

Standard Specifications for

Water Main Construction

Section 300

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Section 300

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Section	Topic	Page
1.0	GENERAL.....	1
1.1	SCOPE OF WORK.....	1
1.2	TERM OF WARRANTY.....	1
1.3	QUALITY CONTROL AND SUBMITTALS.....	1
1.4	PAYMENT.....	1
1.5	ACCEPTANCE.....	2
1.6	REFERENCES.....	2
2.0	MATERIALS.....	3
2.1	WATER MAIN PIPE.....	3
2.2	WATER MAIN FITTINGS.....	3
2.3	MECHANICAL JOINT RESTRAINER DEVICES.....	4
2.4	VALVES.....	4
2.5	FIRE HYDRANTS.....	5
2.6	VALVE BOXES.....	6
2.7	CORPORATION STOP.....	6
2.8	CURB STOP.....	6
2.9	CURB BOX.....	6
2.10	WATER SERVICE LINES.....	6
2.11	TRACER WIRE.....	7
2.12	INSULATION.....	7
2.13	CASING PIPE SPACERS AND END SEALS.....	7
2.14	SELECT FILL AND WATER MAIN BEDDING.....	8
2.15	TRENCH STABILIZATION MATERIAL.....	8
2.16	VALVE BOX MARKERS.....	8

3.0	CONSTRUCTION REQUIREMENTS.....	9
3.1	WATER MAIN PIPE	9
3.2	INTERRUPTION OF SERVICE	9
3.3	ALIGNMENT	9
3.4	UNDERGROUND INTERFERENCE.....	9
3.5	EXCAVATION AND TRENCHING	10
3.6	WATER MAIN	12
3.7	VALVES AND FITTINGS	13
3.8	FIRE HYDRANTS.....	13
3.9	VALVE BOX MARKERS	14
3.10	POLYETHYLENE ENCASEMENT	14
3.11	CONNECTIONS TO EXISTING WATER MAIN	14
3.12	WATER SERVICES	15
3.13	TRACER WIRE	15
3.14	CONCRETE THRUST BLOCKS.....	15
3.15	BEDDING, BACKFILL, AND COMPACTION.....	15
3.16	SURFACE RESTORATION.....	17
3.17	REMOVAL AND ABANDONING OF MATERIALS.....	19
3.18	PIPE INSULATION	20
3.19	JACKING, BORING, AND TUNNELING	20
3.20	INSPECTION AND TESTING.....	20
4.0	METHOD OF MEASUREMENT AND BASIS OF PAYMENT.....	23
4.1	REMOVAL OF WATER MAIN PIPE.....	23
4.2	REMOVAL OF WATER MANHOLE.....	23
4.3	ROCK EXCAVATION	23
4.4	WATER MAIN BEDDING MATERIAL.....	24
4.5	TRENCH STABILIZATION MATERIAL	24
4.6	SELECT FILL FOR WATER MAIN	24
4.7	WATER MAIN INSULATION	24
4.8	WATER MAIN	24
4.9	EXTRA DEPTH WATER MAIN	25
4.10	VALVES AND BOXES	25
4.11	WATER MAIN (INSTALL ONLY)	25

4.12	MECHANICAL JOINT FITTINGS.....	25
4.13	FIRE HYDRANT.....	26
4.14	REMOVE AND SALVAGE FIRE HYDRANT	26
4.15	REMOVE AND RELOCATE FIRE HYDRANT	26
4.16	FIRE HYDRANT EXTENSION	26
4.17	TEMPORARY FIRE HYDRANT	26
4.18	COMBINATION AIR VALVE MANHOLE	27
4.19	SMITH TAP AND BOX	27
4.20	WATER MAIN ADJUSTMENT	27
4.21	CONNECT TO EXISTING WATER MAIN	27
4.22	CUT AND TIE TO EXISTING WATER MAIN	27
4.23	VALVE BOX ADJUSTMENT	28
4.24	VALVE BOX EXTENSION OR REPLACEMENT	28
4.25	WATER SERVICE	28
4.26	WATER SERVICE RECONNECT	28
4.27	WATER MAIN BYPASS PIPE	29
4.28	PRECAST WATER METER VAULT WITH CASTING	29
4.29	CLEAN AND LINE WATER MAIN	29
4.30	ABANDONMENT OF VALVES.....	29
4.31	RESTRAINER DEVICES.....	30
4.32	VALVE BOX MARKER	30
4.33	JACKING, BORING, AND TUNNELING	30
4.34	WATER SERVICE DISCONNECT	31
4.35	WATER SERVICE SETBACK.....	31

Section 300

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1.0 GENERAL

1.1 SCOPE OF WORK

- 1.1.1 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

- 1.2.1 Reference Section 500 – Warranty for Construction Activity.

1.3 QUALITY CONTROL AND SUBMITTALS

- 1.3.1 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.
- 1.3.2 Shop drawings and data shall be submitted for all materials to be installed under the contract. The following is a list of examples:
- a. Fire hydrants, pipe, pipe fittings, corporation stops, curb stop and box, saddles, 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.
- 1.3.3 The Contractor shall submit the number of copies that the Contract requires plus three copies which the Engineer will retain. The Contractor shall obtain shop drawing approval before any of the work related to that material is performed.

1.4 PAYMENT

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

1.5 ACCEPTANCE

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

1.6 REFERENCES

1.6.1 South Dakota Department of Transportation Standard Specifications for Roads and Bridges

1.6.2 American Society of Testing Material, ASTM

1.6.3 American National Standards Institute, ANSI

1.6.4 American Water Works Association, AWWA

2.0 MATERIALS

2.1 WATER MAIN PIPE

2.1.1 DUCTILE IRON

- a. Ductile iron pipe shall meet the requirements of AWWA C150 and C151 and be lined with cement mortar in accordance with AWWA C104. Ductile iron pipe shall be coated on the outside with a 1-mil thick asphaltic coating. Rubber gasket joints for ductile iron pipe shall meet the requirements of AWWA C111.

