

SECTION 556 - POTABLE WATER SYSTEM DESIGN STANDARDS

PART 1: GENERAL

1.1 GENERAL

All potable water distribution systems which are to be extensions to the ECUA system shall be designed and constructed in accordance with these Standards. Potable water distribution systems include transmission and distribution mains, service lines, valves, fire hydrants, meters and other appurtenances. Water system materials, installation, and construction methods and procedures shall be in accordance with current ECUA Specifications. Technical Specifications for Water Transmission, Distribution and Service Lines are included in Section 2556 of this Manual.

1.2 MINIMUM REQUIREMENTS

Proposed extensions to the water distribution system shall be considered minimum requirements, unless otherwise noted. The Design Standards outlined in this Manual are intended to provide an adequate supply of potable water to consumers, and fire protection at all times, at pressures and flows as required by Code.

All proposed system expansions shall be compatible with the Water Master Plan as maintained and amended by ECUA.

1.3 DEVIATIONS

Deviations from these Standards may be allowed by ECUA upon a finding by ECUA that, in accordance with sound engineering principles, the granting of the deviation will not result in an increase in the likelihood of a system failure. Proposed deviations shall be clearly noted on the Construction Plans and explained in an Engineering Report prepared by the Engineer-of-Record. Subsequent approval of proposed deviations from these Standards is at ECUA's sole discretion.

PART 2: OTHER STANDARDS

2.1 GENERAL

ECUA's Potable Water System Design Standards may differ from the requirements of other local, state, and federal agencies. The more stringent requirement shall apply.

2.2 FEDERAL AGENCIES

The governing Standards of federal agencies such as the Environmental Protection Agency, and the U.S. Public Health Service shall be followed when applicable.

2.3 STATE AGENCIES

The potable water distribution system shall conform to the applicable Florida Departments of Environmental Protection and Health and Rehabilitative Services statutes, policies, standards, rules, and regulations for public water systems.

2.4 PLUMBING CODES

The provisions of the Plumbing Code of the City of Pensacola or Escambia County as they pertain to water supply and distribution, service locations and materials, and backflow prevention devices, except as provided for elsewhere in this Manual, shall apply.

PART 3: WATER DISTRIBUTION SYSTEM DESIGN STANDARDS

3.1 FLOW REQUIREMENTS

In sizing extensions to the water distribution system, the minimum required design flow shall be the sum of the required fire flow plus two-thirds (2/3) of the required domestic flow.

A. Required Domestic Flow

1. Required flow for domestic use in residential areas shall be in accordance with the following table:

TABLE 556.1 - REQUIRED DOMESTIC WATER SUPPLY						
MINIMUM SUPPLY, GPM PER DWELLING UNIT						
MAX. NO. DWELLING UNITS	SINGLE FAMILY DETACHED	MULTI-FAMILY		MOBILE HOMES		RETIREMENT SINGLE FAMILY
		2 BDR M	1 BDRM	2 BDRM	1 BDRM	2 BDRM (MAX)
50	4.0	3.6	3.4	3.2	3.0	2.6
100	3.0	2.7	2.6	2.4	2.3	2.0
200	2.0	1.8	1.7	1.6	1.5	1.3
200+	1.5	1.4	1.3	1.2	1.1	1.0

NOTE: Multi-family, mobile home, or retirement units consisting of more than 2 bedrooms shall be considered as single-family detached.

2. The required flow for commercial, industrial, or other nonresidential areas shall be as determined by the Engineer-of-Record and approved by the ECUA for each specific instance. **NOTE:** Fixture Values as contained in the Southern Standard Building Code Chapter XIII, Section 1304 may be used as a guide.

B. Required Fire Flow

1. The required design fire flow for residential areas shall be 600 gpm for each hydrant flowing individually with a minimum residual pressure of 20 psig.
2. The required fire flow for areas other than residential shall be as determined by the appropriate governing authority.
3. ECUA will, on request, provide the designer with available system data.

3.2 GRID SYSTEM LAYOUT

A. Grid System

All mains shall be interconnected to form a grid system. Six-inch mains shall be placed to form grids of 1,000 feet x 1,000 feet or less. In no case should 6-inch mains be installed such that there is more than 1,320 feet of line between grid interconnections unless authorized by the ECUA. Eight-inch mains shall form grids no greater than 4,000 feet x 8,000 feet. When larger grids are necessary, larger diameter pipes shall be used. Four-inch mains may also be used to form localized grid interconnections where appropriate.

