SECTION 33 1000 – WATER UTILITIES (BMU)

PART 1.0 - GENERAL

1.1 SCOPE OF WORK

A. 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, standard plates and/or called for in these specifications or its addenda.

1.2 SECTION INCLUDES

A. PVC Pipe,

B. Ductile Iron Pipe

C. Fittings, Tracer Wire

D. Foster Adapter

E. Anchor Coupling

F. Bolts, Nuts, Gaskets and Other Hardware

G. Coupling Adaptors

H. Mechanical Joint Restrainer Devices

I. Water Service Pipe

J. Curb Stop and Box

K. Pipe Insulation

L. RJ PVC and Steel Casing Pipe

M. Casing Spacers

N. Casing End Seals

O. Temporary Water Main Bypass Pipe

P. Galvanic Anodes

Q. Tapping Saddles

R. Corporation Stops

S. Blow Off Assembly

1.3 RELATED REQUIREMENTS

A. SECTION 01 3000 – ADMINISTRATIVE REQUIREMENTS

B. SECTION 22 1323 – SANITARY WASTER INTERCEPTOR (BMU)

C. SECTION 31 2319 – DEWATERING (BMU)

D. SECTION 31 2333 – TRENCHING AND UTILITY BACKFILLING (BMU)

E. SECTION 33 1419 – VALVE AND FIRE HYDRANTS (BMU)

F. SECTION 33 1900 – WATER UTILITY METERING EQUIPMENT (BMU)

1.4 PRIOR APPROVAL

A. Approval prior to bidding is necessary if it is intended to use materials and equipment other than those specifically named in Approved Manufacturers. Instructions for obtaining such approval are specified in the General Requirements. Prior approved manufacturers shall be named by Addendum.

1.5 CONTRACTOR LICENSE AND PERMITS

A. Any Contractor involved with "sewer and water installation", shall have a valid "Sewer and Water Contractor" or "Sewer and Water Installer" license obtained from the South Dakota Plumbing Commission as defined by SD Administrative Rule Chapter 20:53:01:01, Definitions.

B. Any Contractor installing or repairing private water services, shall obtain a City of Brookings PLUMBING CONTRACTOR LICENSE as specified in Section 22-161-"Required" as found in Article III-PLUMBING of the City of Brookings Code of Ordinances.

C. Contractor shall provide all required documentation needed to secure the City of Brookings PLUMBING CONTRACTOR LICENSE, including, but not limited to, a copy of the "Sewer and Water Contractor" and/or "Sewer and Water Installer" license, current insurance certificate, and performance bond.

D. When required by Section 74-141-"Permit Required" per Article IV-EXCAVATIONS of the City of Brookings Code of Ordinances, the Contractor shall obtain an "EXCAVATIONS PERMIT" issued at no charge from the Brookings City Engineering Office before any installation or repair of water/sewer commences.

E. The Contractor shall obtain any “DEWATERING PERMITS” required from local, state or federal agencies. The discharge area must be prior approved by the Engineer before initiating the dewatering.

F. The Contractor shall be required to obtain any other permits or license required by the project manual. It shall be the Contractor sole responsibility to determine which license and permits are needed for the completion of the project.

1.6 WARRANTY PERIOD

A. The Contractor shall be held responsible for workmanship, materials, settling trenches or any other deficiencies in the water main system during the corrective period. The Contractor shall repair and/or replace all deficiencies in the water system during the corrective period at no cost to the Owner. Any surface restoration costs incurred because of the repairing and/or replacing of deficiencies in the water system shall be borne by the Contractor. The duration of the warranty period is dependent on the method in which the Contract and/or work is completed:

1. When these Standard Specifications for Water Main Construction are included in technical specifications of a project manual, the warranty period for the water system improvements shall be consistent with the warranty period identified in the Agreement, General Conditions, Supplemental Conditions and/or any other project document that defining the corrective period duration.

2. When these Standard Specifications for Water Main Construction are used in conjunction with a project covered by Section 51-64-Street Standards as found in Article VI-SUBDIVISION IMPROVEMENTS AND DESIGN STANDARDS of the

City of Brookings Code of Ordinances, the warranty period for water system improvements shall be the same one (1) year period of time as required by the Ordinance.

