CHAPTER 7

Water Distribution System

A. Introduction

All developments within the corporate limits or under the control of the city shall include provisions for the construction of water distribution facilities designed according to this chapter.

All work done and materials used in connection with any water main extension installation, water main tapping, and the installation of service pipes and appurtenances from the city water distribution system shall be in accordance with the requirements of the Municipal Code of the City of Oak Creek, American Water Works Association specifications, American Standards Association specifications, and Standard Specifications for Sewer and Water Main Construction in Wisconsin, current editions, and the following specifications in this chapter.

B. Design Requirements

1. General

a. All engineering plans and specifications shall be designed, prepared, stamped, and signed by a qualified professional engineer registered in the State of Wisconsin.

b. The design engineer shall prepare final engineering drawings based on the requirements outlined in this document, the Oak Creek Water and Sewer Commission standards, city ordinances, and the municipal code.

c. Except as specified in this manual, all work performed and materials supplied shall conform to the Standard Specifications.

d. As a minimum, the distribution system shall include a system of water mains and service lines between a connection or connections to the existing distribution system at locations approved by the Utility and City Engineer, and at the boundary line of each individual parcel within the development.

e. Extensions to the distribution system shall be a complete network extension or part of a complete network extension and shall include primary feeders, secondary feeders, and distribution mains conforming in general to the existing distribution system pattern.

f. Any water main extension project shall include extending the water main the full length of the property.

g. For water main protection, see Section C 13 b on Page 6-6.

C. Water Main

1. Primary mains are those mains forming the arterial system of the utility and in the case of construction within a development, are further defined as mains 12" except when a diameter larger than 12" is required to meet local fire protection needs.

2. Secondary feeders shall be sized and shall be looped with spacing as required for fire flows and shall have a minimum diameter of 8".

3. Distribution mains shall form a grid to supply water to the local fire hydrants and service lines. Distribution mains shall have a minimum diameter as follows:

Type of Development	Minimum Main Size
Residential cul-de-sac less than 6 homes	6"
Residential cul-de-sac greater than 6 homes	8"
Residential	8"
Commercial	12"
Industrial	12"

Permanent dead ends shall be avoided whenever possible and shall be limited to a maximum length of 500' when the design can demonstrate to the engineer that looping of such water main is not practical. A dead end must end with a hydrant for flushing.

4. The proposed extension shall be arranged so that the effect of a break in a secondary feeder or distribution main will be kept to a minimum.

5. Required Fire Flow

The desired fire flow is 1,500 gallons per minute at 20 pounds per square inch. The minimum fire flow requirement is 500 gallons per minute at 20 pounds per square inch residual, as computed for the critical elevation of the proposed development.

6. Head losses in relation to velocity in water mains shall be computed using the Hazen-Williams formula:

$$V = 1.318\ CHWR h^{0.63} S^{0.54}$$

where,

V = velocity in feet per second
C = 120
R = the hydraulic radius (A/Pwetted)
S = the hydraulic gradient (hf/L)

7. The above size and criteria may be deviated from if the engineer can demonstrate through a detailed hydraulic analysis of the water system that adequate fire flows are attainable.

8. All water mains shall be looped or constructed with the intention to loop unless approved by the Utility and City Engineer.

9. All water main 16" and larger shall be ductile iron pipe (Class 52), cement mortar-lined, push-on joint, and shall meet the requirements of Chapter 6.18.0 of the Standard Specifications. Over 20” may be prestressed watermain concrete cylinder pipe A.W.W.A. C-301.

10. All water main 12" and smaller shall be either ductile iron pipe (Class 52), cement mortar-lined, push-on joint, and shall meet the requirements of Chapter 6.18.0 of the Standard Specifications, or shall be Polyvinyl Chloride (PVC) water pipe and shall conform to the requirements of A.W.W.A. C-900 pressure Class 150 or shall be high density polyethylene (HDPE) and shall conform to the requirements of A.W.W.A. C-906, DR-11, PE 3408, D.I. sizing. All 6” or smaller PVC must be A.W.W.A. C-900 Class 200 DR 14.

11. All non-PVC pipe shall be double wrapped with polyethylene wrap meeting the requirements of the Standard Specifications Section 4.4.4. Fittings shall be triple wrapped.

12. Water mains located outside the ROW must be centered in a 25' wide permanent water main or public utility easement. If the water main is located in the same easement as another utility then the easement shall be increased to 25’ plus the distance between the Utilities.

13. All water mains located inside the ROW but less than 10' from the lot line must have a 10' easement along the lot line.

14. Generally, water main deflection will not be allowed and should follow the sanitary sewer utilizing 22¼ or 45-degree bends when needed.

