

WATER DISTRIBUTION STANDARDS

The Water Distribution Standards provide policies, design and construction guidelines to governmental agencies, design professionals, private developers, and community groups. These standards maintain the public welfare; ensure safe, reliable service for all customers; and promote efficient development within the water service area.



CITY OF ASPEN

Contents

Introduction	7
References	8
Chapter 1: Purpose	9
1.1 Applicability and Definition	9
1.1.1 Purpose	9
1.1.2 Standards Intent	9
Chapter 2: Design and As-Built Guidelines	10
2.1 General Criteria	10
2.1.1 Approved Drawings	10
2.1.2 Ability to Serve	10
2.1.3 Water Main Sizing	11
2.1.4 Pressure Range	11
2.1.5 Looping	11
2.1.6 Utility Easements	11
2.1.7 Valves	11
2.1.8 Oversized Mains	12
2.1.9 Fire Protection	12
2.1.10 Pumping Stations and Storage Tanks	12
2.2 As-Built Drawings and Approvals	13
2.2.1 General	13
2.2.2 As-Built Formats	14
2.2.3 As-Built Certification	14
2.2.4 As-Built Plan Drawing Requirements	14
2.2.5 As-Built Profile Drawing Requirements	15
2.3 Utilities and the Public Right-of-Way	16
2.3.1 Colorado Department of Transportation Right-of-Way	16

2.3.2	City of Aspen Right-of-Way.....	16
2.4	Variances.....	16
Chapter 3: Water Distribution Construction Standards		18
3.1	Pipes and Fittings	18
3.1.1	General	18
3.1.2	Construction Timeframe.....	18
3.1.3	Pipe Classification.....	18
3.1.4	Testing	18
3.2	Installation	18
3.2.1	General	18
3.2.2	Excavation and Potholing Definitions.....	19
3.2.3	Water Shutdown Requests	19
3.2.4	Excavation, Bedding, and Backfill.....	19
3.2.4.1	General	19
3.2.4.2	Bedding/Pipe Zone	20
3.2.4.3	Backfill zone	20
3.2.4.4	Testing and Inspection.....	21
3.2.4.5	Road-Base Material Specification	21
3.2.4.6	Screened Rock Material Specification	21
3.2.5	Depth	22
3.2.6	Thrust Restraint.....	22
3.2.7	Clearances.....	22
3.2.8	Identification.....	22
3.3	Gate Valves and Valve Boxes	23
3.3.1	Gate Valve Operation	23
3.3.2	Gate Valve Size and Type.....	23
3.3.3	Installation at Intersections	23
3.3.4	Valve Box Assemblies	23
3.4	Pressure-Reducing Valve Installation and Vaults.....	24

3.5	Fire Hydrants	24
3.6	Fill Station	24
3.7	Air/Vacuum Valve and Vaults	25
3.8	Abandonment of System Appurtenances	25
3.8.1	Abandonment of Main Lines.....	25
3.8.2	Abandonment of Fire Hydrants	25
3.8.3	Abandonment of Service Lines	25
3.8.4	Abandonment of Tees	25
3.8.5	Abandonment of Valves	25
3.8.6	Abandonment of Pressure-Reducing Valves and Vaults	25
3.8.7	Abandonment of Meter Pits	26
3.8.8	Thrust Restraint of Abandoned Appurtenances	26
3.8.9	City of Aspen Inspection of Abandonments	26
Chapter 4: Inspection, Disinfection, and Testing		27
4.1	City of Aspen Inspection	27
4.2	Disinfection	27
4.2.1	Main Line Disinfection – General Considerations.....	27
4.2.2	Tablet Method.....	28
4.2.3	Bacteriological Sampling and Testing.....	28
4.2.4	Storage Tank Disinfection	28
4.3	Testing	28
4.3.1	Pressure Tests	28
4.3.2	Conductivity Tests	29
Chapter 5: Water Service		31
5.1	Water Taps.....	31
5.1.1	Responsibility for Tapping	31
5.1.2	Tapping Availability and Prerequisites	31
5.1.3	Pre-Tapping.....	32
5.1.4	Service Line Materials.....	32

5.2	Installation	33
5.2.1	Installation of Service Lines (3/4" to 2").....	33
5.2.2	Installation of Service Lines (4"+).....	33
5.2.3	Stub Outs	34
5.2.4	Service Line Inspection	34
5.3	Direct Taps	34
5.4	Service Line Sizing	34
5.5	Common Service Lines.....	34
5.6	Owner Responsibility.....	35
5.7	Utility Investment Charge.....	35
5.8	Meter Installations	35
5.9	Fire Sprinkler Systems	38
5.10	What is a Cross Connection?	38
5.11	Cross-Connection Control Standards	38
5.12	Prevention Devices.....	39
5.13	Containment/Isolation	39
5.14	Two Types of Backflow	39
5.15	Mechanical Backflow Prevention.....	40
5.16	Backflow Prevention Overview.....	40
Chapter 6: Reuse and Irrigation Construction Standards		42
6.1	General	42
6.1.1	Purpose	42
6.1.2	Source	42
6.1.3	Reuse and Irrigation Review	42
6.2	Reuse System	42
6.2.1	Installation	42
6.2.2	Reuse System	42
6.2.3	Reuse Connections	43
6.2.4	Customer Use.....	43

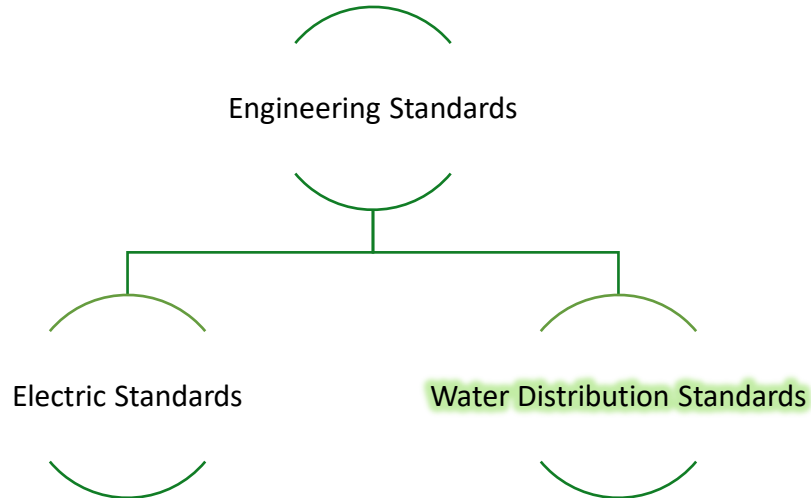
6.3	Pipe Fittings and Appurtenances	43
6.3.5	Ductile-Iron Pipe (DIP), Fittings, and Appurtenances	43
6.3.6	Polyvinyl Chloride Pipe	43
6.3.7	High-Density Polyethylene Pipe.....	43
6.3.8	Transitions.....	44
6.3.9	Pipe Identification	44
6.3.10	Pipe Jointing.....	45
6.3.11	Thrust Restraint.....	45
6.3.12	Mechanical-Joint Retainer Glands	45
6.4	Gate Valves	46
6.5	Valve-Box Assemblies.....	46
6.6	Valve-Key Extensions.....	46
6.7	Air/Vacuum Valves and Vaults.....	46
6.8	Reuse and Raw Water Meters	46
6.9	Excavation, Bedding, and Backfill.....	47
6.9.1	General	47
6.9.2	Bedding/Pipe Zone	47
6.9.3	Backfill Zone	47
6.9.4	Testing and Inspection.....	48
6.9.5	Road-Base Material Specification	48
6.9.6	Screened Rock Material Specification	48
6.10	Testing and Flushing.....	49
6.10.1	Fusion Quality	49
6.10.2	Leak Testing	49
6.10.3	Pipeline Flushing	49
Chapter 7:	Ditches	50
7.1	Alteration of Ditches	50
7.2	Clear Ditch Bottom.....	50
7.3	Landscaping along Ditches.....	50

7.4 Culverts and Ditch Liners 50
7.5 Access by City Employees 50
7.6 Violations and Work Done: Liability Therefor 50

Introduction

Objective

The *Water Distribution Standards* provide policies, design, and construction guidelines for governmental agencies, design professionals, contractors, private developers, and community groups. These standards strive to maintain the public welfare, ensure safe and reliable service for all customers, and promote efficient development within the water service area. Below is a chart that shows how the standards correspond to the Utilities Department's other requirements.



The *Water Distribution Standards* are intended to supplement rather than replace existing engineering, environmental, and public water works standards and requirements, including but not limited to those of the American Water Works Association (AWWA) and Colorado Department of Public Health and Environment (CDPHE).

References

American National Standards Institute (ANSI)

American Society for Testing and Materials (ASTM)

Aspen Consolidated Sanitation District: Pipeline and Manhole Design and Construction Specifications

American Water Works Association (AWWA)

City of Aspen Electric Standards and Specifications for Electric Installation and Use

City of Aspen Engineering Standards

City of Aspen Municipal Code

City of Aspen Urban Runoff Management Plan

City of Aspen Construction Mitigation Plan

Colorado Department of Public Health and Environment (CDPHE)

Ductile-Iron Pipe Research Association (DIPRA)

Environmental Protection Agency (EPA)

International Fire Code (IFC)

National Fire Protection Association (NFPA)

National Science Foundation (NSF)

Chapter 1: Purpose

1.1 Applicability and Definition

1.1.1 Purpose

This document establishes the City of Aspen Utilities Department's minimum standards for working with potable, reuse, and raw water. All proposed work submitted for approval shall conform to the criteria set forth herein.

1.1.2 Standards Intent

The City of Aspen, under the direction of the City of Aspen Director of Utilities, publishes the *Water Distribution Standards* to provide minimum design and construction criteria for any distribution system component installed within the community water system service area and for similar components installed outside the service area if eventual connection to the City's system is contemplated. Where any provision of these *Water Distribution Standards* is inconsistent with the provisions of the City of Aspen's Municipal Code, that Municipal Code – or the water policies adopted by the City Council (Resolution No. 9, Series of 1996) – will take precedence.

This design standard is intended as a manual containing the minimum standards for the design and construction of water distribution systems. It is intended to supplement the conditions contained in the water service agreements adopted by city ordinance, which define the standards that new water systems must meet prior to acceptance.

A utility plan shall be submitted when improvements, connections, or abandonments are proposed. A utility plan is also required when conflicts with existing utilities occur that require the redesign and/or relocation of existing infrastructure. Other utilities must be designed in accordance with their respective utility provider standards.

All public utilities – including without limitation water, wastewater, raw water, electric, and storm drainage systems – shall be located within public right-of-way (ROW) or public utility easements. If, during the building permit process, it is discovered that a public utility is not located within an easement, the City shall require that an easement be created for that utility. Additionally, existing prescriptive easements for water, electric, and raw water will require the dedication of an easement for the prospective utility.

