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 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, trench stabilization material, select fill, 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 and that the Engineer may retain. Submittals may be made electronically in portable document format (PDF). 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 MISCELLANEOUS CONSTRUCTION REQUIREMENTS

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.

1.5 BIDS

Bid items shall be in accordance with the Method of Measurement and Basis of Payment.

1.6 MEASUREMENT AND PAYMENT

Method of measurement and basis of payment shall be as noted in Methods of Measurement and Payment section, unless otherwise stated in the bid or plan documents. Payments to the Contractor shall be made in accordance with the General Conditions.

1.7 ACCEPTANCE

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

1.8 REFERENCES

The most up to date and current revisions or editions shall be used for all references listed below.

A. NSF/ANSI 14 – Standard for Plastics Piping System Components and Related Materials.

B. NSF/ANSI 61 – Standard for Drinking Water System Components, Health Effects.

C. NSF/ANSI 372 – Method of Measurement to Comply with NSF 61.

D. ANSI/AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

E. ANSI/AWWA C105—Polyethylene Encasement for Ductile-Iron Pipe Systems.

F. ANSI/AWWA C110 –Ductile–Iron and Gray-Iron Fittings.

G. ANSI/AWWA C111—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

H. ANSI/AWWA C150 – Thickness Design of Ductile-Iron Pipe.

I. ANSI/AWWA C151—Ductile-Iron Pipe, Centrifugally Cast.

J. ANSI/AWWA C153 – Ductile Iron Compact Fittings.

K. AWWA C502 – Dry-Barrel Fire Hydrants.

L. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.

M. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.

N. AWWA C550 – Protective Interior Coatings for Valves and Hydrants.

O. AWWA C600 —Installation of Ductile-Iron Water Mains and Their Appurtenances.

P. AWWA C605 – Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings.

Q. AWWA C651 – Disinfecting Water Mains.

R. AWWA C800 – Standard for Underground Service Line Valves and Fittings.

S. AWWA C900 —Standard Specification for Polyvinyl Chloride (PVC) Water Transmission Pipe (Nominal Diameters 4–36-inches).

T. AWWA C901 – Polyethylene (PE) Pressure Pipe and Tubing, ¾ In. (19 mm) Through 3 IN. (76 mm), for Water Service.

U. AWWA M41 – Ductile-Iron Pipe and Fittings.

V. ASTM A48 – Standard Specification for Gray Iron Castings.

W. ASTM A674 - Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids

X. ASTM A518 – Standard Specification for Corrosion-Resistant High Silicon Iron Castings.

Y. ASTM A536 – Standard Specification for Ductile Iron Castings.

Z. ASTM B-3 - Standard Specification for Soft or Annealed Copper Wire.

AA. ASTM B88 – Standard Specification for Seamless Copper Water Tube.

BB. ASTM C272 - Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions.

CC. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

DD. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.

EE. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

FF. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.

GG. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

HH. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.

II. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

JJ. ASTM F2657 - Standard Test Method for Outdoor Weathering Exposure of Crosslinked Polyethylene (PEX) Tubing.

KK. ISO 8179-1 – Ductile Iron Pipes, Fittings, Accessories and Their Joints – External Zinc-Based Coating.

LL. NFPA 24: Standard for the Installation of Private Fire Service Mains and Their Appurtenances

MM. South Dakota Department of Transportation Standard Specifications for Roads and Bridges.

NN. City of Sioux Falls Supplemental Specification for Sanitary Sewer.

Related Specification Sections include but are not necessarily limited to:

A. City of Sioux Falls Special Provisions for Trenchless Construction

B. City of Sioux Falls Special Provisions for Cured-In-Place-Pipe

2 MATERIALS

2.1 WATER MAIN PIPE

Water main pipe 4-inches in diameter and greater shall be ductile iron or polyvinyl chloride (PVC) with a gasket joint. PVC pipe shall have a minimum sustained working pressure of 235-pounds per square inch (psi) (or project requirements, whichever is greater) with a minimum cover of 6-feet. Ductile Iron Pipe shall be designed for a minimum 150-psi (or project requirements, whichever is greater) rated working pressure. 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	C900 DR 18

Gaskets for all ductile iron pipe shall meet the requirements of the pipe manufacturer. Sealing pipe joints for all AWWA 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 nitrile gaskets.
- Soils contaminated with volatile organic compounds, use fluorocarbon gaskets.

2.1.1 DUCTILE IRON PIPE

All ductile iron pipe shall be manufactured in full conformance with the most current edition of ANSI/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.

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.

The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179-1. The mass of the zinc applied shall be 200 g/m2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The coating system shall conform in every respect to ISO 8179-1 “Ductile iron pipes – External zinc-based coating – Part 1: Metallic zinc with finishing layer.” The bituminous coating shall then be applied as specified over the zinc coating. Pipe shall clearly be marked as zinc coated pipe meeting the specified requirements.