2.1.2 POLYVINYL CHLORIDE (PVC) PIPE

- a. IPS Pressure Rated Pipe: IPS Pressure Rated Pipe shall meet the requirements of ASTM D-2241. Minimum pressure class shall be 200psi (SDR 21). PVC compounds used in the extrusion of the pipe shall meet or exceed the requirements of ASTM D-1784 cell class 12454. Pipes shall be constructed with an integral bell coupler which meets the requirements of ASTM D-3139 and include a gasket sealing system that conforms to the requirements of ASTM F-477. Spigot ends shall be beveled and include markings for insertion depth.
- b. C900 Pipe: C900 pipe shall meet the requirements of the AWWA C900 specification. Minimum pressure class shall be 235psi (DR 18). PVC compounds used in the extrusion of the pipe shall meet or exceed the requirements of ASTM D-1784 cell class 12454. Pipes shall be constructed with an integral bell coupler which meets the requirements of ASTM D-3139 and include a gasket sealing system that conforms to the requirements of ASTM F-477. Spigot ends shall be beveled and include markings for insertion depth.
- c. C905 Pipe: C905 pipe shall meet the requirements of the AWWA C905 specification. Minimum pressure class shall be 235psi (DR 18). PVC compounds used in the extrusion of the pipe shall meet or exceed the requirements of ASTM D-1784 cell class 12454. Pipes shall be constructed with an integral bell coupler which meets the requirements of ASTM D-3139 and include a gasket sealing system that conforms to the requirements of ASTM F-477. Spigot ends shall be beveled and include markings for insertion depth.

2.2 WATER MAIN FITTINGS

2.2.1 Mechanical Joint Fittings

- a. Mechanical joint fittings shall be manufactured of ductile iron materials as specified in AWWA C110 and have a minimum working pressure of 250 psi. Fittings shall be lined with cement mortar in accordance with AWWA C104 and coated on the outside as required by AWWA C116. Joints shall be mechanical joint type conforming to the specifications of AWWA C111. A rubber gasket sealing

system and bolts shall be included. Bolts shall be stainless steel or core blue in construction.

1. Acceptable manufacturers are American, Griffin, Sigma, Star, Tyler/Union, and U.S. Pipe.

2.3 MECHANICAL JOINT RESTRAINER DEVICES

- 2.3.1 Restraining mechanisms shall provide 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, bolts, and restraint segments, shall be of high-strength ductile iron, ASTM A536. Bolts shall be stainless steel, low alloy corrosion-resistant high-strength steel in accordance with ANSI/AWWA C111/A21.11. Appropriate restrainer devices shall be supplied for the specific type of piping material being used on the project.
- 2.3.2 Restrainer devices shall be MEGALUG® by EBBA Iron, Uni-Flange® by The Ford Meter Box Company, Stargrip® by Star, or One Lok™ by Sigma. Restrainer devices for Ductile Iron Pipe can be Romac Industries “Romagrip.”

2.4 VALVES

- 2.4.1 Valves 4 inches through 12 inches shall be gate valves and valves 16 inches and larger shall be butterfly valves.
- 2.4.2 GATE AND TAPPING VALVES
 - a. Gate and tapping valves shall meet the requirements of AWWA C509 or C515 and have a pressure rating of 250 psi. Valves shall be resilient seated and ferrous components shall be ductile iron. 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 stainless steel, low alloy corrosion-resistant high-strength steel in accordance with ANSI/AWWA C111/A21.11.
 - b. All internal and external ferrous surfaces shall have a fusion bonded epoxy coating applied electrostatically prior to assembly meeting the requirements of AWWA 550. 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 left (counter clockwise). Bonnet and stuffing box bolts shall be stainless steel. Resilient seats shall be bonded or mechanically attached to the gate.

- c. Acceptable manufacturers are American Flow Control, American AVK, and Clow/Kennedy/M&H, or an approved equal.

2.4.3 BUTTERFLY VALVES

- a. Butterfly valves shall meet the requirements of AWWA C504, Class 150B for buried installation. Valves shall be the short body type, tight closing, have a pressure rating of 150 psi, and have mechanical joint ends meeting requirements of AWWA C111. Bolts shall be stainless steel, low alloy corrosion-resistant high-strength steel in accordance with ANSI/AWWA C111/A21.11. Valve body and disc shall be cast or ductile iron. The disc shall have a stainless steel edge and seat at 90 degrees to the pipe axis. The shaft shall be stainless steel. The seat shall be located in the valve body and be Buna-N. Valves shall be complete with a manual operator and a 2-inch square operating nut suitable for buried service. Valves shall open left (counter clockwise).
- b. Acceptable manufacturers are DeZURIK, M&H/Clow, Mueller, and Pratt.

2.5 FIRE HYDRANTS

- 2.5.1 Fire hydrants shall be dry barrel and meet the requirements of AWWA C502. The rated working pressure shall be 250 psi and the rated test pressure shall be 500 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 5¼ inches and be designed so that removal of all working parts can be accomplished without excavating.
- 2.5.2 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 1½ inches point to flat. Hydrants shall open left (counter clockwise).
- 2.5.3 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 2½-inch hose nozzles and one 4½-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 red. 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.

2.5.4 All buried body parts are to be 304 Stainless steel. Bolts shall be fluorocarbon coated cor-ten steel t-bolts and nuts equal to NSS cor-blue or approved equal low alloy corrosion-resistant high-strength steel in accordance with ANSI/AWWA C111/A21.11

2.5.5 Fire hydrants shall be the Waterous Pacer WB-67-250 by American Flow Control, or American Darling B84B.

2.6 VALVE BOXES

2.6.1 Valve boxes shall be cast iron and screw-type adjustable with a 5/8-inch shaft. Lids shall be standard drop type labeled "WATER" with a 1/2-inch long skirt.

2.6.2 Valve boxes shall be the 6850 Series or the 6860 Series by Tyler or an approved equal. The 6850 Series shall be the 666-S box and shall be installed with a valve box adaptor. Valve box adaptors shall be the Valve Box Adaptor II by Adaptor Inc. or an approved equal. The 6860 Series shall be the DD box with a #6 base.

2.7 CORPORATION STOP

2.7.1 The corporation stop shall be AWWA threads, 1" iron pipe size with compression type fitting. The corporation stop shall be Mueller H 15009, Ford F1001 or approved equal.

2.8 CURB STOP

2.8.1 The standard residential curb stops shall be Minneapolis pattern for 1" iron pipe size, female iron pipe size by female iron pipe with iron pipe size compression by male iron pipe adapter; Steel inserts for pipe curb stops shall be Mueller H10287, Ford B11-444M with adapters or B66-444M or approved equal.

2.9 CURB BOX

2.9.1 The curb box shall be iron construction, Minneapolis pattern. The box shall be Mueller H10300, A.J. McDonald 5614 or approved equal.

