines, including the respective names.
 - c) Existing utilities, including franchised utilities above or below ground and drainage facilities that transport surface water onto, across, or from the project site. Existing drainage pipes, culverts, and channels shall include the invert or flow line elevations.
 - d) Existing vegetation, including denoting the type, DBH, and canopy size of trees within the construction limits.

- e) Existing environmentally sensitive areas (e.g., ravines, swales, steep slopes, wells, springs, wetlands, creeks, lakes, etc.). For natural drainage features, show direction of flow, drainage hazard areas, and 100-year floodplain boundary (if applicable).
- f) Adjacent existing features that are within 25 feet outside of the site boundary, including but not limited to construction activities that will potentially compromise the structural stability or condition of off-site features, such as cultivated vegetation, landscaping and trees, buildings, fences, decks, walls, slabs, and pavements. Denote the type, DBH, and canopy size of all trees.
- 3. Plans for proposed water improvements shall include the following:
 - a) Grading and erosion control plan.
 - b) Finished grades, showing the extent of cut and fill by existing and proposed contours, profiles, or other designations. Plan views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City Engineer.
 - c) Horizontal stationing along centerline, showing points of tangency and curvature, including centerline stationing of all intersecting streets.
 - d) Proposed structures, including roads and road improvements, parking surfaces, building footprints, walkways, landscape areas, etc.
 - e) Water facilities, including pipe sizes, pipe types and materials, lengths, joint restraints, and all water system appurtenances, including, but not limited to valves, hydrants, fittings, vaults, meters and thrust blocks. Notes shall be included for referencing details, cross-sections, profiles, etc.
 - f) Existing and proposed utilities, showing exact line and grade of all utilities crossing the proposed water system.
 - g) Connection details at all locations of water system appurtenances, including the size, type, spacing, and connection style of valves, bends, tees, crosses, reducers, thrust blocks and other water system appurtenances as required by the City Engineer.
 - h) Applicable detail drawings.
 - i) Existing and proposed property lines, right-of-way lines, survey monuments, and easements.
 - j) Setbacks from environmentally sensitive areas or resource areas protected within the wetland sensitive areas.
 - k) Any proposed phasing of construction.
 - I) Any additional information that the City Engineer deems necessary.
- 4. Profiles for proposed water improvements will be provided at the same horizontal scale as the plan sheets and a 1" = 5' vertical scale. Profile drawings shall be drawn below the plan view or immediately following the associated plan view sheets. Profile views showing existing features may be required for a distance of up to 100 feet (or further if warranted) beyond the proposed improvement in order to prevent future grade conflicts and will be determined on a case-by-case basis by the City Engineer. The profiles shall include the following:
 - a) Existing and proposed ground along the proposed water main alignment.
 - b) Water facilities, including pipe sizes, pipe types and materials, lengths, backfill material, joint restraints, and all water system appurtenances, including, but not limited to valves, hydrants, fittings, vaults, meters and thrust blocks. Notes shall be included for referencing details, cross-sections, etc.

- c) Existing and proposed utilities, showing exact line and grade of all utilities crossing the proposed water system. The vertical separation from existing and proposed utilities shall be labeled for all proposed utility crossings.
- d) Any additional information that the City Engineer deems necessary.

5.1.4 Surveying

- A. The design engineer shall be responsible for establishing the location of the water line by means of reference stakes offset along the centerline of the water line. No construction shall be allowed to begin before construction staking. All staking shall be performed by or under the direction of a Professional Land Surveyor registered in the State of Oregon.
- B. Stakes shall locate all public tees, crosses, bends, fire hydrants, blow offs, isolation valves, vaults, and booster pump stations. Maximum spacing for reference stakes is 50 feet. Stakes shall reference cuts and fills to the finished grade of the ground, asphalt, or concrete surface at that location to maintain minimum cover requirement. The design engineer shall also be responsible for identifying and staking easements during construction.

5.2 DESIGN GUIDELINES

5.2.1 Fire Protection and Flow Requirements

- A. Water system design shall provide adequate flow for fire protection and maximum water usage and consumption. Required water demands shall be met by maintaining the minimum operation pressures required by the City. For single family residential areas, the minimum static pressure shall be 40 PSI, and the minimum fire flow shall be 1500 GPM at 20 PSI. For all other developments, the required fire flow shall be as determined by the Fire District.
- B. Velocity in distribution and service lines shall not exceed ten feet per second.

5.2.2 Pipe Cover

- A. The standard minimum cover over buried water mains with the street right-of-way or easements shall be thirty-six (36) inches from finished grade to top of pipe.
- B. Where waterlines are constructed on slopes greater than 20%, in areas designated as hazardous, or where there are site conditions that may cause damage to improvements due to slippage or slides as determined by the Public Works Director, a soils and/or geologic report may be required. Where the finished graded surface is greater than 20%, or as required by the Public Works Director, soil stabilization fabric shall be placed over the entire disturbed area.

5.2.3 Separation with Sewer Systems

A. Water mains shall be installed at a minimum clear distance of ten (10) feet horizontally from all sanitary sewer mains and shall be installed to go over the top of such sewers with a minimum of eighteen inches of clearance at intersections of these pipes. Exceptions shall first be approved by the Public Works Director. In all instances, the distances shall be measured edge to edge. The minimum spacing between water mains and storm drains, gas lines, and other underground utilities, excepting sanitary sewers, shall be three (3) feet horizontally when the standard utility location cannot be maintained. Where waterline designs parallel to other waterlines, utility pipe, or conduit lines, the vertical separation shall be twelve (12) inches below or in such a manner which will permit future side connections of mains, hydrants, or services and avoid conflicts with parallel utilities without abrupt changes in vertical grade of the above mentioned main, hydrant, or service. Where crossing of utilities are required, the minimum vertical clearance shall be six (6) inches with one full stick of pipe that is centered at the intersecting pipe.