The City or City’s engineering representative have the authority to reject any pipe they deem damaged or scratched. Zinc coating repair requirements shall meet the requirements of Section 4.3 and 4.5 of the ISO 8179-1. Approved zinc coating repair products are Tnemec Zinc Series 90-98, Sherwin Williams Corothane Galvapac 1k Zinc Primer or approved equal.

Where direct 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.

2.1.2 PVC PRESSURE PIPE

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.

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, RieberLok or prebid Engineer-approved equal.

2.2 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 as “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.

2.3 POLYETHYLENE ENCASEMENT

Polyethylene encasement shall meet all the requirements for ANSI/AWWA C105/A21.5 and ASTM A674. Polyethylene shall be V-bio polyethylene encasement which 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.

2.4 TRENCHLESS CONSTRUCTION

Refer to Special Provisions for Trenchless Construction.

2.5 WATER MAIN FITTINGS

2.5.1 DUCTILE IRON FITTINGS

Ductile iron fittings shall be mechanical joint, except as noted, with a minimum working pressure of 250-psi. Fittings, gaskets, retainer 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 ANSI/AWWA C110 Standards. All fittings shall be provided with mechanical joins restraints.

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.

Fittings on transmission mains shall have fusion bonded epoxy coating applied electrostatically on the exterior of the fittings meeting the requirements of AWWA C550 or zinc coating meeting the ductile iron pipe requirements. Joints shall conform to the most current edition of the requirements of ANSI/AWWA C111.

Ductile iron fittings to be manufactured by U.S. Pipe, American, Tyler, Star, Sigma, or prebid Engineer-approved equal.

2.5.2 COMPACT DUCTILE IRON FITTINGS

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 provided with mechanical joint restraints.

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 on transmission mains shall have fusion bonded epoxy coating applied electrostatically on the exterior of the fittings meeting the requirements of AWWA C550 or zinc coating meeting the ductile iron pipe requirements.

Coupling adapters shall be Hymax 2 or Romac Marco Hp, Hymax Grip 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. Gaskets shall be chloramine resistant and meet NSF/ANSI Standard 61: Drinking Water System Components—Health Effects, NSF/ANSI 372.

Compact ductile iron fittings to be manufactured by: U.S. Pipe, American, Tyler, Star, Sigma, or prebid Engineer-approved equal.

2.6 MECHANICAL JOINT (MJ) RESTRAINER DEVICES

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.

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.

Restrainer devices shall be EBBA Iron MEGALUG with Megabond, Star Products Stargrip with Starbond, Tyler Tufgrip with Tuf-Bond, or prebid Engineer-approved equal.

2.7 VALVES

All valves 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. Restrainer devices will be required on all 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 style with mechanical joint restraints meeting the requirements of ANSI/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.

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 bronze 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.

Extension stems shall be stainless steel with actuator key and nut, diameter not less than stem of valve actuator shaft. All pins shall be stainless steel.

All valves shall be provided with mechanical joint restraints. Valves shall be manufactured by American, Clow, Kennedy, Waterous, and American AVK, or prebid Engineer-approved equal.

2.8 VALVE BOXES

Valves boxes are required on all valves. All valve boxes shall be cast iron in accordance with ASTM A48, shall have a minimum tensile strength of heavyweight 35,000-psi, and furnished with a standard drop cover marked “WATER”.

Valve boxes shall be two or three pieces with screw type adjustment. Valve box shall be adjustable for a 4- to 6-foot trench, with a 5 ¼-inch shaft and a circular base for 8-inch valve. Covers shall have a skirt length of 1 ½-inch.

Valve box adaptors shall be included with all valve boxes. Valve box adaptors shall be Valve Box Adaptor II by Adaptor Inc. or approved equal. Valve boxes shall be manufactured by Tyler, Star, or prebid Engineer-approved equal.

2.9 VALVE BOX MARKERS

Valve box markers shall be a minimum of 3 ¾-inches wide and 78-inches in length. The markers shall be blue in color, ultraviolet resistant and stable in all weather conditions. The markers shall be labeled “CAUTION WATER PIPELINE—CALL BEFORE DIGGING.”

Valve box markers shall be fiberglass Composite Utility Markers as manufactured by Carsonite International or prebid Engineer-approved equal.

2.10 CONCRETE THRUST BLOCKS,

Poured concrete blocking shall have a compressive strength of not less than 3,000-psi. No wood shimming or bracing will be allowed in conjunction with the concrete blocks.

2.11 RESTRAIN EXISTING VALVE

The restraint shall be manufactured of ductile iron conforming to ASTM A536. The split restraint ring, incorporating a plurality of individually-actuating gripping surfaces, shall be used to grip the pipe, and a sufficient number of bolts shall be used to connect the restraint to the mechanical joint.

2.11.1 EXISTING PVC PIPE

The Restraint Ring shall be coated using MEGA-BOND® Restraint Coating System or Approved Equal. The restraint shall be the Series 2000SV as manufactured by EBAA Iron, Inc. or approved equal.

2.11.2 EXISTING DUCTILE IRON PIPE

The restraint devices shall be coated using MEGA-BOND® Restraint Coating System or Approved Equal. The restraint shall be the Series 1100SD, as manufactured by EBAA Iron, Inc., or approved equal.