2.10 WATER SERVICE LINES

2.10.1 POLYETHYLENE PIPE

a. Polyethylene Pipe shall meet the requirements of AWWA C901 with a minimum working pressure of 200 psi. All fittings shall be compression type. No hose clamps shall be permitted.

1. Approved manufactures of polyethylene tubing are Parr-Excel PE Crestline Plastic Pipe Co. Industries, Inc. and Endot Industries, Inc.

2.10.2 COPPER PIPE

- a. Copper piping shall be US Government Type K soft copper tubing. Fittings and valves shall meet the requirements of AWWA C800 and ASTM B62 for Type K soft copper.
 1. Approved manufactures of copper tubing include Cerro, Mueller, Halstead, and Wolverine.

2.11 TRACER WIRE

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

2.12 INSULATION

- 2.12.1 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 permeance shall be 1.1 perm as determined by ASTM E96.
- 2.12.2 Water main insulation shall be STYROFOAM™ Square Edge by the Dow Chemical Company, STYROFOAM™ Brand Scoreboard by the Dow Chemical Company, or an approved equal.

2.13 CASING PIPE SPACERS AND END SEALS

- 2.13.1 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, Louisiana, or an 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 recommend by the manufacturer, with four being the minimum. T-304 stainless steel bolts and nuts shall be supplied with the spacers.

- 2.13.2 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.
- 2.13.3 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, Louisiana, 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.

2.14 SELECT FILL AND WATER MAIN BEDDING

- 2.14.1 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.

2.15 TRENCH STABILIZATION MATERIAL

- 2.15.1 The material for trench stabilization shall consist of ¾- 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.

2.16 VALVE BOX MARKERS

- 2.16.1 Valve box markers shall be a minimum of 3¾ 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 approved equal. The markers shall be labeled "CAUTION WATER PIPELINE—CALL CITY OF BRANDON (605) 582-2273 BEFORE DIGGING."

3.0 CONSTRUCTION REQUIREMENTS

3.1 WATER MAIN PIPE

- 3.1.1 Water main 12 inches in diameter and smaller shall be constructed of IPS Pressure Rated Pipe or C900 pipe. Water mains larger than 12 inches shall be constructed of C905 pipe. Minimum depth of cover shall be 6 feet measured from the proposed finished ground to the top of the pipe installed.

3.2 INTERRUPTION OF SERVICE

- 3.2.1 No valve or other control on the existing water distribution system shall be operated for any purpose by the Contractor. The Contractor shall notify all consumers affected by any interruption of water service at least 24 hours before the interruption of water service. Consumers shall be verbally notified when possible. In the event a consumer cannot be verbally notified, the Contractor shall secure a door hanger to the most frequently used entrance. The Contractor shall initiate valve operation requests with the City.
- 3.2.2 Interruption of water mains shall be scheduled and coordinated with the Owner. Shutdowns shall be scheduled during times of off-peak usage. The Contractor shall anticipate scheduling interruptions during the mornings in areas of residential and after work hours in areas of commercial or industrial.

3.3 ALIGNMENT

- 3.3.1 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.
- 3.3.2 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.
- 3.3.3 The Contractor shall furnish help when requested to stake and measure water main.

3.4 UNDERGROUND INTERFERENCE

- 3.4.1 The location of existing underground public or private utilities may be shown on the plans, as reported by the various utility companies and owner, 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.

- 3.4.2 The bid item "locating utilities" will be used to locate water lines 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 utilities" 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 water lines 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.

3.5 EXCAVATION AND TRENCHING

3.5.1 GENERAL

- a. Excavation shall be classed as either earth or rock excavation. Rock excavation shall consist of solid rock lying in its natural bed which requires fracturing for its removal and boulders of 1 yard or more in volume. All other material shall be classed as earth excavation.

3.5.2 EARTH EXCAVATION

- a. Water mains shall be installed using the open cut method, except that where conditions warrant, the Engineer may permit the use of short tunnels.
- b. The Contractor may use any means he desires to excavate to the proper depth and width necessary for the construction of the sewer according to the plans and specifications. The width of the trench at the top of the pipe shall be a minimum of 6 to 9 inches on each side of the pipe. Trenches shall be excavated with vertical sides from pipe flowline to a point 1 foot above top of pipe where possible.

3.5.3 SHEETING AND BRACING

- a. 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.

3.5.4 EXCAVATION BELOW PIPE GRADE

- a. Trench excavation below pipe grade shall be backfilled with bedding material approved by the Engineer and thoroughly tamped to provide a uniform and continuous bearing and support for the pipe.

3.5.5 EXCAVATION IN UNSTABLE OR UNSUITABLE SOIL

- a. The Contractor shall notify the Engineer when material considered unstable for the pipe foundation is encountered and where additional support, stabilization, and undercutting of the pipe trench are necessary. If the Contractor cannot assure a product in accordance with the specifications, the Contractor may request the use of trench stabilization material and/or geotextile fabric where the trench base is not structurally adequate or otherwise unstable to provide a uniform stable pipe foundation and requires additional undercutting for placement of trench stabilization material and/or geotextile fabric.
- b. The undercutting and use of trench stabilization material and/or geotextile fabric shall only be approved for use in extreme conditions where it is obviously necessary. Approval for the limits of the payment lines for use of trench stabilization material and geotextile fabric must be obtained from the Engineer, prior to installation. If trench stabilization material and/or geotextile fabric is necessary to stabilize the trench foundation, they shall be installed by the Contractor at the unit bid prices for those respective items.
- c. If geotextile fabric is used, it should be placed on the neutral soils and extended up the trench sidewalls to a level of at least the mid-point of the pipe. Placement of the fabric should then be followed by placement of the stabilization material.
- d. The Contractor will be required to furnish weigh tickets for trench stabilization material on a daily basis.
- e. Pipe bedding material will always be required in addition to trench stabilization material where trench stabilization material is used.

3.5.6 ROCK EXCAVATION

- a. 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.
- b. 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.
- c. 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 the city's Fire Department as per City ordinance.

3.5.7 DEWATERING

- a. 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.
- b. 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. All applicable permits must be obtained by the Contractor before the dewatering operation begins.
- c. The water discharged from the dewatering operations shall not be allowed to wash through any excavated material. The Contractor shall be responsible for any damages that might result from this operation.