D. Valves

1. Valves shall be located so as to effectively isolate portions of the system with minimum loss of service.

2. Valves shall be located at all intersections, at the curb flange lines extended, and at spacing of 500' to 800' between intersections, adjacent to fire hydrants or at property lines extended.

3. Tees shall be installed with two valves.

4. Crosses shall be installed with three valves.

5. If a water main is passing along a side yard, valves are required at both ends and service connections are not permitted.

6. Water main 12" in diameter and smaller shall have resilient wedge gate valves for isolating service.

7. Water main larger than 12" in diameter shall have butterfly valves for isolating service. Butterfly valves shall be equipped with traveling nut or enclosed worm gear operators to minimize the closing time, to prevent water hammer, and to provide ease of operation.

8. Buried valves shall have three-piece valve boxes and valve box adapters. Valve boxes shall be wrapped with polyethylene.

9. Valve boxes shall be set 2" below finished pavement grade for asphaltic pavements until final lift of asphalt is complete; and to finished grade for concrete pavements. No ramping will be allowed. No “slider” type adjusting rings shall be used.

E. Fittings

1. All fittings and their installation shall conform to all appropriate requirements of Part IV of the Standard Specifications.

2. All fittings shall be of push-on type. If mechanical joint is specified, the joints shall be made with Cor-ten nuts and bolts, or corrosion-resistant equivalents which conform to C-111, A.W.W.A. Specifications, as approved by the Utility and City Engineer.

3. All fittings shall be cement-lined ductile iron, no lighter than Class D A.W.W.A. Specifications designed for 150 pounds per square inch and provided with push-on joint.

4. All metal fittings, when utilized with PVC pipe, shall be triple-wrapped with polyethylene meeting the requirements of Chapter 6.21.0 of the Standard Specifications. Installation of the wrap shall conform to Section 4.4.4.

5. Push plugs with buttress shall be furnished as specified on the plans and shall be rubber joint.

F. Fire Hydrants

1. All hydrants shall be break-flange type with a 5¼" valve opening, two 2½" hose nozzles and one 4½" pumper nozzle. All hydrants shall be furnished with an o-ring, stuffing boxes, shall have bronze to bronze fittings, and shall open counter-clockwise. Hydrants shall have a 1½" pentagon operating nut and on nozzle caps. See list at the end of this chapter for acceptable hydrant types.

2. Hydrants shall have a minimum of 1 cubic yard of #2 washed stone placed below the hydrant up to a point 6" above the hydrant drain hole.

3. All hydrants shall have a 6'6" barrel length with hydrant extensions as needed. Hydrant extension lengths shall be noted on the utility plans.

4. The hydrant shall be placed perpendicular to the water main and the pumper nozzle oriented toward the pavement.

5. Hydrants shall be placed 4' behind the back of curb or 4' off of the shoulder of the road. All hydrant nozzle elevations shall be located 18" to 24" above finished grade or top of curb. Break away flange and break away shaft coupling shall be positioned just above finished grade.

6. An anchoring tee shall be used to attach the hydrant lead to all water mains. The auxiliary valve shall be directly attached to the anchoring tee and the hydrant shall be mechanically restrained (mega-lug or equal).

7. Concrete buttress shall be used to restrain the tee.

8. Poured concrete buttress will not be allowed.

9. Hydrants shall have an auxiliary isolating valve that shall be 6" mechanical joint resilient wedge gate valve.

10. All hydrants shall be located at property line intersections and meet the following requirements:

    a. At the end of all cul-de-sacs.

b. As near to all high points of the system as possible.

c. At a 400' maximum interval for residential areas.

d. At a 600’ maximum interval for commercial and industrial areas.

e. Near all roadway intersections.

11. Additional fire hydrants may be required per the State or local fire or plumbing codes.

12. All metal pipe and fittings shall be double polyethylene wrapped, meeting the requirements of Chapter 6.21.0 of the Standard Specifications. Installation of the wrap shall conform to Section 4.4.4 of the Standard Specifications.

13. Hydrants shall be painted with a yellow top for public hydrants and red for private hydrants.

G. Thrust Blocks

Blocking to prevent movement of lines under pressure at bends, and fittings shall be Portland cement concrete, a minimum of 12" thick, placed between solid ground and the fittings so that pipe fittings and joints will be accessible in such a manner that pipe fittings and joints will be accessible for repairs. All bends of 11.25° or greater, and all tees and plugs shall be thrust protected to prevent movement of the line under pressure.

Thrust blocks should be installed in accordance with Section 4.3.13 of the Standard Specifications.