2.12 RESTRAIN EXISTING PIPE JOINT

Where restraint is required for bell joints on existing PVC pipe, the restraints shall be manufactured of ductile iron conforming to ASTM A536. The split restraint rings, incorporating a plurality of individually - actuating gripping surfaces, shall be used to grip the pipe on either side of the bell. A sufficient number of tie bars casted from ASTM A536 shall be used to span the distance between the restraints and a sufficient number of bolts shall be used to connect each restraint to the tie bars. The restraint devices shall be coated using MEGA-BOND™ or Approved Equal. The restraint shall be the Series 1100HV, as manufactured by EBAA Iron, Inc., or approved equal.

Where restraint is required for bell joints on existing ductile iron pipe, the restraints shall be manufactured of ductile iron conforming to ASTM A536. The split restraint rings, incorporating a plurality of individually-actuating gripping surfaces, shall be used to grip the pipe on either side of the bell, and a sufficient number of rods shall be used to connect each restraint to one another. The restraint devices shall be coated using MEGA-BOND or Approved Equal. The restraint shall be the Series 1100HD, as manufactured by EBAA Iron, Inc., or approved equal.

2.13 FIRE HYDRANTS

Fire hydrants and 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. The rated working pressure shall be 150-psi and the rated test pressure shall be 300-psi. All hydrants shall be dry barrel meeting the most current requirements of AWWA C502.

The nozzle section, upper and lower barrels, and the hydrant base shall be ductile or gray iron. All hydrants shall open right, 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 ¼-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 ½-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 ½-inch hose nozzles and one 4 ½-inch pumper nozzle, all located on the same horizontal plane. 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. 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.

The centerline of the nozzles shall be a minimum of 18-inches above the ground line groove. The section of the hydrant above ground shall be painted highway yellow.

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.

Fire hydrants shall be Waterous Paver WB67-250 or series 2700 by American AVK, or prebid Engineer-approved equal. All fire hydrant extensions shall be manufactured by American AVK Series 2700 and Waterous Pacer WB 67-250. Hydrant markers shall be manufactured by Flexstake or prebid Engineer-approved equal.

2.14 NUTS AND BOLTS

Nuts and bolts for fittings, valves and fire hydrant connections shall meet the following requirements. Nuts and Bolts shall be grade 304 stainless steel manufactured in full conformance with the most current edition of ANSI/AWWA C111/A21.11.

2.15 WATER SERVICE

2.15.1 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-inch. Water services shall not be tapped off water mains 16-inches and larger unless approved by City Engineering.

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.

Water service saddles for PVC water main, sized 6-inch or 8-inch, with 1-inch service piping and larger shall be Ford Meter Box S90, AY McDonald 3895 or Engineer approved equal.

Water service saddles for PVC water main sized greater than 8-inch with 1-inch service piping and larger shall be Ford Meter Box FC202, AY McDonald 4845A or Engineer approved equal. Tapping saddles shall be double strap saddles.

Water service tapping saddles for DIP/CIP water main shall be Ford Meter Box FC202, AY McDonald 4845A or Engineer approved equal. Tapping saddles shall be double strap saddles.

2.15.2 CORPORATION STOP

Corporation stops shall be Ford Meter Box FB600, FB1000 series, or approved equal and meet the requirements as determined by AWWA C800. Inlet thread as determined by AWWA/CC taper threads. Sizing will be the same as service piping with a ball type valve. Lead is not allowed.

2.16 WATER CURB STOP

Water curb stops shall be Ford Meter Box B22, or B44-M Series, AY McDonald 76100 Series or approved equal with Minneapolis pattern brass ball valve. Lead is not allowed.

2.17 WATER CURB STOP BOXES

Water curb stop boxes shall be Ford Meter Box EM Series or approved equal. The curb stop box shall include pentagon lid style with Minneapolis pattern base and black Armorguard E-coat epoxy.

2.18 WATER SERVICE PIPING

All water service piping, fittings and insert stiffeners shall meet the NSF 14, NSF 61, Uniform Plumbing Code and AWWA C800 requirements. Minimum pressure rating shall be 200-psi. Minimum size of water service piping shall be 1-inch. Water service piping sizes 1-inch to 2-inch between the main and curb stop shall be copper or PEXa. Water service piping sizes 1-inch to 2-inch from curb stop to the backflow preventer, shall be high density polyethylene (HDPE), copper or PEXa.

2.18.1 (HDPE) SERVICE PIPING

HDPE piping shall conform to AWWA C901 and follow SIDR-7. HDPE service piping shall be PE 4710 pipe compounds shall conform to ASTM D3350 and minimum cell class PE 445574C CC3. The outside diameter shall be based on the Iron Pipe Size (IPS) sizing system.

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.

2.18.2 COPPER SERVICE PIPING

Copper piping shall conform to and ASTM B88. U.S. Government Type K Soft Copper Tubing is required. All copper service lines shall have flared connections. Manufacturer shall be Cerro, Mueller Copper Company, Cambridge-Lee Copper, Halstead, Wolverine, or approved equal.

