

**City of Sioux Falls**

**Supplemental Standard Specifications**

**for**

**Water Main Construction**

**Section 300**

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# **Section 300 City of Sioux Falls Supplemental Standard Specifications for Water Main Construction**

## **1.0 GENERAL**

### **1.1 SCOPE OF WORK**

The Contractor shall furnish all the necessary labor, materials, equipment, tools, and supplies that are necessary to install a complete water main system, as shown on the plans and/or called for in these specifications or its addenda. It is the intent of these specifications to install a complete system or job.

### **1.2 TERM OF WARRANTY**

Reference Section 500—Warranty for Construction Activity.

### **1.3 QUALITY CONTROL AND SUBMITTALS**

Retesting of work required because of nonconformance to the specified requirements shall be performed by the same independent firm on the instructions of the Engineer. Payment for retesting performed during the contract period and during the warranty period will be charged to and will be the responsibility of the Contractor.

The Contractor or Supplier may submit appropriate documentation to the Engineer for any materials not listed in these specifications. This documentation must be provided no later than five days prior to bid opening.

Shop drawings and data shall be submitted for, but not be limited to, the following items:

Fire hydrants, pipe, pipe fittings, bedding material, stabilization material, granular material, and any other pertinent information concerning construction materials that the Engineer deems necessary for the review of the materials used on the project in accordance with the specifications and drawings.

The Contractor shall submit the number of copies that the contract requires plus three copies that the Engineer will retain. The Contractor shall obtain shop drawing approval before any of the work related to that material is performed.

All water distribution materials shall meet NSF/ANSI Standard 61—Drinking Water System Components, Health Effects and NSF/ANSI 372.

## **1.4 BIDS**

Unless a lump sum is called for, bids shall be received on a unit price basis.

The unit price bid per lineal foot for water main shall include the complete construction with the tracer wire system and other items as specified, including trench dewatering when necessary. The lineal footage will be determined by measuring from the center of one fitting or valve to the center of the next fitting or valve. When PVC pipe is used, the price bid shall include the cost of encasing the fittings in polyethylene. When ductile iron pipe is used, the price bid shall include the cost of encasing the fittings and the pipe in polyethylene.

## **1.5 PAYMENT**

Payments to the Contractor shall be made in accordance with the General Conditions.

## **1.6 ACCEPTANCE**

Acceptance of the work shall be in accordance with the General Conditions.

# 2.0 MATERIALS

## 2.1 WATER MAIN PIPE

Water main pipe 4 inches in diameter and greater shall be ductile iron or poly vinyl chloride (PVC) with a gasket joint. Pipe shall sustain a working pressure of 150 pounds per square inch (psi) with a minimum cover of 6 feet. Pipe classes shall be as follows:

Pipe Size (Inches)	Ductile Iron Pressure Class	PVC
4	350	C900 DR 18
6	350	C900 DR 18
8	350	C900 DR 18
12	350	C900 DR 18
16	250	C900 DR 18
20	250	C900 DR 18
24	200	C900 DR 18
30	150	Not Allowed
36	150	Not Allowed

All ductile iron pipe shall be manufactured in full conformance with the most current edition of AWWA C150 and C151 standards. All ductile iron pipe shall meet NSF/ANSI Standard 61—Drinking Water System Components, Health Effects and, NSF/ANSI 372.

All PVC shall be manufactured in full conformance with the most current edition of AWWA C900-16 Standards. All PVC pipe shall meet NSF/ANSI Standard 61—Drinking Water System Components, Health Effects and, NSF/ANSI 372.

Ductile iron pipe shall be lined with cement mortar (Portland cement) and shall be manufactured in full conformance with the most current edition of AWWA C104 standards. The thickness of linings shall be not less than the following: 1/16 inch for 6- to 12-inch pipe, 3/32 inch for 16- to 24-inch pipe and 1/8 inch for 30- to 60-inch pipe.

A plus tolerance of 1/8 inch in thickness will be permitted. Linings shall be full thickness to the end of the spigot and to the seat of the bell, or shall be tapered for a length of not more than 2 inches. Ductile iron pipe shall be coated on the outside with bituminous coating at least one nominal mil in thickness.

Gaskets for all ductile iron pipe shall meet the requirements of the pipe manufacturer. Sealing pipe joints for all C900 pipe shall use the Rieber joining system, which has the gasket formed into the pipe during the pipe manufacturing process. All gaskets shall meet NSF/ANSI Standard 61—Drinking Water System Components, Health Effects. Special gaskets will be required for all piping systems noted below:

- Soils contaminated with gasoline: use neoprene or nitrile gaskets.
- Soils contaminated with volatile organic compounds, use nitrile or fluorocarbon gaskets.

Where buried ductile iron restrained joint pipe is shown on the plans, pipe shall be furnished with boltless, flexible, push-on restrained joints such as Fastite Pipe with Fast Grip Gaskets or Flex-Ring by American Ductile Iron Pipe, Tyton Joint Pipe with Field-Lok or Field-Lok 350 restrained joint gaskets by U.S. Pipe or prebid Engineer-approved equal. Field-adaptable restrained joints may be provided for pipe 24 inches in nominal diameter and smaller through the use of Fast-Grip Gaskets by American Ductile Iron Pipe, Sure Stop 350 Gaskets by McWane, or prebid Engineer-approved equal.

Where ductile iron pipe is installed in trenchless, pipe bursting, directional drilling, or other applications where soil load and friction is limited or the pipe is subject to dynamic movement after the pipe systems are assembled, pipe shall be furnished with boltless, flexible, push-on restrained joints such as Flex-Ring by American Ductile Iron Pipe, TR Flex by U.S. Pipe, or prebid Engineer-approved equal.

Where PVC restrained joint pipe is shown on the plans, pipe shall be furnished with boltless, flexible, push-on restrained joints such as Diamond Lok, JM Eagle, Certa Lok, or prebid Engineer-approved equal.

## **2.2 WATER MAIN FITTINGS**

### ***Cast Iron or Ductile Iron Fittings***

The cast iron or ductile iron fittings shall be mechanical joint, except as noted, with a minimum working pressure of 250 pounds per square inch (PSI). All fittings shall be bid complete with gaskets, glands, bolts, and other appurtenances. Fittings, gaskets, glands, and cement linings shall meet NSF/ANSI Standard 61—Drinking Water System Components, Health Effects and NSF/ANSI 372. Fittings shall be manufactured in full conformance with the most current edition of AWWA C110 Standards. All fittings shall be cement lined on the interior and 1-mil nominal thickness bituminous coated on the exterior. Cement lining shall be at least 1/16 inch in thickness and shall be manufactured in full conformance with the most current edition of AWWA C104. Joints shall conform to the most current edition of the requirements of AWWA C111. Bolts shall be grade 304 stainless steel manufactured in full conformance with the most current edition of ANSI/AWWA C111/A21.11.

Acceptable manufacturers are: U.S. Pipe, American, Tyler, Star, Sigma, or prebid Engineer-approved equal.

### ***Compact Ductile Iron Fittings***

The compact ductile iron fittings shall be manufactured in full conformance with the most current edition of AWWA C153. Compact ductile iron fittings shall only be allowed for fittings that are 30 inches in size and smaller provided such fittings do not interfere with the correct installation of reaction blocking. All fittings shall be cement lined on the interior and 1-mil nominal thickness bituminous coated on the exterior as specified for cast iron fittings. Fittings shall be bid with gaskets, glands, bolts, and other appurtenances. Bolts shall be grade 304 stainless steel manufactured in full conformance with the most current edition of ANSI/AWWA C111/A21.11.



Acceptable manufacturers are: U.S. Pipe, American, Tyler, Star, Sigma, or prebid Engineer-approved equal.

Coupling adapters shall be Hymax 2000 or Romac Alpha/Alpha XL. All coupling adapters shall be coated with a 12-mil nominal thickness fusion bonded epoxy conforming to the requirements of the latest revision of AWWA C213 section 4.5. Bolts and nuts to be stainless steel. Gaskets shall be chloramine resistant and meet NSF/ANSI Standard 61: Drinking Water System Components—Health Effects, NSF/ANSI 372 approved for contact with drinking water.

### **2.3 MECHANICAL JOINT RESTRAINER DEVICES**

Restraining mechanisms shall be with wedges or full circle contact and support of the pipe wall. Restraint shall be accomplished by a series of ring or wedge segments mechanically retained inside the gland housing and designed to grip the pipe wall in an even and uniform manner. Restraining devices shall be actuated by bolts featuring twist-off heads to ensure proper installation torque is applied. All components of the restrainer, including the gland, and restraint segments, shall be of high-strength ductile iron and shall be manufactured in full conformance with the most current edition of ASTM A536. Appropriate restrainer devices shall be supplied for the specific type of piping material being used on the project. Bolts shall be grade 304 stainless steel manufactured in full conformance with the most current edition of ANSI/AWWA C111/A21.11. Restrainer devices shall be EBBA Iron Megabond, Star Products Starbond, Tyler, or prebid Engineer-approved equal.