H. Trench Excavation and Backfill

1. Bedding material for water main shall be of "Road Sand" quality and when tested in accordance with ASTM C117 and C136, it shall conform to the requirements in Table 7-A.

U.S. Standard Sieve Size	Percent by Weight Passing
3/8”	100
#4	90-100
#16	45-80
#50	5-30
#100	0-10
#200	0-3

2. Excavation backfill shall be mechanically compacted in 12" lifts within the street ROW. No flushing of trenches shall be allowed. The backfill material shall be graded crushed ¾" stone per Section 6.43.7(c) of the Standard Specifications (3/4" T.B.). Slurry shall be used for all existing street crossing.

I. Connections to Existing Water Mains

All connections to the city water distribution system shall be made under full water service pressure unless otherwise approved by the Utility and City Engineer at locations approved by the Utility and City Engineer.

J. Water Service Lines and Connections

1. In general, a water service shall be installed for each building or buildable lot. Water services shall consist of a corporation stop, service line, and curb stop with box.

2. All water laterals shall be a minimum of 1" in diameter. A larger diameter may be required.

3. A minimum of 6' of cover shall be maintained on all water laterals, including the area through the drainage ditch.

4. The service lines shall be Type "K" copper tubing conforming to the requirements of ASTM B88; or polyvinyl chloride (PVC) water pipe conforming to ASTM D-2737, or HDPE for water lateral use.

5. The corporation stop shall be tapped at a 25° angle on the main when utilizing copper, a vertical loop of piping shall be installed to minimize the potential for pulling the service line from the corporation stop. When utilizing PVC or HDPE, the service shall be installed by snaking the line for slack in the service to minimize the potential for pulling the service line from the corporation stop.

6. All corporation stops, curb stops, and curb boxes for services shall be of those types that are acceptable to the utility and shall be triple poly wrapped.

7. A clay dam shall be constructed with all laterals adjacent to pavement low points.

8. Any existing water lateral to be removed shall be removed at the watermain under Utility inspection.

K. Testing and Inspection

1. Inspection

An inspector shall be on the job site for the unloading of all materials and during construction of the water main and laterals. The contractor responsible for the construction of the water mains and laterals is also responsible for notifying the utility of construction start-up. Contractor shall supply material certification sheets prior to construction.

2. Tests

All water main and laterals shall be tested in full accordance with the requirements of Chapter 4.15.0 and Section 5.5.18 of the Standard Specifications.

L. Construction Requirements

The contractor shall furnish and place a temporary 2" x 6" wood post, marked with blue paint at the end of each water service. Any deviation from approved plans or specifications affecting the performance or installation of the water main and services shall be approved, in writing, by the Utility and City Engineer before such changes are made.

Revised plans or specifications shall be submitted well in advance of any construction work that will be affected by changes to permit sufficient time for review and approval.

Only Utility staff shall be allowed to operate the system valves.

All construction activities shall comply with the Standard Specifications and General Specifications.

A list of all-acceptable fire hydrants, resilient wedge gate valves, butterfly valves, tapping saddles, and all other appurtenances is shown in Tables 7 B, C, & D. Deviations from this list will be considered if specifications for the variance are submitted to the Utility and City Engineer for review two weeks prior to the start of the utility installation.

TABLE 7-B

FIRE HYDRANTS

Brand	Operating Nut Size	Model	Main Valve	Nozzles N.S.T.
Clow	1½" Pentagon	2500	5¼"	2 2½" & 1 4 ½"
Mueller	1½" Pentagon	Centurian	5¼"	2 2½" & 1 4½"
Kennedy	1½" Pentagon	Guardian K81A	5¼"	2 2½" & 1 4½ "

TABLE 7-C

RESILIENT WEDGE GATE VALVE

Brand	Size
Clow - R.W.	3" - 12"
Mueller - R.W.	3" - 12"
M & H R.S.C.V.	3" - 12"
Waterous - 500	3" - 12"
Kennedy - R.W.	3" - 12"
American Flow Control	3"–12"

TABLE 7-D

BUTTERFLY VALVE

Brand	Size
Pratt	16" and larger
Mueller	16" and larger
Clow	16" and larger
Dezurik	16" and larger

TAPPING SADDLE

Used on all PVC water main taps:

Power Seal Stainless Steel #3412 – 1¼" CC through 2" CC
Smith-Blair Stainless Steel #372 – 1¼" CC through 2" CC

For 3" and larger service laterals:

Smith-Blair
Full Circle Stainless Steel Model 663
Romac Full Circle Stainless Steel Model “SST”
Power Seal Full Circle Stainless Steel Model 3490
JCM Full Circle Stainless Steel Model 432
Ford Stainless Tapping Sleeve Model FAST