2.18.3 CROSSLINKED POLYETHYLENE (PEXA) SERVICE PIPING

PEXa piping shall meet the AWW C904 and ASTM F876 requirements. The outside diameter shall be based on Copper Tube Sizing (CTS) sizing system.

PEXa shall be manufactured using the high-pressure peroxide method of crosslinking, shall have a co-extruded UV Shield made from UV-resistant high-density polyethylene, shall be color Blue and shall have a minimum recommended UV exposure time of 1-year when tested in accordance with ASTM F2657, or as per manufacturer's recommendations. Manufacturer shall be Rehau or approved equal.

Stainless steel or plastic insert stiffeners are required for all PEXa service piping compression style fitting connections.

2.19 WATER SERVICE FITTINGS

Service fittings 1- to 2-inches shall conform to AWWA C800 and NSF 372 requirements. Acceptable manufacturers are Ford, AY McDonald or approved equal.

Service fittings 4-inches and larger shall conform to Section 2.6 Supplemental Specifications, Section 300 requirements.

2.20 WATER MAIN 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.

2.21 SELECT FILL

The material for select fill 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.

2.22 WATER MAIN BEDDING

The material for water main bedding shall be pea rock or a clean, dry sand meeting the following gradation of minus 1-inch with not more than 10 percent passing the No. 200 sieve. Water main bedding material will be used for both PVC and ductile iron water main.

2.23 TRENCH STABILIZATION MATERIAL

The material for trench stabilization shall consist of 3/4-inch 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.

2.24 TEMPORARY WATER SERVICE AND TEMPORARY WATER MAIN

Temporary water service and temporary 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.

Temporary water main shall be a minimum of 2-inch diameter unless otherwise specified. Products used shall be manufactured only from water distribution pipe and couplings and shall be NSF-approved for potable water use.

Temporary water service and temporary water main bypass pipe shall be manufactured by CertainTeed—Certa-Lok Yelomine or prebid Engineer-approved equal.

3 CONSTRUCTION REQUIREMENTS

3.1 ABANDONMENT OR REMOVAL OF WATER MAIN, FIRE HYDRANTS, VALVES, VALVE BOXES AND WATER MANHOLES

Water main, fire hydrants, valve boxes, and water manholes shall be removed at the locations shown on the plans or as directed by the Engineer.

Existing water main that is abandoned shall be capped/plugged at the end or filled with flowable fill.

Existing water manholes to be abandoned shall be removed below final grade by a minimum height of 4-feet unless otherwise specified on the plans.

3.2 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.

3.3 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 plugged 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 to the insertion line. The spigot shall not be pushed past the insertion line. 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.

3.3.1 WATER MAIN DEFLECTION AND BENDING

Table 3.3.1 - 1 Pressure Pipe Bending Allowance for PVC

Pipe Diameter (in)	Pipe Length (ft)	Min. Radius (ft)	Max. Offset (in)
4	20	200	12
6	20	288	8.5
8	20	378	6
10	20	462	5.5
12	20	550	4.5

Table 3.3.1 - 2 Maximum Joint Deflection Full Length Ductile Iron Pipe Push-On Joint Pipe

Nominal Pipe Size (in)	Deflection Angle (degrees)	Pipe Length (ft)	Max Offset (in)	Approximate Radius of Curve (ft)
8	2.5	20	10.5	460
10	2.5	20	10.5	460
12	2.5	20	10.5	760
14	1.5	20	6	760
16	1.5	20	6	760
18	1.5	20	6	760
20	1.5	20	6	760
24	1.5	20	6	760
30	1.5	20	6	760

3.4 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.

3.5 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 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.

3.6 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.

Polyethylene encasement 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.

3.7 TRENCHLESS CONSTRUCTION

Refer to Special Provision for Trenchless Construction.

3.8 WATER MAIN CONNECTIONS

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

3.8.1 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.

3.8.2 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.

3.8.3 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 shall coordinate the smith tap with City crews at least 48-hours in advance of excavation.

When using methods 3.8.1 or 3.8.2, 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 connection has been completed, pressure and bacteria testing shall be conducted.

3.9 VALVES AND FITTINGS

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, C509 or C515. Valves and fittings shall remain exposed until the Engineer has field verified, visually inspected and measured the as-built locations.

Extensions shall be used when the valve operation nut is deeper than 10-feet. Pin all extension stem connections. Center in valve box with guide bushing. The extension shall bring the operating nut to within 8-feet of the surface.

Proper concrete blocking shall be installed under all valves.

3.10 VALVE BOXES

The Contractor shall ensure that valve boxes are plumb prior to backfilling. 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.

3.10.1 VALVE BOX ADJUSTMENT

The Contractor shall adjust the valve boxes to the final grade as shown on the standard plates.

3.10.2 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.

3.10.3 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.

3.11 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 by the Engineer.

3.12 EXCAVATE AND BACKFILL FOR VALVE BOLT REPLACEMENT

The Contractor shall excavate and expose the specified existing valves to allow City crews to replace the valve body bolts. The Contractor shall coordinate with water maintenance at least 48-hours in advance of excavation.