B. Dead-Ends

If the installation of a "dead-end" main cannot reasonably be avoided, its dead-end length shall not exceed 1,000 feet unless authorized by the ECUA. All dead-end mains shall have a permanent flushing hydrant with provision for future ties into adjacent properties in accordance with Section 3.2E below, when appropriate.

C. **Single Connection**

A development to be supplied by the ECUA water system, and designed for no more than 25 single family dwellings, may have a single connection to the distribution system if connecting to a larger main. If connection is to an equal size or smaller main, then a multiple connection will be required in accordance with Section 3.2 D.

D. **Multiple Connection**

A development to be supplied by the ECUA water system and designed for more than twenty-five single family dwellings, shall have two (2) or more connections to the distribution system. A single connection may be made by using a pipe diameter sufficient to provide one and one-half (1-1/2) times the required flow with provisions for future connections, provided approval of the ECUA is obtained.

E. **Future Interconnections**

Provisions for future connecting mains shall be made by extending construction of all water mains to the exterior boundaries of the development wherever future connections to adjacent properties are anticipated or are required to form a grid system.

3.3

WATER LINE SIZING

Distribution mains shall be of sufficient size to furnish the required flow at pressures and velocities as herein provided. Mains shall be located to provide service to each metered unit within a development and to form a looped network as provided above.

A. **Required Pressure**

The system shall be designed such that the water pressure at all points in the distribution system shall not be less than 35 pounds per square inch with no fire hydrant in use. Water pressure in the main at ground level shall not be less than 20 pounds per square inch under all conditions, inclusive of fire flows.

NOTE: When the water pressure exceeds 80 pounds per square inch, there shall be installed and maintained by the customer, on the property side of the water meter, an approved pressure regulator in conformance with the Southern Building Code and other applicable codes.

B. Standard Sizes

Distribution mains used shall have nominal diameters of 2, 3, 4, 6, 8, 12 and 16 inches.

C. Minimum Main Size

Minimum distribution main diameter shall be 4 inches in single family residential areas where fire hydrants are not required, and 6 inches in all other areas. Exception: 3-inch mains may be used around cul-de-sacs serving no more than 10 residences, and 2-inch mains may be used for cul-de-sacs serving no more than 4 residences.

D. Velocity

Velocities of water for the non-fire flow conditions in the distribution mains shall not exceed 6 feet per second.

TABLE 3.3 - APPROXIMATE CAPACITIES AND HEAD LOSS OF PIPES @ MAXIMUM DESIGN VELOCITY			
Size	Flow (gpm) at 6 fps	Head Loss C900 Pipe (c=130) ft/1000 ft	psi/1000 ft
4"	235	39	17
6"	530	22	10
8"	950	15	6.5
12"	2100	10	4
16"	3700	7	3

3.4 WATER LINE PLACEMENT

A. Location

All mains to be accepted by ECUA shall be installed only in dedicated streets, alleys, public right-of-ways, utility easements, or on land owned by ECUA.

B. Alignment

Water mains shall be designed to be parallel to the adjoining pavement and/or right-of-way line to the extent practical. In order to keep the main within its desired alignment within the right-of-way or easement, the main may be deflected, or may require standard fittings. Standard fittings are available as 11¼-degree, 22½-degree or 45-degree bends. Joint deflection should be used in preference to fittings.

1. **Deflection**

Deflections of 1 to 5 degrees may be permitted with standard or special pipe joints in accordance with the manufacturer's specifications. Deflections should be made as small as possible at successive joints.

2. **Curving**

Curving of pipe may be permitted in lieu of standard fittings or joint deflection in small diameter pipes (3-inch and less). The radius of the pipe curve shall be not less than 40 feet for 2-inch pipe and 58 feet for 3-inch pipe.

C. **Depth**

1. **General**

Water lines shall be designed to provide a minimum of 30 inches of cover below proposed finish grade. Valves shall be designed for installation at depths not greater than 48 inches below finish grade. Deviations from the required minimum cover may be allowed where conditions require, subject to prior approval of ECUA.