Chapter 2: Design and As-Built Guidelines

2.1 General Criteria

This section includes guidance for furnishing and installing pipe, valves, meters, vaults, controls, and fittings for potable water lines. All materials shall be new and of the best available quality. All materials used shall be manufactured and supplied according to the latest revised standards of the American Water Works Association (AWWA), the American National Standards Institute (ANSI), and the American Society for Testing and Materials (ASTM), or as specified hereinafter.

If a development requires the installation, replacement, or upgrading of any public utilities, including water, wastewater, storm drainage, gas, electric, raw water and telecommunication system infrastructure, then the scope of this work must conform to the minimum clearance standards each utility provider mandates.

All improvements proposed to the City's public utilities system shall conform to the City's goals, policies, and standards – including those for water distribution, wastewater collection, storm water, raw water, and electric – as well as all applicable City department guidelines. All plans and specifications shall be approved prior to construction through the City's development review process. A Colorado-registered professional engineer shall prepare and stamp all such plans and specifications. The City of Aspen will charge reasonable fees for the city's review, or a designee to review, these plans and specifications. The City's review, however, shall not relieve any owner, developer, engineer, or contractor from the ultimate responsibility of assuring full compliance with the requirements imposed by the Municipal Code, these Water Distribution Standards, the CDPHE, the AWWA, or any other valid law or regulation.

Whenever a non-potable conduit and a water main or service line are proposed to cross, the existing line shall be potholed (or otherwise exposed) and physically surveyed to ensure proper separation during the design process.

2.1.1 Approved Drawings

Construction shall not begin until the contractor has received the reviewed and signed drawings from the City of Aspen or its designee. The contractor shall possess, at all times, a physical copy of the reviewed plans and specifications. Any changes to the project after the review and signature of the City of Aspen will require a new submittal and review process.

2.1.2 Ability to Serve

The City of Aspen's water system will maintain sufficient water production capacity to adequately serve every property within the City's limits as well as those properties outside the City that are under the purview of the water service agreements. However, each property owner who is requesting water service is responsible for extending approved facilities to the point of service – and to the far end of the property if a future system expansion can be anticipated (at the sole discretion of the Water Department). These extensions are subject to the minimum standards outlined in this document.

2.1.3 Water Main Sizing

The minimum-size water main shall be 8" in diameter; water main sizes shall be increased, at the cost of the developer, to meet the minimum requirements for simultaneously conveying fire and peak-hour flows. Water mains shall be extended in a looped fashion to the farthest point in each development or area that is to be served, and a fire hydrant shall be installed at the end of any non-looped water main if a future system expansion can be anticipated (at the sole discretion of the Water Department).

2.1.4 Pressure Range

Water tanks shall be sited or pressure reducing valves shall be set to provide water customers with a water pressure ranging from a maximum working pressure of 150 pounds per square inch (psi) and a minimum working pressure of 40 psi during peak hour demand.

2.1.5 Looping

All main-feed water supplies to developments shall be looped for dependability and to meet flow requirements of peak water usage plus fire flows while maintaining 20 psig at any point within that pressure zone. Looping shall be such that an interruption of service due to a water main failure will put no more than 500' of main and no more than two fire hydrants out of service, all while maintaining adequate flows and pressure in the remaining portion of the system.

2.1.6 Utility Easements

Potable, reuse, and raw water pipelines and infrastructure shall be installed within dedicated public ROWs or centered within an easement across private property. All easements shall be at minimum 25' wide for pipelines that are 12" in diameter or smaller, and 30' wide if the pipe is larger or the land has a grade steeper than 25%. Fire hydrants require a square easement with dimensions of 10' by 10' with the Hydrant located in the Center of the Easement. If a property re-develops and there are prescriptive easements the easements should be described, dedicated and recorded based upon the above dimensional criteria.

Public utility easements shall comply with the standards set forth in Title 21 and 25 of the Municipal Code, which includes the Water Distribution Standards, Electric Standards, and Engineering Standards. For public utility easement requirements see the latest revision of the City of Aspen's Engineering Standards.

2.1.7 Valves

Main-line valves shall be installed on each line at all street intersections, with a maximum line distance between valves of 350' in commercial and residential areas and 500' in open-space areas. Valves shall also be installed on all fire hydrant branches. When connecting to existing valves, the Water Department may require the replacement of older valve installations to provide for "as new" conditions. Additional valves may also be required at the discretion of the Water Department and to isolate the new system from older sections to enable the newly completed lines to be tested separately from the existing system.

2.1.8 Oversized Mains

The City may, at its option, require the installation of mains larger than the sizes required by the above criteria. In such cases, the City shall pay the additional cost above the amount required for mains that meet the above criteria. The method and basis for such payment shall be per the applicable City policies in effect at the time or as established through the Water Service Agreement.

2.1.9 Fire Protection

Fire flows shall be determined in accordance with the Insurance Services Office's "Guide for Determination of Required Fire Flow," utilizing the standard method of calculation.

All flows for commercial, multi-family, and single-family residential areas will be met according to the current International Fire Code and reviewed by the Fire Marshal and a City of Aspen representative.

Fire hydrants shall be installed at each street intersection and at intermediate points for maximum spacing of 350' in commercial and multi-family areas and of 400' in single-family residential areas. Prior to submittal for design approval, the location and height of fire hydrants shall be approved by the Aspen Fire Protection District with a signature on an approved site plan that shows the water system layout.

Fire flow calculations will be required for a water service line greater than 2" or at the request of the Water Distribution Manager. This is an effort by the City of Aspen Water Department to minimize the demand and negative impacts on the water distribution system. Fire flow calculations should show:

- That a 2" service line size is not adequate for the necessary demand.
- A summary specifying proposed design and why the two inch line failed.
- Signature block certifying calculations are correct.

2.1.10 Pumping Stations and Storage Tanks

Any extensions that will necessitate a pump station or water storage tank are subject to special, detailed engineering review. They are also subject to the terms of the Water Service Agreement, the AWWA Standards, and the Design Criteria for Potable Water Systems adopted by the CDPHE's Water Quality Control Division. All requirements of the design standards shall apply, and additional easements shall be required for the pump stations, storage tanks, access, and appurtenances. All materials, equipment, piping, valves, and associated appurtenances must be reviewed and approved by the Water Department.

Pumping Station Requirements:

- All pump stations shall have a common meter, electromagnetic-type.
- All pump stations will be designed to provide controls that interface with the centralized supervisory control and data acquisition (SCADA) system currently in use at the City of Aspen's Water Treatment Plant.

- All 110 outlets shall be ground-fault circuit interrupted (GFCI) and protected by either a GFCI circuit breaker or outlet GFCI receptacles. The stations shall use galvanized rigid steel or waterproof flex conduits.
- Lifting equipment shall be incorporated into the building for required future maintenance.
- All isolation valves shall be flange-by-flange, counter-clockwise, non-rising stem, Mueller-resilient seat gate valves. Openings shall be to the left. Each gate valve shall have an operating wheel that indicates the open and closed directions. Valve operators at heights above 5' in elevation shall be outfitted with a chain operator to assist in closing the valve without the aide of a ladder.
- All pump stations shall be designed to be exempt from confined space regulations by incorporating stairs or walk-in access and utilize automatic ventilation.
- All pump stations shall have a check valve or electric pump control valves on the discharge or each pump.
- All pump motors shall be driven by soft starts or variable frequency drives subject to approval by the Water Department.

2.2 As-Built Drawings and Approvals

2.2.1 General

As-built drawings are accurate, scaled representations of appurtenances and infrastructure as they exist in the field at the time of the project's completion. As-built drawings of waterline system infrastructure submitted to the City of Aspen Water Department for final acceptance shall be in accordance with the sections below. As-built drawings of waterlines shall include at minimum the requirements specified below.

The following are not considered as-constructed drawings and will not be accepted:

- Construction plans.
- Freehand drawings or sketches.
- Drawing measurements that are based on water line locations after the installation work has been buried.

Designation of all abandonments will be included as a separate layer on as-constructed drawings and labeled as abandoned with the date of abandonment and the pipe material. Details shall be drawn out where abandoned systems are within a 20' radius of a water-system valve cluster.

The design engineer of record for the project submitting the reviewed and approved construction plans shall certify in writing that the installation has been accomplished in accordance with the plans and specifications approved by the City.

A complete list of installed items shall be submitted to the City with an inventory of pipe sizes and lengths, bends, valves, valve boxes, fire hydrants, copper lines, blow offs, and any additional appurtenances installed with the new systems.

2.2.2 As-Built Formats

Two hard copies of all as-built drawings and a saved version of the drawings in ArcView format shall be given to the Water Department.

- 2 hard copies (on standard 24" x 36" sheets) with the engineer's stamp and signature; labeled "As-Constructed".
- 1 disk with the ArcView drawing in both .mxd and PDF formats.
- As-built survey shots in .mxd form.

2.2.3 As-Built Certification

A Colorado-licensed professional land surveyor (PLS) shall survey the potable water system installations. The locations of all mains, service lines, fittings, bends, valves, tracer wire locator boxes, ARVs, restraint and all other appurtenances shall be surveyed, located, and identified.

2.2.4 As-Built Plan Drawing Requirements

- The plan view must be drawn to a scale that displays the plan in a way that is clearly legible. Recommended scale(s) are 1-inch equals 5, 10, or 20 feet.
- Existing and installed improvements and structures; including, without limitation, all grading, transportation, landscaping, City-operated and non-City-operated public utilities (including storm sewer, telephone, gas, electric, cable television, fiber optics, raw water, water and sewer); floodways, floodplains, driveway locations, street lights, roadways, sidewalks, curbs, and gutters; traffic signal poles and controllers; and pavement edges, trees, and other significant features.
- Match lines that connect information between drawings.
- Utility information is required according to following (for installed unless otherwise noted):

- Pipe type, size, class, and joint, thrust restraint, valves, and valve type(s), fittings and fitting type(s), corporation and curb valves.
- Angles at alignment changes.
- Horizontal locations of structures.
- Special notation where waterline is buried less than 7' or greater than 10' in depth.
- Existing and proposed contours of at least 1-foot intervals (steep slopes may have alternate intervals as approved by the City Project Manager).
- Existing and proposed storm drainage facilities, including storm sewers, inlets, manholes, culverts, swales, detention ponds, and drainage ways.
- Horizontal and vertical locations and sizing of utility covers, surface appurtenances, inlets for storm drainage, potable water, and the electric system.
- Horizontal and vertical location of drainage outfall points.
- Horizontal and vertical location of all utility crossings identified (surveyed) during construction.
- Any installed insulation (type and horizontal alignment).
- Abandoned infrastructure left in place. These should be field located items identified during construction.

2.2.5 As-Built Profile Drawing Requirements

- The profile view is to be located directly below the plan view along a matching survey line and stationing and is to be drawn at a horizontal scale that matches the plan view and a vertical scale of 1-inch equals 5 feet. The profile view shall contain the following information:
 - Finished grade ground elevations.
 - All fittings.
 - Insulation (elevation installed above the infrastructure)
 - Stationing sequence, preferably left to right.