3.13 CONCRETE THRUST BLOCKS

The Contractor shall brace all fittings including mechanical joint caps by means of poured concrete or precast concrete thrust blocks. 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.

3.14 RESTRAIN EXISTING VALVE

Joint restraints for valves shall be installed at the locations shown on the plans or as directed by the Engineer. Joint restraints shall be installed in accordance with the manufacturer’s recommendations.

3.15 RESTRAIN EXISTING PIPE JOINT

Joint restraints shall be installed at the locations shown on the plans or as directed by the Engineer. Joint restraints shall be installed in accordance with the manufacturer’s recommendations.

3.16 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.

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 and joints. 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 ½ -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.

3.17 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.

3.18 NUTS AND BOLTS

Bolts shall be installed and the nuts tightened alternately to the specified torque, such as to produce equal pressure on all parts of the gland. Unless otherwise specified, the bolts shall be tightened by means of a suitable torque-limiting wrench.

3.19 WATER SERVICE DISCONNECT

The Contractor shall excavate a trench to allow the City crew or Contractor to disconnect the water service at the main. The trench shall then be backfilled by the Contractor.

Water service disconnect for 1- to 2-inches shall be at the corporation stop. The disconnect shall be for the City crew to turn off the corporation stop and to either pinch and fold back the service piping or disconnect the service piping from the corporation stop.

Water service disconnect for 4-inches and larger shall be at the service tee. The disconnect shall be for the Contractor to plug the service at the tee.

Unless plan documents state otherwise, all water service disconnections shall be made by the City in development situations on services 2-inch and smaller and by the Contractor on City funded projects or with services 4-inch and larger. In situations where City crews perform the water service disconnections, the Contractor must coordinate with City crews at least 48-hours in advance of excavation. In all cases, the work shall be visually inspected by a City Representative.

3.20 WATER SERVICE RECONNECT

Water service reconnection is the process of disconnecting the water service from the existing water main, protecting the water service during water main replacement and reconnecting the existing service to the newly installed water main.

Unless plan documents state otherwise, all water service reconnections shall be made by the City in development situations, and shall be made by the Contractor on City funded projects. In situations where City crews perform the water service reconnections, the Contractor must coordinate with City crews at least 48-hours in advance of excavation. In all cases, the leak free connection shall be visually inspected by a City Representative.

3.21 WATER SERVICE TAPS

The service tapping operation, installation of tapping saddles and service corporation stops shall be in accordance with the manufacturer's recommendation.

Where the interruption of water service is prohibited, the Contractor shall perform a wet tap. 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.

Service connections or taps to new or existing water main will not be permitted until the water main has passed the necessary disinfection requirements. All service taps and saddles must be adequately supported with concrete blocking prior to backfilling. 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. Ball valve corporation stop shall be supported as shown in the Water Service Installation detail. The outside of the pipe shall be cleaned thoroughly of all dirt, grease, oil and other foreign matter prior to installing the saddle.

The hole drilled or cut in the main shall be equal to the stated nominal size of the threaded tap on the saddle. Effort should be made to tap the water main perpendicular to the curb stop.

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.

Holes cut in DIP water mains may be accomplished by either drilling or the use of a hole saw.

Bolts shall be drawn up in an acceptable pattern and torqued to the manufacturer's specifications.

The water tap material shall be protected from corrosion by use of V-Bio polyethylene encasement. The minimum polyethylene width shall be 3-feet. The wrap shall be held firmly in place with tape. Backfilling operations shall be conducted as to not damage or displace the wrap.

Unless plan documents state otherwise, all water service taps shall be made by the City in development situations and water service taps shall be made by the Contractor on City funded projects. In situations where City crews perform the water service taps, the Contractor must coordinate with City crews at least 48-hours in advance of excavation.

3.22 WATER SERVICE CURB STOP

Water service piping sized 1-inch to 2-inch shall have a curb stop installed. Water service curb stop valves and boxes shall be installed in accordance with the City Water Service Installation detail.

Unless plan documents state otherwise, all water service curb stops shall be installed by the City in development situations and water service curb stops shall be installed by the Contractor on City funded projects.

3.23 WATER SERVICE CURB STOP RELOCATION

Water service curb stop relocation shall include removing the valve box stem and curb stop box, installation of any water service piping needed to relocate, and a new curb stop and curb stop box. Typically, relocation will be to the property line unless otherwise 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, piping shall replace the damaged curb stop.

3.24 WATER SERVICE PIPING

Water service piping shall be installed in accordance with the City's Water Service Installation detail. Service lines between the water main and the curb stop need to be one continuous length of pipe, splicing of pipe is not allowed.

Unless plan documents state otherwise, all water service piping shall be installed by the City in development situations and water service piping shall be installed by the Contractor on City funded projects.

Where City crews will install the water service piping, the Contractor is responsible to excavate a trench between the new water main and the proposed curb stop location. City crews will install the water service piping from the water service tap to the water service curb stop. The Contractor shall install the curb stop valve box. The trench shall then be backfilled by the Contractor.