5.2.4 Alignment

- A. All waterlines shall be located within public right-of-way or as directed by the Public Works Director. These lines are placed in the public right-of-way for ease of maintenance and access, control of the facility, operation of the facility, and to permit required replacement and/or repair. The Public Works Director, under special conditions, may allow a public waterline to be located within a public water easement if no other options are available.
- B. Water systems shall be located twelve (12) feet south and east from the right-of-way centerline or as directed by the Public Works Director. All abrupt changes in vertical or horizontal alignment shall be made with a concrete thrust block and Mega-Lug fitting as required by the Public Works Director. Curved alignment for water lines or main is permitted and shall follow the street centerline when practical. The minimum allowed radius shall be based on allowable pipe deflection for the pipe diameter and the pipe laying length but not to exceed 3° joint deflection.
- C. Dead-end mains which will be extended in the future shall be provided with a line-size gate valve, tie rodded MJ plug at the end. The valve plug shall be tapped with a 2" standard blow-off, except that the 2" gate valve shall not be installed. Permanent dead-end mains shall terminate with a standard blow-off assembly.

5.2.5 Relation to Watercourses

- A. Above Water Crossings:
 - 1. The pipe shall be engineered to provide support, anchorage, and protection from freezing and damage, yet shall remain accessible for repair and maintenance.
 - 2. All above water crossings will require review and approval by the Public Works Director.
 - 3. Valves shall be provided at each end so that the section can be isolated for testing or repair. Valves shall be accessible and not subject to flooding.
 - 4. The valve nearest to the supply source shall be in a manhole. Permanent taps shall be made on each side of the valve within the manhole to allow insertion of a small meter for testing to determine leakage and for sampling.
 - 5. Provide air/vacuum relief valves in locations where air can become trapped.
- B. Under Water Crossings:
 - 1. Mains crossing streams or drainage channels shall be designed to cross as nearly perpendicular to the channel as possible.
 - 2. The minimum cover from the bottom of the stream bed or drainage channel to the top of pipe shall be thirty-six (36) inches.
 - 3. A scour pad centered on the waterline will be required when the top of pipe to bottom of the stream bed or drainage channel is thirty (30) inches or less. The scour pad shall be concrete, six (6) inches thick, six (6) feet wide, and reinforced with #4 rebar placed twelve (12) inches on center each way. The scour pad shall extend horizontally to a point behind the top of bank equal to the height of cover over the pipe at the top of bank.
 - 4. Valves shall be provided at each end so that the section can be isolated for testing or repair. Valves shall be accessible and not subject to flooding.
 - 5. Provide air/vacuum relief valves in locations where air can become trapped.
- C. Case-by-case Pipe Crossings
 - 1. Stream or channel crossings for pipes twelve (12) inches and larger.
 - 2. River or creek crossings requiring special approval from the Department of State Lands and/or Department of Environmental Quality.

5.2.6 Valves

Valves shall be the same size as the mains in which they are installed. Valves shall be installed on each leg of tees and crosses.

5.3 OPERATION OF VALVES IN CITY

Contractor shall request City operation of valves at least 24 hours in advance. At no time shall the contractor undertake to close off or open valves or take any other action that would affect the operation of the existing water system.

5.4 MATERIAL AND TECHNICAL SPECIFICATIONS

All public water distribution systems shall be constructed with C900/C905 PVC or cement mortar lined ductile iron pipe. Due to the aggressive nature of soil in the Independence area, ductile iron pipe is not allowed without express prior written approval from the Public Works Director or authorized representative.

5.4.1 Joints

Pipe joints shall be push-on joints, except where specifically shown or detailed otherwise. Fitting joints shall be mechanical joint ends, except where specifically shown or detailed otherwise. All valves joined to tees and crosses shall be flanged by mechanical joint.

5.4.2 Mechanical Joint Fittings

Mechanical joint D.I. fittings shall conform to the latest revision of AWWA C-110/ ANSI A21.10 and shall be of a class at least equal to that of the adjacent pipe. Bolts and nuts shall conform to AWWA C-111/ANSI A21.11. Mortar lining for fittings shall be the same thickness specified for pipe.

5.4.3 Push-On Pipe

C900/C905 PVC: Pipe shall conform to ANSI/AWWA C900, ANSI/AWWA C905 as manufactured by JM Eagle, PW Eagle, or approved equal. All PVC water mains shall be minimum pressure rated at 235 psi (DR 18). Rubber ring gaskets shall conform to Subsection "Push-on Gaskets," and shall be furnished with the pipe. A nontoxic vegetable soap lubricant (meeting the requirements of AWWA C-111/ ANSI A21.11) shall be supplied with the pipe in sufficient quantities for installing the pipe furnished.

