

SECTION 6

WATER DISTRIBUTION SYSTEM DESIGN

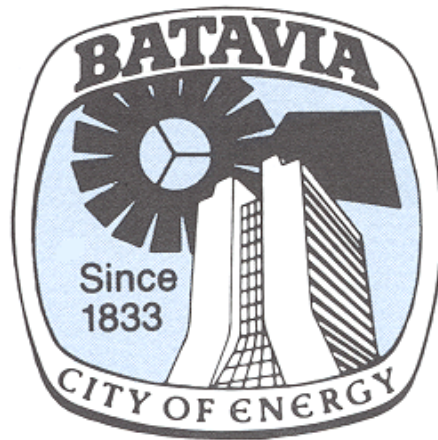


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SECTION 6

WATER DISTRIBUTION SYSTEM DESIGN

6.1 GENERAL DESIGN CRITERIA

6.1.1 Design Approval

The Department of Public Works shall approve all designs and shall alter the following design requirements as necessary to meet the City water system plan. The Department of Public Works and the Engineering Department shall review and comment on all designs.

The City of Batavia's standard details should be used in all construction plans. Any modifications to these standard details require approval from the City Engineer.

6.1.2 IEPA Permit Required

All public water main extensions require an IEPA Construction permit, prior to construction.

6.1.3 Construction Rules and Regulations

The rules, regulations, and ordinances and policies listed herein, and issued by the authorities indicated, are incorporated herein by reference.

- A. The City of Batavia rules, regulations, policies, directives, specifications, general notes, construction details, permit forms and instructions that may be adopted or issued from time to time by the City Council.
- B. The Illinois Environmental Protection Agency (IEPA) Division of Public Water Supplies including all orders, rules and regulations thereof.
- C. Environmental Protection Act, including all orders, technical releases, rules and regulations issued from time to time.
- D. "Standard Specifications for Water and Sewer Main Construction in Illinois", latest edition.
- E. "Recommended Standards for Water Works", Great Lakes-Upper Mississippi River Board of State Sanitary Engineers (Ten State Standards).

- F. "77 Illinois Administrative Code, part 890, Illinois Plumbing Code", latest edition.
- G. The Occupational Safety and Health Administration (O.S.H.A.)– Regulations (Standards-29 CFR) – Standard Number 1926.652.

6.1.4 Differentiation Between Public and Private Water Mains

When the water distribution system is complete and the improvements have been formally accepted by the City, the Department of Public Works shall be responsible for the repairs and maintenance of all service lines and water mains located in the public right-of-way and publicly dedicated water mains. Maintenance and repairs for the portion of the system located on private property shall be the responsibility of the property owner, or property owner's association depending upon the property owner's covenants and guidelines. In such cases where the City performs maintenance or repairs on the private water distribution system, the City reserves the right to charge the property owner for necessary work.

All engineering plans shall clearly differentiate between all portions of the public and private water distribution system.

6.1.5 Easements

All public water mains and fire hydrants that are not located within a public right of way shall be placed in a public utility and drainage easement, minimum 10-foot wide or as directed by the City Engineer, to the City of Batavia. The easement shall be granted to the City either through a recorded plat of subdivision or a recorded plat of easement. The City shall be granted access to these easements if not directly adjacent to public right-of-way.

At the discretion of the Director of Public Works or City Engineer, the City may require additional easements for future maintenance or repair of the system.

6.2 WATER MAINS

6.2.1 Basis of Design

Distribution main size shall be based on the occupancy of the properties along the line and by the average daily water consumption of each, plus fire demand. The main shall be of sufficient size to deliver the required flow at a residual pressure of not less than twenty (20) pounds per square inch. The main shall in no case be less than as hereinafter specified.

Average daily water consumption shall be as follows:

1. One hundred (100) gallons per capita per day per residential development.
2. Four hundred (400) gallons per one thousand (1,000) square feet of floor area for commercial and light industrial development unless otherwise substantiated or quantified.
3. Heavy industrial usage shall be based on the average from past records from the previous 12 months, at a minimum.

Maximum day demand shall be computed by the basis of two (2) times the average day demand. Maximum hourly demand shall be computed by the basis of four (4) times the average day demand.

6.2.2 Public Fire Flow Requirements

Fire flow requirements will be approved by the Department of Public Works.

The required fire flows may be computed at a residual pressure of 20 psi for Fire Department use. It should be recognized that higher residual pressures may be necessary for specific fire protection demands. The supplies shall be available for a continuous four-hour duration except that flows less than 2,000 gpm need be available for a two-hour duration.