3.25 WATER MAIN INSULATION

The insulation work shall be in accordance with the special provisions, drawings, and manufacturer's recommendations.

Water main and water service piping 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 Engineer shall be notified. The Engineer will determine if

insulation shall be used to protect the water main or water service piping from freezing.

Whenever insulation is required for water main, individual water services shall also be evaluated for insulation requirements.

3.26 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 water main and uniformly backfilled with bedding material to the grade-line of pipe. After the water main 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 water main to assure adequate and uniform support along the bottom of the pipe. Care shall be taken to prevent dislodging and misalignment of the water main 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 water main and a minimum of 12-inches on both sides of the pipe.

After the trench bedding is installed, the trench shall then be initially backfilled with suitable material which shall consist of approved excavation material, select fill, 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 at 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 excavation 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 select fill, 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.

3.27 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.

Excavation for City personnel shall be for, but not limited to, smith tap, water service tap, and valve bolt replacement.

3.27.1 ROCK EXCAVATION

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 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 thepipe.

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 and nearby underground utilities 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

3.27.2 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.

3.27.3 EXCAVATION FOR CITY PERSONNEL

Any trench for City personnel work 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 water installation, repair or replacement 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.

3.28 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 and note that a dewatering permit has been issued by the South Dakota DENR.

3.29 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. The Contractor shall not begin construction until all utility companies have been contacted and their respective underground utilities have been located and marked.

3.30 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.

3.31 HYDROSTATIC PRESSURE TESTING

Upon completion of the water main installation, it shall be hydrostatically tested in accordance with AWWA C600-17 and C605-13.

Segments of pipe to be tested shall not exceed 1,200-lineal feet. The owner or its appointed representative shall observe the pressure gauge readings before acceptance of the test

3.31.1 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. The test pressure shall be maintained for a period of 2-hours.

3.31.2 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.

3.31.3 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:

$$Q = \frac{(L)(D)(P)^{0.5}}{148{,}000}$$

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.

3.32 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.

1. 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.

2. Upon completion of the minimum chlorine contact time, the Contractor shall request to have City personnel assist with purging air from line segment.

3. Once air has been purged from the line segment, the line segment shall be hydrostatically tested in accordance with these specifications.

4. 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.

5. 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.

6. 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.

7. 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.

3.33 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 crews at least 24-hours in advance of service interruption.

3.34 TEMPORARY WATER SERVICE AND TEMPORARY WATER MAIN

The Contractor shall coordinate with all property owners when an interruption 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.

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.

Contractor is to submit a temporary water service and water main layout, sequence of operations, and schedule material and fitting specifications to the Project Engineer 4-days prior to the project preconstruction meeting. Any changes to the proposed temporary water service and temporary water main layout shall be approved by the Project Engineer prior to the preconstruction submittal.

Gravel ramps shall be constructed over the temporary water main where necessary and at all driveway approaches.

3.35 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.

Traveled streets shall be kept open and maintained by the Contractor after backfilling and before surfacing or final inspection.

4 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 REMOVE WATER MAIN, FIRE HYDRANT, VALVE BOX, AND WATER MANHOLE

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, valve boxes and water manholes shall be measured per each removed. The removal of valves shall be incidental to the removal of the water main. Disposal of water main, hydrants, valve boxes, and manholes shall also be considered incidental.

Payment for removal of water main will be at the contract unit price per foot regardless of variations in pipe size, materials or depths. Payment for the removal of fire hydrants, valve boxes and water manholes 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.

4.2 ABANDON WATER MANHOLE, WATER MAIN AND VALVE

The abandonment of water manholes shall be measured as a unit for each water manhole abandoned. Abandoning water main shall be measured as a unit for each cap or plug. Usage of K-Crete shall be measured to the nearest cubic yard.

Payment for water manhole abandonment will be at the contract unit price per each and shall include full compensation for all labor, materials, 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.

Payment for all caps or plugs shall be paid for at the contract unit price per each. Payment for K-Crete will be paid at the contract unit price for “Controlled Density Fill (K-crete). Payment for water main abandonment shall be incidental to the installation of water main. Payment for valve abandonment shall be incidental to the installation of water main.

4.3 SALVAGE WATER MAIN, VALVE, VALVE BOX AND FIRE HYDRANT

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

4.4 WATER MAIN

Water main shall be measured to the nearest lineal foot for the respective types and sizes of water main pipe furnished and installed. 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 shall include full compensation for all labor, materials, equipment, and incidentals necessary to complete the installation of the water main including but not limited to gaskets, polyethylene encasement, trench dewatering (unless otherwise specified), excavating and backfilling, disinfection and bacteriological testing, hydrostatic testing, thrust/reaction blocking, and tracer wire.

Where the City or City's Representative authorizes, 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

4.5 WATER MAIN – EXTRA DEPTH

Extra depth water main shall be measured to the nearest lineal foot for the respective types and sizes of water main pipe, furnished and installed. 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 shall include full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the water main including but not limited to gaskets, polyethylene encasement, trench dewatering (unless otherwise specified), excavating and backfilling, disinfection and bacteriological testing, hydrostatic testing, thrust/reaction blocking and tracer wire.