3.6 WATER MAIN

- 3.6.1 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 accordance with AWWA C600 and PVC water main shall be installed in accordance with AWWA C605. Ductile iron water main shall be encased in polyethylene in accordance with AWWA C105. 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.
- 3.6.2 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. Reference Standard Detail Plate 900.12 for water main bedding installation. Care shall be taken to not have any part of the pipe bearing on rocks or stones. Water main shall have a minimum of 6 feet of cover unless otherwise noted on the plans. If 6 feet of cover cannot be achieved/maintained, the Engineer shall be notified. If less than 4 feet of cover is expected, insulation shall be used to protect the water main from freezing. Cover between 4 and 6 feet will be evaluated on a case-by-case situation for insulation requirements. 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.

- 3.6.3 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 pipe to the finished surface elevation. Water main installed with 6 to 8 feet of cover is considered normal depth water main installation.

3.7 VALVES AND FITTINGS

- 3.7.1 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 AWWA C600 and encased in polyethylene in accordance with AWWA C105. 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.
- 3.7.2 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 valve nut extension shall be installed on valves with more than 10 feet of cover as measured from the top of the pipe to the finished surface elevation. Gate valves in PVC water main shall be installed in conformance with the city's Standard Plates.

3.8 FIRE HYDRANTS

- 3.8.1 Fire hydrants shall be installed at the locations shown on the plans or as directed by the Engineer and in accordance with AWWA C600. The centerline of the nozzles shall be a minimum of 18 inches above the finished surface elevation. The bottom of the breakaway flange shall be 2 to 4 inches above the finished surface elevation. Fire hydrants shall be installed 3 feet behind the back of curb, stand plumb, and have their nozzles parallel with or at right angles to the street center line, with the pumper nozzle facing the street.
- 3.8.2 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 proposed curb and gutter.
- 3.8.3 Hydrant leads shall be a minimum of 6 inches in diameter. All hydrant leads shall include a valve. Hydrant lead valves shall be attached to the tee with ¾-inch threaded rods. In situations where it is not appropriate to have the valve located close to the tee, the valve should be at least 30 feet from the fire hydrant. Restrainer devices will be required on all vertical bends. Hydrants shall be set on a concrete block to prevent settlement. Sufficient size concrete thrust blocks shall be installed against undisturbed soil to prevent.
- 3.8.4 Hydrant bases shall be backfilled with a minimum of 1/3 cubic yard of 1½-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. Fire hydrants and the tracer wire system shall be installed in conformance with the city's Standard Plates.

3.9 VALVE BOX MARKERS

3.9.1 Valve markers shall be installed for all valves outside of the street right-of-way that are not in paved areas unless otherwise indicated. Valve box markers shall be installed in conformance with the city's standard plates.

3.10 POLYETHYLENE ENCASEMENT

3.10.1 All buried ductile iron water main, fittings, valves, rods, and appurtenances shall be encased in polyethylene in accordance with AWWA C105, Method A. The polyethylene 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.

3.10.2 The polyethylene shall prevent contact between the pipe and bedding material, but is not intended to be a completely airtight and watertight enclosure. Damaged polyethylene shall be repaired in a workmanlike manner using polyethylene tape or shall be replaced. The polyethylene encasement is considered to be a part of the price bid for the water main.

3.11 CONNECTIONS TO EXISTING WATER MAIN

3.11.1 Water main shall be connected to and extended by utilizing three different methods: removal of an appurtenance and extending, cutting in an appurtenance and extending, or smith tapping and extending. When a water main needs to be connected, a method that will minimize the interruption of service to surrounding properties should be utilized. When a connection is made utilizing methods other than smith tapping, 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. When necessary, 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.

3.11.2 When a smith tap connection is necessary, the Contractor will furnish the tapping sleeve and valve and complete the tap. The Contractor will be responsible for excavating and backfilling the trench for completion of the tapping process and for furnishing and installed the box for the tapping valve. The trench shall be excavated in a manner so as to provide adequate shoring or bench sloping of the sidewalls of the trench.

3.12 WATER SERVICES

- 3.12.1 Water services 1-½ inches in diameter and larger shall be constructed of IPS Pressure Rated Pipe or C900 pipe. Water mains smaller than 1-½ inches shall be constructed of polyethylene pipe. Minimum depth of cover shall be 6 feet measured from the proposed finished ground to the top of the pipe installed. Water service lines greater than 2 inches in diameter that extend vertically through building floors shall be ductile iron pipe.
- 3.12.2 All service connections or taps to the water main system shall be made by the Contractor. Consumption by the end user will not be permitted until the subject water main has passed the necessary disinfection requirements as specified within this document.

3.13 TRACER WIRE

- 3.13.1 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 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 to be a part of the price bid for water mains.
- 3.13.2 The Contractor shall 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. Fire hydrants and the tracer wire system shall be installed in conformance with the city's Standard Plates.

3.14 CONCRETE THRUST BLOCKS

- 3.14.1 The Contractor shall brace all fittings 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 a part of the cost of the fittings. Concrete thrust blocks shall be installed in conformance with the city's Standard Plates.

3.15 BEDDING, BACKFILL, AND COMPACTION

3.15.1 GENERAL

- a. Installation of PVC pipe, including bedding and backfill of the pipe, shall conform to the latest revision of ASTM D2321 "Standard Recommended Practice for

Underground Installation of Flexible Thermoplastic Sewer Pipe,” and the city’s Standard Specifications.

- b. All bedding and backfill areas shall be subject to compaction testing by nuclear or standard methods according to the latest applicable ASTM Specifications. In addition to the construction and testing procedures outlined in other sections of the specifications, the Contractor shall be required to install the pipe in such a manner so that the diametric deflection of the pipe shall not exceed 5 percent (see pipe testing section) and the materials surrounding the pipe shall be compacted to the required Standard Proctor Densities outlined in D2321. The areas requiring compaction shall include the bedding, initial backfill, and final backfill areas, as defined in the following sections. The Engineer may take random compaction tests of the material. If any of these tests indicate that the material has not been compacted to the required density, the Contractor shall recompact said material at no additional cost to the Owner, and the Engineer shall then have the right to take additional compaction tests to assure that this or other material is compacted to the proper density without any additional cost to the Owner.
- c. The contractor shall notify the City’s Engineer to coordinate density tests as needed. The city will contract testing with a certified testing agency. Tests that pass will be paid for by the city. Any failing tests will be paid by the contractor. In the case of a failed test, the contractor shall recompact the area to be retested.
- d. Material for all areas of backfilling is to be free of rock, frozen materials, and hard clay. Care shall be taken in placing backfill over the crown of the pipe to avoid damage to the pipe.

