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## 2 WATER SYSTEM

All labor and material shall be governed by requirements of the latest edition and all amendments thereto of the Standard Specifications for Sewer and Water Construction in Wisconsin (SWS), Public Service Commission (PSC) Rules and Wisconsin Department of Natural Resources (WDNR) Regulations, unless otherwise specified in these Specifications, whichever is more restrictive.

### 2.1 SPECIFICATIONS

#### 2.1.1 WATER MAIN PIPE

##### 2.1.1.1 MATERIALS

All pipe used for water main shall comply with SWS and the following:

6"	Ductile iron – Hydrant leads only
8"	PVC or ductile iron
12"	PVC or ductile iron
16"	PVC or Ductile iron
20"	Ductile iron
Sizing of private mains requires approval by the City Engineer.	

2.1.1.1.1 All Ductile Iron pipe shall be pressure Class 350 or greater unless otherwise noted on the plans approved by the City Engineer. Each Ductile Iron pipe shall be manufactured in the USA, subject to a hydrostatic pressure test of at least 500 psi at point of manufacture. All pipe shall be furnished with Push-On type joints such as "Tyton" or "Fastite" complete with all necessary accessories. Acceptable Manufacturers of Ductile Iron pipe include the following:

- *American Cast Iron Pipe Co.*
- *Clow Water Systems, Co.*
- *U. S. Pipe & Foundry Co.*
- *Pre-approved equal.*

2.1.1.1.2 PVC or PVCO water main for sizes 4" through 16" diameter, excepting service laterals, shall conform to the OD of Ductile Iron pipe and be AWWA C-900 or AWWA C-909, Class 150 or 200, DR-18 or -14. All pipe shall be furnished with Push-On type integral elastomeric bell-spigot joints. Acceptable Manufacturers of PVC/PVCO Water pipe include the following:

- *J. M. Eagle*
- *National Pipe*
- *Diamond Plastics*



- *Northern Pipe Company*
- *Pre-approved equal.*

2.1.1.1.3 Fire and Combination Fire/Water service lines from the connection at the main to the backflow prevention device connection, shall be:

- *Ductile Iron conforming to Section 2.1.1.1., or*
- *PVC/PVCO for sizes 3" through 12" diameters only, conforming to the OD of Ductile Iron pipe, AWWA C-900 or AWWA C-909, Class 200, DR-14*
- *All pipe shall be furnished with Push-On type integral elastomeric bell-spigot joints.*

#### 2.1.1.2 DESIGN STANDARDS

2.1.1.2.1 Main sizes (Minimum).

- *Residential: 8" minimum*
- *Multifamily and commercial : 12" subject to City Engineer approval.*
- *Industrial: 12" subject to City Engineer approval.*

2.1.1.2.2 Watermain Location

- *In streets & easements: 10 feet from sanitary sewer; north and east.*

2.1.1.2.3 Watermain Bury Depth/Pipe Design Cover

- *Turf - 6 feet (Ultimate grade);*
- *Paved Areas - 7 feet minimum*
- *Special situations (i.e.: ditches, etc.)- 5 feet minimum cover with insulation.*
- ***Under 4 feet of cover water main must be offset to achieve 6 foot cover.***

2.1.1.2.4 Tracer wire installation is required on all water mains, branches, and services.

### 2.1.2 WATER SERVICES

#### 2.1.2.1 MATERIALS

2.1.2.1.1 Sizes thru 2" diameter shall be of one manufacturer only, as follows:

2.1.2.1.1.1 *Service Lines*

- *Type K copper tubing or HDPE*
- *250 psi pressure rated, SDR-09,*
- *copper tube size, ASTM D-2737, NSF 14, AWWA C-901*
- *with tracer wire*
- *There shall be no joints between the corporation valve and curb stop and no joint between the curb stop and meter horn valve.*
- *Laying length of HDPE lines shall afford enough slack to allow for thermal contraction of the plastic and in such manner as to avoid placing it under any undue tension.*



#### 2.1.2.1.1.2 Fittings

- *Terminal couplings on HDPE services shall be made with a pressure tight joint with a Buna-N beveled gasket, and stainless steel insert sleeve equal to Ford 50-series, and compression fitting which includes a grooved clamp equal to:*
  - *Ford C84-xx, C14-xx, C04-xx, or*
  - *Mueller 110 or*
  - *pre-approved equal.*

#### 2.1.2.1.1.3 Valves

- *Corporation (Ball) Valves: Mueller B-25000; Ford FB1000; A.Y. McDonald 74701BQ.*
- *Curb (Ball) Valves: Mueller B-25154; Ford B44-M; A.Y. McDonald 76104BQ.*
- *Curb Boxes: (Minn. Pattern) Mueller H-10300 and H-10302; Ford E.M. 2-65-56/57 and 2-70-56/57; A.Y. McDonald 5614/15.*

#### 2.1.2.1.2 Sizes 3" diameter and larger shall be as follows for Service Lines, Valves, and Fittings:

- *Connection to Main: Anchoring tee with service line valve anchored to the main branch tee or tapping sleeve and reducing fitting, when appropriate.*
- *Lines: Per "Water Main – Materials" section.*
- *(Curb) Valves: Per "Valves – Materials" section.*
- *Valve Boxes: Per "Valve Boxes – Materials" section.*
- *Fittings: Per "Fittings – Materials" section.*

#### 2.1.2.1.3 Extension rods are required for curb stop boxes deeper than 12feet.

#### 2.1.2.1.4 All stop boxes and service valves shall be exposed, plumb, clean, and operable, when initially installed during new construction, as well as during rehabilitation or repaving projects.