4.6 TRACER WIRE

No measurement or payment will be made. The tracer wire system is considered incidental to the installation of the water main and its appurtenances.

4.7 POLYETHYLENE ENCASEMENT

No measurement or payment will be made. Polyethylene encasement is considered incidental to the installation of ductile iron pipe, all fittings, valves, rods, hydrants, and appurtenances.

4.8 TRENCHLESS CONSTRUCTION

Refer to Special Provisions for Trenchless Construction.

4.9 MECHANICAL JOINT FITTINGS

MJ fittings shall be measured per each type and size fitting furnished and installed. Fittings shall include, but are not limited to, elbows, tees, reducers, crosses, slip joint plugs, retainer glands, and mechanical joint caps and sleeves. All fittings shall be bid complete with gaskets, bolts, and other appurtenances.

Payment will be at the contract unit price per each and shall include full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the MJ fittings.

4.10 RETAINER GLAND

Retainer devices shall be measured per each respective type and size of retainer device, furnished and installed.

Payment will be at the contract unit price per each and shall include full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the retainer devices.

4.11 WATER MAIN ADJUSTMENT

Water main adjustment is considered additional pay that is required to complete the adjustment. Water main adjustment shall be measured as a unit for each respective size of adjustment completed.

Payment for all materials required for the water main adjustment are paid for under their respective bid item. Water main extra depth will not be paid when a water main adjustment is paid.

Payment for water main adjustment shall be paid for at the contract unit price per each for the size of water main adjusted and shall be full compensation for all labor, materials, equipment and appurtenances necessary to complete the water main adjustment. All fittings necessary for this work shall be paid separately at the contract unit price.

4.12 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 shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the connection.

4.13 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 to cut and tie to the existing water main will be at the contract unit price per each and shall include full compensation for all labor, equipment, and incidentals necessary to complete the connection.

4.14 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 at the Contract unit price per each and shall include full compensation for all labor, equipment and incidentals necessary to complete the excavation and backfill.

4.15 VALVES AND VALVE BOXES

Valves, valve boxes and joint restraints shall be measured as a unit per each type for the respective size of valve, valve box and restraint furnished and installed. Any valve extensions that are necessary, shall be considered incidental to the valve.

Payment for valves, valve boxes and joint restraints shall be at the contract unit price per each and shall include full compensation for all labor, materials, valve box adaptor, equipment, and incidentals necessary to complete the installation of the valve and valve box.

4.16 VALVE BOX ADJUSTMENT, EXTENSION, OR REPLACEMENT

Valve box adjustments, extensions, or replacements shall be measured per each, furnished and installed.

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 shall include full compensation for all labor, materials, equipment, and incidentals necessary to complete the valve box adjustment, extension, or replacement.

4.17 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 shall include full compensation for all labor, materials, equipment, and incidentals necessary to complete the installation of the valve box marker.

4.18 EXCAVATE AND BACKFILL FOR VALVE BOLT REPLACEMENT

Excavate and backfill for valve bolt replacement shall be measured and paid per each.

Payment will be at the contract unit price per each and shall include full compensation for excavation, backfilling, labor, materials, surface restoration, equipment and incidentals necessary to excavate and backfill for the valve bolt replacement.

4.19 CONCRETE THRUST BLOCKS

No measurement or payment will be made. All costs associated for blocking is considered to be incidental to the installation of the fittings and their appurtenances.

4.20 RESTRAIN EXISTING VALVE

Valve restraints shall be measured per each existing valve size, furnished and installed.

Payment will be at the contract unit price per each valve and shall include full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the retainer devices.

4.21 RESTRAIN EXISTING PIPE JOINT

Retainer devices shall be measured per each respective type and size of retainer device, furnished and installed.

Payment will be at the contract unit price per each joint and shall include full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the retainer devices.

4.22 FIRE HYDRANT

Fire hydrants shall be measured per each unit, furnished and installed.

Payment will be at the contract unit price per each and shall include full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the fire hydrant and fire hydrant marker.

4.23 REMOVE & RELOCATE FIRE HYDRANT

Fire hydrants removed and relocated shall be measured per each.

Payment will be at the contract unit price per each and shall include full compensation for all materials, labor, equipment, and incidentals necessary to complete the removal and relocation of the fire hydrant.

4.24 FIRE HYDRANT EXTENSION

Fire hydrant extensions shall be measured per each for the respective 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 shall include full compensation for all labor, materials, equipment, and incidentals necessary to complete the installation of the fire hydrant extension.

4.25 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 labor, materials, equipment, and incidentals necessary to complete the work for installation and removal of the temporary fire hydrant.

4.26 NUTS AND BOLTS

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

4.27 WATER SERVICE DISCONNECT

Water service disconnect shall be measured and paid per each.

Payment will be at the contract unit price per each and shall include full compensation for labor, materials and equipment necessary to shut off the service at the ball valve corporation stop for temporary or permanent service disconnect.