- Finished grade elevation(s)
- Match lines.
- Elevations for invert of pipe. (Top of pipe is acceptable only for existing utilities observed during construction.)
- Crossings of existing and proposed utilities. Crossing call out and specific dimensioning from outside of conduit to outside of conduit.
- Elevations of inlets, inverts, and connection locations.
- Interference drawings that show all crossings for any utilities identified during design or construction.
- Finished grades over utilities.

2.3 Utilities and the Public Right-of-Way

2.3.1 Colorado Department of Transportation Right-of-Way

All work within the Colorado Department of Transportation (CDOT) right of way shall meet all CDOT requirements and standards in addition to these Distribution Standards. All work occurring within the CDOT ROW shall require a permit. To determine the appropriate permitting, contact CDOT for specific requirements.

2.3.2 City of Aspen Right-of-Way

All work within the City of Aspen ROW shall meet all City of Aspen Engineering Department requirements and standards in addition to these Distribution Standards. All work occurring within the City of Aspen ROW shall require a ROW permit. To determine the appropriate permitting, contact the City of Aspen Engineering Department for specific requirements: 970-920-5080.

2.4 Variances

The City may grant variances to the Water Distribution Standards when practical difficulties or unnecessary hardships exist that cause inconsistencies with the purpose and intent of the construction standards. These issuances shall not compromise the operation or safety of the potable water distribution system.

Requests for variances from the standards, policies, or submittal requirements of this document shall be submitted in writing with appropriate documentation and justification to the Director of Utilities. Variance requests must, at a minimum, contain the following:

- Benefit to the City of Aspen and the existing water system and customers.

- Criteria under which the applicant seeks a variance.
- Written justification for non-compliance with the standards, cost is not a compelling reason for a variance.
- Proposed alternate criteria or standards to comply with the intent of the criteria.
- Supporting documentation, including necessary calculations.
- The proposed variance's potential adverse impacts for adjacent landowners.
- An analysis of the variance request, signed and stamped by a Professional Engineer who is licensed in Colorado.

Upon receipt of a complete application for a variance, the Director of Utilities shall prepare a statement of recommendation or denial.

Chapter 3: Water Distribution Construction Standards

3.1 Pipes and Fittings

3.1.1 General

The City of Aspen Water Department requires correct installation of main lines, utilizing AWWA-approved pipes, and appurtenances; the line or system must be inspected by registered Professional Engineer (PE), the design engineer of record, and a City of Aspen Water Department representative (the Engineering Inspector or a Water Department staff member).

3.1.2 Construction Timeframe

All water-line construction shall take place between April 1st and October 31st. Outside of this construction window, no excavation, testing, testholing/potholing, or other valve operations shall be allowed, except when the Distribution Supervisor/Operator in Responsible Charge determines such operations to be necessary for safety reasons.

3.1.3 Pipe Classification

All water mains shall be Class 52 ductile iron pipe (DIP), be thin-cement-lined, use slip joints or mechanical joints with rubber gaskets, and conform to AWWA specification C151 for minimum pressure of 350 psi. All fittings shall be thin-cement-lined, and use mechanical joints in accordance with AWWA C111. All pipes and fittings shall have copper straps or No. 4 solid copper wire welded across joints to ensure conductivity. All welds shall be protected with tar. To resist pipe corrosion, the use of 8-mil polyethylene wrap shall be required in areas of high soil conductivity, as determined by the soils report provided by the developer. When polyethylene wrap is used, additional restraint shall be provided to account for the loss of pipe wall friction.

The City of Aspen will not allow any plastic or polyvinyl chloride (PVC) pipe in its potable water system. This includes private systems attached to the City of Aspen's system.

3.1.4 Testing

Chlorination/bacteriological, hydrostatic/leakage, and conductivity tests shall be required on all new lines and systems before acceptance by the Water Department. These tests shall be performed in accordance with the latest revision of ANSI/AWWA Standard C651.

3.2 Installation

3.2.1 General

Construction shall not begin until the contractor has received the approved and signed drawings from the City of Aspen. The contractor shall possess a physical paper copy of the approved plans and

specifications at all times. Any changes to the project after the City of Aspen's approval and signature will require a new submittal and review process.

The contractor shall notify the City of Aspen Water Department through the front office (phone 970-920-5110) at least 2 full working days prior to the start of construction. Voicemail messages left outside hours of operation will not count towards the 2 full working days of prior notice. No other point of contact will result in a work order to document the adequacy of the notice.

The contractor shall take all precautions with the interior of the water line to be installed, the existing water line, and the valves and appurtenances to keep them dry, clean, and clear of debris. If the pipe is dirty, has gravel or debris inside, or has sat unused for a long-period of time, flushing and/or cleaning the line prior to installation may be required.

Please refer to latest revision of AWWA Standard C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

3.2.2 Excavation and Potholing Definitions

Excavation is defined as any earth moved by mechanical means. Such as track mounted excavator or rubber tire-mounted backhoe.

Pot-holing is defined as any earth moved by hydro-excavation utilizing a high-pressure water nozzle and vacuum such as a Vac-Trailer or Vac-Truck.

3.2.3 Water Shutdown Requests

The contractor shall notify the City of Aspen Water Department through the front office (phone 970-920-5110) at least 2 full working days prior to the any requested shutdown of an active water main for extension or modification. Voicemail messages left outside hours of operation will not count towards the 2 full working days of prior notice. No other point of contact will result in a work order to document the adequacy of the notice. Only the Aspen Water Department, unless otherwise specified, will develop and deliver notices to prepare affected customers for a planned temporary shutdown of an active water main. Water main shutdowns are not permitted for service line work without the written permission of the Operator in Responsible Charge (ORC).

3.2.4 Excavation, Bedding, and Backfill

3.2.4.1 General

Trench excavation shall be performed in accordance with the requirements of the latest revision of the City of Aspen's Engineering Standards.

All bedding and backfill material shall be free of frozen material, organic material, and debris. The materials to be used in each trench zone are indicated on the Water Main Trench Cross-Section Detail as shown on the Water Distribution System Standards Installation Details drawing; these materials are described herein.

3.2.4.2 Bedding/Pipe Zone

The bedding zone shall consist of all material placed below the pipe invert. The pipe zone shall consist of all material placed above the pipe invert to the specified elevation. The bedding/pipe zone material shall be placed for the full length of the pipeline. The bedding/pipe zone material shall be ¾" screened rock that has been hauled in for bedding – not native excavated material. The material shall extend from 6" below the pipe and bells to 12" above the top of the pipe and bells, and it shall extend for the full width of the excavated trench. Tamping equipment shall be used to thoroughly tamp the material to a minimum of 95% maximum dry density or 75% relative density. The moisture content of the material shall be within 2% of optimum.

3.2.4.3 Backfill zone

The backfill zone shall consist of all material above the pipe zone. Fabric shall be installed between the screen rock and all other backfill material. Follow CDOT, Pitkin County, and City of Aspen ROW specifications for backfill and compaction within the ROW or where asphalt is to be placed above the pipeline trench.

Compaction shall be completed by mechanical tamping of 12"-maximum loose lifts using mechanical tampers or vibratory rollers. All other means must be approved in writing by the engineer. All backfill shall be compacted to 95% of maximum laboratory dry density (ASTM D698) or to 75% relative density (ASTM D2079). The material shall be within 2% of optimal moisture content.

The contractor may request approval of alternate means of compaction. Such a request must be submitted to the engineer in writing. The engineer will approve the compaction method in writing only. Use of specified or approved compaction methods does not relieve the contractor from providing a completed project that meets the intent of this specification.

Native backfill material shall consist of suitable material from the excavated earth. No rocks or boulders shall be allowed in the first 24" of the trench above the pipeline. The backfill material above the first 24" of the trench shall have no boulders larger than 6" in any dimension and shall be carefully placed so that no damage will be done to the pipeline. Native backfill shall be used to finished grade if trench excavation occurs in open-field conditions.

Engineered backfill material shall be road-base, Class 6 aggregate base course.

3.2.4.4 Testing and Inspection

Prior to backfilling, all waterlines and appurtenances shall be inspected and approved by the City.

All materials shall be subject to gradation and compaction tests prior to approval. The test results shall be submitted to the City for approval and verification of their accuracy. The contractor shall bear the costs of these tests.

Compaction requirements shall conform to the measurements of maximum dry density according to ASTM D698 (Moisture-Density Relations of Soils [Standard Proctor]). Should ASTM D698 not be suitable for the material placed, the compaction requirements shall conform to ASTM D2049 (Test for Relative Density of Cohesionless Soils).

When the City requires it, the contractor shall excavate backfilled trenches for the purpose of performing compaction tests at the required locations and depths. The contractor shall be responsible for reinstalling and compacting the test excavations at no additional cost to the City.

Minimum compaction testing frequency for pipelines shall be one compaction test per 150 linear feet of piping and wherever piping is within 2-feet of structures. A compaction single test shall contain two samples per lift.

3.2.4.5 Road-Base Material Specification

The road-base material shall be Class 6 aggregate base course, as specified by the State of Colorado Department of Transportation (CDOT); the material shall meet the following gradation:

Aggregate Base Course – CDOT Class 6 Gradation	
Sieve Size	Total Percentage Passing By Weight
3/4"	100%
# 4	30% – 65%
# 8	20% – 55%
# 200	3% – 12%

3.2.4.6 Screened Rock Material Specification

Granular or granular backfill material shall be imported crushed rock or angular surfaced gravel and shall meet the following gradation (ASTM D448, m 67):

Granular Bedding Gradation	
Sieve Size	Total Percentage Passing By Weight
3/4"	100%
3/8"	22% – 55%
# 4	10%
# 8	5%

3.2.5 Depth

New lines and systems installed in the City of Aspen’s water system must be at least 7’ deep from the top of the pipe to the finished grade. The maximum depth at the finished grade will not exceed 10’. Additional fill placed on the line beyond 10’ in depth will require removing the fill or moving the main at the property owner’s expense. The City may require a survey and/or potholing, at the property owner’s expense, to determine the depth of bury after final grades are established. Insulation shall not be used as a substitute for the full 7’ of cover for new construction. If necessary, water mains shall have extra depth of cover at tie-ins so that the tie-ins can be made without vertical bends.

3.2.6 Thrust Restraint

City of Aspen requires two forms of thrust restraint at all bends and fittings to resist hydraulic thrust. Allowable forms of thrust restraint are concrete thrust blocks, zinc-coated steel tie rods, or Mega-Lug retainer glands. Concrete thrust blocks shall be designed by a licensed professional engineer, formed and poured in place on all fittings, including taps that are 4” or larger. A poly wrap bond breaker shall be installed between concrete and fittings. Concrete shall only be in contact with the fitting and not the pipe that is attached to the fitting. Concrete shall have a minimum 28-day compressive strength of 3,000 psi.

