DIVISION B - WATER DISTRIBUTION SYSTEM

B 1.00 – GENERAL

B 1.01 PURPOSE

The purpose of these *Water Distribution System Engineering Standards* is to provide a consistent policy under which certain physical aspects of water distribution design will be implemented. Most of the elements contained in this document are Public Works oriented. The intent is that these *Engineering Standards* apply to both City-initiated projects as well as private development of public infrastructure.

These *Engineering Standards* cannot provide for all situations. They are intended to assist, but not to serve as a substitute for competent work by design professionals. Engineers are expected to bring the best of skills from their respective disciplines to each project. If the Engineer anticipates challenges in meeting these *Engineering Standards*, they should contact the City prior to extensive design efforts.

These *Engineering Standards* are not intended to limit any innovative or creative effort that could result in better quality, better cost savings, or both. Any proposed departure from the *Engineering Standards* will be judged, however, on the likelihood that such variance will produce a long-term compensating or comparable result, in every way adequate for the user and resident. Any departure from these standards shall only be allowed by the approval of the City Engineer.

These *Engineering Standards* have the objective of developing a water distribution system that will:

A. Be consistent with the adopted water master plan.

B. Be of materials strong enough to resist all expected loads, both internal and external, and able to preserve the potability of the water supply.

C. Provide a water distribution system that is consistent and predictable.

D. Be economical and safe to build and maintain.

B 1.02 REVISIONS TO THESE ENGINEERING STANDARDS

Revisions to these *Engineering Standards* will likely be made from time to time. The date appearing on the title page is the date of the latest revision. Users should apply the latest version to the contemplated work.

B 1.03 SHORTENED DESIGNATION

These City of Millersburg Water Distribution System Engineering Standards will be referred to in the text as the "*Engineering Standards*."

B 1.04 APPLICABILITY

These *Engineering Standards* shall govern construction and upgrading of all public water system facilities in the City of Millersburg including applicable work within its service areas.

B 1.05 REFERENCES

These Engineering Standards are intended to be consistent with the most currently

adopted provisions of:

A. *Millersburg Municipal Code*

B. *Millersburg Comprehensive Plan*

C. Master Facility Plans

D. *Oregon Administrative Rules* Chapter 333

B 1.06 CITY OF MILLERSBURG STANDARD CONSTRUCTION SPECIFICATIONS

The City of Millersburg has adopted the City of Albany's *Standard Construction Specifications*. Except where the *Engineering Standards* provide otherwise, design detail, workmanship, and materials will be in accordance with the current edition of the City of Albany's *Standard Construction Specifications.*

B 1.07 DEFINITIONS AND TERMS

A. Approved Backflow Prevention Assembly: An assembly that has been investigated and approved by the State of Oregon Department of Human Resources Health Division for preventing backflow.

B. As-Built Drawings: Final project drawings that have been revised by the Engineer to reflect as-built construction conditions.

C. City: The City of Millersburg, Oregon.

D. City Engineer: The City Engineer of the City of Millersburg or his/her authorized representative.

E. Cross Connection: Any connection or arrangement, physical or otherwise, between a potable water supply system and any plumbing fixture or any tank, receptacle, equipment, or device, through which it may be possible for non-potable water, or other substances, to enter into any part of the potable water system under any condition.

F. Definition of Words: Wherever, in these *Engineering Standards*, the words directed, required, permitted, ordered, designated, or words of like importance are used, they will be understood to mean the direction, requirement, permission, or order of designation of the City Engineer. Similarly, the words approved, acceptable, and satisfactory will mean approved by, acceptable to, or satisfactory to the City Engineer.

G. Distribution System: Distribution main pipelines, pumping stations, valves, and associated equipment used to transmit water from the supply source to the service line.

H. Double-check Valve Assembly: An assembly composed of two single, independently acting, internally-loaded check valves, four properly located test cocks, and two tightly closing isolation valves.

I. Double-Detector Check Valve Assembly: A line-sized approved, double-check valve assembly with a parallel meter and meter-sized approved, double-check valve assembly. The purpose of this assembly is to provide double-check valve protection for the distribution system and at the same time provide partial

metering of the fire system showing any system leakage or unauthorized use of water.

J. Dwelling Unit: A facility designed for permanent or semi-permanent occupancy and provided with minimum kitchen, sleeping, and sanitary facilities for one family. This definition is specific to these Engineering Standards and is not intended to be used as a definition for billing purposes.