### 2.1.2.2 DESIGN STANDARDS

#### 2.1.2.2.1 Location, as you face the property, shall be to the left of the sanitary sewer lateral. Each habitable building shall have its own unshared service connection to the main.

#### 2.1.2.2.2 On new construction, curb stop shall not be located within 5 feet of the driveway.

#### 2.1.2.2.3 Water services shall have a trench check dam installed on the property side of the curb stop. See Specification 2.1.3 and Detail Figure 20.



2.1.2.2.4 Pipe design cover:

- *Turf (Ultimate grade) - 6 feet minimum*
- *Paved areas - 7 feet minimum*
- *Special Situation (i.e.: ditches, etc.) - 5 feet minimum cover with insulation*
- ***Under 4 feet of cover water main must be offset to achieve 6 foot cover.***

2.1.2.2.5 Following sizes are minimums, larger sizes may be required based upon fixture units and point of service pressure:

Type	Distance (building to main)	No. of Units	Size
Single Family	<55'		1 ¼" ID
	>55'		1 ½" ID
Two Family	<55'		1 ½" ID
	>55'		2" ID
Multi-Family		≤4	2" ID
		≤8	4" ID
		≤12	4" ID
		≤24	6" ID
		≤48	8" ID
Commercial			2" ID
Industrial			2" ID

2.1.2.2.6 Laterals 2" diameter and smaller may be installed in common trench with the sanitary sewer; Place the shut off at the (future) ROW or easement line.

2.1.2.2.7 Laterals greater than 2" diameter shall be installed a minimum of 8.0 feet away from sanitary or storm laterals; place the shut off at the water main connection tee.

2.1.2.2.8 Generally, copper service lines shall be installed in accordance with SWS Chapters 5.1.0, 5.2.0 and 5.5.0, and File Nos. 50 & 51, and the following requirements.

- *Copper service pipe 1¼" diameter and smaller shall be installed with NO coupling or joint from the corporation stop to the curb stop valves, and the run from the curb stop valve to the meter horn.*
- *Copper service pipe 1½" and 2" diameter shall be installed with NO coupling or joint from the corporation stop to the curb stop valve, and the run from the curb stop to the meter horn. In the event of a run greater than 55 ft., then the shortest pipe length shall be 20 ft.*

2.1.2.2.9 Existing laterals not used in a development shall be abandoned at the main when a development, land division or building razing occurs. See Section 2.2 regarding Abandonment.



#### 2.1.2.2.10 HDPE Service Lines

2.1.2.2.10.1 *The entire laying length shall be carefully inspected before placement into the trench for cuts or gouges or kinks. If a cut or gouge is found to be deeper than 10% of the minimum standard wall thickness of the pipe, the entire affected length shall be removed and discarded. If there is any kink in the laying length, the entire affected length shall be removed and discarded. The pipe to be placed shall not be kinked, cut or gouged during installation, or the preceding requirements shall be applied.*

2.1.2.2.10.2 *Laying length of HDPE lines shall afford enough slack to allow for thermal contraction of the plastic and in such manner as to avoid placing it under any undue tension. The pipe shall be laid by snaking the pipe in the bottom of an 18" wide trench and continuously supporting it on a smooth bedding surface. Before placing cover and backfill materials in the trench, water is to be run through the pipe to check connections for leaks and to cool the pipe to ambient ground temperature, and NOT ambient air temperature.*

2.1.2.2.10.3 *Cover materials shall be placed immediately after the leak check and while the pipe is still at ambient ground temperature. A minimum of two (2.0) feet of material, referenced in Section 2.1.13, shall be placed over the pipe before additional backfill material may be plowed or dumped into the trench to final grade. HDPE pipe shall be carefully placed to ensure minimum cover to final grade to be not less than 6.0-ft. in turf areas and not less than 7.0-ft. under paved areas.*

2.1.2.2.11 Prior to applying curing material on the curb and gutter, the face of the curb shall be "branded" with a "W" designating the location(s) of water services. Physical placement of the branding shall be reasonably accurate in a vertical plane above the respective service.

### 2.1.3 TRENCH CHECK DAM

#### 2.1.3.1 MATERIALS

2.1.3.1.1 Clay material shall have no organic material and shall be compacted to 95 percent standard proctor. Or;

2.1.3.1.2 Pre-approved equals such as: AquaBlok®, slurry and others.

#### 2.1.3.2 DESIGN STANDARDS

2.1.3.2.1 Trench check dam shall be installed on all water services.

2.1.3.2.2 The check dam shall be located on the property side of the curb stop.

2.1.3.2.3 See Detail Figure No. 20.



## 2.1.4 VALVES

### 2.1.4.1 MATERIALS

All valves shall be Resilient type; acceptable valves are:

2.1.4.1.1 Butterfly Valves - for 12" and larger diameters, conforming to AWWA C504-94, stems sealed by at least two O-Rings, and worm gear operators for 2" square valve key operation from above, turn left (CCW) to open. Install with operating nut on North or East side of water main. Acceptable valves include:

- *M & H 4500*
- *Pratt Groundhog*
- *Mueller LineSeal III-3211-20 or XP-5227-20, or*
- *Pre-approved equal.*

2.1.4.1.2 RW Gate Valves - for 10" and smaller diameters, conforming to AWWA C-509-94, non-rising stems sealed with two O-Rings, MJ ends (or MJ-F), turn left (CCW) to open, 2" square operating nut. Acceptable valves include:

- *Clow R/W*
- *Kennedy R/W – 4571*
- *Mueller R/W A-2361 or 2362*
- *Waterous Series 2500*
- *Pre-approved equal.*

2.1.4.1.3 All exposed and non-epoxy coated bolts and nuts on hydrants and valves shall be stainless steel; T-Bolts shall be Cor-Blue or have a fluoropolymer coating as pre-approved by the City Engineer.

2.1.4.1.4 All valves shall be furnished with interior and exterior epoxy coatings per AWWA C-550-90. All valves not installed in vaults or manholes shall be installed per SWS File No. 37, and shall be wrapped with polyethylene per Section 2.1.10 of these Specifications.

### 2.1.4.2 DESIGN STANDARDS

2.1.4.2.1 Valve locations.

- *On all legs of branch lines: Mega-lugged to watermain*

2.1.4.2.2 Maximum spacing between valves:

- *At each intersection.*
- *Every 800 feet.*
- *Not greater than 24 residential equivalent units. (i.e.: 24 SF units; 3 – 8 Family Units).*



## 2.1.5 VALVES BOXES

### 2.1.5.1 MATERIALS

2.1.5.1.1 Valve boxes shall be cast iron, manufactured in the USA, and shall properly accommodate the selected valves. Acceptable manufacturers are:

- *Tyler Series 6860 US Domestic*
- *Pre-approved equal.*

2.1.5.1.2 Valve & enclosure type.

<u>Size</u>	<u>Box</u>	<u>Type</u>	<u>Manhole Vault</u>
4"	Yes	RW – GV	
6"	Yes	RW – GV	
8"	Yes	RW - GV	(Special circumstances)
12"	Yes	RW – BV	(Special circumstances)
16"	Yes**	RW - BV	(6 foot diameter option**)

2.1.5.1.3 All valve boxes deeper than 12.0 ft. from top of the operating nut to finish grade shall have solid extension rods with a centering ring. The extension rod shall be pinned to operating nut as approved by the Utility Department. In these cases, tracer wire connected to each valve shall be attached and run up the outside of each valve box to avoid interference with the extension rod(s).

2.1.5.1.4 A valve box adaptor by Adapter, Inc., or pre-approved equal, shall be furnished as part of the complete valve box for direct-bury gate & butterfly valves.

2.1.5.1.5 Top sections of valve boxes shall be whole factory lengths. Breaking of the top section to shorten its length is not acceptable.

2.1.5.1.6 Screw-in risers are acceptable and preferred. Slip in risers may be used with prior approval.

2.1.5.1.7 Valve box cover shall have the word "Water" stamped on the top surface.

2.1.5.1.8 All valve boxes shall be wrapped with polyethylene per Section 2.1.10 of these Specifications.

2.1.5.1.9 All valve boxes shall be installed straight and plumb when initially installed during new construction, as well as during rehabilitation or repaving projects. The top of the valve box shall be set 3/8" – 1/2" below pavement grade to avoid damage from snowplows and streets cleaning equipment.

2.1.5.1.10 Valve boxes shall be operable, cleaned and free of debris after installation, after rehabilitation or repaving projects or after any work done by non-Utilities and Streets Department personnel.



## **2.1.6 VALVE VAULTS**

### **2.1.6.1 MATERIALS**

- 2.1.6.1.1 When designated on the plans or required by the City Engineer, valve vaults/manholes shall be installed in accordance with this Section.
- 2.1.6.1.2 All manholes shall be pre-cast concrete with integral base and reinforced concrete flat slab top, or approved equal.
- 2.1.6.1.3 All pre-cast manhole barrel joints shall be made with preformed butyl rubber gasket material (ie. 'Easy Stik' or equal).
- 2.1.6.1.4 All manhole steps shall comply with SWS, Section 8.40.1.A or B.
- 2.1.6.1.5 All pre-cast manhole barrel sections shall be rotated to align all manhole steps vertically in the manhole.
- 2.1.6.1.6 All manhole lids shall be equal to Neenah R-1900-D with gasketed lid.
- 2.1.6.1.7 All frame/casting adjusting rings shall be reinforced concrete rings having 36" I.D. The minimum height for a chimney section shall be the height associated with the proper placement of one 2" adjusting ring. The maximum height of adjusting rings above the cone as measured from the slab top is 16". If more than 16" of adjusting rings are needed to set the casting to finished grade, then an additional barrel section shall be installed on the manhole. Paving rings which have an adjustable diameter are not allowed.
- 2.1.6.1.8 All chimney joints, including the frame-chimney joint, and all barrel & cone section lifting holes shall be sealed with a premixed, non-metallic, high-strength, non-shrink cementitious grout such as Pennegrout by IPA Systems, or approved equal, which meets requirements of ASTM C-1-91 and C-827 as well as CRD C-588 and C-621.
- 2.1.6.1.9 Waterproofing mastic shall be placed over all lift holes and exterior of manhole chimneys that are approved to remain raised above existing grade. Trowelable grade mastic, Tremco 60 or approved equal, shall be applied to a minimum 50 mil WFT.
- 2.1.6.1.10 An external sealing wrap shall be placed at all joints between pre-cast manhole sections. The external sealing wrap shall meet, or exceed, the requirements of ASTM C-877, Type II. External joint seals shall be MacWrap, as manufactured by Mar-Mac Manufacturing Co. Inc. or pre-approved equal.