5.4.4 Flanged Ductile Iron Fittings

Flanged fittings shall conform to ANSI/AWWA C-207 Class D or ANSI B16.5 150-lb class for pressure ratings up to 150 psi, and either ANSI/AWWA C-207 Class E or ANSI B 16.5 150-lb class for pressure ratings between 150 psi and 275 psi. Flanges shall have flat faces and are attached with bolt holes straddling the vertical axis of the pipe. Bolts and nuts shall conform to AWWA C-111/ANSI A21.11. The fittings shall be cement-mortar lined to same thickness specified for pipe.

5.4.5 Push-on Gaskets

Unless otherwise approved by the Public Works Department authorized representative, locking rubber gaskets shall be used for ductile iron bell ends when available for the specified pipe size. Locking gaskets shall meet pipe manufacturer's specifications.

5.4.6 Flanged Gaskets

Gaskets shall be suitable for the specified pipe sizes and pressures. Flanged gaskets shall be full cut, with holes to pass bolts. Gasket material shall be free from corrosive alkali or acid ingredients.

5.4.7 Mechanical Couplings

Mechanical couplings, clamps, or sleeves, not part of the pipe itself, shall be D.I. or steel with rubber rings or gaskets. Gaskets, bolts, and nuts shall conform to AWWA C-111/ANSI A21.11. Couplings, clamps, or sleeves shall be Dresser[®], or approved equal.

5.5 CONSTRUCTION SPECIFICATIONS

5.5.1 General Provisions

All installation and testing of water system improvements shall conform to the latest adopted revision of the Oregon Health Division Administrative Rules, Chapter 333, "Public Water Systems," except where the City's provisions exceed those of the state.

5.5.2 Scheduling

The contractor shall plan their construction work in conformance with Chapter 1 Subsection "Scheduling." Newly installed water lines shall not be placed in service until necessary testing and sterilization are complete and system has been approved by the Public Works Department authorized representative.

5.5.3 Environmental Protection, Erosion Prevention, and Sediment Control

The contractor shall take all appropriate measures and precautions to minimize the work's impact on the environment and shall control erosion, as outlined in Chapter 1 Subsection "Environmental Protection, Erosion Prevention, and Sediment Control."

5.5.4 Interferences and Obstructions

Various obstructions may be encountered during the work. The contractor shall follow the guidelines established in Chapter 1 Subsection "Interferences, Obstructions, and Abandoned Utilities."

5.5.5 Contaminated Soil or Hazardous Material

If during construction contaminated soil or with hazardous materials or chemicals are encountered, the Contractor shall follow the procedures specified in Chapter 1 Subsection "Contaminated Soils or Hazardous Materials."

5.5.6 Trench Excavation, Preparation, and Backfill

Trench excavation, preparation, and backfill shall conform to the requirements of Chapter 6, "Trench Excavation and Backfill Standards."

5.5.7 Preservation, Restoration, and Cleanup

Cleanup of all construction debris, excess excavation, and excess materials and complete restoration of all fences, mailboxes, ditches, culverts, signposts, and similar items shall be completed according to Chapter 1 Subsection "Preservation, Restoration, and Cleanup."

5.6 PIPE INSTALLATION

5.6.1 Suitable Conditions for Laying Pipe

- A. Provide and maintain ample means and devices at all times to remove and dispose of water seepage and runoff entering the trench excavation during the process of pipe laying.
- B. Do not lay pipe in water or when, in the opinion of the Public Works Department authorized representative, trench conditions are unsuitable.

5.6.2 Handling

- A. Distributing Pipe: Distribute material on the job from vehicles, equipment, or storage yards no faster than it can be used to good advantage. In general, distribute no more than one week's supply of material in advance of the laying.
- B. Handling Pipe and Fittings: Provide and use proper implements, tools, and facilities for safe and proper work. Lower all pipe, fittings, and appurtenances into the trench, piece by piece, by means of a crane, sling, or other suitable tool or equipment, to prevent damage to the pipeline materials and protective coatings and linings. Do not drop or dump pipeline materials into the trench.

5.6.3 Cleaning Pipe and Fittings

- A. Remove all lumps, blisters, and excess coating from the bell and spigot ends of each pipe. Wire-brush the outside of the spigot and the inside of the bell and wipe them clean, dry, and free from oil and grease before the pipe is laid.
- B. Wipe clean all dirt, grease, and foreign matter from the ends of mechanical joint and rubber gasket joint pipe and fittings.

5.6.4 Placing Pipe in Trench

- A. Pipe Bells/Joints
 - 1. At the location of each joint, dig bell (joint) holes of ample dimensions in the bottom of the trench and at the sides, where necessary, to permit the joint to be made properly and to permit easy visual inspection of the entire joint.
 - 2. Unless otherwise directed, lay pipe with the bell end facing in the direction of the laying.
 - 3. For lines on steep slopes, face bells upgrade only.
 - 4. Do not allow foreign material to enter the pipe while it is being placed in the trench.
 - 5. Lay and join pipe with push-on type joints in strict accordance with the manufacturer's recommendations. Provide all special tools and devices, such as jacks, chokers, and similar items required for the installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes shall be permitted under any circumstances.
 - 6. After the first length of push-on joint pipe is installed in the trench, secure the pipe in place with approved backfill material that is tamped under and along the spring line to prevent movement. Keep the ends clear of backfill. After each section is joined, place backfill as specified to prevent movement.
 - 7. Mechanical joint fittings vary slightly with different manufacturers. Install the furnished fittings in accordance with the manufacturer's recommendations. In general, the procedure shall be as specified here. Clean the ends of the fittings of all dirt, mud, and foreign matter by washing with water and scrubbing with a wire brush. When the ends of the fittings are clean, slip the gland and gasket on the plain end of the pipe. If necessary, lubricate the end of the pipe to ease sliding the gasket in place. Then guide the fitting onto the spigot of the laid pipe.