3.2.7 Clearances

Water mains shall be located at least 10’ horizontally from any non-potable pipe system, including manholes. At all perpendicular crossings, the water main shall be at least 18” above the non-potable pipe as measured from outside diameter and bottom of the water pipe to outside diameter and top of non-potable pipe. In addition, a full length of water pipe must be located so both water pipe joints will be as far from the non-potable pipe as possible. All other crossing circumstances shall require a variance (see Section 2.4 above). Also, the contractor must consult the Aspen Consolidated Sanitation District to determine where sanitary sewer crossings exist.

3.2.8 Identification

Potable water systems shall be marked with blue identification tape. Tape shall be installed 2’ above the pipe (non-potable systems will be marked with purple identification tape). Where there are potable and raw water lines in the same area, as defined by the City of Aspen or its designee, the pipe being laid at the tie (whether raw or potable) will also be wrapped with the appropriate identification tape.

3.3 Gate Valves and Valve Boxes

3.3.1 Gate Valve Operation

City of Aspen Water Department employees are the only people authorized to operate valves on the water distribution system. (Note: The service line starts at the corporation valve; it is the responsibility of the property owner and is not part of the water distribution system.) It is unlawful for any persons other than Water Department personnel to operate any City of Aspen Water Department water system appurtenances, per City Ordinance 25.08 ("City of Aspen Water Utility Operation and Control"). The contractor shall notify the City of Aspen Water Department through the front office, (phone 970-920-5110), at least 2 full working days prior to any requested operation of a water system valve for either main line extensions or testing. Voicemail messages left outside hours of operation will not count towards the 2 full working days of prior notice. No other point of contact will result in a work order to document the adequacy of the notice.

3.3.2 Gate Valve Size and Type

Gate valves shall be installed for all valves 12" and smaller. Gate valves shall be Mueller or a pre-approved equivalent, have a resilient seat, be epoxy-coated, use a mechanical joint or flange (as required), have a non-rising valve stem, and open by turning to the left (counterclockwise). Gate valves shall conform to latest revision of AWWA Specification C509 and be certified by ANSI/NSF 61.

Valves greater than 12" shall be Mueller or a pre-approved equivalent butterfly valves, with the model selected depending on the working pressure that they will be accommodating. Water Department shall evaluate valve selection for valves greater than 12" on a case-by-case basis.

3.3.3 Installation at Intersections

At intersections, gate valves shall be installed within 3' of a tee, cross, or bend. All connections shall have Mega-Lug® followers on the fittings. All mechanical joint fittings shall have the appropriate restraint as required in section 3.2.5 above.

3.3.4 Valve Box Assemblies

Valve boxes shall be three-piece Tyler Pipe cast-iron (or preapproved equivalent) valve boxes to accommodate 4" through 12" valves. The shaft size shall be 5.25", and the screw type shall be 6850 Series-668-S and/or 6865 Series-F. Complete extension shall be 62" to 82". Parts shall be universally interchangeable for other valve boxes within the system. Lids shall be flat-shallow or ribbed-regular and are to be marked with the word "WATER." The top of the valve boxes shall be set recessed below the existing or future asphalt surface. In areas that are not to be paved, the valve box shall extend 6" above the finished grade and be protected by a metal fence post or other means as approved by the Water Department.

For valves that are on lines deeper than 9', extension rods and a rod-centering ring are required. A solid 6" DIP shall be required in place of the sectional valve boxes. This alternate riser shall incorporate valve box tops with standard water lids, as specified above.

At completion, the contractor – in the company of the City or its representative – shall inspect the valve boxes to ascertain that they are plumb, that the valve-operating nuts are centered in the valve boxes, that the key will fit over all the operating nuts, and that all valve boxes are clean of obstacles that might prevent operation. If any of these conditions are not met, the installation will not be accepted.

3.4 Pressure-Reducing Valve Installation and Vaults

Design and installation of pressure reducing valves and associated vaults must be approved by the Water Department and will be evaluated on a case-by-case basis.

3.5 Fire Hydrants

Fire hydrants shall be Mueller A-403 Super Centurion with the 40" top barrel, painted Glass-Black or a preapproved equivalent with a minimum of 7' burial. Hydrants shall have one 4 ½" pumper connection and two 2½" hose connections. No other type of hydrant connections will be accepted. Hydrants shall have National Standard Thread, open to the left (counterclockwise), and have a standard five-sided operating nut. The main valve opening shall be 5¼" minimum. Hydrants shall be designed to operate under less than 250 psi working pressure. Tees for fire hydrant laterals shall be mechanical-joint on the run and 6" flanged on the branch (a swivel tee is acceptable). Valves on fire hydrant laterals shall be 6" flanged x mechanical joint. Megalugs will be installed on all branch and run connections. Megalugs and concrete thrust blocks will be accepted where virgin soil is available. Megalugs and tie rods will be installed where soil disturbance has occurred. Two ¾" zinc-coated, high-strength steel tie rods (or preapproved equivalents), nuts, and bolts shall be installed from the mechanical-joint side of the fire hydrant valve. A minimum 2 cubic feet of ½" screened-rock drain bed, 12" deep, shall be provided at the base of each fire hydrant and covered with a double thickness of plastic sheeting for a distance of at least 3' around the barrel of the hydrant. All fire hydrants should be verified for proper operation and witnessed by City staff prior to acceptance. A minimum of 4' of clear area (with no fences, shrubs, trees, or bushes) shall be kept around all hydrants. Hydrants shall be installed in accordance with manufactures installation instructions and be buried to the manufacturer's bury line indicated on the hydrant column. Hydrant laterals shall be installed as straight possible with minimal number of joints.

Fire hydrants will not be used for purposes other than authorized Fire Department and Water Department use.

Aspen Water Department personnel and Aspen Fire Department personnel are the only people authorized to operate the system's fire hydrants, per Municipal Code 25.08.

3.6 Fill Station

Contractors who require fill station water must contact the Water Department's front office at 970-920-5110, fill out a Fill Station Permit, and use the fill station to fill their trucks. The fill station permit sticker must be in the cab of the truck and visible to vehicular traffic. An approved and certified backflow device or adequate air gap is required on all commercial water-transport systems.

3.7 Air/Vacuum Valve and Vaults

Design and installation of air release valves and associated vaults must be approved by the Water Department and will be evaluated on a case-by-case basis.

3.8 Abandonment of System Appurtenances

3.8.1 Abandonment of Main Lines

All main lines scheduled to be abandoned shall be removed where applicable. Main lines that are to be left in place shall be plugged/capped at both ends of abandonment unless otherwise specified by the City of Aspen.

3.8.2 Abandonment of Fire Hydrants

Fire hydrants, associated valves, and laterals shall be removed. The tee on the main waterline where the hydrant lateral began shall be removed and replaced with two restrained solid sleeves and a similar-sized ductile iron pipe pup.

3.8.3 Abandonment of Service Lines

Service lines shall be abandoned at their source prior to the tapping of a new service. Abandonment(s) are the responsibility of the owner, owner's representative, or contractor. Abandonment(s) shall include the owner, owner's representative, or contractor turning off the corporation valve, cutting the old service above the compression nut, and crimping the abandoned service line. In the event the corporation valve leaks, a non-lead solder end-cap or repair clamp shall be utilized. This shall be inspected by Water Department Staff before the work is backfilled and buried. The contractor shall notify the City of Aspen Water Department through the front office (970-920-5110) at least 2 full working days prior to the day the service is to be abandoned. Voicemail messages left outside hours of operation will not count towards the 2 full working days of prior notice. No other point of contact will result in a work order to document the adequacy of the notice.

3.8.4 Abandonment of Tees

Tees shall be removed and replaced with two restrained solid sleeves and a similar-sized ductile iron pipe pup.

3.8.5 Abandonment of Valves

Valves shall be removed and replaced with two restrained solid sleeves and a similar-sized ductile iron pipe pup.

3.8.6 Abandonment of Pressure-Reducing Valves and Vaults

PRVs and PRV vaults shall be removed including all associated appurtenances, including the vault. Prior to abandonment of PRV vault the Water Department shall determine which appurtenances shall be salvaged and turned over to the Water Department. Electric and telecom service to the physical vault

shall be properly disconnected and abandoned according to the specifications of the service provider. PRVs shall be removed and replaced with two restrained solid sleeves and a similar-sized ductile iron pipe pup.

3.8.7 Abandonment of Meter Pits

Meter pits shall be abandoned by removing all metering equipment and associated metering pit infrastructure.

3.8.8 Thrust Restraint of Abandoned Appurtenances

All capped or plugged pipe ends or fittings shall be restrained with a properly installed concrete thrust block and Megalug joint.

3.8.9 City of Aspen Inspection of Abandonments

A City of Aspen Water Department representative shall visually inspect and witness any and all infrastructure scheduled to be abandoned. The City of Aspen Water Department shall be notified through the front office (970-920-5110) at least 2 full working days prior to the day any infrastructure is to be abandoned. Voicemail messages left outside hours of operation will not count towards the 2 full working days of prior notice. No other point of contact will result in a work order to document the adequacy of the notice.

Chapter 4: Inspection, Disinfection, and Testing

4.1 City of Aspen Inspection

Backfill shall not be done until the main and its services (where applicable) have been inspected by the City's designated representative for alignment, depth, and proper bedding. Inspections of water system improvements shall be made each day prior to the trench backfill.

4.2 Disinfection

4.2.1 Main Line Disinfection – General Considerations

A disinfection plan, provided by the contractor or design engineer of record, conforming with AWWA C-651 is required for submittal, review and approval prior to delivery of potable water to customers. Disinfection of main lines shall start with a clean line. Disinfection by chlorination of the pipe shall be performed prior to its acceptance by the City. Flushing, chlorination agent, and method of application shall be approved by the City of Aspen or its designee in accordance with latest revision of ANSI/AWWA Standard C651. The City will not provide labor, material, or test kits for disinfection to contractors installing mains. The chlorine level shall be at least 25 mg/L at the pipe extremities and at other respective points, and this level shall be retained in the line for at least 24 hours. The main shall be flushed as soon as possible after the chlorination is accepted by the City of Aspen. Chlorine residuals greater than 200 mg/L are detrimental to the lining of the pipe; therefore, the City will not accept lines with higher than 200 mg/L residuals. The contractor shall test the chlorine residual and flush water with an appointed City of Aspen representative to witness the testing. Copies of the test results shall be provided to the City of Aspen Water Department. Care shall be taken in flushing the pipeline to prevent property damage, danger to the public, and stream contamination. Please refer to ANSI/AWWA Standard C655, Field Dechlorination. The chlorination, flushing, and bacteriological testing of the finished pipeline shall be done prior to hydrostatic testing. All valves connecting to the City of Aspen's water system shall be operated by City of Aspen Water Department personnel only.

The City of Aspen Water Department recognizes all disinfection methods presented in ANSI/AWWA Standard C651. The Water Department *prefers* the disinfection of new water lines be accomplished using the tablet chlorination method. Should alternate disinfection methods be desired by designer/contractors, a written request shall be submitted to justify use of alternate method to disinfect the pipeline(s).