3.15.2 BEDDING OF PIPE

- a. The trench base shall be undercut a minimum of 4 inches or one-fourth of the outside diameter of the pipe barrel (whichever is larger) 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 (bedding material shall be used to the top of the pipe for all pipes with a diameter of 12 inches or less). The bedding material shall be “shovel-sliced” or hand tamped around and under the haunches of 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.
- b. When the foundation material is not suitable to provide a uniform base for the pipe, the trench shall be undercut to sufficient depth to build an acceptable base. Such areas shall be backfilled with trench stabilization and/or geotextile fabric material to build a uniform foundation. The trench stabilization material shall be brought up to the bottom of the bedding material specified for the pipe and the

bedding material shall be used up to the spring line (bedding material shall be used to the top of the pipe for all pipes with a diameter of 12 inches or less).

3.15.3 INITIAL BACKFILLING OF PIPE TRENCH

- a. All pipe installed in an open trench shall be initial backfilled to at least 12 inches above the top of the pipe. The initial backfill shall be placed evenly so as not to disturb the grade or line of the pipe. Above the bedding area the pipe shall be backfilled with acceptable native material (Class I, II, and III as described in ASTM D2321), approved by the Engineer, or with granular material to a minimum of 90 percent Standard Proctor Density to 12 inches above the top of the pipe.
- b. Where no suitable backfill material is available, the initial backfilling shall be constructed with granular material.

3.15.4 FINAL BACKFILLING OF TRENCH TO GRADE

- a. All final backfill material shall consist of approved excavation material, granular material, or as otherwise specified. Sand may be used if approved by the Engineer. The final backfill shall be placed in layers 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.
- b. Excess material not required for final backfilling shall be removed by the Contractor or otherwise disposed of as ordered by the Engineer.
- c. If the material encountered in the trench excavations is unsuitable to be used as 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. 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.
- d. At least 36 inches of cover shall be placed over the top of the pipe before the trench is wheel-loaded, and 48 inches of cover shall be placed over the top of the pipe before the trench is hydro-hammered for compaction.

3.16 SURFACE RESTORATION

3.16.1 GENERAL

- a. Unless stated specifically to the contrary in the Special Provisions, the Contractor shall replace all surface material and shall restore paving, curbing, sidewalks, gutters fences, trees, sod, topsoil, and other items disturbed to a condition equal to 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 Provisions or Bid Proposal.

3.16.2 USE AND REPAIR OF STREET

- a. The Contractor shall carry on the work in such a manner as to interfere as little as possible with the use of the street for public travel and as specified in the Special Provisions.
- b. Wherever any paved gutters, pavements, graveled highways or street crossings, or other improvements are interfered with or removed, they must be replaced by the Contractor and left in as good condition as previously. The Contractor shall also remove all surplus material leaving the streets clean and in good order.
- c. No more than 300 feet of trench will be opened at any one time in advance of the complete construction of the sewers and the backfilling shall follow up the installation of the sewers.
- d. All street repairs and cleaning shall be promptly done as the work progresses. The Contractor shall not obstruct any street gutters, but shall provide for the passage of surface water along the same at all times.
- e. It shall be the Contractor's responsibility to protect all sanitary sewer pipes, manholes, and trenches from extraneous water and storm water entering the sanitary sewer system at all times during construction.

3.16.3 CONCRETE PAVEMENT REMOVAL AND REPLACEMENT

- a. The surface of all concrete pavements shall be sawed with a concrete saw to the full pavement depth. The width of pavement removed shall be 12 inches wider than the trench excavation to provide a shoulder on all sides. Where within 2 feet of existing joint, concrete shall be removed to the joint.
- b. The Contractor shall place a 6-inch gravel cushion unless otherwise specified and replace the concrete pavement to the same thickness as the original pavement, with a minimum thickness of 6 inches. The concrete shall be Class M6 as specified by SDDOT and shall be finished the same as the existing pavement.
- c. The cost of pavement removal, replacement, and sawing of the concrete shall be included in the unit price bid for pipe unless otherwise provided for in the Bid Proposal or specified in the Special Provisions.
- d. All concrete pavement shall be removed and replaced in accordance with the Standard Specifications and Standard Plates.

3.16.4 ASPHALT PAVEMENT REMOVAL AND REPLACEMENT

- a. Where streets are asphalt surfaced, the Contractor shall cut the asphalt surfacing to a minimum depth of 4 inches by an approved method to a width of 12 inches wider than the trench excavation.
- b. When asphalt surfacing has a concrete base, the asphalt shall be cut in the previously described manner and the concrete base removed with a pneumatic or mechanical type hammer or by similar means.
- c. Unless otherwise specified, the Contractor shall place a 6-inch gravel cushion under the concrete base; replace the concrete base with a minimum of 6 inches of Class M6 concrete; and then place a minimum of 2 inches of asphalt surfacing meeting SDDOT Standard Specifications for Roads and Bridges on top of the concrete base, or as otherwise specified in the Special Provisions.
- d. On all excavations in asphalt surfaces without concrete base, there shall be a minimum of 6 inches aggregate base course and a minimum of 4 inch asphalt mat or the thickness of the existing mat whichever is the greater.
- e. All asphalt surfacing shall be replaced and rolled in accordance with the SDDOT Standard Specifications for Roads and Bridges.
- f. All street surfacing cuts, asphalt or concrete, shall be in a straight line parallel to the existing curb and gutter or perpendicular to the centerline of the street. No jagged, skewed, or irregular cuts will be allowed. All asphalt cuts shall be in an approved manner and not ripped out with the bucket. Such work lifts the remaining mat away from the base material and shall be cause for widening the street cut and increasing the amount of surfacing replaced at the Contractor's expense.

3.17 REMOVAL AND ABANDONING OF MATERIALS

3.17.1 REMOVAL OF PIPE

- a. This work shall consist of removal and disposal of pipe that is not designated or permitted to remain and which is not removed and disposed of under other items in the contract. Removals shall be in accordance with the Standard Specifications.

3.17.2 ABANDONING OF PIPE

- a. Abandoned pipe that is to remain in-place shall be entirely filled with K-crete unless otherwise indicated.

3.18 PIPE INSULATION

- 3.18.1 Pipe insulation shall be required on all water main pipe installations where the cover depth to finished grade elevation is 6 feet or less above the pipe. The insulation work shall be in accordance with the City's Standard Plates and manufacturer's recommendations.