5.6.5 Cutting Pipe

- A. Cut pipe for inserting valves, fittings, or closure pieces in a neat and workmanlike manner, without damaging the pipe or lining and leaving a smooth end at right angles to the axis of the pipe.
- B. Dress cut ends of push-on joint pipe by beveling with a heavy file or grinder, or as recommended by the manufacturer.

5.6.6 Permissible Deflection of Joints

Wherever it is necessary to deflect the pipe from a straight line either in a vertical or horizontal plane, to avoid obstructions, or where long-radius curves are permitted, the amount of deflection allowed shall not exceed the values shown in **Table 5.1** or the manufacturer's recommendations, whichever is less.

	Mechanical Joint	Push-On	Joint	
Diameter (inches)	Max. Defl. Angle (degrees-minutes)	Deflection ¹ (inches)	Max. Defl. Angle (degrees)	Deflection ¹ (inches)
4	4° – 09′	15	3°	10
6	3° – 33′	13	3°	10
8	2° – 40′	10	3°	10
12	2° – 40′	10	3°	10

Table 5.1. MAXIMUM PERMITTED DEFLECTION, 18-FOOT-LONG PIPE

Note: Maximum deflection shall be the value shown in the table or that recommended by the pipe manufacturer, whichever is less. ¹Safe deflection shown is for 150 psi of pressure. For higher pressure, reduce tabulated deflection 10% for each 150 psi of added pressure.

5.6.7 Alignment

Pipelines intended to be straight shall not deviate from the straight line at any joint in excess of on (1) inch horizontally or one (1) inch vertically.

5.6.8 Anchorage and Restraint

All pipelines four (4) inches in diameter or larger shall be secured with a suitable mechanical joint restraint system (such as Megalug[®], RomaGrip[™], or approved equals) at all tees, plugs, caps, and bends, and at other locations where unbalanced forces exist. Where required, provide thrust blocking as specified in Subsection "Thrust Blocking and Restraint." Gaskets shall be installed in accordance with Subsection "Push-on Gaskets" and Subsection "Flanged Gaskets."

5.6.9 Construction of Blow-offs

Blow-offs shall be constructed in accordance with these standards. Straddle blocks shall be constructed of reinforced concrete; the concrete mix shall be commercially produced and have a compressive strength of not less than 3,000 psi at 28 days, unless otherwise approved by the Public Works Department authorized representative. Blow-offs shall not be flushed or pressurized until a minimum of seven (7) days after concrete is installed. If high-early cement is used for the straddle block, the time may be cut by two days.

5.6.10 Locating Wire

Install tracer wire (10-gauge solid copper core with blue THNN insulation) taped at the 12 o'clock on top of the pipe. Wire shall surface at all fire hydrants, valve boxes, and blow-offs.

5.7 VALVES AND VALVE BOXES

5.7.1 Scope

This section covers the work necessary for furnishing and installing gate valves, butterfly valves, and valve boxes, complete.

5.7.2 Materials

- A. Gate Valves:
 - 1. Resilient-seated gate valves, sized three (3) inches through twelve (12) inches, shall conform to AWWA Standard C-509 or C-515. The manufacturer's name, the model, and the year of manufacture are to be cast on each valve.
 - 2. Valve ends are to be flanged or mechanical joint by flanged, as shown on the plans, and conform to AWWA C-111 and ANSI Class 125. Buried service valves shall open with a counterclockwise rotation of a 2-inch operating nut.
 - 3. All internal parts shall be accessible without removing the body from the line. The one-piece wedge shall be completely encapsulated by resilient material. The resilient sealing material shall be permanently bonded to the wedge with a rubber tearing bond meeting the requirements of ASTM D-429.
 - 4. Non-rising stems (NRS) shall be cast bronze with integral collars in compliance with AWWA C-509 or C-515. The NRS shall have two O-ring seals above the thrust collar and one below. The two top O-rings are to be field replaceable (in the fully open position) without removing the valve from service. Low friction thrust bearings shall be placed above and below the stem collar. The stem nut shall be bronze and independent of the wedge.
 - Outside screw and yoke valves shall have a bronze stem attached to the disc assembly. An adjustable follower gland shall be incorporated to compress braided packing and seal the stem.
 - 6. The waterway in the seat area shall be smooth, unobstructed, and free of cavities. The cast iron body and bonnet shall be fully coated, both interior and exterior, with a fusion-bonded, heat-cured thermo setting material meeting all the application and performance requirements of AWWA C-550.
 - Gate valves shall meet the testing requirements as presented in AWWA C-509 and C-515.
- B. Butterfly Valves:
 - 1. Butterfly valves shall be the rubber-seated type, suitable for direct-burial service. They shall withstand 150 psi working pressure and a 150-psi pressure differential across the valve. Except as noted, the butterfly valve shall conform to AWWA C-504 for Class 150B.
 - 2. Valve ends are to be flanged or flanged by mechanical joint, as shown on the plans, and conform to AWWA C-111 and ANSI Class 125.
 - 3. All joint accessories shall be furnished with valves.
 - 4. Valves shall be equipped with an iron body and 304 stainless-steel circular shaft. Shaft and disc seals shall be designed for a bottle-tight seal. The valve disc shall be cast iron with stainless-steel edge with acrylonitrile-butadiene (NBR) seat.
 - 5. The butterfly valve shall be furnished with a totally enclosed, integral valve operator design to withstand a minimum of 300 foot-pound input torque without damage to the valve or operator. Operators shall be fully gasketed and greased-packed and designed to withstand submersion in water to a pressure of 10 psi. Valves shall open with a counterclockwise rotation of a 2-inch operating nut. A minimum of 30 turns of the

operating nut shall be required to move the disc from a fully opened position to a fully closed position.