4.2.2 Tablet Method

Just prior to the pipe's installation in the trench, tablets shall be attached to the inside top of the pipe with Permatex Form A Gasket No. 2, Permatex Clear RTV Silicone Adhesive Sealant, or food-grade adhesives that have USDA and NSF 61 approval. A base dose of 25 mg/L shall be in the line for a minimum of 24 hours and tested for concentration. If the water temperature is less than 41°F, leave the line to soak for 48 hours to dissolve tablets. The 48 hours soak period shall not be exceeded and cannot occur over a weekend. If the concentration is at least 25 mg/L or greater after the required holding period, then flush the line and proceed to take a bacteriological test.

4.2.3 Bacteriological Sampling and Testing

Water samples shall be collected for bacteriological examination and residual chlorine content testing before the pipe is pressure tested. This sampling will be done by the contractor and witnessed by the City of Aspen representatives assigned to the project. The testing shall conform to AWWA Standards C651, Section 5.1.1.1, Option B:

Before approving a main for release, let it sit for a minimum of 16-hr without any water use. Then collect, using the sampling site procedures outlined in the Standard and without flushing the main during this period, two sets of samples a minimum of 15-min apart while sampling taps are left running. Both sets of samples must pass for the main to be approved for release.

The state-certified laboratories in the immediate area are:

Snowmass Water and Sanitation District (970-923-2056)

Aspen Consolidated Sanitation District (970-920-7262, ext. 14)

4.2.4 Storage Tank Disinfection

Refer to AWWA Standard C652, Disinfection of Water-Storage Facilities for complete tank disinfection procedures and guidance. Storage tank disinfection procedures shall be evaluated by the Water Department on a case-by-case basis.

4.3 Testing

4.3.1 Pressure Tests

In the presence of the City of Aspen's designated representative, the contractor shall pressure test all pipelines and piping to 150 psi or 150% of the static pressure, whichever is greater (to a maximum of 350 psi), for 2 continuous hours. No hydrostatic test shall be conducted on any portion of the pipeline

until all field-placed concrete has properly cured, the line has been chlorinated, and the bacteriological test has been passed.

Prior to testing, the pipeline shall be filled at a rate that will neither cause surges nor exceed the rate at which air can be released through the air valves at a reasonable velocity. All the air within the pipe shall be properly purged. If no air valves are installed on the pipeline, air shall be released through fire hydrants and blow offs. Where blow offs or hydrants are not available – or where they are not effective in purging air from the line – the Water Department or its inspector shall require a tap to purge the line. The location of the tap shall be at the inspector's discretion – preferably at the highest point on the line. The size of the tap will be determined by a Water Department representative. The tap will be removed, and a stainless steel full-circle clamp will be placed over the pipe penetration after the testing is complete. In the event that a blow off needs to be maintained on the pipe, the tap will be made on top of the main, with a curb valve installed to control the flow. The curb box and associated blow off pipe will reside inside a 5.25" valve box embedded in 12" of gravel. Materials for the blow off will consist of a Type-K copper pipe and a 1" Mueller curb box.

The contractor shall furnish the water, pump, and means of measuring water volume associated with pressure testing at testing locations designated by the Water Department. The contractor shall also furnish all labor, bulkheads, and miscellaneous material. The contractor will do all work (except operating the valves on the City's water system) to test the pipeline, maintain the required test pressure, and relieve the pressure in the pipeline after testing.

The filling of the pipeline and the proper disposal of chlorinated or other water shall be done only with approval of the City of Aspen's designated representative.

All valves connected to the City system shall be operated solely by City of Aspen Water Department Personnel.

All testing procedures shall be conducted in accordance with the latest revision of ANSI/AWWA C600 Section 5.2.1.2.

4.3.2 Conductivity Tests

The pipeline shall also be tested for electrical conductivity in the presence of the City of Aspen's designated representative. Connectors or bonds shall be installed so that the pipeline will act as a conductor. To be sure that all installed bonds are effective, no more than 1000' of pipeline will be electrically tested at one time. The line shall be tested after the trench is backfilled and compacted but before any street surfacing or seeding has taken place. The line shall be tested by connecting a low-voltage source to be sure that the pipe acts as a conductor. House services and fire hydrants shall be tested on a section-by-section basis. If the pipeline does not conduct an electrical current, the bonds or connectors will be checked and repaired until the defect is found.

The contractor shall notify the City of Aspen Water Department through the front office (970-920-5110) at least 2 full working days prior to the start of any testing. Voicemail messages left outside hours of operation will not count towards the 2 full working days of prior notice. No other point of contact will

result in a work order to document the adequacy of the notice. All tests, including pressure and electrical tests, shall be performed in the presence of the City of Aspen's designated representative.

Please refer to latest revision of AWWA Standard C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

Chapter 5: Water Service

5.1 Water Taps

5.1.1 Responsibility for Tapping

Tapping of mains shall be the responsibility of the City of Aspen Water Department. A Mueller corporation valve (or a preapproved equivalent) with CC threads and copper compression fittings shall be used. An appropriately sized gooseneck shall be made in all copper service lines to prevent them from being pulled from the main during backfill and compaction operations.

All coupons and shavings from taps shall be removed from the main line to protect the system from future damage.

The homeowner, contractor, or developer owns the service lines including the corporation valve, curb box, curb valve, and all exterior components of the service line excluding the City owned main.

5.1.2 Tapping Availability and Prerequisites

Water service taps to the City of Aspen's water mains will be made only from April 1st through October 31st. Taps will not be made on Fridays or on the days before holidays. Billing for utility hookup charges will be done after the work is completed.

Existing taps that are to be replaced will be abandoned prior to the installation of a new tap (see Abandonment of System Appurtenances Section 3.7). The Water Department requires at least 2 full working days of notice through the Water Department Front Office (920-5110) prior to service abandonments and new taps. No other point of contact will result in a work order to document the adequacy of the notice.

Service taps, curb stops, and service lines shall be located within 10' of the primary access to the property (either the driveway or the sidewalk to the front door) unless the Water Department recommends and approves a different location based on the availability of water mains. Curb stops should be located outside of the Public ROW and in a location open and accessible to the Homeowner, locations should be reviewed and approved by the Engineering Department and Water Departments prior to the City scheduling any taps.

Prior to tapping 3/4" to 2" services, the main shall be exposed for a minimum of 4' in length, with a 2' clearance around the pipe and 6' of clear trench on the side of the main where the tap is to be made. The proposed tap location must be at least 18" away from any other fitting, tap, or pipe disturbance. Prior to tapping services of 4" and larger, the main shall be exposed for a minimum of 4' in length, with a 3' clearance around the main and 10' of clear trench on the side of the main where the tap is to be made. Taps that are 4" and larger shall also have a concrete thrust block installed. In every case, the excavation shall meet all OSHA requirements.

5.1.3 Pre-Tapping

To avoid disruption of a roadway surface, pre-tapping of a system may be permitted for new subdivisions only through a prior written pre-tap agreement.

The written pre-tap agreement will specify the following:

- Standards for mapping service lines and curb-box locations
- Responsibility for maintaining connections until service is initiated
- Procedures for setting up an account when water service is desired at a pre-tapped location
- Penalties for failure to comply with the agreement or to connect new uses to the municipal system
- Water Department charges for tap installations and inspections

For private systems, the City of Aspen Design Standards will be followed for materials and construction.

The Water Department will provide, at the customer's expense, the tapping saddle and the corporation valve. The contractor will provide and install the approved pipe, fittings, curb valve, curb box with rod, thaw wire, and clamp. The curb valve shall be a Mueller-type (or preapproved equivalent) copper compression type. The curb box shall be a 1" Mueller type with a rod and saddle (or a preapproved equivalent).

5.1.4 Service Line Materials

Each water-service line shall be a continuous tube of Type-K copper from the tap on the main to the curb box and from the curb box to the building/structure, unless otherwise authorized in advance by the Water Department. A solid #4, or larger, copper thaw wire shall be connected to the service line at the corporation valve with a bronze clamp and laid in the service trench, separated from the service line and the curb box by a horizontal distance of 12", and attached only at the top of the curb box.

A compression-type Mueller ball-curb valve and 1" Mueller-type curb box with a rod and saddle (or a preapproved equivalent) shall be installed. Services that are 1.5" to 2" will have enlarged curb box bases and use a 1" curb box. Services that are located within a pressurized system (i.e., a portion of the water distribution system not connected to a storage tank is open to the atmosphere) shall include backflow prevention that is rated for a high degree of cross-connection hazard.

Dissimilar metals or materials containing lead will not be allowed.

5.2 Installation

5.2.1 Installation of Service Lines (3/4" to 2")

All 3/4" through 2" water services shall be installed after the water mains have been installed unless they are placed as part of a pre-tapping agreement. All water services shall be placed at least 10' away from any non-potable conduit from the main to the building. All plumbers and contractors are advised to perform a pressure test on all services. Where pre-tapping is permitted, the pressure test will include the service lines connected to the main and include the entirety of the service line from corporation valve to within the building/structure. All service lines shall be inspected by Water Department prior to backfill.

New service lines must be buried a minimum of 7' deep. The Aspen Water Department requires correct installation of service lines in full compliance with AWWA Standards. All services from 3/4" through 2" will be connected to the building using Type-K copper.

Each water-service line shall consist of a continuous tube of Type-K copper from the tap on the main to the curb box and from the curb box to the building unless otherwise approved by the Water Department.

All service lines shall be bedded with road base or washed sand from 6" below to 6" above the service line. A compression-type Mueller ball curb valve and 1" Mueller-type curb box with a rod and saddle (or a preapproved equivalent) shall be installed. Services that are 1.5" to 2" will have enlarged curb-box bases and use a 1" curb box. Services that are located within a pressurized system (i.e., a portion of the water distribution system not connected to a storage tank is open to the atmosphere) shall include backflow prevention that is rated for a high degree of cross-connection hazard. Backfill shall not be done until the line is inspected by the City's designated representative for alignment, depth, and proper bedding. Inspections of all water-system improvements shall be made each day prior to the backfill of the trench.

A solid, bare #4 copper thaw wire must be installed from the corporation valve to the top of the curb box. The thaw wire shall make contact with the water line only at the corporation valve and at the top of the curb box.

Saddle taps shall be a Mueller series DR2A with double alloy-steel straps, epoxy-coated ductile iron body, and high-strength alloy nuts and bolts (or a pre-approved equivalent).

5.2.2 Installation of Service Lines (4"+)

Services that are 4" and larger will be of DIP, and the specifications for installation will be the same as those for the main lines except that as-built drawings may be omitted at the utility's discretion. Separation from non-potable water conduits shall be the same as for water mains.

All service lines shall be bedded with road base or washed sand from 6" below to 6" above the service line. Backfill shall not be done until the line is inspected for alignment, depth, and proper bedding by the City's designated representative. Inspections of all water-system improvements shall be made each day prior to the backfill of the trench.