Water lines shall not be installed at depths greater than 36 inches below proposed finish grade, unless otherwise permitted by these Standards. Deviations from the required maximum cover may be allowed where conditions require, subject to prior approval of ECUA.

2. **Roadway Crossings**

- a. Water line installation in public rights-of-way shall conform to all applicable requirements of the governing agency responsible for the maintenance and operation of the roadway.
- b. In cases where open-trench construction of roadway crossings is allowed, water lines may be installed without casing, using an appropriate, approved pipe material in accordance with ECUA's Technical Specifications.

- c. In cases where open trench construction of roadway crossings is not allowed, water lines shall be installed in a steel casing in accordance with Section 2224 of ECUA's Technical Specifications. An appropriate, approved pipe material meeting the requirements of ECUA's Technical Specifications shall be installed in the casing. In cases where the length of casing required is excessive, or in other circumstances where conditions warrant, valves may be required on both sides of the casing.

3. **Water Crossings**

- a. Water line installation involving construction under or across water shall conform to all applicable requirements of the governing agency, or agencies, having jurisdiction for such activities.
- b. Creek, stream, river, or wetlands crossings not exceeding 100 feet in length as determined by the 100-year flood plain, and where open trenching is permitted, shall be constructed using ductile iron pipe (or other approved equal) at a depth not less than 36 inches below the bottom surface of the crossing. The ductile iron pipe shall extend at least 20 feet beyond either side of the maximum width of the crossing.
- c. Major streams and other crossings where the 100-year flood plain will create a width at the point of crossing of 100 feet or more, and where open trenching is permitted, shall be constructed using ductile iron river crossing pipe (or other approved equal) at a depth not less than 36 inches below the bottom surface of the crossing. The ductile iron pipe shall extend at least 20 feet beyond either side of the maximum width of the crossing, with valves on each side beyond the flood plain.
- d. Water lines installed under crossings where open trenching is not permitted shall be installed in a steel casing in accordance with Section 2224 of ECUA's Technical Specifications. Directional boring, where an appropriate pipe material is installed under the waterway without disturbance to the ground or water surface, may be considered in some circumstances. See Section 2234 of ECUA's Technical Specifications for further information.
- e. Where an existing or proposed bridge crosses the waterway at the same location as the proposed water line, provision should

be made to attach the water line to the bridge structure. Prior consent must be obtained from the agency responsible for the maintenance and operation of the bridge. Design of pipe restraints for the bridge attachment shall allow for limited movement of the pipe as a result of expansion and contraction.

4. **Railroad Crossings**

- a. Water line installation involving construction under railroads shall conform to all applicable requirements of the governing agency, or agencies, having jurisdiction for such activities.
- b. Railroad crossings of any length shall be installed in a steel casing in accordance with Section 2224 of ECUA's Technical Specifications, or in accordance with any special requirements of the railroad company, whichever is more strict.

5. **Other Crossings**

- a. Water lines which must be installed under existing obstructions, such as pipes or conduits, shall maintain a vertical separation of at least 6 inches. In cases where a minimum separation of at least 6 inches cannot be maintained, or in any case where there is a potential threat to the integrity of the water line as a result of an existing obstruction, the pipe shall be installed in a steel casing in accordance with Section 2224 of ECUA's Technical Specifications. Alternatively, Ductile Iron or C900 DR18 pipe shall be used. These special provisions shall extend at least 10 feet on either side of the pipe or obstruction being crossed.
- b. Water lines installed within easements for the purpose of extending or looping the system shall be constructed with Ductile Iron pipe through the entire length of the easement. Valves shall be installed at both ends of the line, unless otherwise approved by ECUA.

D. **Separation of Potable Water Lines From Sanitary Sewer Lines**

1. When a potable water line must cross over a gravity sewer line with less than 18-inch vertical clearance, one of the following methods may be used to protect the water line:
 - a. Fully encase the sewer line with a minimum of four inches of concrete ($F_y = 2500$ psi min.) for a minimum distance of ten feet on either side of the point of crossing. The point of crossing must be at least five feet from a water line joint. If the crossing

is other than at right angles, increase the length of encasement so that the end of the encasement will be at least ten feet from the nearest water line joint.