- 2.1.6.1.11 Coal-tar epoxy coating (two coats @ 8.0 mils DFT each) shall be applied to the exterior of ALL manholes in accordance with SWS 8.7.0. Alternate waterproofing materials and application may be pre-approved by the City Engineer.
- 2.1.6.1.12 Pipe-Manhole Connection device shall be Kor-N-Seal boot with stainless steel Snap-In banding rings or pre-approved equal.

## 2.1.7 HYDRANTS

### 2.1.7.1 MATERIALS

2.1.7.1.1 Acceptable Manufacturers are:

- *Clow Medallion*
- *Kennedy Guardian*
- *Mueller Super Centurion 250, Model A423*
- *Waterous 5.25" Pacer*
- *Pre-approved equal.*

2.1.7.1.2 All hydrants shall be provided as follows:

- *MJ connection*
- *Turn left to open*
- *depth of bury 6.5'*
- *Weather shield top*
- *Painted Brite Hydrant Red (5 mil DFT)*
- *Break flange (traffic) type*
- *5.25" main valve opening*
- *Two 2.5" hose nozzles*
- *One 4.5" pumper nozzle*
- *One 5' long Heavy Duty Candy Cane Fire Hydrant Marker with a spring-equipped L-bracket for hydrant flange bolt mounting. Available at Ferguson Waterworks (Part # CHMHRW), HD Supply (Hydra Finder Flag) or USA Bluebook (Part # ME-22516).*

2.1.7.1.3 Hydrant leads shall be six (6) inch, Class 52 ductile iron pipe.

2.1.7.1.4 Hydrants shall be connected to watermain with a Clow F1217 Anchoring Tee or pre-approved equal, a branch RW Gate Valve at main, a valve box and adaptor base.

2.1.7.1.5 All hydrants and valves shall be restrained by Mega-lugs or pre-approved equal from the main to the hydrant. Any push on joints in hydrant leads need to be harness restrained.



- 2.1.7.1.6 Contractor shall provide for a 6.5' burial depth for all hydrant leads shown on plans. If a water main burial depth is greater than 6.5', Contractor shall install fitting(s) to raise the hydrant lead to meet the required burial depth.
- 2.1.7.1.7 Hydrants that are not placed in service shall have a "Not in Service" tag attached to the pumper nozzle.
- 2.1.7.1.8 All pumper nozzle caps on private fire hydrants shall be painted safety yellow.
- 2.1.7.2 DESIGN STANDARDS**
- 2.1.7.2.1 Location:
- *Maximum spacing: 400-ft. diameter from center of hydrant to center of hydrant.*
  - *At all high points in distribution system.*
  - *At lot lines extended, where practical. In the event a hydrant location conflicts with a valve location at an intersection, the hydrant tee shall be located 10 feet away from the main valve.*
  - *Rural: 3 feet off of Right-of-Way. Provide 5-ft. deep x 10-ft. wide hydrant easement.*
  - *Urban: 4 feet behind back of curb line.*
  - *Sidepaths, recreation trails and other pedestrian ways: Minimum separation distance from edge of pathway to closest physical feature of the hydrant shall be 18".*
- 2.1.7.2.2 Design height: Pumper nozzle above surrounding finish ground = 18" to 24".
- 2.1.7.2.3 Design cover: 6.5 feet minimum bury.
- 2.1.7.2.4 Branch pipe design cover:
- *Turf - 6 feet minimum (Ultimate grade)*
  - *Paved areas - 7 feet minimum*
  - *Special Situation (i.e.: ditches, etc.) - 5 feet minimum cover with insulation*
- 2.1.7.2.5 Break flange must be at grade or not greater than 6 inches above grade.
- 2.1.7.2.6 Branch tee shall be anchor-style with gate valve at the tee.
- 2.1.7.2.7 An asphalt service drive with culvert shall be installed in all ditch crossings greater than 2.0 feet deep or that have traverse slopes greater than 4H:1V.
- *The service drive shall be 7 feet wide and extend to 2 feet behind the hydrant. The drive shall be constructed with 8 feet wide by 6" deep of No.2 open graded base course and 7 feet wide by 3" depth of asphalt.*



- *Culverts shall be hydraulically sized for each location consistent with Section 4 of the Development Handbook.*