All service lines 4" and larger shall be reviewed, tested and inspected in the same manner as the main lines. The line shall be restrained to the first fitting inside the building, this can be accomplished via wall flanges, tie rods or other methods to be reviewed during the submittal process. All parts for service-line installations must be available for inspection prior to the start of construction. Private systems will abide by the system's pre-tap agreement.

5.2.3 Stub Outs

The City of Aspen Water Department does not allow connection to an existing "stub-out" style of pipe coming from an existing or new structure. All new service lines shall penetrate structure to maintain one solid service line, without joints or fittings, into the structure.

5.2.4 Service Line Inspection

All new service lines installed within the City of Aspen Water Distribution System shall be inspected and approved by a State of Colorado certified water professional. Upon approval, service line will be allowed back filled. Inspection must be complete before service line has been back filled.

5.3 Direct Taps

Direct taps to potable water pipelines are not allowed by the Water Department, no exceptions.

5.4 Service Line Sizing

Domestic service lines without oversizing for fire flows will use the same size pipe as the tap (source) on the main line to the discharge side of the meter. This includes all fittings and appurtenances.

Combined fire-flow and domestic service will be the same size from the main to the domestic service junction and will use a common line with a single penetration into the building. For purposes of utility billing (demand charges and tap fees), tap size will then be determined by the sizes of the meter and the piping on the domestic side.

Fire flow calculations will be required for a water service line greater than 2" or at the request of the Water Distribution Manager. This is an effort by the City of Aspen Water Department to minimize the demand and negative impacts on the water distribution system. Fire flow calculations should show:

- That a 2" service line size is not adequate for the necessary demand.
- A summary specifying proposed design and why the two inch line failed.
- Signature block certifying calculations are correct.

5.5 Common Service Lines

When separate accounts are supplied by a common service line, the Water Department must approve and record a common service line agreement. Separate controls to each service must be installed in a

mechanical room, which will remain accessible to the Water Department and to emergency workers. In the event that it is not feasible to locate separate controls, meters, and any required backflow devices in an accessible mechanical room, a special review may be made by the Water Department to meet the intent of these standards.

5.6 Owner Responsibility

It is the responsibility of the owner to maintain and repair the service line in its entirety, including the curb stop valve. Leaking service lines are the responsibility of the owner to fix and shall be repaired within 48-hours of notice by the Water Department to repair those leaking fixtures or be subject to immediate shutdown of water service in accordance with the latest revision of the City of Aspen Municipal Code.

City customers with service lines 4" and larger are responsible for service line and the first valve off of the mainline tee that connects and isolates their service from the City's water system.

5.7 Utility Investment Charge

Utility investment charges (commonly known as tap fees) must be paid before the tap will be scheduled. The tap permits and accompanying work order will state the size of the permitted tap. The Water Department requires at least 2 full working days' notice through the front office (970-920-5110) to locate a service or main line. Voicemail messages left outside hours of operation will not count towards the 2 full working days of prior notice. Taps will not be made on Fridays or on days before holidays. Billing for utility-hookup charges will be done after the work is completed.

5.8 Meter Installations

All potable and raw water services shall be metered.

Installation of water meters and remotes will be the responsibility of the property owner. All meters installed will be inspected and meet the standards as specified by the City of Aspen Water Department. It will be the responsibility of the installer to notify the Water Department to conduct an inspection when installation has been completed.

Specifications are as follows:

- All meters will be set as close as possible to the point where the service enters the building.
- Meters shall be protected from freezing.
- The installation shall be readily accessible for servicing and repairs. If a meter is installed in a crawlspace, an access panel or trap door will be provided for quick and safe access.

- All meters will be installed no more than 36" above the floor or work surface with a minimum clearance of 12" above or in front of the meter for easy visual inspection of register face.
- The meter will be the same size as the domestic service line on both the inlet and outlet sides of the meter. A .75" meter is the smallest meter allowed.
- Bypass piping around existing or future water meters shall be accepted on a limited case-by-case basis and can only be implemented if a customer has received written approval from the Aspen Water Department. Bypass piping materials and configuration shall be installed in accordance with the latest edition of the City's Water Standards.
- All applications will install an approved reduced pressure principle backflow device on both the service line and the bypass. Backflow devices shall be downstream from the meter and installed according to current or amended Colorado Department of Health regulations (Colorado Primary Drinking Water Regulations Section 12.2).

Meter vaults, meter pits, and areas defined as confined spaces are unacceptable locations for meter installations. Meter and backflow devices will be placed aboveground **inside a structure** when the water service is specifically for irrigation purposes. The owner of the account will be responsible for winterization of the service.

All installations will be set up in the following order:

- 1st – Ball valve
- 2nd – Water cop if desired
- 3rd – Pressure-reducing valve set at 80 pounds or less
- 4th – Bypass. Note: when a bypass is required, it will have a sealable valve
- 5th – Meter
- 6th – Ball valve
- 7th – Backflow preventer. Note: Second assembly may be required with a ball valve following this second assembly.

8th – Jumper wire from the inlet side of the pressure-reducing valve to the outlet side of the meter using N.E.C. standards and from the outlet side of the backflow (if a backflow is required).

Note: A “water cop” device may need to be installed after the pressure-reducing valve. Do not exceed the maximum operating pressure recommended by the manufacturer.

Sealed valves shall be maintained closed. Removal of seal will be considered evidence of unauthorized water usage (City of Aspen Municipal Code 25.16.030). All new installations, as well as “substantial remodels” (as defined by City of Aspen Municipal Code 25.12.070), shall be made to comply with current City of Aspen Standards. In addition, “old” installations that are currently non-compliant shall be made to comply as equipment fails and needs repair.

The City of Aspen is installing automated meter infrastructure (AMI) Smartpoints connected to the meter will provide read data to the utility. Smartpoints will require a 16/3 to the exterior of the building and will replace the visually read remote readout. We have chosen a fixed area network that will allow us to obtain meter readings via the internet. Data collector units (DCU) installed within our community allow us to obtain meter readings from meter transmitting units (MTUs) installed at individual properties. The MTUs will replace the remote reader that is currently on the exterior of every home and business and that is read manually each month.

Water meters installation will be the owner’s responsibility. Smartpoint installation will be completed by City of Aspen Staff.

A minimum of three low voltage wires (thermostat wire) shall installed from the area where the water meter is located to the exterior of the property. Preferably by electric and/or gas meters.

The MTU will be supplied by the City of Aspen Water Department. If the MTU is physically damaged, the property owner will be charged for the replacement MTU.

Specifications are as follows:

All meters shall be, Kamstrup Ultrasonic Water meters.

Kamstrup Water Meter Specifications for the City of Aspen (Approved for Horizontal or Vertical Installation in upward flow)

- ¾” Kamstrup Water Meter flowIQ 2100 Smart Ultrasonic Water Meter with Encoded Output (EO) with 3 bare wires from register for connection to the Aclara MTU.
- 1.0” Kamstrup Water Meter flowIQ 3101 Smart Ultrasonic Water Meter with Encoded Output (EO) with 3 bare wires from register for connection to the Aclara MTU.
- 1.5” Kamstrup Water Meter flowIQ 3101 Smart Ultrasonic Water Meter with Encoded Output (EO) with 3 bare wires from register for connection to the Aclara MTU.

- 2.0" Kamstrup Water Meter flowIQ 3101 Smart Ultrasonic Water Meter with Encoded Output (EO) with 3 bare wires from register for connection to the Aclara MTU.

For Technical Briefs please visit www.kamstrup.com

5.9 Fire Sprinkler Systems

Where a common service line is used for domestic and fire suppression systems, a separate isolation valve and backflow prevention device will be recommended for each side of the water system. For the domestic side, the requirement for backflow prevention is dependent on the presence and type of hazard based on the uses connected to the domestic side of the system. For the fire suppression side, a backflow preventer that meets the current requirements of the State of Colorado Department of Public Health is recommended. Current State Standards permit a double check valve for class 1, 2, and 3 fire suppression systems. When fire systems are filled with Glycol or any material other than air or domestic water (class 4 or 5 fire suppression systems), a reduced pressure principal device will be the standard used for connections to the City of Aspen water system. External connections for fire pumper trucks will only be provided downstream of the backflow device to prevent introduction of unknown sources of water into the municipal water system. The fire line size will be of uniform size from the corporation valve through the backflow device. Tap fees are not assessed for increased service sizes recommended for fire sprinkler systems when recommended by the Aspen Fire Marshal. Where tap fees are waived for increased service line sizes, documentation from the manufacturer or engineer will be required to determine the minimum line size necessary to provide fire suppression. All backflow assemblies shall include isolation valves on both sides of the backflow device.

5.10 What is a Cross Connection?

A cross-connection is an unprotected direct connection or an indirect connection between a potable water system used to supply water for drinking purposes and any source or system containing unapproved water or a substance that is not or cannot be approved as safe, wholesome and potable. Bypass arrangements, jumper connections, removable sections, swivel or changeover devices, or other devices through which backflow could occur shall be considered cross-connections.

5.11 Cross-Connection Control Standards

Backflow prevention devices are now required on all commercial, industrial, institutional, and irrigation connections. Once installed, these devices must be tested annually. The Backflow Prevention Education Council of Colorado provides a listing of testers by region on their website.

Cross-connections occur when the public drinking water supply is physically connected to contaminated sources (e.g., a hose submerged in a bucket or lying on the ground). Cross-

connections provide a pathway for the backflow of polluted or contaminated water into the drinking water system.

Backflow can also occur when the pressure in the public distribution system drops. Normally this pressure is high enough to prevent backflow; but certain events – such as main breaks, flushing, or firefighting – can lower the pressure enough to allow the water to flow backwards.

5.12 Prevention Devices

The type of backflow prevention device or assembly needed on a system is determined by the level of hazard posed by the owner's water use. Note: Assemblies are in-line, testable components, whereas devices are not testable system components.

In general, the City requires the following in-line testable backflow prevention assemblies:

- **Main Water Service:** reduced pressure principal backflow prevention assembly or double check valve backflow prevention assembly.
- **Fire Systems:** double check backflow prevention assembly or RP backflow prevention assembly.
- **Irrigation Systems:** vacuum breaker backflow prevention assembly or RP backflow prevention assembly.

5.13 Containment/Isolation

A backflow prevention assembly on the incoming line or service is called a containment. The assembly comes after the water meter, but before any branches or connections to the service line. Containment assemblies have been installed on service lines of multi-family and commercial accounts for the past three decades. The State of Colorado regulations require containment assemblies be tested at the time of installation, repair, relocation, and/or at least once annually thereafter, or more often when required by the authority having jurisdiction.

A backflow device installed on a residential lawn sprinkler system is an example of an isolation device. This device prevents lawn sprinkler water from getting back into the home.