K. Easement: Land upon which the City has obtained the right, from a private property owner or other public entity, to construct, own, and maintain the public water system.

L. Engineer: The Engineer, including the City's Engineer, shall be a professional engineer licensed in the State of Oregon, under whose direction the plans, profiles, details, and specifications for the project work are prepared and submitted for City review and approval.

M. Fire Protection Service: A connection to the public water main intended only for extinguishing fires and for flushing the system as necessary for its proper maintenance.

N. Irrigation Service: A metered connection, with an approved backflow prevention device, intended for seasonal use and delivering water that is not discharged to the sanitary sewer.

O. Multiple Family Dwelling: A building or portion thereof designed for occupancy by two or more families, living independently of each other. This definition is specific to these Engineering Standards and is not intended to be used as a definition for billing purposes.

P. Plans: Engineering design construction drawings, which depict the location, character, dimensions, and details of the water distribution system to be constructed or rehabilitated.

Q. Potable Water: Water that is satisfactory for drinking, culinary, and domestic purposes and meets the requirements of the health authority having jurisdiction.

R. Private Distribution System: A privately-owned and maintained water distribution system serving an industrial or commercial subdivision or a multi-building development on a single lot served through a master meter and backflow prevention assembly installed at an approved location.

S. Residential User: The owner, lessee, or occupant of a single dwelling unit in one structure.

T. Right-of-Way (ROW): Land or interest therein that by deed, conveyance, agreement, easement, dedication, usage, or process of law is reserved for or dedicated to the use of the general public, within which the City shall have the right to install and maintain water mains and related appurtenances.

U. Roadway: That portion of the right-of-way used, or to be used, for vehicle movement, which exists between the curbs or proposed curb lines.

V. Service Line: The public portion of the water service line connecting the City water main to the water meter.

W. Single Family Dwelling: Any residential building designed to house one family. This definition is specific to these Engineering Standards and is not intended to be used as a definition for billing purposes.

X. Standard Drawings: The drawings of structures or devices commonly used on City work and referred to on the plans. The Standard Drawings are contained within and considered a part of the *Standard Construction Specifications*.

Y. Uniform Plumbing Code: Uniform Plumbing Code adopted by the International Association of Plumbing and Mechanical Officials, current edition as revised by the State of Oregon, called the *Oregon State Plumbing Specialty Code*.

B 1.08 SPECIALTY ITEMS

The design of the following items is considered non-standard and unique. They are not covered in detail in this Section:

A. Water Distribution Pump Stations

B. Reservoirs

C. Relining of Existing Water Mains

D. Treatment Plants

E. Pressure Regulating Devices

F. Flow Measurement Devices

Review and approval of the above special projects by the City Engineer will be required. When requested by the City, full design calculations will be submitted for review prior to approval. Items A, B, and D also require approval by the Health Division of the Oregon Department of Human Resources.

B 2.00 – SYSTEM DESIGN AND SIZING CRITERIA

B 2.01 GENERAL DESIGN CONSIDERATIONS

Water distribution systems shall be designed to accommodate maximum development of the service area with recognition of possible industrial expansion, etc. Systems shall be designed to provide for future extension with minimal disruption of existing service.

As a condition of water service, developments will be required to provide public water mains of sufficient size for consumption and fire protection to adjacent parcels. This will include the extension of water mains in easements across the property to adjoining properties and across the street frontages of the property to adjoining properties when the main is located in the street right-of-way. Property with multiple frontages will be required to extend water along all frontages. Service lines or laterals, as required, will be extended to vacant lots if street overlays or reconstruction is contemplated.

Design capacities will meet requirements of the current master plan and will be determined by consideration of the following factors and assumptions:

A. Area to be served, both immediate and adjacent.
B. Current and projected population within the areas to be served.
C. Current and projected land use within the areas to be served.
D. Commercial, industrial, or institutional users to be served.
E. Changes in any of the above factors that are likely to occur within a foreseeable time period.

B 2.02 WATER SYSTEM CAPACITY

The system will have sufficient capacity to maintain 40 PSI at the building side of the meter for one- and two-family dwellings. For other developments a minimum pressure of 35 PSI will be provided at the building side of the meter during periods of maximum day demand, and to provide the required volumes of water at adequate pressures to satisfy the expected maximum daily demand plus fire flows, as defined hereinafter. Normal working pressure in the distribution system should be approximately 60 PSI with a range of 40 PSI to 80 PSI. Any isolated locations with pressure above 80 PSI require a Pressure Reducing Valve (PRV) on the customer side of the meter.