### **2.4 VALVES**

Open right resilient-seated gate valves (4 inches to 36 inches inclusive) and tapping valves shall be manufactured in full conformance with the most current edition of AWWA C509 or C515. The valve seat shall be able to withstand 200 PSI of working pressure and the body shall withstand 400 PSI test pressure. Gate valves shall be mechanical joint meeting the requirements of AWWA C111 and tapping valves shall have a mechanical joint end and a flanged end to correspond to the branch flange of the tapping sleeve. Bolts shall be grade 304 stainless steel manufactured in full conformance with the most current edition of ANSI/AWWA C111/A21.11. All valves supplied under this proposal shall meet the requirements of NSF/ANSI Standard 61: Drinking Water System Components—Health Effects and NSF/ANSI 372.

All internal and external ferrous surfaces shall have a fusion bonded epoxy coating applied electrostatically prior to assembly meeting the requirements of AWWA C550. Valves shall have a ductile iron wedge encapsulated with nitrile rubber or an EPDM rubber compound. Stems shall be nonrising, bronze or stainless steel, and shall be sealed by three o-rings. Valves shall have a 2-inch ductile iron operating nut and open right (clockwise). Bonnet and stuffing box bolts shall be stainless steel. Resilient seats shall be bonded or mechanically attached to the gate.

Acceptable manufacturers are American, Clow, Kennedy, Waterous, and American AVK, or prebid Engineer-approved equal.

## 2.5 FIRE HYDRANTS

Open right hydrants shall be Waterous Pacer WB67-250 or series 2700 by American AVK, or prebid Engineer-approved equal and shall be dry barrel meeting the most current requirements of AWWA C502. Hydrants shall meet the requirements of NSF/ANSI Standard 61: Drinking Water System Components—Health Effects and NSF/ANSI 372. The rated working pressure shall be 150 psi and the rated test pressure shall be 300 psi. The nozzle section, upper and lower barrels, and the hydrant base shall be ductile or gray iron. The main valve closure shall be of the compression type, opening against the pressure and closing with the pressure. The main valve opening shall not be less than 5 1/4 inches and be designed so that removal of all working parts can be accomplished without excavating.

The bronze seat shall be threaded into mating threads of bronze for easy field repair. The draining system of the hydrant shall be bronze and be positively activated by the main operating rod. All threads shall be National Standard threads. Internal travel stop nut shall be bronze or zinc plated steel. Hydrant operating threads to be factory lubricated and sealed from the waterway with o-rings. Operating nuts shall be pentagon shaped and measure 1 1/2 inches point to flat.

Hydrants shall have a 6-inch mechanical joint inlet, and the barrel shall be sized for a trench depth of 7 feet. Hydrants shall have two 2 1/2-inch hose nozzles and one 4 1/2-inch pumper nozzle, all located on the same horizontal plane. The centerline of the nozzles shall be a minimum of 18 inches above the ground line groove. Nozzle cap nuts shall be the same dimension and shape as the operating nuts described above, and the nozzle caps shall be furnished with security chains. The section of the hydrant above ground shall be painted highway yellow. Hydrants shall be capable of being extended in 6-inch increments and shall be equipped with traffic features that include a breakaway flange and stem with a shaft coupling.

All buried body parts and bolts are to be 304 stainless steel in full conformance with the most current edition of ANSI/AWWA C111/A21.11.

All permanent fire hydrants shall be installed with fire hydrant markers at the time of installation. Each hydrant marker shall be impregnated polycarbonate material, red color with adhesive reflector, and with a flexible galvanized hinge riveted to hydrant marker. Each marker shall be hinge mounted to bonnet with bonnet bolt at 48-inch length and 3-inch width. Hydrant markers to be manufactured by Flexstake or prebid Engineer-approved equal.

All fire hydrant extensions must be manufactured by American AVK Series 2700 and Waterous Pacer WB 67-250. All barrel extensions that may come into contact with water shall meet the requirements of NSF/ANSI Standard 61: Drinking Water System Components—Health Effects and NSF/ANSI 372.

## **2.6 VALVE BOXES**

Valve boxes shall be cast iron and shall include the following: Two or three pieces, including base as required.

5 1/4-inch shaft.

Standard drop covers marked "WATER."

Screw-type.

Circular base for 8-inch valve.

Heavyweight 35,000-pound tensile strength.

Adjustable for a 4- to 6-foot trench.

Covers shall have a skirt length of 1 1/2 inch.

Extensions shall be in lengths shown and be compatible with the valve boxes bid.

The valve box top section extensions and caps shall be compatible with the above valve box specifications. Valve boxes to be manufactured by Tyler, Star, or prebid Engineer-approved equal. Cotter and shear pins shall be 5/8-inch stainless steel.

## **2.7 TRACER WIRE**

The components of the tracer wire system shall be suitable for direct bury applications. The conductor shall be 12 AWG, solid-strand, soft-drawn copper per ASTM B-3. The conductor shall be insulated with high molecular weight polyethylene. The minimum insulation thickness shall be 0.045 inches and the color shall be blue. Splices and/or connectors shall be capable of handling from two to four wires per connection and be designated at "waterproof." Ground rods shall be a 3/8-inch diameter, 60-inch-long steel rod uniformly coated with metallically bonded electrolytic copper. Ground rod clamps shall be a high-strength, corrosion-resistant copper alloy.

Acceptable manufacturers of the tracer wire are Coleman Cable, Kris-Tech Wire, or prebid Engineer-approved equal. Splice kits/connectors shall be Scotchlok™ DBY by 3M, LV 9000 by SNAPLOC™, or prebid Engineer-approved equal.

## **2.8 POLYETHYLENE ENCASEMENT**

Polyethylene encasement shall meet all the requirements for ANSI/AWWA C105/A21.5 and ASTM A674. Polyethylene shall be V-bio as manufactured by DIPRA, or approved equal.

In addition, polyethylene encasement shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than 8 mils.

The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of antimicrobial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion.

## **2.9 INSULATION**

Water main insulation shall be an extruded polystyrene board and meet the requirements of ASTM C578, Type IV. The minimum R-value shall be 5.0 as determined by ASTM C518. The minimum compressive strength shall be 25 psi as determined by ASTM D1621. The maximum water absorption shall be 0.1 percent by volume as determined by ASTM C272. The maximum water vapor permeability shall be 1.1 perm as determined by ASTM E96.

Water main insulation shall be STYROFOAM™ Square Edge by the Dow Chemical Company, STYROFOAM™ Brand Scoreboard by the Dow Chemical Company, or prebid Engineer-approved equal.

## **2.10 CASING PIPE SPACERS AND END SEALS**

Casing spacers shall be Model SSI-8 for carrier pipes 24 inches in diameter and smaller and Model SSI-12-2 for carrier pipes 30 inches in diameter and greater as manufactured by Advance Products & Systems, Inc., Lafayette, LA, or prebid Engineer-approved equal.

Casing spacers shall be constructed of circular T-304 stainless steel segments, which bolt together forming a shell around the carrier pipe. The spacers shall be designed with risers (when needed) and runners to support and center the carrier pipe within the casing pipe and maintain a minimum clearance of 1 inch between the casing pipe inside diameter (ID) and the spacer outside diameter (OD). On carrier pipes with an OD of 16 inches or less, each spacer shall have four riser/runner combinations—two on each half. On carrier pipes with an OD of 20 inches and greater, the number of riser/runner combinations shall be as recommended by the manufacturer, with four being the minimum. T-304 stainless steel bolts and nuts shall be supplied with the spacers.

The band shall be manufactured of 8-inch (SSI-8) or 12-inch (SSI-12-2) wide, 14-gauge T-304 stainless steel. The risers shall be constructed of T-304 stainless steel having a minimum length of 6 inches (SSI-8) or 10 inches (SSI-12-2). Abrasion-resistant runners, having a minimum length of 7 inches (SSI-8) or 11 inches (SSI-12-2), and a minimum width of 2 inches, shall be attached to each riser to minimize friction between the casing pipe and the carrier pipe as it is installed. Runner material shall be of glass reinforced plastic with the following minimum properties: compression strength of 25,000 psi, flexural strength of 32,000 psi, and tensile strength of 22,000 psi. The ends of all runners shall be beveled to facilitate installation over rough weld beads or the welded ends of misaligned or deformed casing pipe.