5.14 Two Types of Backflow

Backsiphonage. A negative pressure that can be caused by water main breaks, fire hydrant flushing or firefighting. Backsiphonage can draw all the water from a private water system. If this water is used for boilers, sprinkler systems, etc., it could contain contaminated water.

Backpressure. This is caused by the pressure in the private water system exceeding that of the City's water system, usually because a privately owned pump is being used to increase pressure inside a single structure. This causes water to be forced back into the City's distribution system.

5.15 Mechanical Backflow Prevention

1. Pressure Vacuum Breaker Assembly – ASSE 1020 Standard

This assembly is used mainly on lawn irrigation systems. It has a one-way check and a spring-loaded air inlet valve that closes when City water main pressure drops.

Requirements:

- No backpressure
- 12" above high point of use
- Protect from freezing

2. Double Check Valve Assembly – ASSE 1015 Standard

This assembly consists of 2 tightly closing shut-off valves, 2 independently acting check valves force-loaded to a closed position, and 4 properly located test cocks.

- Used in low-hazard applications
- The DVCA provides backpressure and backsiphonage protection
- The DVCA can be used on fire sprinkler systems that do not contain chemicals – i.e., antifreeze, corrosion inhibitors, or other chemicals.

3. Reduced Pressure Principal Assembly – ASSE 1031 Standard

This assembly is used for high-hazard and low-hazard applications. The RP assembly consists of 2 tightly closing shut-off valves, 2 independently acting check valves, 4 properly located test clocks, and 1 relief valve.

- The RP assembly provides backpressure and backsiphonage protection.

Installing backflow prevention assemblies prevents the possibility of contaminated water returning to the distribution line. Please consult the Backflow Prevention Reference Manual or the Plumbing Code for installation requirements and limitations.

5.16 Backflow Prevention Overview

If you do not have a backflow device:

1. Call a plumber licensed to do work in the City of Aspen and schedule an installation.
2. Obtain a building and/or plumbing permit.
3. After the device is installed, it must be tested. Your tester is required to submit test reports to the City of Aspen. Test reports should be sent in pdf format to backflow@cityofaspen.com.

Now that the device is installed:

1. Contact a company qualified to perform backflow testing and repair. These companies are listed at the Backflow Prevention and Education Council of Colorado website, as well as being available from the City of Aspen Water Department, main phone # 970-920-5110.
2. Ask the backflow tester to send a copy of the test report to the City of Aspen Water Department, 130 South Galena Street, Aspen, CO 81611.

Next year:

1. The device must be retested. Prior to the anniversary of your test date, you will receive a reminder notice from the City of Aspen. Contact a qualified backflow tester and return the test results to the City of Aspen Water Department.

For more information about the program, please email backflow@cityofaspen.com or call 970.920.5110.

Additional Links:

[American Backflow Prevention Association](#)

[List of Approved Assemblies](#)

Chapter 6: Reuse and Irrigation Construction Standards

6.1 General

6.1.1 Purpose

This section covers providing and installing the following for reuse water lines: buried pipes, valves, meters, vaults, controls, and fittings. All materials shall be new and of the best available quality. All materials used shall be manufactured and supplied according to the latest revised standards of the AWWA, the ANSI, and the ASTM, or as mentioned hereinafter. Miscellaneous valves and fittings shall operate as called out in the drawings.

The City of Aspen publishes this Standard, which is prepared under the direction of the City of Aspen's Director of Utilities, to provide minimum design and construction criteria for any covered distribution system component that is installed within the reuse water system service area and for similar components installed outside the service area when eventual connection to the City's system is contemplated.

This design standard is intended as an engineering reference manual that contains the minimum standards for the design and construction of reuse water systems. It is intended to supplement conditions contained in reuse water service agreements adopted by City ordinances to define the engineering standards that new water systems must meet prior to acceptance.

6.1.2 Source

Similar to raw water, reuse water will be delivered via a contract to customers, who will be required to sign reuse water usage agreements.

6.1.3 Reuse and Irrigation Review

The City of Aspen or its designee will review all system design plans for the reuse water system.

6.2 Reuse System

6.2.1 Installation

Bury depth shall ensure positive drainage to a low-point drain line. This system shall be placed with a positive slope to facilitate easy draining for winterization.

6.2.2 Reuse System

The City's reuse water will be delivered through the City's reuse system. All reuse installations will be marked with purple identification tape labeled "Reuse" 2' above the line. Tracer wire will be installed for ease of location. Where there are potable and raw water lines in the same area, the new pipe (raw or potable) that is being laid at the time will also be installed with the appropriate identification tape.

Similar to raw water, reuse water will be delivered via a contract to customers, who will be required to sign reuse water usage agreements.

6.2.3 Reuse Connections

All connections will require the installation of a main line tee (to meet the main line sizing), a three-valve complex (a main-line valve on each side of the tee and a branch isolation valve), a branch sized to meet the approved flow requirements, a meter with a remote flow-control valve, and a vault for the meter and valve. The City will own the tap, main-line valves, and isolation valve. The user will own the meter vault, meter, control valve, and any additional control features. The City will have the ability to read the meter and adjust the timer on the control valve to ensure that the agreed-upon water delivery quantities are met. The user shall pay for all labor, material, and installation costs for the reuse tap and controls.

6.2.4 Customer Use

The user shall abide by State regulations pertaining to use of reclaimed or reuse irrigation water provided by the City of Aspen. The City of Aspen shall not be responsible for the user's use of the water.

6.3 Pipe Fittings and Appurtenances

6.3.5 Ductile-Iron Pipe (DIP), Fittings, and Appurtenances

DIP shall be used in vaults, pump stations, PRV vaults, in or under other reuse facilities, or where specifically approved. DIP is used with written approval from the Director of the Water Department only, as specifically addressed in the Special Construction Provisions. All DIP fittings used with mechanical joints (MJs) shall have HDPE-to-MJ adaptors where applicable. All HDPE-to-DIP fittings shall be restrained with MJ adaptors or Thermo-Weld couplings. In specifically approved installations, DIP material will be specified at the time of the proposed use and will require DIP fittings to be installed with megalugs.

6.3.6 Polyvinyl Chloride Pipe

This material is to be used for controls only. The pipe shall be similar or equal to Schedule 40 PVC and shall conform to ASTM D-1784 (Type 1 Grade 1 Cell Class 12454B, 1" through 4") unless otherwise designated in the drawings or Special Construction Provisions. The pipes and fittings shall be made from clean, virgin, NSF-approved Class 12454-A or 12454-B PVC and conform to requirements of ASTM D1784 (latest revision).

6.3.7 High-Density Polyethylene Pipe

The pipe shall meet the requirements of AWWA C901/C906, ASTM D2239, ASTM D2737, ASTM D3035, ASTM F714, and ANSI/NSF-14; have a cell class per ASTM D3350; and use Plastic Pipe Institute (PPI) listed material (TR-4) PE 4710. The pipe shall be DIP size SDR 11.0, as shown in the drawings. The pipe material shall meet the requirements of ASTM 3350 cell classification 445574C/E and have a pressure rating of 200 psi (DR 11) or greater. The pipe shall be JM Eagle HDPE PE4710 or equivalent. Depending on location and previous design standards, the specification will generally use DIP-size HDPE. Some

locations will use IPS sizing, however. The contractor shall confirm the existing DIP or IPS sizing prior to design approval and make connections by potholing or by another form of identification prior to ordering materials.

The fittings shall be standard commercial products manufactured through injection molding or extrusion and machining, or they shall be fabricated from AWWA C901/C906 pipe conforming to this specification. For each project, all fittings shall be provided or recommended by the pipe manufacturer. The fittings shall be manufactured from the same (or better) resin, grade, and cell classification as the pipe itself. The fittings shall be fully pressure-rated by the manufacturer to provide a working pressure equal to that of the pipe. The manufacture of the fittings shall be in accordance with good commercial practice to provide fittings that are homogeneous throughout and free from cracks, holes, foreign inclusions, voids, and other injurious defects. The fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties. The minimum quick-burst strength of the fittings shall not be less than that of the pipe with which the fitting is to be used. All fittings shall be pressure tested by the pipe/fitting manufacturer to the specifications and requirements of AWWA C901/C906.

Alternative fittings that will be accepted for construction with high-density polyethylene pipe include:

- 1) Epoxy-lined (polyethylene-encased) ductile fittings used in combination with welded MJ adapters (provided at the contractor's expense), as manufactured by Central Plastics or Chevron Phillips (or an approved equivalent)
- 2) Electro-fused fittings as manufactured specifically for HDPE pipe by JM Eagle, Drisco Pipe, Frialen, or Central (or an approved equivalent)
- 3) Fused, welded HDPE fittings welded directly onto the existing pipe

6.3.8 Transitions

Transitions from HDPE to DIP may be accomplished through the use of the following products:

- 1) Epoxy-lined (polyethylene encased), cast iron, or ductile reducers used in combination with a welded MJ adapter as manufactured by Central Plastics or Chevron Phillips (or an approved equivalent)
- 2) HDPE-fused diffusers, welded MJ transition adapters, or Drisco pipe (or an approved equivalent)

Use of megalugs on HDPE pipe is not allowed.

6.3.9 Pipe Identification

Each length of pipe and all fittings shall have marked on the exterior the following:

1. Manufacturer's name or trademark

2. Nominal pipe size and dimension ratio
3. HDPE cell classification (e.g., PE 345434C)
4. Legend – Type C901/C906 pressure pipe
5. PE 4710 or other applicable designations
6. Color-coded stripe (e.g., purple to designate raw or reuse irrigation)

6.3.10 Pipe Jointing

Joints shall be made through heat fusion or MJ adaptors. Use welded MJ adaptors (DIP to HDPE fittings) at all required tees, bends, and transitions from HDPE to DIP. HDPE-welded bends or tees are allowed. HDPE pipeline requires # 10 tracer wire to be installed with the pipeline along with locator boxes and locator tape. See the Reuse Water System Standard Detail Drawing, which is part of these specifications, for more information regarding installation information and details.

6.3.11 Thrust Restraint

Mega-Lugs as defined in section 6.3.8 and one other form of restraint are required for any and all fittings. Concrete Thrust Blocks as defined below are preferable, however where disturbed soils or space constraints exist Cor-Ten Rods (or equivalent) will be reviewed as a second form of restraint.

Concrete thrust blocks shall be formed and poured in place as a second form of restraint on fittings, including taps 4" or larger, to resist hydraulic thrust. Thrust blocks shall be sized based on sound engineering judgments and will be subject to review by the City of Aspen if needed. A poly wrap bond breaker shall be installed between concrete and all pipes or associated appurtenances.

Where designated in the drawings and where existing conditions do not permit the use of concrete thrust blocks, fitting restraints shall be made with tie rods and either pipe clamps or special fitting bolts. Tie-rod restraint systems shall have a minimum of 2 rods per joint or clamp subject to review during the permit process.

The tie bolts shall be fabricated from a Cor-Ten steel or equivalent, according to the requirements of ASTM A242, with a minimum yield stress of 46,000 psi. Retainer clamps shall be equal to socket clamp Figure 595, as manufactured by ITT-Grinnell or equivalent.