- 6. Butterfly valves shall meet the testing requirements as presented in AWWA C-504.
- C. Extension Stems for Valve Operators:
 - 1. Where the depth of the operating nut is more than three (3) feet, operating extensions shall be provided to bring the operating nut to a point eighteen (18) inches below the surface of the ground or pavement.
 - 2. Where the depth of the operating nut is more than six (6) feet, install a second rock guard plate equidistant between the first rock guard plate and the 2-inch operating nut.
 - 3. The extension shall be constructed of solid steel rod and approved by the Public Works Department authorized representative. Cut extensions to the proper length so the valve box does not ride on the extension when set at grade.

5.7.3 Workmanship

- A. Valves:
 - 1. Valves shall be installed in accordance with these standards. Valves shall be flanged by mechanical joint; valves shall be flanged to all tees and crosses.
 - 2. Before installation, the valves shall be thoroughly cleaned of all foreign material. Valves shall be inspected for proper operation, both opening and closing, and to verify that the valves seat properly.
 - 3. Valves shall be installed so that the stems are vertical, unless otherwise directed.
 - 4. Jointing shall conform to AWWA C-600 or AWWA C-603, whichever applies. Joints shall be tested with the adjacent pipeline. If joints leak under test, valves shall be disconnected and reconnected, and the valve or the pipeline or both shall be retested.

B. Valve Boxes:

- 1. Valve boxes shall be installed in conformance with these standards.
- 2. Center the valve boxes and set plumb over the wrench nuts of the valves. Set valve boxes so they do not transmit shock or stress to the valves. Set the valve box covers flush with the surface of the finished pavement, in conformance with these standards or to another level as may be required.
- 3. VC 212 valve box base, self-centering.
- 4. Where the depth of the operating nut is more than three (3) feet, operating extensions shall be provided in accordance to Subsection "Materials."
- 5. Valve boxes shall be the two-piece sliding type, cast iron with 6⁵/₈ inch shaft, and shall be Vancouver-style of appropriate length for the installation, or as approved. The letter W shall be cast into the top of the lid. Extension pieces, if required, shall be the manufacturer's standard type for use with the valve box.
- 6. Backfill shall be the same as specified for the adjacent pipe. Place backfill around the valve boxes and thoroughly compact it to a density equal to that specified for the adjacent trench and in such a manner that will not damage or displace the valve box from the proper alignment or grade. Misaligned valve boxes shall be excavated, plumbed, and backfilled at the contractor's expense.
- 7. In non-paved areas, the valve box shall be set in a concrete collar in accordance with these standards

5.8 FIRE HYDRANTS

5.8.1 Scope

This section covers the work necessary for furnishing and installing the fire hydrants, complete. Fire hydrants shall be installed in accordance with these standards.

5.8.2 Hydrants

- A. Hydrants shall have a nominal 5¼-inch main valve opening with 6-inch bottom connections. The main valve shall be equipped with O-ring seals and shall open when turned left or counterclockwise.
- B. The operating nut shall be a 1½-inch national standard pentagon nut.
- C. Hydrants shall be equipped with two 2½-inch hose nozzles and one 4½-inch pumper nozzle with a Storz HPHA40–45NH permanent hydrant adapter, or as approved by the Fire District.
- D. Hydrants shall conform to AWWA C-502 and to the City's standards. The normal depth of bury shall be four (4) feet. Nozzle threads shall be American National Standard. The inlet connection shall be mechanical joint, restrained by a mechanical joint restraint system such as Megalug[®], or approved equal.
- E. Hydrants shall be Waterous Pacer or approved equal.
- F. Hydrants shall be painted with Miller Paint Acrinamel #1117 Siren Red, Rust-Oleum Enamel 3800 Safety Red, or approved equal.
- G. Hydrant leads are to be C900/C905.

5.8.3 Base Block

The base block shall be solid precast concrete pier block with nominal dimensions of 8-inch thickness and 12-inch square base.

5.8.4 Workmanship

Construction and installation shall conform to these standards and to the provisions of AWWA C-600, except where otherwise specified.

5.8.5 Location and Position

- A. Fire hydrants shall be located in compliance with Fire District requirements. Locate as shown, or as directed, to provide complete accessibility and to minimize the possibility of damage from vehicles or injury to pedestrians. The maximum distance from a Fire District approved driving surface to a fire hydrant is fifteen (15) feet. Improperly located hydrants shall be disconnected and relocated at the contractor's expense.
- B. When the hydrant is placed behind the curb or sidewalk, set the hydrant barrel so that no part of the pumper or hose nozzle cap is less than twenty-four (24) inches from the face of the curb or the back side of the sidewalk.
- C. Set all hydrants plum and nozzles parallel with the curb, or at right angles to it. With the pumper nozzle facing the curb, set hydrants so that the safety flange is at least three (3) inches and at most 6 inches above the finished ground or sidewalk level, to clear bolts and nuts.
- D. Install an approved blue bi-directional, reflectorized button one foot from the center of the near travel lane using an approved fast-setting bonding agent.
- E. No fire hydrant shall be installed on a main of less than 8-inch in diameter unless it is a looped system of 6-inch mains. The hydrant lead shall be a minimum of 6-inches in diameter.