Interior surfaces of the stainless steel shell shall be lined with EPDM having a minimum thickness of 0.090 inches with a hardness of durometer “A” 85-90. Placement of the

spacers shall be a maximum of one foot on each side of the bell joint and one every 6–8 feet thereafter. End seals shall be Model AW Wraparound casing end seals as manufactured by Advance Products & Systems, Inc., Lafayette, LA, or an approved equal. Full conical-shaped wraparound seals made of 1/8-inch-thick neoprene rubber shall be provided for each end of the casing pipe. T-304 stainless steel banding straps with a 100 percent nonmagnetic worm gear mechanism and pressure sensitive butyl mastic strips shall be provided to seal edges.

## **2.11 SELECT FILL AND WATER MAIN BEDDING**

The material for select fill and water main bedding shall be minus 1 inch with not more than 10 percent passing the No. 200 sieve. The select fill will be bid per ton and will only be used on a limited basis for replacement material to aid in gaining acceptable trench compaction. Water main bedding material will be used for both PVC and ductile iron water main.

## **2.12 TRENCH STABILIZATION MATERIAL**

The material for trench stabilization shall consist of 3/4- to 4-inch crushed angular, well-graded material. Larger material may be used if necessary to stabilize the bottom of the trench. The trench stabilization material will be used as directed by the Engineer. The use of trench stabilization material will not eliminate the need for water main bedding material.

## **2.13 VALVE BOX MARKERS**

Valve box markers shall be a minimum of 3 3/4 inches wide and 78 inches in length. The markers shall be blue in color. The markers shall be ultraviolet resistant and stable in all weather conditions. The markers shall be Composite Composition Utility Markers as manufactured by Carsonite International or prebid Engineer-approved equal. The markers shall be labeled “CAUTION WATER PIPELINE—CALL BEFORE DIGGING.”

## **2.14 WATER SERVICE TAP**

Tapping saddles may be used for dry or wet (live water main under pressure) taps. Tapping saddles shall be limited to a maximum nominal outlet diameter of 2". Water services shall not be tapped off water mains 16" and larger unless approved by City Engineering. All Water Service Saddles shall conform to the following requirements:

- a. C900 PVC Water Main, Size 6" or 8", Size 1" Service Piping
  - a. Ford Meter Box S90, AY McDonald 3895 or Engineer approved equal
- b. C900 PVC Water Main, Size >8" and/or >1" Service Piping
  - a. Tapping saddles shall be double strap saddles. Saddle bodies conforming to ASTM A536, grade 65-45-12, protected with fusion bonded epoxy coating. The gasket shall be virgin NBR, or Buna-N rubber; formulated for treated water. Gaskets shall be cemented in place on the saddle bodies prior to steel electro galvanized with Di-chromate seal, or Mayari-R (Corten) steel. The saddle boss shall be tapped with standard iron pipe threads.
  - b. Ford Meter Box FC202, AY McDonald 4845A or Engineer approved equal

- c. DIP/CIP Water Main
  - a. Tapping saddles shall be double strap saddles. Saddle bodies conforming to ASTM A536, grade 65-45-12, protected with fusion bonded epoxy coating. The gasket shall be virgin NBR, or Buna-N rubber; formulated for treated water. Gaskets shall be cemented in place on the saddle bodies prior to steel electro galvanized with Di-chromate seal, or Mayari-R (Corten) steel. The saddle boss shall be tapped with standard iron pipe threads.
  - b. Ford Meter Box FC202, AY McDonald 4845A or Engineer approved equal

Corporation Stops shall meet the following requirements:

- a. Ford Meter Box FB600 or approved equal
- b. AWWA C800
- c. No lead
- d. Inlet thread AWWA Type CC
- e. Size: Same size as service piping
- f. Ball type valve

## **2.15 WATER CURB STOP**

Water Curb Stops shall meet the following requirements:

- a. Ford Meter Box B22 Series, AY McDonald 76100 Series or approved equal
- b. Minneapolis pattern brass ball valve
- c. No lead

Water Curb Stop Boxes shall meet the following requirements:

- a. Ford Meter Box EM Series, AY McDonald 5614 Series, AY McDonald 5615 Series or approved equal
- b. Pentagon lid
- c. Minneapolis pattern base

## **2.16 WATER SERVICE PIPING AND FITTINGS**

All water service piping and fittings shall meet the following requirements:

- a. NSF 14
- b. NSF 61
- c. Uniform Plumbing Code

High Density Polyethylene Service Lines shall conform to the following requirements:

- a. AWWA C901 250 PSI, SIDR-7.
  - 1. PE 4710 pipe compounds shall conform to ASTM D3350 and minimum cell class PE 445574C CC3.
- b. The outside diameter shall be based on the Iron Pipe Size (IPS) sizing system.
- c. Stainless steel insert stiffeners are required for all polyethylene service piping compression style fitting connections. The stiffeners shall be Ford Meter Box 70 Series or approved equal.

Copper Service Lines shall conform to the following requirements:

- a. AWWA C800.
- b. ASTM B88.
- c. U.S. Government Type K Soft Copper Tubing.
- d. Manufacturer shall be one of the following: Cerro, Mueller Copper Company, Cambridge-Lee Copper, Halstead, Wolverine, or approved equal.
- e. Flared connections are required for all copper service piping fitting connections.

Service Fittings (1"–2") shall conform to the following requirements:

- a. AWWA C800.
- b. NSF 372.

Service Fittings (4" and larger) shall conform to the following requirements:

- a. Section 2.2 Supplemental Specifications, Section 300.

Ductile Iron Pipe (4" and larger) shall conform to the following requirements

- a. Section 2.1 Supplemental Specifications, Section 300.

PVC (4" and larger) shall conform to the following requirements

- a. Section 2.1 Supplemental Specifications, Section 300.

## **2.17 TEMPORARY WATER/WATER MAIN BYPASS PIPE**

Temporary water/water main bypass pipe and associated appurtenances that may come into contact with water shall meet the requirements of NSF/ANSI Standard 61: Drinking Water System Components—Health Effects and NSF/ANSI 372. All PVC piping systems shall be manufactured in full conformance with the most current edition of AWWA C900-16 Standards. All PVC pipe shall meet NSF/ANSI Standard 61—Drinking Water System Components, Health Effects and NSF/ANSI 372. Approved Products: CertainTeed—Certa-Lok Yelomine or prebid Engineer-approved equal.

## **3.0 CONSTRUCTION REQUIREMENTS**

### **3.1 MISCELLANEOUS**

No valve or other control on the existing water distribution system shall be operated for any purpose by the Contractor.

For City-funded projects, the Engineer will stake all water main alignment and inspect all water main installation. All fittings, valves, hydrant extensions, etc., will be left open until inspected and measured by the Engineer. When necessary, the Engineer will provide grade stakes for alignment. The Contractor shall carry line and grade into the trench by means of approved survey methods. At no time shall the Contractor or his employees change the grade without approval of the Engineer. If underground interference is encountered at the assigned grade, the Contractor shall notify the Engineer for alternate alignment. The Contractor shall furnish help when requested to stake and measure water main.

The Engineer or his/her representatives shall have access at all times to all parts of the job. The Contractor must furnish such personnel, facilities, equipment, tools, materials and appurtenances as needed to make whatever tests and inspections that are deemed necessary.

### **3.2 REMOVE WATER MAIN, FIRE HYDRANTS, VALVES AND WATER MANHOLES**

Water main, fire hydrants, and water manholes shall be removed at the locations shown on the plans or as directed by the Engineer. The removal of valves shall be considered incidental to the work. Disposal of water main, hydrants, and manholes shall also be considered incidental.

### **3.3 SALVAGE WATER MAIN, VALVES, AND FIRE HYDRANTS**

Water main, valves, or fire hydrants shall be salvaged at the locations shown on the plans or as directed by the Engineer. All salvaged items shall be properly disconnected and transported to the City Water Shop and neatly stockpiled. The Water Shop shall be contacted 24 hours prior to delivery of the materials.

### **3.4 WATER MAIN PIPE**

Water main shall be installed in the locations shown on the plans or as directed by the Engineer. Ductile iron water main shall be installed in full conformance to the most current addition of AWWA C600, and PVC water main shall be installed in full conformance to the most current edition of AWWA C605. Water main shall not be installed in frozen ground or in water, and no water will be allowed to run into or through the pipe. Before installing water main, it shall be cleaned of all foreign matter and kept clean thereafter. Open ends shall be protected at all times to prevent the entrance of dirt, trench water, animals, or foreign matter into the pipe. The bell and spigot shall be



wiped clean and sufficient lubrication placed on the gasket and spigot before the pipe is pushed fully into the bell. The lubricant shall be approved for use with potable water.