NOTE: A pump will not be used on a service line to provide adequate pressure to a subdivision lot or property located above the pressure level of the supply main.

Head loss will be determined by the Hazen-Williams equation. Table B 2.02-A provides the "C" values that are to be used on various pipe diameters for in-service mains.

Table B 2.02-A

Pipe Diameter	C Value
8 Inches and Less	100
10 to 12 Inches	110
Greater than 12 Inches	120

Velocities and head loss will meet the requirements outlined in Table B 2.02-B.

Table B 2.02-B

Line Type	**Max. Velocity** (ft./sec)	**Max. Head Loss** (ft./1000 ft.)
Distribution	10	10
Transmission	5	3

A 20 PSI residual pressure under fire flow conditions will be maintained in the distribution system.

In the absence of consumption data or other reliable information, the following factors are assumptions that should be used to calculate demands:

A. Peak hour demands are as follows:

Single Family Residence	0.75 gpm
Residential	0.25 gpm per person
Commercial Development:	
Light	4,500 gal/ac/day
General	7,500 gal/ac/day
Industrial Development:	
Park	3,000 gal/ac/day
Light	3,250 gal/ac/day
Heavy	6,300 gal/ac/day

B. Demand for unique commercial installations, industrial users, Planned Unit Developments (PUDs), multiple, and institutional facilities will be calculated on an individual basis.

C. Fire flows are to be as follows:

Table B 2.02-B

Land Use	**Fire Flows (GPM)**	**Duration (Hr.)**
Industrial	5,000	4
Commercial	3,500	3
Multiple Family	3,500	3
Residential	1,500	2
Mixed Use	3,500	3
Schools	5,000	4
Institutional	3,500	3

B 2.03 MAIN CLASSIFICATION

A. Transmission Mains (16-inches and larger). Mains used for transporting water from the source of supply and storage reservoirs to the distribution system and distribution reservoirs. Some transmission lines serve a dual purpose as distribution lines also to avoid the need for multiple lines in one location.

B. Distribution Mains (12-inches and smaller). Mains that are used for supplying the individual consumer.

B 2.04 SIZE OF PIPE

Standard pipe sizes for distribution and transmission mains will be 4-inch, 6-inch, 8-inch, 12-inch, 16- inch, 20-inch, 24-inch, and 30-inch. Approval of the City Engineer is required for use of 4-inch and 6- inch diameter lines. Designs requiring pipe sizes larger than 30-inch will be reviewed on a case-by-case basis.

Table B 2.04-A

Minimum Pipe Size	Use
1-inch & 2-inch Copper or HDPE	For services only. 1-inch is minimum size for domestic services and is used for ¾-inch and 1-inch meters. 2-inch services are minimum size for 1½-inch and 2-inch meters.
4-inch & 6-inch Ductile Iron	• Fire Sprinkler Service Lines • Dead-end streets • No contemplated extension of the water main • Serving 12 or less residential properties • No requirement for fire hydrants
6-inch Ductile Iron	Fire hydrant lines off of minimum 8-inch distribution lines.
8-inch Ductile Iron	Residential zoning distribution water mains for a looped system, not to exceed an unsupported length of 600 feet and will not be *permanently* dead-ended. Looping of the distribution grid will be at least every 600 feet.
12-inch Ductile Iron	Commercial, multi-family, and industrial zoning.
16-inch Ductile Iron and larger	As required for specific development demands or transmission mains.

B 3.00 - PHYSICAL DESIGN REQUIREMENTS

B 3.01 MATERIALS

New water main pipe will be ductile iron with push-on joint end configuration. Design details, including pipe specifications, for bridge crossings, stream crossings, pipe installed in casings, and other special situations will be developed on a case-by-case basis.

Bends will be limited to 11.25, 22.5, and 45 degrees. Ninety-degree bends are not permitted. Wherever possible, fittings will utilize mechanical joint and flange end configuration.

B 3.02 THRUST RESTRAINT

In applications requiring thrust restraint, new water mains shall be constructed of ductile iron with an internal, push-on joint restraint system. New water mains will not be restrained externally with concrete reaction blocking without specific approval of the City Engineer (see *Standard Construction Specifications*).