5.8.6 Excavation

Do not carry excavation below the depth necessary to install base rock and hydrant support blocks. Refill over excavated areas with gravel and compact the fill to create a firm foundation.

5.8.7 Base Rock

Place base rock on a firm, level subbase or subgrade to assure uniform support.

5.8.8 Installation of Hydrants

Place the hydrant carefully on the base block to prevent the base block from breaking. After the hydrant is in place and is connected to the pipeline, place temporary blocks to maintain the hydrant in a plumb position during subsequent work.

5.8.9 Drain Rock

Gravel for drainage shall be washed $1\frac{1}{2}$ " – $\frac{3}{4}$ " aggregate or graded river gravel free of organic matter, sand, loam, clay, or other small particles that will restrict water flow through the gravel. Place gravel around the base block and hydrant bottom after the hydrant is blocked in place. Top of gravel shall be not less than six (6) inches above the hydrant drain opening. Do not connect the drainage system to the sewer.

5.8.10 Thrust Blocking and Restraint

- A. Fire hydrants shall be secured by thrust blocking. Provide reaction or thrust blocking in accordance with these standards, or as directed. Place blocking between the undisturbed ground and the fitting to be anchored. Blocking bearing surface shall comply with thrust blocking requirements for waterlines.
- B. Place the blocking so that the pipe and fitting joints will be accessible to repairs by wrapping all joints and fittings in new plastic sheeting (minimum 8 mil thickness).
- C. The concrete mix shall be commercially produced and have a compressive strength of not less than 3,000 psi at 28 days, unless otherwise approved by the Public Works Department authorized representative.
- D. Fire hydrant laterals shall be secured with a mechanical joint restraint system such as Megalug[®], RomaGrip[™], or approved equals.

5.8.11 Thrust Ties

Thrust ties may be used with concrete thrust blocking, with prior approval of the Public Works Department authorized representative, when the top of the existing ground behind the fire hydrant is less than 2 feet above the top of the hydrant base or where unsuitable ground prevents proper anchorage.

5.9 HYDROSTATIC TESTING AND STERILIZATION OF WATERLINES

5.9.1 Hydrostatic Testing

- A. Contractor shall make pressure and leakage tests on all newly laid pipe; follow the procedures specified in AWWA C-605, Subsection "Hydrostatic Testing." Contractor shall furnish all necessary equipment and material, make all taps in the pipes as required, and conduct the tests. The Public Works Department authorized representative will monitor the tests and assure that all taps are installed, and service pipe extended.
- B. Furnish the following equipment and materials for the tests:

Amount	Description
2	Pressure gauges
1	Hydraulic force pump approved by the Public Works Department authorized representative
1	Suitable hose and suction, as required

- C. Conduct the tests after the trench is backfilled or partially backfilled with the joints left exposed for inspection, or when completely backfilled, as permitted by the Public Works Department authorized representative. Where any section of pipe has concrete thrust blocking, do not take the pressure tests until at least five days elapse after the concrete thrust blocking is installed. If high-early cement is used for the concrete thrust blocking, the time may be cut by two days
- D. Conduct pressure tests in the following manner, unless otherwise approved by the Public Works Department authorized representative. After the trench is backfilled or partially backfilled as specified here, fill the pipe with water, expelling all air during the filling. The minimum test pressure shall be 150 psi. For lines working with operating pressures in excess of 100 psi, the minimum test pressure shall be 1½ times the operating pressure at the point of testing, however, test pressure shall not exceed pipe or thrust-restraint design pressures. The duration of each pressure test shall be two (2) hours, unless otherwise directed by the Public Works Department authorized representative.
 - Procedure: Fill the pipe with water and apply the specified test pressure by pumping, if necessary. Then valve off the pump and hold the pressure in the line for the test period. Test pressure shall not vary by more than ±5 psi for the duration of the test. At the end of the test period, operate the pump until the test pressure is again attained. The pump suction shall be in a barrel or similar device or metered so that the amount of water required to restore the test pressure can be measured accurately.
 - 2. Leakage: Leakage shall be defined as the quantity of water necessary to restore the specified test pressure at the end of the test period. No pipe installation will be accepted if the leakage is greater than the number of gallons per hour, as determined by the following formula:
 - $L = \frac{SD(P)^{\frac{1}{2}}}{2}$

133,200

Where: L = allowable leakage (gallons per hour).

- S = length of pipe to be tested (feet).
- D = nominal diameter of pipe (inches).
- P = average test pressure during the leakage test (psi).
- 3. Correction of Excessive Leakage: Should any test of laid pipe disclose leakage greater than that allowed, locate and repair the defective joints or pipe until leakage in a subsequent test is within the specified allowance

5.9.2 Sterilization

Pipeline intended to carry potable water shall be sterilized before it is placed in service. Disinfection by chlorination for pipelines shall be accomplished according to AWWA C-651, as modified or expanded below, and City requirements. Disinfection of water-storage facilities, water treatment plants, and wells shall be accomplished according to the appropriate sections of AWWA C-651 through AWWA C-654.