4.28 WATER SERVICE RECONNECT

Water service reconnect shall be measured and paid per each for the respective size.

If the service reconnection requires less than 5-feet of new water service piping, the water service piping, bedding materials and incidentals required for the service reconnection shall be considered incidental. Water service piping necessary in excess of 5-feet shall be measured and paid under the bid item “Water Service Piping.”

Payment will be at the contact unit price per each and shall include full compensation for all labor, materials and equipment necessary to complete the service reconnection.

4.29 WATER SERVICE TAP

Water service taps shall be measured and paid per each for the respective size, furnished and installed. All fittings and connections necessary to complete the installation shall be considered incidental to the bid item.

Payment will be at the contract unit price per each and shall include full compensation for all labor, materials and equipment necessary to complete the installation of the tapping saddle, service corporation stop and the service tap.

4.30 WATER SERVICE CURB STOP

Water service curb stop shall be measured and paid per each for the respective size, furnished and installed. All fittings and connections necessary to complete the installation shall be considered incidental to the bid item.

Payment will be at the contract unit price per each and will be full compensation for all labor, materials and equipment necessary to complete the installation of the curb stop valve and valve box.

4.31 WATER SERVICE CURB STOP RELOCATION

Water curb stop relocation shall be measured and paid per each for the respective size of service. All fittings, piping and connections necessary to complete the installation shall be considered incidental to the bid item.

Payment will be at the contract unit price per each and shall include full compensation for all labor, materials and equipment necessary for the water service curb stop relocation.

4.32 WATER SERVICE PIPING

Water service piping shall be measured and paid to the nearest lineal foot for the respective material, size of piping, furnished and installed. All fittings and connections necessary to complete the installation shall be considered incidental to the bid item.

Payment will be at the contract unit price per lineal foot and shall include full compensation for all labor, materials and equipment necessary to complete the installation of the service piping.

4.33 WATER MAIN 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 shall include full compensation for all materials labor, equipment, and incidentals necessary to complete the installation of the insulation.

4.34 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 respective 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 for accepted quantities will be at the contract unit price per foot and shall include full compensation for all materials, labor, equipment, and incidentals necessary to complete the installation of the water main or water service bedding material.

4.35 TRENCH STABILIZATION MATERIAL

Trench stabilization material shall be measured per ton to the nearest 0.1- ton, furnished and installed.

Payment for accepted quantities will be at the contract unit price per ton and shall include full compensation for excavation, removal and disposal of unstable soils, labor, materials, equipment and all appurtenances necessary to complete the installation of the trench stabilization material.

4.36 SELECT FILL

Select fill for water main shall be measured per ton to the nearest 0.1-ton, furnished and installed.

Payment for accepted quantities will be at the contract unit price per ton and shall include full compensation for labor, materials, equipment and all appurtenances necessary for the proper installation of the select fill material.

4.37 ROCK EXCAVATION

Rock excavation shall be measured per cubic yard to the nearest 0.1 yard of rock removed. Pay lines for computing rock excavation shall be described as follows:

Pipe Size	Trench Width Pay Limits
Pipe diameter ≤ 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.

Payment for the accepted quantities shall be paid for at the contract unit price per cubic yard and shall include full compensation for, but not be limited to, 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 bid item “Select Fill”.

4.38 EARTH EXCAVATION

No measurement or payment will be made. Excavation is considered incidental to the installation of the water main and all appurtenances.

4.39 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 shall be included in the contract bid price for installing water main unless otherwise stated in the plan documents.

4.40 TRENCH DEWATERING

No measurement or payment will be made. Dewatering is considered incidental to the installation, replacement or removal of the water main and its appurtenances unless stated otherwise in the plan documents.

4.41 UNDERGROUND INTERFERENCE

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 and/or excavation necessary for determining the location and depth of utilities, protection, support, removal, or relocation of said structure shall be included in the contract bid price for installing or replacing water main and its appurtenances, unless specifically provided for in the bid items.

4.42 DISINFECTION, BACTERIOLOGICAL TESTING, HYDROSTATIC TESTING

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

4.43 TEMPORARY WATER SERVICE AND TEMPORARY WATER MAIN

Temporary water service shall be measured as per each furnished, installed and removed. Temporary water main shall be measured to the nearest lineal foot furnished, installed and removed. All fittings, connections, replacement parts, disinfection and flushing, pressure testing necessary to complete the temporary bypass system shall be considered incidental to the respective bid items.

Payment for temporary water main shall be paid for at the contract unit price and shall include full compensation for all materials, labor, equipment and incidentals for furnishing, installing and removing the bypass main piping.

Gravel ramp installation and removal will be paid for separately at the contract unit price as “Aggregate Base Course.”

4.44 SURFACE RESTORATION AND CLEANUP

No measurement or payment will be made. The cost of all such work is considered incidental to the installation, replacement or removal of the water main and its appurtenances unless stated otherwise in the plan documents. Contractor shall provide all labor, materials, and equipment necessary for surface restoration and cleanup.