The following flow requirements are guidelines which will be modified based upon construction types, size and height of the buildings:

Use	Flow (gpm)
Manufacturing and Storage	3,000 to 5,000
Institutional (Assumed limited hazard, fire resistive)	3,000 to 4,000
Commercial and Mercantile	3,000 to 5,000
Business and Office (Assumed limited hazard)	2,500 to 3,500
Single Family Detached Residential (1,000 gpm typically used)	1,000 to 1,500
Town or Row Houses (1,500 gpm average, additional quantity)	1,000 to 2,000
Apartments (Low-end requirements for fire resistive structures,	3,000 to 4,000

6.2.2.1 Private Fire Protection

Private fire protection demands (standpipe systems, sprinkler systems, etc.) will not be considered cumulative with public fire flow demands. These requirements are based upon the building height, area, use, and construction type.

6.2.3 Watermain Pipe Material

Ductile iron pipe Class 52 or 54 conforming to the latest edition of the following Standards:

1. American Water Works Association (AWWA) Standard C-150, Thickness Design of Ductile-Iron Pipe;
2. American Water Works Association (AWWA) Standard C-151, Centrifugally Cast Ductile Iron Pipe;
3. AWWA Standard C-104, Cement-Mortar Lining for Ductile Iron Pipe and Fittings;
4. AWWA Standard C-111, Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings;
5. AWWA Standard C600, Pipe Laying Conditions, Type 3 minimum.
6. AWWA Standard C-900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Transmission and Distribution.

Polyvinyl Chloride (PVC) pressure pipe meeting the requirements of AWWA C-900 shall only be used with prior design approval by the City of Batavia Water Division. For information regarding applicable ANSI, AWWA, and ASTM designations, refer to Section 8 of the City of Batavia Standard Specifications and typical drawings.

6.2.4 Watermain Pipe Fittings

Watermain pipe fittings shall be constructed of ductile iron with mechanical joints conforming to the latest edition of the following Standards::

1. AWWA Standard C110, Ductile Iron and Gray Iron Fittings;
2. AWWA Standard C111, Rubber Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA Standard C104, Cement-Mortar Lining for Ductile Iron Pipe and Fittings;

Note that retainer glands shall be required on all fittings.

6.2.5 Location in the Public Right-Of-Way

Water mains shall be generally be located on the north and west sides of the public right-of-way, or as directed by the Director of Public Utilities.

6.2.6 Sewer and Water Main Separation

Water mains and water service lines shall be protected from sanitary sewers, storm sewers, combined sewers, house sewer service connections, drains, and sanitary sewer force main. In addition to the guidelines as indicated in Section 41 the Standard Specifications for Sewer and Water Construction in Illinois, refer to the requirements as shown in the City of Batavia Standard Details.

6.2.7 Depth of Pipe Cover

All pipe shall be laid to a minimum depth of five and one half (5.5) feet and a maximum of ten (10) feet as measured from the proposed ground surface to the top of the pipe, unless specifically allowed otherwise in special circumstances by the Director of Public Works or City Engineer. If approved, the pipe shall be insulated with 2-inch exterior grade rigid insulation board. One 2-inch thick sheet of insulation shall be provided for each 6 inches of cover below the required 5-foot minimum depth and extend a minimum of 12 inches on each side of the water main. The insulation shall be extruded polystyrene with a minimum R-value of R-9 in compliance with ASTM C 578- 15 Type VI.

6.2.8 Water Main Sizing

Water mains shall be constructed of 8-inch diameter, 10-inch diameter or 12-inch diameter pipe or as directed by the Department of Public Works. Refer to Section 6.2.1 and 6.2.2 design requirements for distribution main sizing.

6.2.9 Oversizing Requirements

The City of Batavia Water Division may require that the water main be oversized in order to provide service to additional benefiting properties (refer to Section 8-2-9-3 of the City of Batavia Municipal Code for further information).

6.2.10 Limits of Installation

At a minimum, water main shall extend across the frontage of the property, at the developer's cost, such that a connection could be made with minimal disturbance in the future. In some cases, the City may require that the water main be installed from one corner to the diagonally opposite corner, at the developer's cost.

All water main stubs for future extension shall terminate with a valve and hydrant. Restrained joints shall be located 40 feet from the capped end.