## **2.1.8 FITTINGS**

### **2.1.8.1 MATERIALS**

- 2.1.8.1.1 All pipe fittings used for water main shall comply with SWS and be manufactured in the USA.
- 2.1.8.1.2 All fittings shall be Ductile Iron and be Class 350 or greater, conforming to the current ANSI/AWWA C-153/A21.53.
- 2.1.8.1.3 Fittings shall have a standard asphaltic coating and shall have a cement mortar lining on the interior in accordance with current (USA Domestic Only) ANSI/AWWA C-104/A21.4.
- 2.1.8.1.4 Fittings and accessories shall be furnished with mechanical-type joints with lugged retainer glands in accordance with current (USA Domestic Only) ANSI/AWWA C-111/A21.11.
- 2.1.8.1.5 All nuts and bolts shall be stainless steel on hydrants and valves. All T-Bolts shall be Cor-Blue.
- 2.1.8.1.6 All tees and fittings shall be anchored with restraints or pre-approved equal.
- 2.1.8.1.7 Angle Fittings shall be as follows:
- *All 90° bends: Full body, long radius, anchored, and mega-lugged or buttressed.*
  - *Other Angle Fittings: Short body acceptable; anchored and buttressed.*
- 2.1.8.1.8 Acceptable Manufacturers of Ductile Iron pipe fittings include the following:
- *American Cast Iron Pipe Co.*
  - *Clow Water Systems, Co.*
  - *Tyler Union*
- 2.1.8.1.9 Acceptable restraints include the following:
- *EBAA Mega-lug*
  - *Romac Roma Grip*
  - *Or approved equal*

### **2.1.8.2 DESIGN STANDARDS**

- 2.1.8.2.1 All fittings shall be wrapped with polyethylene per Section 2.1.10 of these Specifications.



## 2.1.9 WATER METERING REQUIREMENTS

### 2.1.9.1 DESIGN STANDARDS

- 2.1.9.1.1 Refer to Municipal Code Chapter 267-13 for general requirements.
- 2.1.9.1.2 Two-Family units shall require a split service lateral into the building in accordance with Standard Detail Figure No. 19.
- 2.1.9.1.3 Multi-Family Condominium buildings: A water metering room shall be required at the water service entrance location. Each water meter room shall be designed to meet the requirements of the New Berlin Water Utility, including an outside doorway. An entry key shall be provided to the New Berlin Water Utility.
- 2.1.9.1.4 Multi-Tenant Commercial and Industrial buildings: A water metering room shall be required at the water service entrance location. Each meter room shall be designed to meet the requirements of the New Berlin Water Utility, including an outside doorway. All commercial and industrial buildings shall have ball valves installed on the inlet, outlet, and bypass for water meters. An entry key shall be provided to the New Berlin Water Utility.
- 2.1.9.1.5 The water meter room shall:
- *Be large enough to allow work on the water meters. The size of the meter room would vary depending on the meter size(s) and number of meters going into the building. The Utility Department must approve the size of the meter room.*
  - *Be unobstructed by water softeners, vacuum cleaners, garbage cans, electric service, phone services, etc.*
  - *Not be used for cleaning supply storage or storage area.*
  - *Have adequate heating and lighting*
  - *Have a floor drain*
  - *The size of the water meter shall be on the plan to make sure the room is big enough to house the entire meter.*
- 2.1.9.1.6 Irrigation and/or Sprinkler Meter:
- *Must be connected prior to the main water meter of the residence or building.*
  - *Shall not be connected after the main meter under any circumstances.*

## 2.1.10 POLYETHYLENE WRAP

### 2.1.10.1 MATERIALS

- 2.1.10.1.1 Polyethylene film materials shall comply with SWS, Chapter 8.21.0.



- 2.1.10.1.2 Wrap all ductile iron pipe, valves, fittings and valve boxes with polyethylene film. When wrapping valve boxes, only wrap the bell portion and the bottom of the first section.

## **2.1.11 TRACER WIRE**

### **2.1.11.1 MATERIALS**

- 2.1.11.1.1 Copperhead high strength Tracer Wire or pre-approved equal.
- 2.1.11.1.2 Tracer wire shall be a #12 AWG fully annealed, high carbon 1055 grade steel, high strength solid copper clad steel conductor, insulated with a 30 mil, high-density, high molecular weight polyethylene insulation, and rated for direct burial use at 30 volts.
- 2.1.11.1.3 Tracer wire shall be laid parallel with and above centerline of the main, fittings and service line, and taped at maximum of 10-foot intervals.

### **2.1.11.2 DESIGN STANDARDS**

- 2.1.11.2.1 Tracer Wire Required on ALL mains and services:.

### **2.1.11.3 INSTALLATION**

- 2.1.11.3.1 Branch or connections with the tracer wire shall require 10 full turns of exposed and undamaged copper-to-copper contact and water-tight wrap to prevent corrosion or any deterioration of electrical conductivity (i.e.: Western Union splice).
- 2.1.11.3.2 Tracer wire shall be terminated behind hydrant barrels and curb stop boxes using a ½" PVC electrical conduit to carry the wire from bottom to top of structure, with a 1.5 foot pigtail. The tracer wire shall be run from each curb stop box and terminate at the meter or meter horn location within the building.
- 2.1.11.3.3 Tracer wire on service laterals shall be terminated at the marker board (maple hearth) in a ½" conduit taped to the board.
- 2.1.11.3.4 When installing ductile iron mains and fittings, provide and install "Cable Bond" type conductors on/at each joint. Note that epoxy coated valve bodies are not to be compromised. As an alternative, install tracer wire.