3. If the work is being completed within an established right-of-way, including excavation in or upon any street, sidewalk, alley or public ground in the city, the Contractor shall be required to obtain a "EXCAVATIONS PERMIT" from the City of Brookings. The corrective period for work covered by the executed Excavation Permit shall be a period of five (5) years as specified in Section 74-148-Warranty as found in Article IV-EXCAVATIONS of the City of Brookings Code of Ordinances.

1.7 WATER SERVICE TAPPING FEES

A. Contractor shall be responsible for payment to BMU for all water tapping fees. Water tapping fees shall be charged to the Contractor at the cost identified on the BMU annually published “SERVICE CHARGES – WATER/SEWER” rate sheet.

1. The Contractor will be responsible for furnishing all pipe saddles and corporation stops needed to complete the project.

2. BMU shall install the saddle, drill and tap the water up to and including 2-inch corporations. Upon completion of work, BMU will generate an invoice and will bill accordingly. Water services 2-inch or larger shall require prior BMU approval.

1.8 QUALITY CONTROL

A. Testing and/or retesting of materials because of nonconformance to the specified requirements shall be performed by an independent firm as per the instructions of the Engineer of Record.

B. Payment for retesting performed during the Contract period and during the warranty period will be the responsibility of the Contractor.

1.9 SUBMITTALS

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

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

1. Pipe, pipe fittings, bedding material, stabilization material, road topping material, and any other pertinent information concerning construction materials that the Engineer of Record deems necessary for the review of the materials used on the project in accordance with the specifications and drawings.

C. The Contractor shall submit appropriate documentation to the Engineer of Record for any materials not listed in these specifications. The Engineer of Record may forward any shop drawing to the BMU Engineer for consideration. Correspondence shall indicate any discrepancies between the BMU specification requirements and the Contractor provided submittal.

1. BMU Engineer reserves the right to reject any and all materials that do not meet the requirements for water mains as indicated in these standard specifications.

D. If a Temporary Water Main Bypass System is deemed necessary by the Engineer of Record, the Contractor shall submit a comprehensive Temporary Water Main Bypass Plan to the BMU Engineer for approval.

1.10 TRAFFIC CONTROL

A. The Contractor shall furnish, install and maintain any and all traffic control devices as required by the project plans. All traffic control devices shall be provided and installed according to the manual on "Uniform Traffic Control Devices" for streets & highways whenever applicable. The Federal Highway Administrator approves this manual as the National Standard.

PART 2.0 - PRODCTS

2.1 POLY VINYL CHLORIDE (PVC) WATER MAIN PIPE

A. Water main pipe 4-inches in diameter and greater shall be Poly Vinyl Chloride (PVC) with a gasket joint. Pipe shall sustain a working pressure of 150 pounds per square inch (psi). Pipe classes shall be as follows:

Table 4- PVC Water Main Material

Pipe Size	PVC Pipe Type
4" – 12"	C900 DR 18
14" – 48"	C905 DR 18

B. All PVC pipe shall be manufactured in full conformance with the most current edition of AWWA C900 and C905 Standards. All PVC pipe shall meet NSF/ANSI Standard 61 - Drinking Water System Components, Health Effects and NSF/ANSI 61 Annex G, NSF/ANSI 372.

C. Sealing pipe joints for all C900 and C905 PVC 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.

D. Acceptable Manufacturers are Diamond, JM Eagle, or prebid BMU Engineer approved equal.

2.2 RESTRAINT JOINT PVC WATER MAIN PIPE

A. Spline Lock PVC or Fusible PVC Pressure pipe shall be manufactured in accordance with the dimensions, materials, quality control and markings specifications found in AWWA C900/C905.

B. PVC Material shall conform to a minimum cell classification of 12454 as defined by ASRM D1784. The pipe compound is listed as standard grade material with a Hydrostatic Design Basis (HDB) of 4000 psi.

C. Pipe classes shall be as follows:

Table 5- PVC Water Main Material

Pipe Size	PVC Pipe Type
4" – 12"	C900 DR 18
14" – 48"	C905 DR 18

D. All PVC pipe and gasket materials shall meet NSF/ANSI Standard 61 - Drinking Water System Components, Health Effects and NSF/ANSI 61 Annex G, NSF/ANSI 372.