6.3.12 Mechanical-Joint Retainer Glands

On all fittings, restraint shall be made with MJ retainer glands. These glands shall be cast from 60-40-12 ductile iron and shall have bolt circles, bolt holes, and dimensions that will permit the glands to be used with standard MJ bells and standard-length bolts, as per ANSI A21.11 and AWWA C111. All special tools recommended by the manufacturer shall be used during installation, supplied to the owner, and designated in the required operations and maintenance manual. Mega-lug retainer glands shall be manufactured by EBAA Iron, Inc., Series 100 (or approved equivalent).

6.4 Gate Valves

Gate valves for buried pipelines 2" and larger shall use a Mueller (or preapproved equivalent) iron-body, bronze-mounted, resilient seat; conform to AWWA C509 for buried service; open counterclockwise; have a non-rising stem and 2" operating nut; and use a working pressure of 250 psi.

The joints for valves connected to the ductile iron shall be MJs in accordance with ANSI A21.11. All gaskets shall be for standard water service.

Valves greater than 12" will be specified and evaluated by the Water Department on a case-by-case basis.

6.5 Valve-Box Assemblies

Valve-box assemblies shall use Tyler Pipe 3-piece cast iron valve boxes. Assemblies shall accommodate 4" through 12" valves. Valve shaft shall be 5.25" shafts and screw types 6850 Series-668-S and/or 6865 Series-F with complete extension of 62" to 82". The difference between the boxes is primarily in the base type. The parts for the different valve boxes must be interchangeable. Lids for reuse or irrigation shall be marked "REUSE." Where the valves are greater than 9' deep, solid pipe must be used instead of sectional valve boxes.

6.6 Valve-Key Extensions

All reuse system valves shall have extension rods with centering rings and set screws. Extensions shall be to within 12" of the finished grade on all valves.

6.7 Air/Vacuum Valves and Vaults

Design and installation of air release valves and associated vaults must be approved by the Water Department and will be evaluated on a case-by-case basis.

6.8 Reuse and Raw Water Meters

Meters shall be magnetic meters as manufactured by Badger (or equivalent). Connections shall be 150-pound flanges. The meters shall have an accuracy of 0.5% of the measured reading. A Badger Recordall® Reclaimed-Disc Turbo Meter with Remote Readout shall be provided. The meter shall be supplied with a lavender lid with the word "RECLAIMED" cast or engraved on the meter's body, printed on the register dial, and cast or engraved on the bronze covers or bottoms. A non-potable symbol shall be placed on the register lid, and the chamber assembly shall be designated as non-potable only. The signal converter shall be remotely mounted up to 300' from the meter. A local indication shall be displayed on the flow computer. The meter shall be sized to meet the flow demands for accurate readings.

The meter shall be capable of having a control signal installed to deliver the meter reading to a remote location through radio signals. The output shall be from 4 to 20 mA. Due to system requirements, no equivalent shall be accepted.

6.9 Excavation, Bedding, and Backfill

6.9.1 General

Trench excavation shall be performed in accordance with the requirements of the latest revision of the City of Aspen's Engineering Standards.

All bedding and backfill material shall be free of frozen material, organic material, and debris. The materials to be used in each trench zone are indicated on the Water Main Trench Cross-Section Detail as shown on the Water Distribution System Standards Installation Details drawing; these materials are described herein.

6.9.2 Bedding/Pipe Zone

The bedding zone shall consist of all material placed below the pipe invert. The pipe zone shall consist of all material placed above the pipe invert to the specified elevation. The bedding/pipe zone material shall be placed for the full length of the pipeline. The bedding/pipe zone material shall be $\frac{3}{4}$ " screened rock that has been hauled in for bedding – not native excavated material. The material shall extend from 6" below the pipe and bells to 12" above the top of the pipe and bells, and it shall extend for the full width of the excavated trench. Tamping equipment shall be used to thoroughly tamp the material to a minimum of 95% maximum dry density or 75% relative density. The moisture content of the material shall be within 2% of optimum.

6.9.3 Backfill Zone

The backfill zone shall consist of all material above the pipe zone. Fabric shall be installed between the screen rock and all other backfill material. Follow CDOT, Pitkin County, and City of Aspen ROW specifications for backfill and compaction within the ROW or where asphalt is to be placed above the pipeline trench.

Compaction shall be completed by mechanical tamping of 12"-maximum loose lifts using mechanical tampers or vibratory rollers. All other means must be approved in writing by the engineer. All backfill shall be compacted to 95% of maximum laboratory dry density (ASTM D698) or to 75% relative density (ASTM D2079). The material shall be within 2% of optimal moisture content.

The contractor may request approval of alternate means of compaction. Such a request must be submitted to the engineer in writing. The engineer will approve the compaction method in writing only. Use of specified or approved compaction methods does not relieve the contractor from providing a completed project that meets the intent of this specification.

Native backfill material shall consist of suitable material from the excavated earth. No rocks or boulders shall be allowed in the first 24" of the trench above the pipeline. The backfill material above the first 24" of the trench shall have no boulders larger than 6" in any dimension and shall be carefully placed so that no damage will be done to the pipeline. Native backfill shall be used to finished grade if trench excavation occurs in open-field conditions.

Engineered backfill material shall be road-base, Class 6 aggregate base course.

6.9.4 Testing and Inspection

Prior to backfilling, all waterlines and appurtenances shall be inspected and approved by the City. All materials shall be subject to gradation and compaction tests prior to approval. The test results shall be submitted to the City for approval and verification of their accuracy. The contractor shall bear the costs of these tests.

Compaction requirements shall conform to the measurements of maximum dry density according to ASTM D698 (Moisture-Density Relations of Soils [Standard Proctor]). Should ASTM D698 not be suitable for the material placed, the compaction requirements shall conform to ASTM D2049 (Test for Relative Density of Cohesionless Soils).

When the City requires it, the contractor shall excavate backfilled trenches for the purpose of performing compaction tests at the required locations and depths. The contractor shall be responsible for reinstalling and compacting the test excavations at no additional cost to the City.

Minimum compaction testing frequency for pipelines shall be one compaction test per 150 linear feet of piping and wherever piping is within 2-feet of structures. A compaction single test shall contain two samples per lift.

6.9.5 Road-Base Material Specification

The road-base material shall be Class 6 aggregate base course, as specified by the State of Colorado Department of Transportation (CDOT); the material shall meet the following gradation:

Aggregate Base Course – CDOT Class 6 Gradation	
Sieve Size	Total Percentage Passing By Weight
3/4"	100%
# 4	30% – 65%
# 8	20% – 55%
# 200	3% – 12%

6.9.6 Screened Rock Material Specification

Granular or granular backfill material shall be imported crushed rock or angular surfaced gravel and shall meet the following gradation (ASTM D448, m 67):

Granular Bedding Gradation	
Sieve Size	Total Percentage Passing By Weight
3/4"	100%
3/8"	22% – 55%
# 4	10%
# 8	5%

6.10 Testing and Flushing

6.10.1 Fusion Quality

The contractor shall ensure the field setup and operation of the fusion operator's fusion equipment and procedure while on site. Upon the owner's request, the contractor shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; test straps shall then be cut out and bent-strap tested in accordance with ASTM D 2657. If the bent-strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The contractor, at his or her expense, shall make all necessary corrections to the equipment and the setup, operation, and fusion procedures; the contractor shall then remake the rejected fusions.

6.10.2 Leak Testing

As a normal procedure, new pipelines shall be flushed and tested before connection to the existing system. When new pipelines are allowed to be connected to an existing pipeline, the following sequence shall be followed: flushing, leakage and pressure tests, and conductivity tests. Failure at any step shall require that each item be repeated until all are accepted. The engineer shall be notified at least 48 hours before the pipe is to be tested so that he or she may be present during the test. Lines shall be tested to a minimum of 150% the anticipated working pressure of the line, with a minimum test pressure of 150 psi. The contractor shall remove all air prior to testing the line. Testing shall be performed at the high point of the line unless otherwise approved.

6.10.3 Pipeline Flushing

The contractor shall flush the pipelines as the work progresses in accordance with good practices to ensure that sand, rocks, and other foreign materials are not left in the pipelines. If possible, the flushing shall be made through an open pipe end; otherwise, use of the service line may be acceptable – but only with the engineer's approval.

Chapter 7: Ditches

7.1 Alteration of Ditches

Ditches may not be altered or restricted without the approval of the City Engineering, Water Department, Aspen Parks Department, and/or Golf Department. This includes but is not limited to the rerouting of a ditch, the addition or removal of culverts, and the creation of ponds for a home irrigation system that uses a stilling well as its water source.

7.2 Clear Ditch Bottom

With the exception of ditches located in the west end of Aspen, where 12" of clear ditch bottom shall be required, it shall be unlawful for any person to place any material in a ditch so as to create a ditch with less than 24" of clear ditch bottom.

7.3 Landscaping along Ditches

A ditch in the public ROW may not be newly landscaped, and current landscaping may not be altered, unless a landscaping plan is submitted to the City of Aspen and a landscaping permit is issued by the Aspen Parks Department, Water Department, or Golf Department.

7.4 Culverts and Ditch Liners

Prior to installation, culverts and ditch liners shall be approved by the Parks Department, Water Department, or Golf Department. Culvert installation and replacement shall be completed at the expense of the homeowner. No culverts or ditch liners shall be approved near large trees. Any pipe that is to be used for replacement or new installation shall be ADS-N-12 or equivalent. The pipe shall be installed with a minimum slope of .50. The size shall be determined by flow-capacity charts; however, the pipe shall not be smaller than 8" in diameter. In no situation can culverts, ditch crossings and/or bridges reduce the potential flow, either by grade change or sizing, of a ditch. Whenever possible, ADS-N-12 installation specifications shall be met for bury depth and compaction. When specifications cannot be met, flow-fill shall be used. Pipes shall be installed with water-tight couplings.

7.5 Access by City Employees

Landowners shall provide City employees with free, unrestricted access to all ditches for reasonable maintenance of the ditches. The City shall not be legally responsible for damage to landscaping resulting from either reasonable maintenance or emergency repairs.

7.6 Violations and Work Done: Liability Therefor

(a) In the event of any person failing to comply with this chapter's ditch ordinance provisions, COA staff may – as soon as practicable after such failure – correct the situation.

(b) The COA Staff shall ascertain and keep a record of the exact cost of all work that he or she initiates in accordance with this section on account of each act or the omission of each responsible party. The COA Staff shall also identify the responsible party with particularity.

(c) The cost of work done in accordance with this section, plus a penalty of 100% of such cost, shall be charged against the land abutting the ditch where such work was done as a municipal lien; this lien shall be collected in the same manner as City taxes. Alternatively, such costs and penalty may be recovered by the City in a lawsuit against the owner or the person whose act or omission made it necessary for such work to be done.