## 2.1.12 TAPPING

### 2.1.12.1 MATERIALS

2.1.12.1.1 Service saddles shall be used on all corporation valve sizes larger than 1", subject to specific pipe manufacturer restrictions for the pipe to be tapped. Saddles shall be all 304 stainless, double bolt saddle. Acceptable products for service sizes through 2" corps include:

- *Cascade Series CSC2 and CS22*
- *Ford FS303*
- *PowerSeal 3412AS*
- *Romac Style 306*
- *Smith-Blair 372*
- *Pre-approved equal.*

2.1.12.1.2 Tapping sleeves, that have a flanged outlet, shall be used when tapping all existing pipe in service for branch lines 3" and larger in size. The body shall be 304 stainless steel, have a minimum of 1/3 of the interior surface fully lined with a raised "donut" area around the branch opening, and a test port. All bolts, washers, and nuts shall be stainless steel. Acceptable tapping sleeves include:

- *Cascade CST-EX*
- *Mueller H304SS*
- *Power Seal 3490AS & AS-MJ*
- *Romac Series SST*
- *Smith-Blair 662*
- *Ford Style FTSS*
- *Pre-approved equal.*

### 2.1.12.2 DESIGN STANDARDS

2.1.12.2.1 Location of all taps, tapping devices or fittings/valves for ALL water pipes shall be in accordance with the following:

2.1.12.2.2 The minimum distance from the beginning/end of the Bell or MJ of a water pipe, fitting or another tap shall be:

- *Corporation direct tap = 2.0 ft.*
- *Corporation Tapping Saddle (up to 2" size) = not less than 2.0 ft.*
- *Branch Tapping Sleeve = not less than 4.0 ft.*



### 2.1.12.3 INSTALLATION

- 2.1.12.3.1 Activation of tap can only be authorized by the Water Utility after passing pressure tests and safe water tests. **A Utility representative shall be present on-site during tapping and sleeve work and any connection(s) to existing main(s).** Two working days advance notice before making the connection is required by the Water Utility.
- 2.1.12.3.2 All taps to water mains shall be made under full system pressure, with the main full of water. No taps may be made on an inactive or non-pressurized main.
- 2.1.12.3.3 All curb stops shall be installed under full system pressure prior to hydrostatic testing for acceptance of installation.
- 2.1.12.3.4 When tapping, thoroughly clean and inspect the pipe surface. Wet the pipe surface with a soap/water solution prior to placing a saddle, sleeve or repair clamp. Confirm that the main OD falls with the tapping device's OD range. Ensure that the tapping device is properly aligned to connect with the branch pipe. Ensure that the tapered ends of the gasket are smooth, not folded or rolled in any manner.
- 2.1.12.3.5 The saddle, sleeve or repair clamp shall be installed and all bolts finger-tightened for uniform gap. Tighten all bolts working from the ends to the center using torque wrenches in accordance with manufacturers specifications. After approximately 10 minutes to allow the gasket to fully compress, all bolts shall be re-tightened to manufacturer's specifications, but not exceeding 150 ft-lbs torque. Make sure the tapping device and tapping machine are fully supported and all cutting edges sharpened. Teflon tape or Teflon pipe dope shall be used on the corporation stop and all other pipe threads.
- 2.1.12.3.6 If tapping device is for 3" or larger branch line, the sleeve shall have a test port and be tested at 100 psi for 5 minutes by the Contractor BEFORE the actual tap proceeds. A Water Utility representative shall witness the tapping device installation, pressure test and tapping procedure.
- 2.1.12.3.7 All taps to existing and new mains shall be "live" or "wet" taps, utilizing a tapping machine with appropriate cutting tools and sharp cutting heads. All tap cut-outs shall be given to the Construction Inspector or Water Utility representative witnessing the tap.
- 2.1.12.3.8 No taps will be permitted to begin after 1:00 P.M. Additionally, pre-approval by the Water Utility is required for tapping on a Friday or preceding a holiday.
- 2.1.12.3.9 Two business days prior notice to Water Utility is required to be given prior to installation of new taps on existing mains.



2.1.12.3.10 Notice shall also be given to the Plumbing Inspector (Department of Community Development, 262-797-2445) for new taps on existing mains.

### **2.1.13 BEDDING/COVER/BACKFILL**

#### **2.1.13.1 MATERIALS**

2.1.13.1.1 Pipe Bedding: In accordance with SWS, Section 8.43.2 to 1.0 foot above pipe: 3/8" limestone chips for PVC/PVCO pipe, HDPE services. All Ductile Iron pipe, fittings, and copper services shall use "torpedo" sand. No. 1 clean stone shall be placed within a 5 ft. radius of valves and valve boxes.

2.1.13.1.2 Cover Material: In accordance with SWS, Section 8.43.3. No stone, rock or other similar material with a sieve size greater than 1" shall be permitted.

2.1.13.1.3 Granular Backfill: In accordance with SWS, Section 8.43.4. No stone, rock or other similar material with a sieve size greater than 3" shall be permitted. In spot construction in trench lengths less than 50' Granular Backfill shall be crushed limestone per SWS, Section 8.43.6.