Field cut spigot ends of push-on joints shall have a square end with beveled edge equal to a factory cut prior to being pushed into the bell. Every pipe shall be bedded uniformly throughout its length with water main bedding material. Care shall be taken to not have any part of the pipe bearing on rocks or stones.

For restrained joint pipe with “grip-” type gasket systems, the contractor shall set the joint and engage the teeth of the gasket during installation. When installed in encasing pipes, the restrained joint pipe with “grip-” type gasket systems shall be pulled through the encasement in lieu of being pushed to ensure that the locking mechanisms are adequately retained in the socket during installation through the encasement. Water main shall have a minimum of 6 feet of cover unless otherwise noted on the plans. If 6 feet of cover to the top of the pipe cannot be achieved or maintained, the City Engineering Division shall be notified. The City Engineering Division will determine if insulation shall be used to protect the water main from freezing. Whenever insulation is required for water main, individual water services should be evaluated for insulation requirements. The insulation work shall be in accordance with the special provisions, drawings, and manufacturer’s recommendations.

### **3.5 EXTRA DEPTH WATER MAIN PIPE**

Extra depth water main shall be installed in the locations shown on the plans or as directed by the Engineer. Extra depth water main is water main that is installed using the open cut method resulting in 8 feet or more of cover as measured from the top of the pipe to the finished surface elevation. Water main installed with 6 to 8 feet of cover is considered normal depth water main installation.

### **3.6 TRACER WIRE**

Tracer wire shall be installed with PVC and ductile iron water mains. The wire shall be installed along the lower quadrant of the pipe, but the pipe shall not be laid directly on the wire. Ground rods shall be installed adjacent to connections to existing piping and in the locations specified on the plans. The tracer wire shall be brought to each fire hydrant and connected to a 60-inch ground rod that extends up to the bottom of the breakaway flange. The ground rod shall be duct taped to the fire hydrant barrel in at least four locations below the ground surface. The tracer wire shall be spliced only if approved by the Engineer. All underground splices shall be inspected by the Engineer prior to backfilling. The tracer wire system is considered incidental to the installation of the water main and its appurtenances. The Contractor shall review test methods with the Engineer and be responsible for testing the tracer wire system for conductivity. Testing for conductivity shall be completed after the service lines have been tapped. If the tracer wire system does not function as intended, the Contractor shall repair the system to the satisfaction of the Engineer.

### **3.7 POLYETHYLENE ENCASEMENT**

All buried ductile iron water main, fittings, valves, rods, hydrants, and appurtenances shall be encased in polyethylene in full conformance with the most current edition of AWWA C105, Method A for tube-type installation.

Polyethylene encasement shall be installed in accordance with AWWA C600 and ANSI/AWWA C105/A21.5 and also in accordance with all recommendations and practices of the AWWA M41, Manual of Water Supply Practices – Ductile Iron Pipe and Fittings. Specifically, the wrap shall be cut 2 feet longer than the pipe section and shall overlap the ends of the pipe by 1 foot. The polyethylene shall be gathered and lapped to provide a snug fit and shall be secured at quarter points and each end with polyethylene tape. The polyethylene shall prevent contact between the pipe and bedding material but is not intended to be a completely airtight and watertight enclosure.

Any wrap at tap locations shall be taped tightly prior to tapping and inspected for any needed repairs following the tap.

Damaged polyethylene shall be repaired in a workmanlike manner using polyethylene tape or shall be replaced.

### **3.8 WATER MAIN CONNECTIONS**

Water main shall be connected to and extended by utilizing one of the following methods unless otherwise specified:

- A. Connect to Existing Water Main: The Contractor shall remove an existing plug, cap, reaction blocking or hydrant, prepare the end of the existing water main, and complete the new water main connection.
- B. Cut and Tie to Existing Water Main: The Contractor shall cut into an existing water main, prepare the end of the existing water main, and complete the new water main connection.
- C. Smith Tap: The Contractor shall excavate a trench at the water main to allow City crews to perform a smith tap into the existing water main. The City will furnish and install the tapping sleeve and valve. The Contractor will be required to furnish and install the valve box and backfill the trench. The Contractor will be required to coordinate the smith tap with City crews.

The trench for the water main connection shall be excavated to meet all applicable OSHA trench safety requirements prior to any work that is completed by City personnel. If the trench is unsafe to complete tapping operations, the Contractor will be required to provide the necessary additional work to ensure safety of the trench to the satisfaction of the City tapping personnel.

When using methods A or B, interruption of service to surrounding properties will be minimized; the Contractor shall have all materials for the connection on site, and to the extent possible, shall have fittings assembled and tied prior to cutting the existing water main and making the connection. Puncturing of existing water mains by machinery or other means will not be allowed. Pipe cutting shall be neat and completed in a

workmanlike manner without damage to the pipe, interior lining, or exterior coating. Cutting shall be performed with an approved mechanical cutter, using a wheel cutter when applicable and practical. Piping systems shall be cleaned and swabbed with a bleach solution to minimize contamination. Once the connections has been completed, pressure and bacteria testing shall be conducted.

### **3.9 WATER SERVICE DISCONNECTION**

All water service disconnections from the water main system shall be made by the City in development situations. Water service disconnection from the water main system shall be made by the contractor on City funded projects, unless plan documents state otherwise. In situations where City Crews perform the water service disconnections, the Contractor must coordinate in advance with City crews:

- a. Disconnection at the Corporation Stop: The Contractor shall excavate a trench to allow City crews or Contractor to turn off and disconnect the water service at the water corporation stop. On the owner side of the corporation stop, pinch and fold back the service piping or disconnect the service piping from the corporation stop. The trench shall then be backfilled by the Contractor.
- b. Disconnection at the Curb Stop: City crews or Contractor will close the curb stop valve. The Contractor shall excavate down to within one foot on the owner side of the curb stop, pinch and fold back the service piping to the curb stop or disconnect the water service piping from the curb stop. The trench shall then be backfilled by the Contractor. The existing curb stop box shall remain in place and set flush with the proposed finished grade.
- c. In all cases, the work shall be visually inspected by a City Representative.

### **3.10 WATER SERVICE RECONNECTION**

Water Service Reconnection is the process of removing service from the existing main, protecting the service during water main replacement and reconnecting the existing service to the newly installed water main. This work includes the temporary disconnection and permanent reconnection of the water service to the water main. The new service piping installed to complete this reconnection shall be copper.

Unless plan documents state otherwise, all water service reconnection to the water main system shall be made by the City in development situations, and water service reconnection to the water main system shall be made by the contractor on City funded projects. In situations where City Crews perform the water service reconnections, the Contractor must coordinate in advance with City crews. In all cases, the leak free connection shall be visually verified by a City Representative.

### **3.11 WATER SERVICE TAPS**

All water service taps to the water main system shall be made by the City in development situations. Water service taps to the water main system will be made by

the contractor on City funded projects, unless plan documents state otherwise. In situations where City Crews perform the water service taps, the Contractor must coordinate in advance with City crews. The following are additional requirements:

- a. Where the interruption of water services is prohibited, the contractor shall tap the service "live". If the service is tapped in a low pressure or no pressure situation, the tap shall be left exposed until the main pressure has been restored and a water tight connection has been verified.
- b. Service connections or taps to new or existing water main will not be permitted until the subject water main has passed the necessary disinfection requirements. Per the City's Water Installation detail, service taps/saddles must be adequately supported with concrete blocking prior to backfilling and the service saddle and service line shall be bedded with sand or other such material to provide a uniform and consistent bed to 2-inches above both the spring line of the pipe and around the corporation stop.
- c. The service taps operation, installation of tapping saddles and service corporation stops shall be in accordance with the manufacturer's recommendation. Water services shall not be tapped off water mains 16" and larger in diameter unless approved by City Engineering.
- d. The hole drilled or cut in the main shall be equal to the stated nominal size of the threaded tap on the saddle.
- e. Holes cut in PVC water mains shall be accomplished with a ribbon-type cutter. Drills and hole saws are prohibited. Ribbon cutters shall be advanced slowly and not forced through the pipe wall. Forcing the bit will cause undue heat or fracturing of the PVC material.
- f. Holes cut in DIP water mains may be accomplished by either drilling or the use of a hole saw.
- g. The outside of the pipe shall be cleaned thoroughly of all dirt, grease, oil and other foreign matter prior to installing the saddle.
- h. Bolts shall be drawn up in an acceptable pattern and torqued to the manufacturer's specifications.
- i. Corrosion Protection: The water tap material shall be protected from corrosion by use of V-Bio Polywrap. The minimum polywrap width shall be 3'. The wrap shall be held firmly in place with tape. Backfilling operations shall be conducted as to not damage or displace the wrap.
- j. Ball valve corporation stop support: The ball valve corporation stop shall be supported as shown in the Water Service Installation detail.
- k. Effort should be made to tap the water main perpendicular to the curb stop.