E. Spline Lock PVC Pipe:

1. Pipe system shall utilize a restrained joint utilizing a precision-machined groove on the pipe spigot and inside the pipe bell or coupling. A spline shall be inserted through an entry hole in the pipe bell, resulting in a continuous circumferential restrained joint that locks the pipe segments together.
2. All PVC pipe supplied for potable water applications shall be blue in color.
3. Standard pipe laying length on 20 feet shall be provided unless otherwise specified on project plans.
4. Acceptable Manufacturers are NAPCO Certa Lok, Certainteed Yelomine or prebid BMU Engineer approved equal.

F. Fusible PVC pipe:

1. Fusible polyvinylchloride pipe shall conform to AWWA C900, AWWA C905, ASTM D2241 or ASTM D1785 for standard dimensions, as applicable. Testing shall be in accordance with the referenced AWWA standards for all pipe types.
2. Fusible PVC Pipe shall be extruded with plain ends. The ends shall be square to the pipe and free of any bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe.
3. Fusible polyvinylchloride pipe shall be manufactured in a standard 40' nominal length, or custom lengths as specified.
4. Fusible polyvinylchloride pipe shall be blue in color for potable water use.
5. Pipe shall be marked as follows:
    a. Nominal pipe size
    b. PVC
    c. Dimension Ratio, Standard Dimension Ratio, or Schedule 15065-5 RSM - 50 Rev 3.5 2/12/13
    d. AWWA pressure class, or standard pressure rating for non-AWWA pipe, as applicable
    e. AWWA standard designation number, or pipe type for non-AWWA pipe, as applicable
    f. NSF-61 mark verifying suitability for potable water service
    g. Extrusion production-record code
    h. Trademark or trade name
    i. Cell Classification 12454 and/or PVC material code 1120 may also be included
6. Pipe shall be homogeneous throughout and be free of visible cracks, holes, foreign material, blisters, or other visible deleterious faults.
7. Acceptable Manufacturers are IPEX or prebid BMU Engineer approved equal.

2.3 DUCTILE IRON (DI) WATER MAIN PIPE

A. Ductile iron pipe shall only be used if approved by the BMU Engineer, NO EXCEPTIONS.

B. Ductile iron pipe shall be designed in accordance with the latest revision of ANSI/AWWA C150/A21.50 for a minimum 150 psi rated working pressure plus a 100-psi surge allowance. This design standard incorporates a 2 to 1 factor of safety on the sum of working pressure plus surge pressure. The laying condition and water main depth shall be as shown on the project plans.

C. Ductile iron pipe shall be manufactured in accordance with the latest revision of ANSI/AWWA C151/A21.51. The raw material for ductile iron shall have an average minimum recycled content consisting of 90% scrap iron and steel. Ductile iron pipe shall be manufactured in the USA in accordance with ANSI/AWWA C151/A21.51.

D. Each pipe shall be subjected to a hydrostatic pressure test of at least 500 psi at the point of manufacture.

E. Pipe shall have the standard coating on the exterior and shall also have a cement-mortar lining on the interior in accordance with ANSI/AWWA C104/A21.4, of latest revision.

F. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the mark of the manufacturer, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.

G. All pipe shall be furnished with push-on type joints. Joints shall be in accordance with ANSI/AWWA C111/A21.11, of latest revision, and be furnished complete with all necessary accessories.

H. Acceptable Manufacturers for ductile iron pipe shall by American Cast Iron Pipe Company, U.S. Pipe or prebid BMU Engineer approved equal.

2.4 RESTRAINT JOINT DI WATER MAIN PIPE

A. All ductile iron restraint joint pipe shall be furnished with positively restrained push-on joints and meet the requirements for ductile iron pipe as indicated in Section 2.9.

1. Acceptable Manufacturers for ductile iron pipe shall by American Cast Iron Pipe Company Flex-Ring or MJ Coupled Joint, U.S. Pipe TR Flex or BOLT-LOK joint or prebid BMU Engineer approved equal.