2.1.13.1.4 Spoil Backfill: In accordance with SWS, Section 8.43.5. No stone, rock or other similar material with a sieve size greater than 3-inches shall be permitted within 2.0 ft. above or beside the pipe. For HDPE service lines, the sieve size shall not be greater than 1¼" within 2.0 ft. above or beside the pipe.

2.1.13.1.5 Slurry Backfill: Aggregate slurry in accordance with SWS, Section 8.43.8, or in accordance with a street opening permit, when issued. In special cases, City Engineer may require Sand Slurry consisting of 50 pounds of flyash and a ½ bag of Portland cement per cubic yard of mix.

#### **2.1.13.2 DESIGN STANDARDS**

2.1.13.2.1 Mechanically compact all trench backfill per Section 2.6.14(b) of SWS.

2.1.13.2.2 Backfill in accordance with all street opening permit(s); generally this will be slurry aggregate. All areas not within 5 ft. of paved surface (and above a 45-degree intercept line) may receive suitable spoil backfill as provided herein.

### **2.1.14 CAPS & PLUGS**

#### **2.1.14.1 MATERIALS**

2.1.14.1.1 Acceptable caps & plugs include:

- *Clow F-1155, F-1159 and F-1165 solid cap or pre-approved equal.*
- *Poured buttresses shall be used*
- *Mega-lugs or pre-approved equal shall also be used when appropriate.*



## **2.1.15 CASING/CARRIER PIPE**

### **2.1.15.1 MATERIALS**

2.1.15.1.1 Installation of water lines within casings shall be accomplished by using Stainless Steel Casing Spacers installed in accordance with the manufacturer's recommendations. Spacers shall be:

- *Style CCS by Cascade Waterworks Mfg. Co. of Yorkville, IL*
- *Model 4810 by PowerSeal Pipeline Products of Wichita Falls, TX*
- *Pre-approved equal.*

2.1.15.1.2 End seals, installed on both ends of each casing, shall be:

- *Cascade Style CCES*
- *PowerSeal 4810ES*
- *Pre-approved equal.*

2.1.15.1.3 Water mains within the casing shall be installed with mechanical joints and mega-lugs or pre-approved equal.

### **2.1.15.2 DESIGN STANDARDS**

2.1.15.2.1 Casing watermain shall be used for all plastic pipe crossing a right-of-way and for all arterial crossings.

## **2.1.16 INSULATION**

### **2.1.16.1 MATERIALS**

2.1.16.1.1 Minimum of 2" thick polystyrene board as manufactured by:

- *UpJohn*
- *Dow*
- *Pre-approved equal.*

### **2.1.16.2 DESIGN STANDARDS**

2.1.16.2.1 Under 4 feet of cover or separation, offset is required to achieve 6 feet of cover or separation. All water system pipes (mains, hydrant leads, services, stubs) having less than 5 feet of cover material over the pipe or passing within 4 feet of an underground structure which may experience freezing temperatures shall be insulated in accordance with SWS, Sections 4.17.0 and 5.5.20



## 2.2 ABANDONMENT

### 2.2.1 General

2.2.1.1 All existing water mains and service lines that will not be used in new construction, or re-used for reconstruction of existing building sites shall be abandoned at the main.

2.2.1.2 **A representative from the City Water Utility shall be present to witness the abandonment.**

2.2.1.3 All excavations within public rights-of-way shall require City (Department of Community Development, 262-797-2445) and/or County Permits.

2.2.1.4 Excavations within 5 ft. of and under paved surfaces shall be backfilled with Slurry Aggregate per the SWS to within 1.0 ft. of surface, followed by appropriate street restoration and not less than 3-inches of binder and 2-inches of wearing surface bituminous pavements.

2.2.1.5 In special circumstances, when approved in writing by the City Engineer, water service lines may be temporarily made inactive at the right-of-way or easement boundary. The service shut-off valve shall be turned off and the pipe plugged or capped at the property line. Water services not abandoned at the main shall meet the following conditions:

- *As part of the demolition permit, a certified check or Letter of Credit, in the amount of \$5,000 per lateral, shall be submitted to the City Engineer to guarantee the permanent abandonment of the service at the main is completed in a timely manner.*
- *Any service line that is not abandoned at the main shall be subject to separate “availability” or “ready to serve” charges in the interim period until properly abandoned.*
- *Water lines made inactive in this manner shall be marked with a marker post placed 1 ft. from the end of the pipe and extending from the pipe to 3 ft. above the ground surface and painted a blue color.*
- *The location of the terminal pipe locations shall be surveyed or otherwise “tied” to permanent objects that will remain undisturbed at the site, with an as-built drawing provided to the City Engineer and Utility Department for record purposes.*

### 2.2.2 Water Services

2.2.2.1 All water services 2” diameter and smaller shall be abandoned at the street main by turning off the corporation tap stop valve, disconnecting and removing 2 - 3 ft. of the service line and installing a standard brass cap on the corporation valve.