### **3.12 WATER SERVICE CURB STOP**

All water service curb stops shall be installed by the City in development situations. Water service curb stops shall be installed by the contractor on City funded projects, unless plan documents state otherwise.

Water service curb stop valves and boxes shall be installed in accordance with the City Water Service Installation detail.

### **3.13 WATER SERVICE CURB STOP RELOCATION**

Water service curb stop relocation shall include removing the valve box stem and curb stop box. Installation of a new curb stop and curb stop box will be in the location as required by the engineer. The Contractor shall verify the original curb stop is in the fully open position and water tight prior to removal of the water curb stop box. If the existing curb stop is damaged or leaking in any way, it shall be replaced. Typically, the new curb stop will be relocated to the property line.

### **3.14 WATER SERVICE PIPING**

All water service piping shall be installed by the City in development situations. Water service piping shall be installed by the Contractor on City funded projects, unless plan documents state otherwise.

Water service piping shall be installed in accordance with the City's Water Service Installation detail.

In development situations, The Contractor is responsible to excavate a trench between the new water main and the proposed curb stop location, which in most cases is located at the property line unless otherwise specified, to allow City crews to install the tap, water service, and curb stop. The trench shall then be backfilled by the Contractor.

The trench for the water services shall be excavated to meet all applicable OSHA trench safety requirements prior to any work that is completed by City personnel. If the trench is unsafe to complete tapping operations, the Contractor will be required to provide the necessary additional work to ensure safety of the trench to the satisfaction of the City tapping personnel.

Water services shall have a minimum of 6 feet of cover unless otherwise noted on the plans. If 6 feet of cover to the top of the service cannot be achieved or maintained, the City Engineering Division shall be notified. If 6 feet of cover cannot be achieved the City Engineering Division may require insulation to prevent the risk of freezing. The insulation work shall be in accordance with the special provisions, City's Water Main Insulation detail, and manufacturer's recommendations.

### **3.15 VALVES AND FITTINGS**

- A. Valves and fittings shall be installed at the locations shown on the plans or as directed by the Engineer. Valves and fittings shall be installed in accordance with the most current edition of AWWA C600. Valve and fitting locations shall be field verified and recorded on the as-built drawings by the Engineer. Valves and fittings shall remain exposed until the Engineer has visually inspected and measured the as-built locations.
- B. Proper concrete blocking shall be installed under all valves. In addition, valves 12 inches in diameter and greater shall be installed with two restrainer devices per valve. A stainless steel valve nut extension shall be installed on valves with more than 8 feet of cover as measured from the top of the pipe to the finished surface elevation.

### **3.16 VALVES BOXES**

- A. Valve Box Adjustment: The Contractor shall adjust the valve boxes to the final grade as shown on the standard plates.
- B. Valve Box Extension: The Contractor shall extend existing valve boxes if the existing box has inadequate adjustment length remaining or if extra depth water main had been installed that requires the use of an extension.
- C. Valve Box Replacement: The Contractor shall replace existing valve boxes as specified. This work includes excavating to the existing valve and removing the existing valve box. A new valve box shall be installed and the trench backfilled.
- D. Valve Box Markers: Valve markers shall be installed for all valves outside of the street right-of-way that are not in paved areas unless otherwise indicated.
- E. The Contractor shall ensure that valve boxes are plumb prior to backfilling.
- F. Valve stems within valve boxes shall be clear of any debris. The Contractor is responsible for checking stems and boxes so they can be freely operated after backfilling operations, prior to paving, and at project completion.

### **3.17 FIRE HYDRANTS**

Fire hydrants shall be installed at the locations and elevations as shown on the plans or as directed by the Engineer and in accordance with the most current edition of AWWA C600. The centerline of the nozzles shall be a minimum of 18 inches above the finished surface elevation but no higher than 24 inches. The bottom of the breakaway flange shall be 2 to 4 inches above the finished surface elevation. Fire hydrants shall be installed 2 feet behind the back of curb unless otherwise indicated on the plans, stand plumb, and have their nozzles parallel with or at right angles to the street centerline, with the pumper nozzle facing the street. Hydrant markers shall be affixed after each hydrant becomes operational.

Flushing hydrants installed for testing purposes shall be removed once testing has been completed. If the flushing hydrants will remain in place for the duration of a winter season, they shall be installed behind the existing or proposed curb and gutter.

Hydrant leads shall be a minimum of 6 inches in diameter and have a gate valve located as close as possible to the tee. Hydrant lead valve shall be mechanically restrained and attached to the tee. Restrainer devices will be required on all bends. Hydrants shall be set on a concrete block to prevent settlement. Concrete thrust blocks shall be installed against undisturbed soil to prevent movement of the hydrant lead.

Hydrant bases shall be backfilled with a minimum of 1/3 cubic yard of 1 1/2-inch crushed rock to facilitate drainage. The crushed rock shall extend to 6 inches above the weep hole and be covered with two layers of heavy felt paper or heavy construction plastic. Before installing the ground rod or tracer wire, the fire hydrant barrel shall be encased in polyethylene up to the ground surface. The weep holes shall not be covered by the polyethylene. A 60-inch ground rod shall be taped to the fire hydrant barrel at a minimum of four locations and be extended to the bottom of the breakaway flange. Tracer wire shall be attached to the bottom of the ground rod.

### **3.18 FIRE HYDRANT EXTENSION**

Fire hydrant extensions shall be installed to ensure the hydrant nozzle is at the correct elevation. The Contractor shall remove and reinstall the top section of the fire hydrant as part of this work.

### **3.19 CONCRETE THRUST BLOCKS**

The Contractor shall brace all fittings including mechanical joint caps by means of poured concrete or precast concrete thrust blocks. No wood shimming or bracing will be allowed in conjunction with the concrete blocks. Poured concrete blocking shall have a compressive strength of not less than 3,000 psi. Concrete shall be poured against undisturbed earth. Care shall be taken not to cover up joints, bolts, and fittings with concrete. If a concrete thrust block cannot be poured due to poor soil condition or inadequate support for blocking, restrained joints shall be utilized. The cost for blocking is considered to be incidental to the installation of the fittings.

### **3.20 DISINFECTION, FLUSHING AND BACTERIOLOGICAL TESTING**

The Contractor shall place sufficient chlorine tablets or chlorine powder in the water main as it is installed as required by the most current addition of AWWA C651 disinfection standards. Once water main construction is complete, the Contractor shall request to have the pipe segment filled by City personnel.

The chlorinated water shall remain in the water main for a minimum of 24 hours and a maximum of 72 hours.

Upon completion of the minimum contact time, the Contractor shall request to have the water main flushed by City personnel. The water main shall be flushed as required by the most current addition of AWWA C651 to remove all heavily chlorinated water and remaining particulates. The remaining chlorine measurement shall be no higher than the level generally prevailing in the distribution system or that is acceptable for domestic use. The Contractor will be responsible for disposal of heavily chlorinated water such that residual levels of chlorine in the discharge water do not exceed 0.05 mg/L when entering the waters of the City.

Once flushing is complete, City personnel will collect a water sample from an acceptable water service tap or fire hydrant source for residual chlorine and coliform bacteria testing. A minimum of one sample will be required for every 1,200 feet of water main installed. If the coliform bacteria test passes (coliform bacteria absent), the water main can be put into service and service lines tapped. If the coliform bacteria test fails (coliform bacteria present), the Contractor must request that the water main be reflushed and resampled. If the coliform bacteria test fails after the second attempt, the Contractor shall rechlorinate the water main by the continuous feed or slug method (liquid chlorine injection through a service tap) until the coliform bacteria test passes.

For all projects funded through the State Revolving Fund (SRF), a minimum of two consecutive passing coliform bacteria samples are required.

This testing is considered incidental to the installation of the water main and its appurtenances.

### **3.21 HYDROSTATIC PRESSURE TESTING**

Upon completion of the water main installation, it shall be hydrostatically tested in accordance with AWWA C600-10 and C605-13 and using the following guidelines:

- A. Testing Pressure. Water main shall be tested at a pressure of 120 psi for mains 12 inches and smaller. The testing pressure shall be 150 psi for mains larger than 12 inches. However, in no case shall the test pressure exceed the rated working pressure for any joint, thrust restraint, valve, fitting, or other connected appurtenance of the test section.
  - 1. The test pressure shall be maintained for a period of two hours.
  - 2. Segments of pipe to be tested shall not exceed 1,200 lineal feet.
  - 3. The owner or its appointed representative shall observe the pressure gauge readings before acceptance of the test.
  