6.2.11 Distribution System

The grid of the minor distributor mains supplying residential districts shall have a minimum pipe size of eight inches (8") internal diameter and arranged so that the lengths between intersecting mains do not exceed eight hundred feet (800'). Minimum pipe size supplying high value commercial and industrial areas shall be ten inches (10") or larger. Principal supply mains shall be spaced not greater than two thousand five hundred feet (2,500') apart, and shall be of the size shown in the Batavia Master Water Plan or larger if the type of development warrants.

No dead-end water mains shall be allowed.

6.2.12 Thrust Blocking

All fire hydrants, valves tees and bends require thrust blocking with at least 10"

thick preformed concrete block(s) against undisturbed vertical earth face. The placement of all thrust blocks shall be done in conformance with the standards of "Specifications for Water and Sewer Construction in Illinois". In addition to the above thrust blocking all mechanical joints, bends and fire hydrants shall have a "Mega-lug" restraint, or other as approved by the City of Batavia Water Division. For further details, refer to the thrust block installation detail.

6.3 WATER SERVICES

No more than one building shall be supplied from one service pipe. Whenever possible, the service pipe shall enter the building in a direct line with the curb stop and tap. Said pipe shall be provided with a valve before and after the water meter, not less than 1- foot inside of the wall or above the foundation floor (main building shutoff valve). The property owner shall be responsible for the maintenance, repair or replacement of the main shutoff valves.

Every building, except auxiliary buildings shall be individually metered.

All valves shall be arranged so that each line can be shut off from the exterior of the building.

6.3.1 Pipe Material

Service line pipe materials and joints shall meet the requirements of the Illinois Plumbing Code.

6.3.2 Water Service Line Sizing

The following guidelines shall be used to size water service lines:

Water Supply Fixture Units	Size, diameter (inches)
< 60	1"
≥ 60	1-1/2"

Building service connections to the mains shall be made by tapping the water main and installing a corporation cock. Service lines shall be a minimum of one inch (1") type "K" copper tubing from the main to the meter. A shut-off with a buffalo box shall be set in the water service line on the property line. Building service connection and pipe shall be installed up to the property line with the installation of all secondary water mains in all new service areas and subdivisions.

6.3.3 Buffalo Boxes

The buffalo box shall not be located in driveways or sidewalks.

6.4 FIRE HYDRANTS

6.4.1 Fire Hydrant Locations

Fire hydrants shall be located along public streets so that no portion of the building or structure to be protected will be over (300) feet from any required hydrant. Where this may not be possible, additional hydrants shall be located upon the premises accessible to motorized fire apparatus.

Hydrants shall be located on the north and west side of roads, streets and access routes. Hydrants shall typically be located at street intersections, and in no case shall the space between hydrants exceed (400) feet in single-family areas or 300 feet elsewhere.

Fire hydrants shall be situated five (5) feet from a paved roadway and seventy-five (75) feet from a Fire Department connection, unless otherwise approved by the City of Batavia Water Division.

Access to hydrants shall be provided by paved roadways (minimum structural number = 2.5) routes adequate in width, clearance and strength to support all fire equipment. Such routes shall be maintained during all seasons of the year.

6.4.2 Fire Hydrant Materials

Fire hydrants shall conform to the latest edition of AWWA Standard C502, Dry-Barrel Fire Hydrants and shall include one four and one-half inch (4 1/2") steamer outlet and two (2) two and one-half inch (2 1/2") hose connections. Additional fire hydrant requirements are shown in the City of Batavia Standard Fire Hydrant Detail and Specifications. All threads shall be national standard. Operating nuts shall open to the left in a counter clockwise direction.

6.5 VALVES

6.5.1 Water Valves

For all water main 20" or less, a resilient wedge gate valve shall be used. Gate Valves shall meet the requirements of AWWA C509, latest edition. Butterfly Valves may be required for water mains greater than 20" in diameter at the discretion of the City of Batavia Water Division. Butterfly Valves shall meet the requirements of AWWA C504, latest edition. All below grade factory installed bolts and fasteners shall be 304-grade stainless steel.

6.5.2 Water Valve Vaults

Valves for water mains or fire service lines 8 inches or larger shall be provided with a vault with a minimum inside diameter of five (5) feet. Refer to the City of Batavia Water Standard Valve Vault Detail for further information.

All adjustments and frames shall be sealed to prevent infiltration. The water valve vault lids shall conform to the requirements shown in the City of Batavia Standard Water Manhole Lid Detail.