- 2.2.2.2 The brass cap (& plug) shall be:
- *Ford copper tube nut with FIP on small end and MIP nut (P/N: C01.xx and C08.xx)*
  - *Mueller brass cap (P/N: H-15540)*
  - *Or pre-approved equal.*
- 2.2.2.3 The remaining service line may be left in place, but the valve box/curb stop shall be removed.
- 2.2.2.4 The completed work shall be double wrapped with polyethylene per SWS, Chapter 6.21.0.
- 2.2.2.5 For water service lines larger than 2" diameter, the abandonment procedure would consist of:
- *Removal of the service shut-off valve (if at the main), plus 2 - 3 ft. of service pipe at the street main branch fitting.*
  - *Installation of a gasketed blind flange or MJ plug at the branch fitting, as appropriate.*
- 2.2.2.6 All bolts and gaskets shall comply with these standards.
- 2.2.2.7 In the event that the shut-off valve is not at the street main branch fitting, then 2 - 3 ft of the service pipe shall be removed and a gasketed blind flange or plug installed onto the branch fitting at the main.
- 2.2.2.8 The valve box/curb stop shall be removed.

## **2.3 INSPECTION**

### **2.3.1 SUBMITTALS AND SAMPLES**

- 2.3.1.1 Material samples shall be taken as provided in SWS 8.1.0 and the Contract Documents.
- 2.3.1.2 All materials delivered to the Work Site shall have legible markings in accordance with ANSI, ASTM, AWWA and SWS 8.3.0.
- 2.3.1.3 All materials of each type or use shall be from a single manufacturer for the entire Contract.
- 2.3.1.4 Prior to the start of work, the Contractor shall submit six (6) sets of the following for approval:
- *Letter of Certification and representative test reports by manufacturer for all pipe delivered to the Work Site for EACH material item furnished.*



- *Representative test reports for EACH material item furnished to the Work Site.*
- *Installation manuals for all valves, operators, hydrants, etc.*
- *Maintenance manuals for all mechanical equipment furnished to the Work Site.*
- *Generally, installation shall be in accordance with SWS and as modified by these Specifications.*

### **2.3.2 DISINFECTING**

- 2.3.2.1 No chlorination or flushing between safe samples.
- 2.3.2.2 Use only chlorine tablets glued to the top interior wall of the pipe (no powder) to disinfect pipelines and service/fire lines in accordance with SWS, Section 4.3.12. The Water Utility will collect samples of the chlorinated water for safe water testing. Contractor shall supply all labor assistance to flush mains and to take sample(s).
- 2.3.2.3 Water wasted to surface may not contain any substances in concentrations that adversely affect the water as determined by the Wisconsin Administrative Code, NR 105 and 106. For chlorine, no total residual chlorine may be measured in the water being discharged to a surface water greater than ambient total chlorine residual in system water supply (typically 0.5 mg/L). Advise the Water Utility and City Engineer of proposed discharge schedule to arrange DNR-required chlorine residual measurements for main flushing water.

### **2.3.3 ACCEPTANCE TESTING**

#### **2.3.3.1 General**

- 2.3.3.1.1 Pressure and leakage testing shall include all installed system components, such as mains, branches, services and fire protection taps to terminus of all lines to be installed under the Contract.
- 2.3.3.1.2 Two (2) business days advance notice to the Engineering Project Inspector and Water Utility shall be required.
- 2.3.3.1.3 Water for filling, testing and flushing for safe sampling of watermain will be supplied only by permission of the Water Utility via permit. All water that is used for filling new mains, pressure testing, flushing of mains, trench flushing, and safe sampling etc., will be witnessed by an inspector or Utility employee. Water used will be charged at the current rate.



### 2.3.3.2 Tests

- 2.3.3.2.1 Prior to pre-punch list work, tracer wires shall be tested by Contractor prior to City accepting the work. The Utility Department has the option to spot check the continuity of the tracer wires.
- 2.3.3.2.2 Pressure and leakage tests shall be performed in accordance with SWS and under the jurisdiction of the Engineering Project Inspector and Water Utility.
- 2.3.3.2.2.1 *Pressure Test: After the test connections are made and the main filled with water, the test section shall be subjected to water pressure normal to the area. After examination of exposed parts of the system, the test pressure will be increase to 150 psi on the main at the lowest elevation. The main shall be examined and if any defects are found, the Contractor shall immediately make the necessary repairs at his own expense. The pressure test shall be repeated until no defects can be found. The duration of the final pressure test shall be one hour. If it is found unnecessary to add water during the duration of the pressure test, the leakage test may be waived at the direction of the Inspector and Water Utility. If waived by the Inspector and Water Utility, a combination leak/pressure test will be performed.*
- 2.3.3.2.2.2 *Leakage Test: The leakage test, if required, shall be conducted after satisfactory completion of the pressure test. The test section shall be subjected to approximately 100 psi gauge pressure at eh point of highest elevation of the main under test. The duration of the leakage test shall be two hours unless otherwise specified. Should any test section fail to meet the leakage test, the Contractor shall immediately make the necessary repairs at his own expense. The duration of the final leakage test shall be one continuous hour.*
- 2.3.3.2.3 Fire and Combination water/fire service lines shall be tested at 200 psi for 2.0 hours.
- 2.3.3.2.4 The Water Utility shall take the water samples. The first 2 water samples are at the utilities expense. After the initial 2 samples are taken, the Developer/Contractor shall pay all utility expenses until the system is considered safe.
- *Approximate cost per sample trip is \$250*
  - *No first sample will be taken on a Friday, weekend, or adjacent to a holiday.*
  - *Note: In order for acceptance, 2 consecutive samples must pass in a 24 hour period.*