- B. Procedure. Tests shall be performed only after the pipeline has been properly filled, flushed, and purged of air. If the pressure drops during testing, repressurize the pipe by pumping in potable water in sufficient quantity to bring the pressure back to the original test pressure after the two-hour test has concluded. Accurately measure the amount of water required to repressurize the system to the initial test pressure.



- C. Test Allowance. The testing allowance shall be defined as the quantity of water that must be supplied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure. No installation will be accepted if the quantity of makeup water is greater than that determined by the following formulas:

$$\text{Ductile Iron Water Main} \quad L = \frac{(S)(D)(P)^{0.5}}{148,000}$$

Where:

L = allowable leakage, in gallons per hour

S = length of pipe section being tested, in feet

D = nominal pipe diameter, in inches

P = average test pressure, in pounds per square inch

$$\text{PVC Water Main} \quad Q = \frac{(L)(D)(P)^{0.5}}{148,000}$$

Where:

Q = allowable leakage, in gallons per hour

L = length of pipe section being tested, in feet

D = nominal pipe diameter, in inches

P = average test pressure, in pounds per square inch

Note: If the average measured leakage per hour exceeds the maximum allowable leakage rate, repair and retest the water main. Repair all visible leaks regardless of the amount of leakage.

### **3.22 INTERRUPTION OF SERVICE**

The Contractor shall notify all customers affected by any interruption of water service at least 24 hours before the interruption of water service. Customers shall be verbally notified and provided an interruption of service notice. In the event a consumer cannot be verbally notified, the Contractor shall secure the interruption of service notice provided by City Engineering to the most frequently used entrance. The Contractor shall initiate valve operation requests with the City Engineering Division.

### **3.23 DISINFECTION, BACTERIOLOGICAL, AND PRESSURE TEST SEQUENCING**

Sequencing shall be followed by the Contractor unless an alternative sequencing plan is provided in writing by the Contractor and approved by the City prior to performing any of the required sampling or pressure testing:

- A. Once water main construction is complete, the Contractor shall request to have the pipe segment filled by City personnel between 8 a.m. to 5 p.m., Monday–Friday.

- B. Upon completion of the minimum chlorine contact time, the Contractor shall request to have City personnel assist with purging air from line segment.
- C. Once air has been purged from the line segment, the line segment shall be hydrostatically tested in accordance with these specifications.
- D. The Engineer or his appointed representative shall observe the pressure gauge readings before acceptance of the test. The Contractor shall provide evidence to the Engineer or his appointed representative that the test hydrant lead valve is in the open position prior to initiating the pressure test.

Should the test disclose damaged or defective materials or leakage greater than that permitted, the Contractor shall at his own expense locate and repair and/or replace any defective materials. The test shall be repeated until the leakage is within the permitted allowance.

- E. Once a passing hydrostatic test has been obtained, the water main shall be adequately flushed by City personnel. The Contractor will be responsible for disposal of heavily chlorinated water.
- F. Once flushing is complete, the line segment shall be bacteriological tested in accordance with these specifications.

The Contractor shall furnish all pumping equipment, labor, gauges, and other appurtenances required for the pressure test. This testing is considered incidental to the installation of the water main and appurtenances.

### **3.24 UNDERGROUND INTERFERENCE**

The location of existing underground public or private utilities may be shown on the plans, as reported by the various utility companies and the City, but this does not relieve the Contractor of the responsibility of determining the accuracy or completeness of said locations. The Contractor shall determine the location of all underground ducts, conduits, pipes, or structures, which will be affected by the work, and shall take steps necessary to support, protect, remove, or relocate said structures by any means suitable to the owners of the structure involved and the Engineer. In those instances where their relocation or reconstruction is impracticable, a deviation from line and grade may be ordered by the Engineer. The Contractor shall be responsible for notifying the various utility companies if the Contractor's work will expose, affect, or endanger any existing utility. All cost of investigation and any necessary protection, support, removal, or relocation of said structures shall be included in the contract bid price for installing water main unless specifically provided for in the bid items. The Contractor shall not begin construction until all utility companies have been contacted and their respective underground utilities have been located and marked.

The bid item "Locate Utility" will be used to locate waterlines only if the service location marked exceeds the actual service location by 4 feet in either direction and additional excavation is required. The bid item "Verify Utility" will be used only when it is necessary

to excavate down to the utility to determine if any vertical and/or horizontal conflicts exist between existing utilities and the proposed new waterlines to be installed as shown on the plans. All costs of other exploratory investigation/excavation necessary for determining the location and depth of utilities shall be included in the contract bid price for installing pipe.

### **3.25 EXCAVATION**

Trenches shall be excavated on lines furnished by the Engineer. Excavation shall be classed as either rock or earth excavation. Rock excavation shall consist of solid rock lying in its natural bed, which requires fracturing for its removal, as defined under "Rock Excavation," and boulders one cubic yard in volume or greater. All other materials shall be classed as earth excavation.

#### **A. *Rock Excavation***

All rock excavation shall be under one classification. It shall include solid ledge rock in its natural location that requires systematic quarrying, drilling, and/or blasting for its removal and boulders one cubic yard in volume or greater.

When rock is encountered in the trench, it shall be stripped of earth, and the Engineer shall be notified by the Contractor and given ample time to make a profile thereof, before removal operation begins, to determine quantities. Prior to installing water main through a rock excavation, a 6-inch cushion of bedding material will be placed to protect the pipe.

Procedures for rock removal operations shall be subject to the approval of the Engineer. The use of explosives shall be limited to the magnitude of the charge that will not cause damage to the adjoining property through shock vibrations or other stress loadings. In addition, the Contractor shall provide adequate protection to ensure that there will not be fragments of rock or other debris flying through the air when discharging explosives. The entire rock removal operation shall be the responsibility of the Contractor, and the Contractor shall pay for any damage caused by the rock removal operations. Adequate insurance protection, in addition to the standard liability insurance required, shall be purchased by the Contractor for payment of any damage that may be caused by the use of explosives. Explosive permits must be obtained from Sioux Falls Fire Rescue as per City ordinance.

#### **B. *Earth Excavation***

Water mains shall be installed using the open cut method, except that where conditions warrant, the Engineer may permit the use of short tunnels. In unstable soil, the trench shall be supported by shoring or sheeting as required to prevent caving. Sheeting shall be withdrawn after the pipe has been properly covered.

Wherever, in the opinion of the Engineer, the bottom of the trench does not afford a reliable or suitable foundation, the trench shall be excavated to such additional depth as is required and replaced with trench stabilization material. Pipe bedding material will always be required in addition to trench stabilization material.

### **3.26 SHEETING AND BRACING**

If City, state, or federal regulations dictate the necessity of sheeting, bracing, or pulling a trench box or shield, the cost of such sheeting, unless a special price is called for in the contract proposal form, shall be included in the contract bid price for installing water main.

### **3.27 DEWATERING**

Water main installation shall be accomplished in a relatively dry trench. Joints shall not be connected under water. If ground water is encountered, the Contractor shall dewater the trench with suitable pumps and equipment. Lowering of the groundwater level shall be by means of wells, well points, or other suitable means.

Water resulting from the dewatering operation shall be disposed of in a manner approved by the Engineer and South Dakota Department of Environment and Natural Resources (DENR). It shall not be pumped onto private property without the property owner's approval. Any damage to property, either public or private, shall be rectified to the satisfaction of the owner and the City. If dewatering operations are expected, construction documents shall describe methods for providing temporary erosion control devices or note that a dewatering permit has been issued by the South Dakota DENR.

### **3.28 SURFACE RESTORATION AND CLEANUP**

Unless stated specifically to the contrary in the Special Information Provisions, the Contractor shall replace all surface material and shall restore paving, curb and gutter, sidewalks, fences, trees, sod, topsoil, and other items disturbed to a condition equal to or better than that before the work began, furnishing all labor, materials, and equipment necessary to do this work. Traveled streets shall be kept open and maintained by the Contractor after backfilling and before surfacing or final inspection. The cost of all such work shall be absorbed in the unit price bid for pipe installation unless otherwise specified in the Special Information Provisions or Bid Proposal.

### **3.29 TEMPORARY WATER/WATER MAIN BYPASS PIPE**

The Contractor shall coordinate with all property owners when a disruption in water service is expected. Contractor will complete connections to minimize disruptions in water service either during the day or at other suitable times that meet the needs and requirements of the property owner(s).

The Contractor must provide a 24-hour contact person who has adequate parts and equipment on hand to make necessary repairs to temporary water service in a timely manner.

Products used shall be manufactured only from water distribution pipe and couplings and shall be NSF-approved for potable water use.