For 8" diameter mains and larger the valve shall be installed within a 60" diameter precast concrete vault. The valve vault shall be sealed with the use of concrete blocks and mortar. All pipes entering the manhole shall have a 2" wide mortared collar on both the inside and outside walls of the vault. Valve vaults may also be sealed with the use of rubber boots meeting the requirements of ASTM C923.

6.5.3 Valve Boxes

Valve boxes may only be used for fire service lines that are less than 8 inches in size. The valve box shall be located in a grassy area; otherwise a valve vault must be used. Valve box construction and materials shall conform to all standards found in "Standard Specifications for the Construction of Water and Sewer Main in Illinois". Valve boxes shall be sealed as to not allow the entrance of any loose impediments. All valve boxes shall be installed upon the valve with the use of a Valve Box Adaptor as manufactured by Adaptor Inc. or an approved equal.

The valve box shall be placed vertical with the opening directly above the operating nut. The operating nut of the valve shall be keyable as determined by the City of Batavia Water Department. All boxes shall be adjustable with a minimum of 6" of adjustment remaining, after the box has been brought to match existing grade.

6.5.4 Valve Locations

Gate valves shall be located so that services may be maintained with the least disruption in the case of break or other emergency. Valves shall be located such that no more than a maximum of 600 feet of main may be shut off at any given time on distribution mains or one thousand feet (1,000') apart on principal feeder mains. This spacing should be reduced, such that no more than 25 to 30 single-family homes, or 50 multi-family residences (excluding apartment buildings) would be shut off at any given time.

Where a "tee" is installed, at least two (2) valves will be utilized. Where a "cross" is installed, at least three (3) valves will be utilized.

6.5.5 Pressure Taps

Connections for extending existing water mains shall be made with a tapping tee and valve unless otherwise permitted by the City. Work shall be so scheduled and timed as to cause the least possible interference with the operation of the existing water distribution system. Water shall not be allowed to flow from the new mains into the existing mains until the new mains have been thoroughly flushed and sterilized. Care should be taken so as not to

cause turbulence in the existing mains.

Pressure taps shall be ductile iron tapping sleeves for size-on-size taps, or taps on mains greater than 12 inches ($> 12''$). Stainless steel tapping sleeves can only be used for non- size-on-size taps or taps on mains less than or equal to 12 inches ($\leq 12''$). Pressure tap and valve shall be located within a valve vault. Also, refer to the requirements as shown in the City of Batavia Standard Pressure Connection Detail.

6.6 APPURTENANCES

6.6.1 Casing Pipes

Manufactured non- metallic or non-corrosive casing spacers, adjustable runners, or cradles shall be used to support the pipe in the casing. A minimum of three supports shall be used per pipe, or per manufacturer's recommendation. The annular space shall be filled with pea gravel or as required by the permitting agency, and provisions shall be made so that no voids are left. Water main installed within casing pipes shall have restrained joint construction the entire length of the casing pipe for future removal if necessary.

6.6.1.1 Casing Pipe Material

The steel casing pipe shall be bituminous coated, minimum of 30 mils thickness inside and out, and shall be of leak proof construction, capable of withstanding the anticipated loadings. The steel casing pipe shall have a minimum yield strength of 35,000 psi and shall meet the requirements of ASTM A139, Grade B. Ring deflection shall not exceed 2% of the nominal diameter. The steel casing pipe shall be delivered to the jobsite with beveled ends to facilitate field welding.

Steel Casing Diameter	Minimum Wall Thickness (Inches)
20" and 22"	0.344
24"	0.375
28"	0.438
30"	0.469
32"	0.501
34" and 36"	0.532

6.6.1.2 Sizing of Casing Pipes

The diameter of the casing pipe shall be a minimum of 12 inches greater than the outside nominal diameter of the water main.

6.7 TESTING

All watermain installed within the City of Batavia shall adhere to all applicable

tests found in the “Standard Specifications for Water and Sewer Main Construction in Illinois”. The City of Batavia shall receive a minimum 48 hours notice prior to any testing.

Ductile iron water mains shall be installed and tested in accordance with A.W.W.A. C600 Standard latest edition thereto.

All water mains and appurtenances thereto shall be sterilized before they are put into service. The installer shall be responsible for sterilizing the mains and shall, under the supervision of a representative of the City, take samples which are to be submitted to the Certified Laboratory for bacteriological analysis. Acceptable bacteriological tests shall be required before the water mains will be permitted to be put into service. Water mains shall be disinfected in general accordance with A.W.W.A. C601 Standard latest edition thereto.

6.8 IRRIGATION SYSTEMS

Private lawn irrigation systems shall not encroach into public right-of-way.