- b. Use pressure pipe for the sewer line that is the same as or better than the water line being crossed; with joints no closer than 10 feet apart and at least 6 inches of vertical clearance.
 - c. Install sewer pipe in a 20-foot section of steel casing centered under the water line, so that each end of the casing will be at least 10 feet from the nearest water line joint. Seal the ends of the casing with non-shrink grout.
2. When a gravity sewer line must cross over a potable water line, regardless of the clearance (because the water line cannot be relocated above the sewer) use method 'b' or 'c' in subsection 1 above. Concrete encasement will not be allowed.
 3. When a sanitary force main must cross under a potable water line with less than an 18-inch vertical clearance, or over the water line, use method 'b' or 'c' in subsection 1 above.
 4. The above requirements do not apply when the water line being crossed is a house or building service 2 inches or smaller and the service is a continuous piece of PE DR9 tubing, located so that the distance to a sewer or force main joint is as great as possible.
 5. When a gravity sewer line must run parallel to and less than 18 inches below a potable water line and:
 - a. 6 to 10 feet apart for less than 40 feet, use method 'a', 'b' or 'c' in subsection 1 above.
 - b. 6 to 10 feet apart for over 40 feet, use method 'b' and stagger joints.
 - c. 3 to 6 feet apart for any distance, use a higher rated pressure pipe and staggered joints.
 6. When a sanitary force main must run parallel to and less than 18 inches below a potable water line and:
 - a. 6 to 10 feet apart for any distance, use a higher rated pressure pipe as in method 1 (b) above.

- b. 3 to 6 feet apart, use C-900 DR18 pipe for both water and force main.

E. **Pipe Restraints**

All water line fittings and appurtenances shall be restrained. See Section 2556-2.4.1.4 for further information.

3.5 **APPURTENANCES**

A. **Valves**

General

In-line valves shall be spaced such that no more than 1,000 feet of pipe would be out of service with valves shut, and shall be located on every branch line, with at least one valve on the main line at the junction. The valve may be located on the opposite side of the street from the fittings, except in cases where a tapping sleeve and valve is used. Butterfly valves may be used on lines of 16 inches and larger. Air release valves shall be located on distribution mains as required by ECUA. Valves shall be installed in accordance with ECUA Standard Detail D-34.

B. **Fire Hydrants**

Fire hydrant location shall be governed by the local Life Safety Officer or Fire Department, but in general shall be located on a 6-inch or larger main, and no more than 1,000 feet apart along rights-of-way. Fire hydrants shall be located at intersections when practical, otherwise as close as practical to common property lines.

Fire hydrants shall be located in single family residential areas so that no more than 600 feet of fire hose, as laid along a public right-of-way, will be required to reach any proposed house.

Fire hydrants shall be located in multi-family residential or commercial areas, so that no more than 500 feet of hose, as laid across unobstructed terrain, will be required to reach the most remote part of any proposed building.

Fire hydrants may be installed on private land supplied by a private dedicated fire line of at least 6 inches diameter, and protected with an appropriate detector-check assembly located at the property line.

C. **Flushing Hydrants**

Flushing hydrants shall be located within a right-of-way or easement near lot/property corners such that their location and use will not be hampered by improvements (driveways, fences, shrubbery).

All dead-end lines 4 inches and smaller shall have at least a 2-inch post hydrant assembly.

All dead-end lines 6 inches and larger shall have a standard fire hydrant with valve. See ECUA Standard Detail D-35.

D. **Backflow Preventers**

(see Section 3.7 below)

E. **Double Check Detector Assemblies**

An appropriate double check detector assembly may be required in any private fire line.

F. **Meters**

Residential meters and meter boxes are typically provided by ECUA. Commercial water meters less than 2 inches in size are also typically provided by ECUA. For commercial water meters 2 inches and larger, the developer is required to supply the meter vault in accordance with ECUA Standard Detail D-25 or D-26 as applicable.

3.6

SERVICE LINES:

A. Potable Water Services

1. General

Line size must be selected with due consideration for length, peak demand, elevation and pressure loss, including loss across backflow preventers, for the anticipated end use(s). A water meter of the size requested by the customer will be supplied and installed by the ECUA at each connection point. The meter size should be shown on the plans for all commercial developments. Refer to Table 3.6 for tubing size.