Temporary water main shall be a minimum of 2-inch diameter unless otherwise specified. Temporary water main is required to be disinfected, flushed, and sampled (a single passing bacteriological test) prior to any service connections being made. Two

consecutive coliform bacteria tests shall be taken 24 hours apart when the project is SRF-funded. The temporary water main shall be tested at static main pressure for a period of two hours. Gravel ramps shall be constructed over the temporary water main where necessary and at all driveway approaches and will be paid for separately as "Aggregate Base Course."

Chlorination, testing, pipe, necessary isolation valves, bends, fittings, hydrants, all necessary appurtenances, gravel ramp construction, maintenance, repairs to damaged piping, removal, and all other materials and labor necessary to construct the temporary water main and flush each individual service before connection to the City water system shall be considered incidental to each temporary water service.

Contractor is to submit temporary water main layout, sequence of operations, and schedule material and fitting specifications to the Project Engineer four days prior to the project preconstruction meeting. Any changes to the proposed temporary water service layout shall be approved by the Project Engineer prior to the preconstruction submittal.

### **3.30 BEDDING, BACKFILL, AND COMPACTION**

All bedding and backfill areas shall be subject to compaction testing by nuclear or standard methods according to the latest applicable ASTM Specifications D6938 for compaction and D698 for standard proctor.

The trench bedding shall be undercut a minimum of 6 inches below the grade line of the pipe and uniformly backfilled with bedding material to the grade-line of pipe. After the pipe has been installed on top of the first layer of bedding material, the haunching area shall be backfilled with bedding material up to the "spring-line" (halfway) on the pipe. The bedding material shall be placed uniformly without void space around the pipe to assure adequate and uniform support along the bottom of the pipe. Care shall be taken to prevent dislodging and misalignment of the pipe and to provide adequate bell hole for the pipe. Bedding Material shall be installed to a minimum of 6-inches above the top of the pipe and a minimum of 12-inches on both sides of the pipe. Clean, dry sand may be used for trench bedding.

After the trench bedding is installed, the trench shall then be initially backfilled with suitable material which shall consist of approved excavation material, granular material, or as otherwise specified by the Engineer. Sand may be used if approved by the Engineer. Care shall be taken in placing initial backfill over the sand bedding to avoid damage to the pipe. No less than 24 inches and no greater than 36 inches of appropriate back fill shall be placed over the top of the trench bedding before the trench is compacted. The initial backfill shall be compacted by suitable and approved compaction methods to at least 95 percent Standard Proctor Density, or as otherwise specified prior to proceeding with final backfill.

The final backfill shall be placed in 12-inch lifts and compacted by suitable and approved compaction methods in a manner approved by the Engineer to at least 95 percent Standard Proctor Density, or as otherwise specified. Excess material not required for final backfilling shall be removed by the Contractor or otherwise disposed of as ordered by the Engineer. In final backfill areas below pavement, the Engineer may

direct the Contractor to use native material a specified distance below the pavement elevation to ensure a consistent material is utilized under the pavement section.

If the material encountered in the trench excavations is unsuitable to be used as initial or final backfill material, it shall be replaced with other suitable material available at the project site or with granular material, as approved by the Engineer. Material for all stages of backfilling is to be free of rock, frozen materials, and hard clay. The Engineer may take random compaction tests of the backfill material. If any of these tests indicate that the material has not been compacted to the required density, the Engineer shall have the right to require additional compaction tests to assure that this or other material is compacted to the proper density without any additional cost to the Owner.

## **4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT**

### **4.1 REMOVAL OF WATER MAIN, FIRE HYDRANTS, VALVES, AND WATER MANHOLES**

The removal of water main shall be measured to the nearest lineal foot of pipe removed. No measurement will be made for the removal of short sections of abandoned water main if it must be removed to facilitate the installation of new water main or other utilities. The removal of fire hydrants and water manholes shall be measured per each removed. Payment for removal of water main will be at the contract unit price per foot and payment for the removal of fire hydrants, valves and water manholes will be at the contract unit price per each and will be full compensation for all labor, equipment, and incidentals necessary to complete the work.

### **4.2 SALVAGE WATER MAIN, VALVES, AND FIRE HYDRANTS**

Salvage water main shall be measured per lineal foot salvaged. Valves and fire hydrants shall be measured per each item salvaged. Payment will be at the contract unit price per each and shall be full compensation for all labor, equipment, and incidentals necessary to complete the work including delivery costs.

### **4.3 WATER MAIN**

Water main shall be measured to the nearest lineal foot for the respective types and sizes of water main pipe. Measurement shall be from center to center of fittings or to the end of pipe. Payment will be at the contract unit price per lineal foot and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the water main including gaskets, polyethylene encasement, trench dewatering (unless otherwise specified), excavating and backfilling, disinfection and bacteriological testing, hydrostatic testing, thrust/reaction blocking, and tracer wire. Additional compensation shall be provided for each structural best management practice (BMP) device that is constructed with excavated material for the purpose of treating heavily chlorinated water.

### **4.4 EXTRA DEPTH WATER MAIN**

Extra depth water main shall be measured to the nearest lineal foot for the respective types and sizes of water main pipe. Measurement shall be from center to center of fittings or to the limits of the extra depth water main installed. Payment will be at the contract unit price per lineal foot and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the water main including gaskets, trench dewatering (unless otherwise specified), excavating and backfilling, disinfection and bacteriological testing, hydrostatic testing, and tracer wire.

### **4.5 POLYETHYLENE ENCASEMENT**

No measurement or payment will be made. These items are considered incidental to the installation of ductile iron pipe, fittings, valves, rods, hydrants, and appurtenances.

#### **4.6 DISINFECTION, BACTERIOLOGICAL TESTING, HYDROSTATIC TESTING, POLYETHYLENE ENCASEMENT, THRUST BLOCKS, AND TRACER WIRE**

No measurement or payment will be made. These items are considered incidental to the installation of the water main and its appurtenances.

#### **4.7 CONNECT TO EXISTING WATER MAIN**

Connect to existing water main shall be measured per each water main connection location. Payment will be at the contract unit price per each and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the connection.

#### **4.8 CUT AND TIE TO EXISTING WATER MAIN**

Cut and tie to existing water main shall be measured per each water main cut and tie location. Payment will be full compensation for all labor, equipment, and incidentals necessary to complete the connection. All water main materials necessary shall be paid for with their respective bid items.

#### **4.9 EXCAVATE AND BACKFILL FOR CITY FURNISHED SMITH TAP**

Measurement shall be per each location excavated and backfilled for the installation of a City-furnished smith tap valve and sleeve. Payment will be full compensation for all labor, equipment, and incidentals necessary to complete the work. Separate payment will be made for furnishing and installing the valve box.

#### **4.10 WATER SERVICE DISCONNECT**

Water Service Disconnect shall be measured and paid per each. Payment will be full compensation for all labor, materials and equipment necessary to shut off the service at the ball valve corporation stop for permanent service retirement.

#### **4.11 WATER SERVICE RECONNECT**

Water Service Reconnect shall be measured and paid per each for the respective size. Payment will be full compensation for all labor, materials and equipment necessary to complete the process of removing service from the existing main, protecting the service during water main replacement and reconnecting the existing service to the newly installed water main. All fittings, connections, sterilization, replacement parts and flushing necessary to complete the service reconnection and restoration shall be considered incidental to the bid item unless stated otherwise in the plan documents.

If the service reconnection requires less than 5' of new water service piping, the water service piping required for the service reconnection shall be considered incidental to the bid item "Water Service Reconnect". Water service piping necessary in excess of 5' shall be measured and paid under the bid item "Water Service Piping".



#### **4.12 WATER SERVICE TAP**

Water Service Tap shall be measured and paid per each for the respective size installed. Payment will be full compensation for all labor, materials and equipment necessary to complete the installation of the tapping saddle, service corporation stop and the service tap. Additional incidental items include, but are not limited to: Polywrap, blocking, sterilization and flushing.

#### **4.13 WATER SERVICE CURB STOP**

Water Service Curb Stop shall be measured and paid per each for the respective size installed. Payment will be full compensation for all labor, materials and equipment necessary to complete the installation of the curb stop valve and valve box stem. All fittings and connections necessary to complete the installation shall be considered incidental to the bid item unless stated otherwise in the plan documents.

#### **4.14 WATER SERVICE CURB STOP RELOCATION**

Water Curb Stop Relocation shall be measured and paid per each for the respective size of service. Payment will be full compensation for all labor, materials and equipment necessary to remove the existing curb stop box and install a new curb stop and curb stop box in the location specified. All fittings and connections necessary to complete the installation shall be considered incidental to the bid item unless stated otherwise in the plan documents.