3.19 JACKING, BORING, AND TUNNELING

- 3.19.1 It shall be the responsibility of the Contractor to maintain the alignment and grade specified. The jacking, boring, and tunneling specifications shall be in accordance with the standard plates, drawings, and Special Provisions.

3.20 INSPECTION AND TESTING

3.20.1 GENERAL

- a. The Engineer shall have access at all times to all parts of the job, and the Contractor must furnish such personnel, facilities, equipment, tools, and materials as are necessary to make whatever tests and inspection that are deemed necessary.

3.20.2 PIPE MATERIAL TESTING

- a. The Engineer may require a test of specimens not to exceed 5 percent of the quantity of pipe to be furnished in order to prove the acceptability of the pipe. The manufacturer shall provide an approved testing stand near the site of the plant.

3.20.3 PIPE INSPECTION

- a. Prior to being lowered into the trench, each pipe shall be carefully inspected by the Contractor and those not meeting the specified requirements shall be removed from the site immediately. Rejections may be made for any of the reasons as stated in the specifications for each specific type of pipe. Pipe shall be protected during handling against impact, shocks, and free fall.
- b. The engineer shall inspect all mainline and service fittings once constructed in place and prior to backfilling operations. Fittings shall remain exposed for the engineer to visually inspect and record data for as-built plans. The Contractor shall notify the engineer when they are ready for an inspection.

3.20.4 DISINFECTION AND BACTERIOLOGICAL TESTING

- a. Water main installed shall be disinfected in accordance with AWWA C651 or as directed by the Engineer. The Contractor shall place sufficient chlorine tablets or chlorine powder in the water main as it is installed. Disinfection methods and procedures are available upon request from the City Engineer. Once water main construction is complete, the Contractor shall request to have the pipe segment

filled by City personnel. Once the pipe segment has been filled, the Contractor can begin the hydrostatic pressure testing requirements (Section 3.18).

- b. The chlorinated water shall remain in the water main for a minimum of 24 hours. Upon completion of the minimum contact time, the Contractor shall request to have the water main flushed by the City. In order to prevent corrosion damage to the pipe lining, heavily chlorinated water shall not remain in contact with the water main for more than 72 hours. The water main shall be adequately flushed to remove all heavily chlorinated water and remaining particulates. The contractor shall be responsible for the dechlorination and/or disposal of heavily chlorinated water.
- c. Once flushing is complete, the contractor shall contact the owner to collect a water sample from an acceptable source for coliform bacteria testing. A minimum of two samples taken 24 hours apart will be required and tested 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 have the water main flushed 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.
- d. Costs for assisting the owner to collect samples and testing shall be included in the unit price bid for water mains.

3.20.5 HYDROSTATIC PRESSURE TESTING

- a. All newly constructed water main shall be pressure tested as discussed below. Mechanical joint fittings, service saddles, and corporation stops shall also be tested. In new developments, water services shall be tested to the curb stop.
- b. Upon completion of the water main installation, it shall be hydrostatically tested at a pressure of 120 psi. This pressure shall be maintained for a period of two hours. The test pressure shall not vary by more than +/- 5 psi for the duration of the test. Before applying the specified test pressure, all air shall be expelled from the section of pipe being tested. The Engineer shall observe the pressure gauge readings before acceptance of the test.
- c. New water main will have an allowable leakage equal to the amount of makeup water that must be supplied to maintain pressure within 5 psi of the specified test pressure. The allowable leakage shall not exceed the values as calculated by the following formulas:

1. DUCTILE IRON PIPE

$$L = \frac{SD\sqrt{P}}{133,200}$$

L = testing allowance (makeup water), in gallons per hour

S = length of pipe tested, in feet

D = nominal diameter of the pipe, in inches

P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

2. PVC PIPE

$$L = \frac{ND\sqrt{P}}{7400}$$

L = allowable leakage, in gallons per hour

N = number of joints in the length of pipeline tested

D = nominal diameter of the pipe, in inches

P = average test pressure during the leakage test, in pounds per square inch (gauge)

- d. 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 defective materials. The test shall be repeated until the leakage is within the permitted allowance. The Contractor shall furnish all pumping equipment, labor, and gauges required for the pressure test and any added costs for this test shall be included in the unit price bid for water mains.

4.0 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

4.1 REMOVAL OF WATER MAIN PIPE

- 4.1.1 The removal of water main shall be measured as lineal foot of pipe removed. The removal footage shall be rounded up to the nearest 1-foot increment.
- 4.1.2 The removal of water main shall be paid for at the contract unit price for each foot of water main removed. Payment for removal of water main pipe shall be full compensation for excavation, removal and disposal of the pipe, and all appurtenances necessary for proper removal.

4.2 REMOVAL OF WATER MANHOLE

- 4.2.1 The removal of a water manhole shall be measured as a unit for each manhole removed. The removal of water manhole shall be paid for at the contract unit price for each water manhole removed. Payment for the removal of a water manhole shall be full compensation for removal and disposal of the manhole, frame and cover, and all appurtenances necessary to complete the work.

4.3 ROCK EXCAVATION

- 4.3.1 The excavation of rock shall be measured as cubic yards of rock removed, rounded to the nearest 0.1 increment. 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:

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

- 4.3.2 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.
- 4.3.3 The accepted quantities of rock excavation shall be paid for at the contract unit price per cubic yard. Payment for rock excavation shall be full compensation for permits, excavation, blasting, removal and proper disposal of the rock offsite, and all appurtenances necessary for the proper removal of the 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.

4.4 WATER MAIN BEDDING MATERIAL

- 4.4.1 Water main bedding material shall be measured by the lineal foot of material furnished and installed for the respective types and sizes of pipe. Water main bedding material shall be measured from pipe end to end. The measured length shall be rounded up to the nearest 1-foot increment.
- 4.4.2 The furnishing and installing of water main bedding material shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes furnished and accepted. Payment for water main bedding material will be full compensation for furnishing and installing the water main bedding material and all appurtenances necessary for the proper installation of the material.

4.5 TRENCH STABILIZATION MATERIAL

- 4.5.1 The furnishing and installing of trench stabilization material shall be measured as cubic yards 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.

4.6 SELECT FILL FOR WATER MAIN

- 4.6.1 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.

4.7 WATER MAIN INSULATION

- 4.7.1 Water main insulation shall be measured by the lineal foot of the pipe length that is insulated and for different sizes of insulation.
- 4.7.2 The measured length shall be rounded up to the nearest 1-foot increment.
- 4.7.3 The furnishing and installing of water main insulation shall be paid for at the contract unit price per lineal foot for the sizes furnished and accepted. Payment for water main insulation will be full compensation for furnishing and installing the insulation and all appurtenances necessary for the proper installation of it.