Calculations for determining restrained lengths of pipe to protect specified bends and other assemblies will be based on the following general parameters: 1) minimum 2:1 safety margin, 2) minimum 150 PSI test pressure, 3) three (3) feet of cover, and 4) marginal trench and backfill conditions.

Table B 3.02-A Minimum Restrained Pipe Lengths (feet)

	FITTING TYPE							
PIPE	11.25°		22.5°		45°		90°	DEAD END
SIZE	HORIZ	VERT	HORIZ	VERT	HORIZ	VERT	HORIZ	HORIZ
4"	2	3	4	7	9	14	21	35
6"	3	5	6	10	12	20	30	49
8"	4	6	8	13	16	27	39	64
10"	5	8	9	15	20	32	47	77
12"	5	9	11	18	23	37	56	90
16"	7	11	14	23	30	48	72	115
20"	9	14	17	28	36	58	87	140
24"	10	16	20	32	42	67	101	162

Source: EBAA restraint design calculation software

Notes: 1. Dead end also is used for branch runs of tees
2. Vertical value should be used for upper fitting, horizontal value can be used for lower fitting
3. Restraint length required for reducers shall be calculated on a case-by-case basis.

B 3.03 WATER MAIN CONFIGURATION

The distribution system mains will be looped at all possible locations. The installation of permanent dead-end mains providing fire protection and/or serving large areas will not be permitted.

Developments will be required to extend mains across existing or proposed streets for

future extensions by the City or other developments. Property with multiple frontages will be required to extend water along all frontages. Terminations will be planned and located such that new or existing pavement will not have to be cut in the future when the main is extended.

Tie-ins to existing, non-standard water mains (as to size and material) will be configured for future extension with minimal impact on local water service (see *Standard Construction Specifications*). Tie-ins to existing water mains not contemplated for replacement will be made with 22.5 or 45 degree bends. The City does not allow the use of 90 degree bends.

B 3.04 MINIMUM DEPTH

The minimum cover will be 36 inches as measured from finish surface grade to the top of the water line. However, potential final finish grades for unimproved areas may require the water line to be designed at a greater depth than 36 inches. Consideration also must be given to construction loads that may affect system integrity for projects involving street construction over new and existing water mains.

B 3.05 LOCATION

A. Relation to Other Utilities. Water lines will be separated from other utilities in accordance with OAR 333. If during design conflicts with existing utilities are identified when trying to achieve the minimum depth requirement listed in B 3.04 MINIMUM DEPTH, deflection will be allowed, within the manufacturer's specifications, up to a maximum trench depth of five feet. Beyond five feet, deflection will be evaluated on a case-by-case basis. Vertical bends may be required in lieu of deflection. Neither deflections nor bends will be accepted as a means of avoiding other utilities proposed with the new construction.

B. Water Mains Within Street Right-of-Way. The standard location for water mains will be within public right-of-way on the north and east sides of streets, 10 feet from the street center line (see *Standard Construction Specifications)*. Exceptions to these requirements may be made in order to avoid conflicts with other existing underground facilities, and to permit sanitary sewers to be installed on the low sides of streets.

   Generally, mains shall not be installed in alleys. Wherever possible, mains will be installed on a particular street at a constant distance from the curb. On curved streets, mains may be laid on a curve concentric with the street centerline with deflections no greater than the manufacturer's specifications, or mains may be laid in straight lines along the tangent between selected angle points to avoid conflicts with other utilities. The angle point and tangent section will not be less than 3 feet in front of the curb face.

B 3.06 SURFACE WATER CROSSING

Surface water crossings of mains will be in accordance with OAR 333 and the following:

A. Mains crossing streams or drainage channels will be designed to cross as nearly perpendicular to the channel as possible.

B. Surface water crossings will be reviewed on a case-by-case basis. Some crossing may require the installation of a casing.

C. The minimum cover from the bottom of the stream bed or drainage channel to the top of pipe will be thirty-six (36) inches. However, this cover requirement may be increased for surface crossings in which channel erosion is a concern.

D. Specifications for scour pads (scour protection for the stream bed over the pipe) will be site specific and will be determined by the City Engineer.

E. Valves will be installed on either side of the crossing and a service will be installed between the valves to facilitate testing and sampling.