#### **4.15 WATER SERVICE PIPING**

Water Service Piping shall be measured and paid to the nearest lineal foot for the respective size of piping installed. Payment will be full compensation for all labor, materials and equipment necessary to complete the installation. All fittings and connections necessary to complete the installation shall be considered incidental to the bid item unless stated otherwise in the plan documents.

#### **4.16 MECHANICAL JOINT FITTINGS**

Mechanical Joint (MJ) fittings shall be measured per each type and size fitting furnished and installed. Fittings include elbows, tees, reducers, crosses, slip joint plugs, and mechanical joint caps and sleeves. Payment will be at the contract unit price per each and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the MJ fittings.

#### **4.17 RESTRAINER DEVICES**

Restrainer devices shall be measured per each size of restrainer device furnished and installed. Payment will be at the contract unit price per each and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the restrainer devices.

#### **4.18 VALVES AND BOXES**

Valves, valve boxes, and valve box extensions shall be measured as a unit per each type and size of valve with valve box furnished and installed. Valve boxes shall be measured per each when installed on City-furnished smith tap valves or on existing valves.

Payment for valves with boxes shall be at the contract unit price per each and shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the valve and box. Payment for individual valve boxes or valve box extensions shall be per each and shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the valve box.

#### **4.19 ABANDONMENT OF VALVES**

Abandonment of valves shall be measured by each unit of respective type, class, and size of valve abandoned. The abandonment of valves shall be paid for at the contract unit price per each for the types, classes, and sizes abandoned in accordance with the specifications and accepted. Payment for abandonment of valves shall be full compensation for removing the top section of the valve box, select fill material to fill the remaining section of valve box, and all necessary appurtenances for proper completion of the abandonment of valves.

#### **4.20 VALVE BOX ADJUSTMENT, EXTENSION, OR REPLACEMENT**

Valve box adjustments, extensions, or replacements shall be measured per each. A valve box adjustment will be measured whenever a valve box must be adjusted to final grade including all new installations, extensions, and replacements; however, valve box adjustments will only be measured once per valve per project. Payment will be at the contract unit price per each and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the valve box adjustment, extension, or replacement.

#### **4.21 VALVE BOX MARKER**

Valve box markers shall be measured per each marker furnished and installed. Payment will be at the contract unit price per each and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the valve box marker.

#### **4.22 WATER MAIN ADJUSTMENT**

Water main adjustment shall be measured as a unit for each respective size of adjustment completed. The water main adjustment shall be paid for at the contract unit price per each for the size of water main adjusted.

Payment for water main adjustment shall be full compensation for excavating, dewatering of the water main and trench, additional time required for the installation of materials, backfilling, and all necessary appurtenances for proper completion of the water main adjustment. All materials required for the water main adjustment are paid for under their respective bid item. Water main adjustment is considered additional pay that is required to complete the adjustment.

#### **4.23 ABANDON WATER MANHOLE**

Abandoning water manholes shall be measured as a unit for each water manhole abandoned. Payment will be at the contract unit price per each and will be full compensation for all materials, labor, equipment, and incidentals necessary to abandon the water manhole including breaking the manhole down to the required height, furnishing and installing the sand, and backfilling to finished grade. If the required height is not specified, the manhole shall be removed below final grade by a minimum of 4 feet.

#### **4.24 INSULATION**

Insulation for water main shall be measured to the nearest lineal foot furnished and installed. Payment will be at the contract unit price per nearest lineal foot and will be full compensation for all materials labor, equipment, and incidentals necessary to complete the installation of the insulation.

#### **4.25 FIRE HYDRANTS**

- A. Fire Hydrants: Fire hydrants shall be measured per each unit furnished and installed. Payment will be at the contract unit price per each and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the fire hydrant and fire hydrant marker.
- B. Remove and Relocate Fire Hydrant: Fire hydrants removed and relocated shall be measured per each. Payment will be at the contract unit price per each and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the relocation including excavating, backfilling, blocking, new gaskets, disconnection, new hydrant marker, and reconnection.
- C. Fire Hydrant Extension: Fire hydrant extensions shall be measured per each size of extension furnished and installed. Measurement will only be made if the existing conditions prevented the installation of the fire hydrant at the correct elevation. Payment will be at the contract unit price per each and will be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the fire hydrant extension.
- D. Temporary Fire Hydrant: Temporary fire hydrants shall be measured per each furnished, installed, and removed. Payment will be at the contract unit price per each and shall include all materials, labor, equipment, and incidentals necessary to

complete the work including excavating, backfilling, gaskets, connection, and disconnection.

#### **4.26 WATER MAIN AND WATER SERVICE BEDDING MATERIAL**

Bedding material shall be measured to the nearest lineal foot of water main or water service furnished and installed for each size of pipe. Water main or water service bedding material shall be measured from center to center of fittings or to the end of the pipe. The measured length shall be rounded up to the nearest 1-foot increment. Payment will be at the contract unit price per foot and shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the water main or water service bedding material.

#### **4.27 ROCK EXCAVATION**

The excavation of rock shall be measured as cubic yards of rock removed, rounded to the nearest 0.1 yard. All rock excavation shall be under one classification. The classification shall include solid ledge rock in its natural location that requires systematic quarrying, drilling, and/or blasting for its removal and boulders 1 cubic yard in volume or greater. Pay lines for computing rock excavation shall be described as follows:

<b>Pipe Size</b>	<b>Trench Width Pay Limits</b>
Pipe diameter $\leq$ 24 inches	4 feet
Pipe diameter $>$ 24 inches	Pipe diameter plus 24 inches

Pay lines for computing depth of the rock excavation shall be described as the distance from top of rock to 12 inches below the pipe invert elevation. The top of the rock profile will be measured and determined by the Engineer and used to determine the rock quantities.

The accepted quantities of rock excavation shall be paid for at the contract unit price per cubic yard. Payment for rock excavation shall include all permits, labor, tools, equipment, explosives, protective mats, blasting, excavation, removal, and proper disposal of rock. Furnishing and installing suitable fill material to replace the rock removed (except in locations where bedding material is required) will be paid for with the Granular Material bid item.

#### **4.28 TRENCH STABILIZATION MATERIAL**

The furnishing and installing of trench stabilization material shall be measured as tons of trench stabilization material to the nearest 0.1 ton. The accepted quantities of furnished and installed trench stabilization material will be paid for at the contract unit price per ton. Payment for trench stabilization material will be full compensation for furnishing and installing the trench stabilization material, excavation, removal and disposal of unstable soils, and all appurtenances necessary for the proper installation of the material.

#### **4.29 SELECT FILL FOR WATER MAIN**

The furnishing and installing of select fill for water main shall be measured as tons of select fill for water main material to the nearest 0.1 ton. The accepted quantities of furnished and installed select fill for water main will be paid for at the contract unit price per ton. Payment for select fill for water main will be full compensation for furnishing and installing the select fill for water main and all necessary work for the proper installation of the material.

#### **4.30 TEMPORARY WATER/WATER MAIN BYPASS PIPE**

Furnishing and installing of water main bypass pipe shall be paid for at the contract unit price per each service provided for the types, classes, and sizes furnished and accepted. Payment for water main bypass pipe shall be full compensation for furnishing and installing the bypass piping, pressure testing, bacteria testing, and all necessary appurtenances for proper completion of the water main bypass piping.

#### **4.31 JACKING, BORING, AND TUNNELING**

The basis of measurement shall be by the lineal foot for casing pipe and carrier pipe. The measured length of carrier pipe and casing pipe shall be rounded up to the nearest 1-foot increment.

Furnishing and installing of casing pipe and carrier pipe shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes furnished and installed in accordance with the specifications and accepted. Furnishing and installing end seals and casing spacers shall be considered incidental to the installation of the carrier pipe. Payment for casing pipe will be full compensation for furnishing and installing of the casing pipe by boring, jacking or tunneling, excavating and backfilling of bore pits, welding, trench dewatering (unless otherwise specified), and all necessary appurtenances for proper installation of casing pipe.

Payment for carrier pipe will be full compensation for furnishing and installing of the carrier pipe, gaskets, and all other appurtenances necessary for the proper installation of the carrier pipe.

Payment for boring obstruction will be full compensation for the labor, equipment, and materials needed for removal of the obstruction. Payment for boring obstructions will be paid only for boring obstructions with mechanical equipment. If the project work is performed by a hand-mining operation, all such obstructions will be considered part of the normal operation and will not be paid for as a boring obstruction.

A boring obstruction shall be defined as any rock, boulder, etc., or similar material, which is encountered during the excavation that cannot be removed by the boring machine and requires shutdown of the equipment for removal. The Contractor shall be aware that all quantities are estimates and that there may be no obstructions or could be a large number of obstructions on the project. The Contractor will only be paid for obstructions encountered and reported to and verified by the Engineer. The bid item quantities are not guaranteed items.