4.8 WATER MAIN

- 4.8.1 Water main shall be measured by the lineal foot for the respective types, classes, and sizes of pipe. Pipe shall be measured from center to center of fittings or to the end of pipe. The measured length shall be rounded up to the nearest 1-foot increment. The furnishing and

installing of water main shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes furnished and accepted. Payment for water main will be full compensation for furnishing and installing the water main pipe, gaskets, trench dewatering (unless otherwise specified), excavating and backfilling, and all appurtenances for the proper installation of water main.

4.9 EXTRA DEPTH WATER MAIN

- 4.9.1 Extra depth water main shall be measured by the lineal foot for the respective types, depths, classes, and sizes of pipe. Piping shall be measured from center to center of fittings or to the limits of pipe installed at extra depth as defined previously. The measured length shall be rounded up to the nearest 1-foot increment.
- 4.9.2 The furnishing and installing of extra depth water main shall be paid for at the contract unit price per lineal foot for the types, depths, classes, and sizes furnished and accepted. Payment for extra depth water main will be full compensation for furnishing and installing the extra depth water main pipe, gaskets, trench dewatering (unless otherwise specified), excavation, backfilling, and all appurtenances for the installation of extra depth water main to the depths as described in project plans and specifications.

4.10 VALVES AND BOXES

- 4.10.1 Valves and boxes shall be measured as each unit of respective type and size. The furnishing and installing of valves and boxes shall be paid for at the contract unit price per each for type and size furnished and accepted. Payment for valves and boxes will be full compensation for furnishing and installing the valve, box, gaskets, bolts, operator, excavating, backfilling, blocking, dewatering, and all appurtenances necessary for proper installation of the valves and boxes.

4.11 WATER MAIN (INSTALL ONLY)

- 4.11.1 Water main for installation only shall be measured by the lineal foot for the respective types, classes, and sizes of pipe. Piping 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. The installed water main shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes installed and accepted. Payment for water main installation will be full compensation for installing the water main pipe, furnishing and installing the new gaskets, trench dewatering (unless otherwise specified), excavating, backfilling, and all appurtenances for the proper installation of the water main.

4.12 MECHANICAL JOINT FITTINGS

- 4.12.1 Mechanical Joint (MJ) Fittings shall be measured as each unit of respective type and size. Fittings include elbows, tees, reducers, crosses, plugs, and sleeves. The furnishing and installing of MJ fittings shall be paid for at the contract unit price per each for the types, classes, and sizes installed and accepted. Payment for MJ fittings will be full compensation for

furnishing and installing the MJ fittings, gaskets, trench dewatering (unless otherwise specified), excavating, blocking, backfilling, and all appurtenances for the proper installation of MJ fittings.

4.13 FIRE HYDRANT

4.13.1 Fire hydrants shall be measured as each unit. The furnishing and installing of fire hydrants shall be paid for at the contract unit price per each for type furnished and accepted. Payment for fire hydrants will be full compensation for furnishing and installing the hydrant, gaskets, blocking, excavating, backfilling, and all appurtenances necessary for proper installation of the fire hydrant.

4.14 REMOVE AND SALVAGE FIRE HYDRANT

4.14.1 The item for remove and salvage fire hydrant shall be measured as a unit for each hydrant that has been removed and salvaged. The removal and salvage of fire hydrants shall be paid for at the contract unit price per each for the locations indicated on the project plans and specifications. Payment for removal and salvage of fire hydrants shall be full compensation for excavation, disconnection, removal, salvaging to designated location, and all necessary appurtenances for proper completion of the work item.

4.15 REMOVE AND RELOCATE FIRE HYDRANT

4.15.1 The item for remove and relocate fire hydrant shall be measured as a unit for each hydrant that is removed and relocated. The removal and relocation of fire hydrant shall be paid for at the contract unit price per each for the locations indicated on the project plans and specifications. Payment for removal and relocation of fire hydrant shall be full compensation for excavation, disconnection, reconnection, removal, relocation to designated location, blocking, and all necessary appurtenances for proper completion of the work item.

4.16 FIRE HYDRANT EXTENSION

4.16.1 The item for fire hydrant extension shall be measured as a unit for each respective size and type of extension. The fire hydrant extension shall be paid for at the contract unit price per each for the locations, types, and sizes indicated on the project plans and specifications. Payment for fire hydrant extension shall be full compensation for the extension, removal and reinstallation of the top section of the fire hydrant, and all necessary appurtenances for proper completion of the fire hydrant extension.

4.17 TEMPORARY FIRE HYDRANT

4.17.1 Temporary fire hydrants shall be measured as a unit for each respective hydrant required. The temporary fire hydrant shall be paid for at the contract unit price per each for the locations, types, and sizes indicated on the project plans and specifications. Payment for temporary fire hydrant shall be full compensation for the temporary fire hydrant, excavation, gaskets,

connection, subsequent removal, backfilling, and all necessary appurtenances for proper completion of the temporary fire hydrant.

4.18 COMBINATION AIR VALVE MANHOLE

4.18.1 Combination air valve manholes shall be measured as a unit for each respective manhole required. The combination air valve manhole shall be paid for at the contract unit price per each for the locations, types, and sizes indicated on the project plans and specifications. Payment for combination air valve manhole shall be full compensation for precast manhole, concrete footings, ¾-inch crushed rock, excavation, backfill, frame and cover, gaskets, valves, and all necessary appurtenances for proper completion of the air release manhole.

4.19 SMITH TAP AND BOX

4.19.1 Smith tap and box shall be measured as a unit for each respective size and type required. Payment for smith tap and box shall be paid for at the contract unit price per each for the locations, types, and sizes indicated on the project plans and specifications.

4.20 WATER MAIN ADJUSTMENT

4.20.1 Water main adjustment shall be measured as a unit for each respective size and type of adjustment completed. The water main adjustment shall be paid for at the contract unit price per each for the types, classes, and sizes 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. Note: All materials required for the water main adjustment are paid for under their respective bid item. Water main adjustment is considered as additional pay required to complete the adjustment.

4.21 CONNECT TO EXISTING WATER MAIN

4.21.1 Connect to existing water main shall be measured as each unit connection. The connection to existing water main shall be paid for at the contract unit price per each for the connection to existing water mains for the purpose of extending an existing water main. Payment for connection to existing water main shall be full compensation for excavating, backfilling, dewatering of the water main and trench, removing the plug or hydrant, and all necessary appurtenances for proper completion of the connection to existing water main.