A. Flushing: Before sterilizing, flush all foreign matter from the pipeline. Contractor shall provide hoses, temporary pipes, ditches, etc., as required to dispose of flushing water without damaging adjacent properties. If flushed into a sewer system, the contractor shall provide screening and remove all accumulated construction debris, rocks, gravel, sand, silt, and other foreign material from the system at or near the closest downstream manhole; no material shall be flushed into the downstream city sewer system. Flushing velocities shall be at least 2.5 feet per second (fps). For large-diameter pipe that is impractical or impossible to flush at 2.5 fps, clean the pipeline in place from the inside by brushing and sweeping, flush the line at a lower velocity.

- B. Sterilizing Mixture:
 - A solution with a free chlorine residual of at least 25 mg/l must be introduced to the pipe such that the solution will contact all surfaces and trapped air will be eliminated. The solution must remain in place for at least twenty-four (24) hours.

5.9.3 Point of Application

- A. Inject the chlorine mixture into the pipeline to be treated at the beginning of the line through a corporation stop or a suitable tap in the top of the pipeline. Water from the existing system or other approved source shall be controlled to flow slowly into the newly laid pipeline during the application of chlorine. The proportion of the flow rate of the chlorine mixture to the rate of water entering the pipe shall be such that the combined mixture shall contain 40 to 50 ppm of free available chlorine.
- B. Valves shall be manipulated so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water. Use check-valves if necessary.
- C. Operate all valves, hydrants, and other appurtenances during sterilization to assure that the sterilizing mixture is dispersed into all parts of the line, including dead ends, new services, and similar areas that otherwise may not receive the treated water.
- D. Do not place the concentrated quantities of commercial sterilizer in the line before it is filled with water.
- E. After chlorination, flush the water from the line, see Subsection "Disposal of Flushing and Sterilizing Water", until the water through the line is equal chemically and bacteriologically to the permanent source of supply.

NOTE: When testing and sterilizing procedures are complete, remove the testing corporation stop and replace it with a threaded brass plug.

NOTE: The practice of adding a small amount of chlorine powder or tablets at each joint as the main is being laid is *not* an acceptable method of chlorinating a pipeline. The procedure does not permit preliminary flushing, nor does it distribute chlorine uniformly.

5.9.4 Retention Period

After twenty-four (24) hours, if the free chlorine residual is 10 mg/l or greater, the chlorine solution must be drained and the pipe flushed with potable water. If the free chlorine residual is less than 10 mg/l after twenty-four (24) hours, the pipe must be flushed and rechlorinated until a free chlorine residual of 10 mg/l or more is present after a 24-hour period.

5.9.5 Disposal of Flushing and Sterilizing Water

- A. Dispose of flushing and sterilizing water in a manner approved by the Public Works Department authorized representative. If the volume and chlorine concentration is such as to pose a hazard to the City's Wastewater Treatment Plant operation, the sterilizing water shall be metered into the system per direction of the Public Works Department authorized representative. Notify the Public Works Wastewater Division at least twenty-four (24) hours or one business day before disposing of sterilizing water into the City sanitary system.
- B. Do not allow sterilizing water to flow into a waterway or storm line without reducing the chlorine to a safe level via adequate dilution or another neutralizing method, as approved by the Public Works Department authorized representative.

5.9.6 Bacteria Testing

A. After the pipe is disinfected, flushed, and filled with potable water, bacteriological samples must be collected to determine the procedure's effectiveness. At least two samples must be collected from the new pipe at least 24 hours apart and analyzed for coliform bacteria. Once the potable water has been in the pipe for 24 hours, a test will be taken at multiple orifices.

After 48 hours of the pipe setting with potable water, a second test will be taken at the same points. If the results of both analyses indicate the water is free of coliform bacteria, the pipe may be put into service. If either sample indicates the presence of coliform bacteria, the pipe may be re-flushed, filled with potable water and re-sampled. If this second set of samples is free of coliform bacteria, the pipe may be put into service, otherwise the disinfection and flushing process must be repeated until samples are free of coliform.

5.10 WATER SERVICE CONNECTIONS

5.10.1 Scope

The work includes trench excavation and backfill, furnishing and installing service saddles, corporation or valves, meter vaults or boxes, meters, service connection piping, fittings, and appurtenances within the designated limits, testing, flushing, and other incidental work as required for a complete installation.

5.10.2 Hydrostatic Test and Leakage

Test service connections and service connection pipe in conjunction with the main, as detailed in Subsection "Hydrostatic Testing".

5.10.3 Materials

- A. Service Lines and Fittings ¾-inch and 1-inch: Single service lines, ¾-inch or 1-inch, shall be blue Centennial Water HDPE pipe or approved equal service lines. All service line fittings shall have CTS Ford pack joint compression fittings.
- B. Service Lines 1.5-inch to 2-inch: All service lines 1.5 inch to 2-inch shall be blue or clear potable water Centennial CTS HDPE pipe or approved equal service lines. All service line fittings shall have CTS Ford pack joint compression fittings.
- C. Service Lines Larger Than 2-inch: All service lines greater than 2-inch shall be in increments of 4-inch, 6-inch, and 8-inch and shall be C-900 pipe.
- D. Service Saddles ¾-inch to 2-inch: Service saddles shall be Romac 202NS IPS thread, service saddle or approved equal. Saddle casting must be black or blue nylon or epoxy coated, and both straps must be Type 304 (18-8) heavy gauge Stainless Steel per ASTM A-240.
- E. Install tracer wire, 12-gauge solid copper core with blue THNN insulation.
- F. Service Connections Greater Than 2-inch: All service connections greater than 2-inch shall be made with a FL by MJ tee and FL by MJ gate valve. Gate valve shall be connected directly to the tee. No spools will be allowed between the tee and gate valve.
- G. Domestic service taps are not allowed on fire protection services or fire hydrant leads.
- H. Meter Boxes and Covers: Generally, meter boxes and covers are installed in landscape areas and shall be Pedestrian Rated, or approved equal. Occasionally, with the approval of the Public Works Department authorized representative, installation of meter boxes in driveway areas may be allowed. In these cases, meter boxes and covers shall be Traffic Rated, or approved equal. In all cases, any meter box installed in pavement shall have a full faced, steel, traffic rated removable lid. All boxes shall be ordered with a 3" x 6" mouse hole precut into one end of the box.