All meters shall be installed in boxes adjacent to the property line at the public right-of-way or easement and readily accessible to ECUA meter readers. Meter boxes shall not be located in driveways or where they might be obstructed by landscaping or other structures, or closer than five feet to the sanitary sewer service lateral.

TABLE 3.6 RECOMMENDED TUBING SIZE FOR WATER SERVICES					
Size of Meter	Max. Flow (gpm)	Max. Pressure Loss (psi)	Max. Length of Tubing for Size Indicated		
			1"	1-1/2"	2"
5/8"	20	10	92	661	2679
1"	50	10	17	121	492
1-1/2"	100	10	-	34	136
2"	160	10	-	14	57

2. Residential

Provision shall be made for individual service lines to each lot within all residential developments. Services should be located centrally on each lot. See ECUA Standard Detail D-21. Duplex water services will not be permitted except in the case of a zero-lot-line townhouse-type development where common lot lines are clearly established.

3. Commercial

Service connections to industrial or commercial lots may be omitted if the service size cannot be predetermined, provided approval is obtained and paving will not have to be cut when installation is required.

Master meters are required for shopping centers, malls and similar developments. Exceptions may be made when a beneficial part of the Distribution System runs through the development.

A master meter is required for a wholesale customer, where water is to be distributed to individual units through private lines and that development is not served by the ECUA wastewater system.

Master meters shall be used for apartment, condominium and other such complexes.

B. Fire Service Lines

1. ECUA will provide a fire line service at the customer's expense, provided that there is adequate existing capacity.
2. ECUA will accept for operation and maintenance only such portions of the fire line within a public right-of-way or in an easement.
3. An approved backflow preventer shall be installed by the customer at his expense adjacent to the property line. (See Section 3.7 below.)
4. All fire line services shall be pressure tested and chlorinated up to the backflow preventer in the same manner as other line extensions.

C. Irrigation Service Lines

Provision shall be made for separate irrigation services and meters to be installed at customer's expense, if required.

3.7 CROSS CONNECTION CONTROL AND BACKFLOW PREVENTION

A. Protective Devices

Backflow prevention devices shall be installed to protect the distribution system from potential contamination.

B. Where Required

1. **Single Family Residential** - Backflow prevention devices shall be installed by owner in accordance with the Standard Plumbing Code - latest edition.
2. **Commercial** - Backflow prevention devices shall be installed by owner for all services.

3. **Irrigation Services** - Backflow prevention devices shall be installed by owner in accordance with the Standard Plumbing Code - latest edition.

C. **Type of Protective Device**

1. The selection of an appropriate protective device will be based on the degree of hazard involved. However, the ECUA shall retain the final decision in individual cases. Refer to ECUA Code, Chapter 5, "Cross-Connection Control." All devices must be approved for use in potable water service by one or more of the following: NSF, ANSI, ASSE, UL.
 - a. **Air-Gap Separation Backflow Prevention Device:** will be used in any high-risk installation, but is acceptable in all situations described in this section.
 - b. **Reduced Pressure Principle Backflow Prevention Device:** will be used in any moderate to high-risk installation.
 - c. **Double Check Valve Assembly:** will be used in any moderate-risk installation, which will include most private fire lines, and private fire hydrants.
2. The type of backflow device shall be shown on the Construction Plans.
3. Bypasses around backflow devices are expressly prohibited.
4. A low flow detector meter may be required on any backflow device located on an unmetered water line.

D. **Location**

1. All backflow prevention devices are to be located immediately after the meter or immediately inside the property line at the right-of-way line, and be readily accessible for inspection and visible from the public right-of-way.
2. All backflow prevention devices are to be located above the 100-year flood elevation or a minimum of 18 inches above ground, whichever is higher, and should be protected from freeze and traffic.
3. Any deviation from No. 1 above must be individually approved by the ECUA.
4. The location of the backflow device is to be shown on the Construction Plans for all commercial developments.

E. **Installation**

Installation of the backflow device will be done by the Developer's Contractor. See ECUA Code, Chapter 5, "Cross Connection Control."

F. **Inspection and Testing**

Inspection and testing of the backflow device will be conducted by the ECUA as outlined in ECUA Code, Chapter 5, "Cross Connection Control."