4.22 CUT AND TIE TO EXISTING WATER MAIN

4.22.1 Cut and tie to existing water main shall be measured as a unit for each respective connection made. Payment for cut and tie to existing water main shall be at the contract unit price per each for cutting and tying to existing water main. Payment for cutting and tying to existing water main shall be paid for at the contract unit price per each for the locations indicated on the project plans and specifications. Payment for cutting and tying to existing water main shall be full compensation for excavating, backfilling, dewatering of water main and trench, cutting

water main, tying to water main, and all necessary appurtenances for proper completion of the cutting and tying work item. Note: All materials required for the connection to the existing water main shall be paid for separately under their respective bid items.

4.23 VALVE BOX ADJUSTMENT

4.23.1 Valve box adjustment shall be measured as each unit adjusted. The valve box adjustment shall be paid for at the contract unit price per each for the valve boxes adjusted. Payment for valve box adjustment shall be paid for at the contract unit price per each for the locations indicated on the project plans and specifications. Payment for valve box adjustment shall be full compensation for adjusting the valve box to the desired finished grade as indicated on the project plans and specifications and all necessary appurtenances for proper completion of the valve box adjustment. Valve box adjustment will only be paid for once per valve per project.

4.24 VALVE BOX EXTENSION OR REPLACEMENT

4.24.1 Valve box extension and replacement shall be measured as each unit extended or replaced. The furnishing and installing of valve box extensions or replacements shall be paid for at the contact unit price per each installed and accepted. Payment for valve box extension or replacement shall be full compensation for furnishing and installing valve box extension or replacement, excavating, backfilling, and all necessary appurtenances for proper completion of the valve box extension or replacement.

4.25 WATER SERVICE

4.25.1 Water service shall be measured by the lineal foot. The measurement length shall be rounded to the nearest 1-foot increment.

4.25.2 The water service shall be paid for at the contract unit price per lineal foot. Payment for water service shall be paid for at the contract unit price per lineal foot at the locations indicated on the project plans and specifications. Payment for water service shall be full compensation for materials and installation including excavating, backfilling, and all necessary appurtenances for proper completion of the water service.

4.26 WATER SERVICE RECONNECT

4.26.1 Water service reconnect shall be measured by each unit of respective size and type. The water service reconnect shall be paid for at the contract unit price per each. Payment for water service reconnect shall be paid for at the contract unit price per each at the locations indicated on the project plans and specifications. Payment for water service reconnect shall be full compensation for all materials and labor including excavating, backfilling, and all necessary appurtenances for proper completion of the water service reconnection.

4.27 WATER MAIN BYPASS PIPE

- 4.27.1 Water main bypass pipe shall be measured by the lineal foot for the respective types, classes, and sizes of pipe. Piping shall be measured from end to end with no deduction for length through fittings. The measured length shall be rounded up to the nearest 1-foot increment.
- 4.27.2 The furnishing and installing of water main bypass pipe shall be paid for at the contract unit price per lineal foot 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.

4.28 PRECAST WATER METER VAULT WITH CASTING

- 4.28.1 Precast water meter vault with casting shall be measured by each unit of the respective type, class, and size of vault constructed. The furnishing and installing of precast water meter vault with casting shall be paid for at the contract unit price per each for the types, classes, and sizes furnished and accepted. Payment for water meter vault with casting shall be full compensation for excavation, drain rock, subgrade preparation, precast vault, backfilling, gaskets, rubber rope sealant, casting, and all necessary appurtenances for proper completion of the water meter vault with casting.

4.29 CLEAN AND LINE WATER MAIN

- 4.29.1 Clean and line water main shall be measured by the lineal foot for the respective types, classes, and sizes of cleaned and lined water main. The pipe shall be measured along the centerline of the pipe without deduction for valves and fittings. The measured length shall be rounded up to the nearest 1-foot increment.
- 4.29.2 The cleaning and lining of water main shall be paid for at the contract unit price per lineal foot for the types, classes, and sizes cleaned and lined in accordance with the specifications, and accepted. Payment for cleaning and lining water main shall be full compensation for dewatering the water main, cutting and opening the pipe, mechanically cleaning the interior of the pipe, lining the pipe with cement mortar, replacing and coupling all open pipe, sterilizing and thoroughly flushing the lined pipes, and all necessary appurtenances for proper completion of the water main cleaning and lining.

4.30 ABANDONMENT OF VALVES

- 4.30.1 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, top 2 feet of manhole (if applicable), select fill material to fill the remaining section of valve box, and all necessary appurtenances for proper completion of the abandonment of valves.

4.31 RESTRAINER DEVICES

4.31.1 Restrainer devices shall be measured by each unit of respective type, class, and size. Furnishing and installing restrainer devices shall be paid for at the contract unit price per each for the types, classes, and sizes installed in accordance with the specifications, and accepted. Payment for restrainer devices shall be full compensation for excavation, restrainer device, gaskets, and all necessary appurtenances for proper completion of restrain device furnish and installation.

4.32 VALVE BOX MARKER

4.32.1 Valve box markers shall be measured by each unit furnished and installed.

4.32.2 The furnishing and installing of manhole markers shall be paid for at the contract unit price per each furnished and accepted. Payment for valve box markers will be full compensation for furnishing and installing the valve box markers and all necessary appurtenances for the proper installation of the valve box markers.

4.33 JACKING, BORING, AND TUNNELING

4.33.1 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.

4.33.2 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.

4.33.3 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.

4.33.4 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.

4.33.5 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.

4.34 WATER SERVICE DISCONNECT

- 4.34.1 Water service disconnects shall be measured on a per each basis.
- 4.34.2 Payment for water service disconnect shall be paid for at the contract unit price per each at the locations indicated on the project plans and specifications. Payment for water service disconnect shall be full compensation for excavating, backfilling, the disconnection and all necessary appurtenances for proper completion of the water service disconnect.

4.35 WATER SERVICE SETBACK

- 4.35.1 Water service setbacks shall be measured on a per each basis to setback a water service curb stop box. The water service setback shall be paid for at the contract unit price per each. Payment for water service setback shall be paid for at the contract unit price per each at the locations indicated on the project plans and specifications. Payment for water service setback shall be full compensation for excavating, backfilling, the setback and all necessary appurtenances for proper completion of the water service setback.