- I. Corporation Stops: 1-inch corporation stops shall be as identified in the standard details or approved equal.
- J. Angle Valves: Shall be as identified in the standard details or approved equal.

5.10.4 Workmanship

- A. Trench Excavation, Preparation, and Backfill: Trench excavation, preparation, and backfill shall conform to the requirements of Chapter 6, "Trench Excavation and Backfill Standards." Backfill material in the trench to within six (6) inches of service connection pipe or line. Cover over pipe shall be in accordance with these standards.
- B. Connection to Main: Service connections shall be installed in accordance with these standards. Taps shall be made in the pipe by experienced workmen, using tools in good repair, with proper adapters for the size of pipe being tapped. Line taps shall be 30° above the horizontal for 1" service connections and centered on the spring line of the pipe being tapped for 1½" or 2" service connections. Tap shall be made no closer than 18 inches from the outside edge of the sleeve to the beginning of the bell flare or end of the MJ fitting. The Public Works Department authorized representative shall be notified and shall be present during tapping of City water main, unless otherwise approved by the Public Works Department authorized.
- C. Installation of Meters and Meter Boxes:
 - 1. Meters and meter boxes or vaults shall be installed in accordance with these standards, or as directed by the Public Works Department authorized representative.
 - 2. City of Independence Water Division shall install all meters two (2) inches in diameter or less. Meters larger than two (2) inches in diameter shall be installed by the contractor under the supervision of City of Independence Water Division.
 - 3. Meters shall not be installed until the entire water system is ready for operation, the system has been tested and approved, and water meter permit(s) have been obtained from the City of Independence Building Division.
 - 4. The remainder of the service connection, excluding the meter, may be installed at any time during or after construction of the main. Before the meter is connected, the angle valve shall be opened, and the service line flushed of all foreign materials, and shall be properly tested and chlorinated.
 - 5. The finish grade of the completed meter enclosure shall allow a minimum of 6 inches and a maximum of twelve (12) inches of clearance from the top of the meter to the meter box. Meter boxes or vaults shall be set or constructed plumb, with the top set horizontally. Lightly compacted earth backfill shall be placed inside the meter boxes to the bottom of the meter stop. Grade adjustments of the meter boxes or vaults shall be made by using standard extension sections for the specified box or vault. Backfill around meter vaults shall be as specified for adjoining pipe. Provide adequate space to allow for sidewalk installation. Under no circumstances shall meter boxes be placed in the sidewalk.
 - 6. Depending on the elevation difference between the meter and the main line water system working pressure, the City may require a backflow-prevention valve and/or a pressure-reducing valve on the customer side of the meter, at the meter box. Installation shall be approved by the Public Works Department authorized representative.

5.11 WARRANTEES AND ACCEPTANCE

5.11.1 Activation

The City of Independence will provide water to the project when the following are complete.

- A. Compliance with these standards.
- B. Installation of the materials and workmanship as described herein.
- C. Successful hydrostatic pressure tests, as witnessed and approved by the Public Works Department authorized representative.
- D. Adequate flushing and chlorination of mains.
- E. Approval by an Oregon Health Division certified water quality laboratory of samples taken for bacteriological examination.

5.11.2 Legal Recordings

Dedication of any required easements or rights-of-way have been recorded with the County Recorder and the Engineering Department receives a reproducible copy of the recorded documents.

5.11.3 Project Completion

After completion of construction of the total project, and after all testing has been satisfactorily completed, project closeout shall proceed as outlined in Chapter 1 Subsection "Project Closeout."

5.11.4 Maintenance Period

- A. The Contractor or Applicant shall be responsible for providing Maintenance Assurance for Public Improvements as outlined in Chapter 1 Subsection "Maintenance Assurance and Warranty." Public water improvements shall be warranted for a minimum of one year; public landscape improvements shall be warranted for a minimum of two years.
- B. At any time during the warranty period, the Public Works Department authorized representative has reason to believe the public water improvements have defects that were the result of faulty workmanship or flaws in construction material, the responsible party shall be required, at that party's own cost, to repair any problems or faults to the public water improvements deemed necessary by the Public Works Department authorized representative.
- C. Before the end of the Construction Maintenance period, the City's authorized representative shall inspect the project for any remaining deficiencies. If the deficiencies that remain are determined to be the responsibility of the contractor or the applicant, the contractor or applicant shall then make such repairs.
- D. The Landscape Maintenance assurance shall be released two years after acceptance of construction, providing the landscaping meets the 90% survival level (see Chapter 3 Subsection "Landscape Inspection for Warranty")