B 3.07 VALVES

A. Sizes. Valves will be the same size as the mains in which they are installed. Gate valves will be used for applications 8-inch and smaller and butterfly valves for 12-inch and larger.

B. Location. Distribution system valves will be located at the tee or cross fitting. There will be a sufficient number of valves located such that not more than four (4) and preferably three (3) valves need to be operated to effect any one particular shutdown. The spacing of valves will be such that the length of any one shutdown does not exceed 500 feet.

   Tee intersection will be valved on the branch and one run, and a cross-intersection will be valved on both branches and one run as a minimum. Transmission water mains will have valves at not more than 2,000-foot spacing. Crossings, such as creek, railroad, and freeway crossings, will be valved on each side. The valves shall be restrained and located far enough away from the casing such that the pipe in the casing can be removed and replaced between the valves.

C. Phased Construction. Water mains installed by phased construction, which will be extended in the future, will terminate with a permanent blowoff assembly.

B 3.08 BACKFLOW PREVENTION

Where required, privately maintained backflow prevention devices will be installed to meet *Oregon Health Division Standards*.

B 3.09 FIRE HYDRANTS

A. Spacing. Hydrant spacing will be 500 feet or less in residential areas, 300 feet in commercial districts and industrial subdivisions and, in all cases, no further than 250 feet from any dwelling, business, garage, or building. Heavy industrial areas may require closer spacing of hydrants as determined by the Fire Department.

B. Location. Fire hydrant assemblies will be installed on 8-inch or larger mains. Hydrants will be located as nearly as possible to the corner of street intersections and at least 200 feet from any cul-de-sac radius point. No hydrant will be installed within five (5) feet of an existing utility pole or guy wire.

B 3.10 AIR/VACUUM RELEASE VALVES

Water lines will be designed to minimize the need for air/vacuum release valves. When required, an air/vacuum release valve will be permanently installed at high points on water mains where air can accumulate (see *Standard Construction Specifications*).

B 3.11 SERVICE LINES

A. Sizes. The sizes of service lines that may be used are 1-inch and 2-inch copper or HDPE, and 4-inch, 6- inch, 8-inch, 10-inch, and 12-inch ductile iron. Service lines will be reviewed for effects on the distribution system and, notwithstanding existing system configuration, will not be greater in size than the distribution main.

   Service piping will be equal to or greater than the meter size; however, 3-inch meters require a 4- inch tap and 4-inch minimum piping and fittings.

B. Location:

   1. Domestic: The service lines will extend from the main to the property line, with the curb stop, meter, and meter box being located at the termination of the service. In general, individual service lines will be perpendicular to the main and will terminate in front of the property served. Domestic service lines will not be connected to the private side of fire protection services. Combined services, with the domestic service connected to the public side of the fire service, is encouraged in some instances.

   2. Fire Service: The fire service line will extend perpendicular from the main to the property line with the backflow prevention assembly and vault being the termination of the service. The backflow assembly shall be located outside of the public right-of-way. Additional valving is required to delineate the public and private portions of the fire service lines.

C. Abandonment. Services and lines to be abandoned will be removed completely back to the line that will remain in service.

B 3.12 METERS

A. Installation:

   1. For new water systems in undeveloped areas, the meters will be installed by the City through the water meter permit process as development occurs.

   2. For water system reconstruction or replacement, existing meters will be removed and replaced by the contractor as directed by the City.

B. Location:

   1. Three-quarter (¾)-inch through 2-inch meters will be located at the termination of the City service line. Meter boxes will be located in the sidewalk. Meters will not be located in the same vault with a backflow prevention device.

   2. Three (3)-inch and larger meters will be installed in vaults and will be located in the public right-of-way to allow easy reading and maintenance without entering private property. The vault will be accessible by a crane truck to within ten feet of the installation with a ten-foot vertical clearance over the vault. Provision will be made for a minimum 3-foot clear space around the vault to provide ample working space for maintenance. The vault will be located such that storm water will not pond or flow into the installation.

B 3.13 MANUFACTURED HOME PARKS AND PLANNED UNIT DEVELOPMENTS (PUD)

The review of plans and the inspection of mobile home parks and planned unit

developments are under the jurisdiction of the City of Millersburg Building Department. Private distribution systems will be designed in accordance with the Oregon Plumbing Specialty Code.

Public water mains within manufactured home parks and planned unit developments will be in exclusive easements to the City of Millersburg.