2.5 TRACER WIRE FOR WATER MAINS

A. Tracer Wire - Direct Bury

1. All components of the tracer wire system shall be suitable for direct bury applications. The conductor shall be 12 AWG, solid, soft-drawn copper, with a minimum insulation thickness of 0.045-inches of high molecular weight polyethylene, and shall be blue in color.

a. Acceptable Manufacturers for direct bury tracer wire shall be CCI, Kris Tech, Southwire, Copperhead or prebid BMU Engineer approved equal.

2. Splice kits shall utilize Scotchlok Y electrical spring connector, to electrically connect two or more pre-stripped copper wire ends in a pigtail application and moisture seal the connection for direct burial. The device shall be UL listed as wire connector system for use with underground conductors.

a. Acceptable Manufacturers for splice kit shall be 3M DBR/Y or prebid BMU Engineer approved equal.

B. Tracer Wire - Pipe Burst or Directional Drill

1. The conductor shall be 12 AWG, 21% conductivity copper-clad hard drawn high carbon steel with copper cladding, pipe burst and extreme horizontal directional drill tracer wire, 4,700 lb average tensile break load, 50 mil high molecular weight-high density polyethylene jacket complying with ASTM D1248, 30 volt rating. Tracer wire shall be blue in color.

a. Acceptable Manufacturers for pipe bursting or directional drill tracer wire shall be Copperhead Soloshot Xtreme PBX-50 or prebid BMU Engineer approved equal.

2. Splice kits shall provide water-proof, corrosion-proof dielectric sealant that protects wires and prevents breaks in wire conductivity. Splice kit shall be provided with a clear body to view/verify that wires are fully inserted into splice kit. Splice kit shall utilize 90-degree twist-lock design that makes wire connections easy and keeps wires locked in place.

a. Acceptable Manufacturers for splice kits in pipe bursting or directional drill applications shall be Copperhead SnakeBite or prebid BMU Engineer approved equal.

C. Ground Rod

1. Ground rods, shall be pointed copperbonded ground rods, 1/2-inch diameter, 60-inch long steel rod uniformly coated with 5-mil metallically bonded electrolytic copper.

a. Acceptable Manufacturers for ground rods shall be Erico, Nvent, Eritech 611350 or prebid BMU Engineer approved equal.

D. Ground Rod Clamps

1. Ground rod clamps shall be standard duty bronze rod clamp used to attach ground wire to rod. Rod camp size shall retain up to 10 solid conductors. Rod clamp shall be suitable for direct burial and UL listed for direct burial in earth or concrete.

2. Acceptable Manufacturers for ground rod clamps shall be Erico, Nvent, Eritech CP58 or prebid BMU Engineer approved equal.

2.6 WATER MAIN FITTINGS

A. Mechanical joint water main fittings with accessories, 3-inch through 48-inch shall be manufactured from ductile iron in accordance with and meet all applicable terms and provisions of standard ANSI/AWWA C153/AWWA C111.

B. Ductile Iron mechanical joint fittings 3-inch through 24-inch shall be rated for 350 psi working pressure. Fittings 30-inch through 48-inch shall be rated for 250 psi working pressure.

C. Interior and Exterior Coating: The interior and exterior of the fittings shall have an electrostatically applied fusion bonded epoxy according to AWWA C550. Coating thickness shall be 8-12 mils DFT. Supplier shall provide manufacturer’s recommended epoxy coating for touch-up of coating damage and defects. The contractor shall repair all coating defects prior to installation per manufacturer’s recommendation.

D. Mechanical joint fittings shall be provided with gaskets, glands, bolts, and other appurtenances.

E. Acceptable Manufacturers are Sigma, Star, Tyler-Union or prebid BMU Engineer approved equal.

2.7 FOSTER ADAPTOR

A. Where indicated on the project plans, mechanical joint (MJ) valves and fittings shall be connected using a bolt-through positive restraint mechanism manufactured of U.S.A. ductile iron conforming to ASTM A536, 65-45-12.

B. The positive restraint device shall connect the valves and/or fittings at a linear distance not to exceed three (3) inches and without attachment to pipe.

C. The device shall come complete with all accessories, including standard styrene butadiene rubber MJ gaskets conforming to the latest revision of AWWA C111/ASTM F-477 and blue fluorocarbon coated bolts and nuts.

D. The bolt-through MJ positive restraining device and the ductile iron spacers shall be supplied with an NSF 61, 7-mil. fusion bonded epoxy conforming to AWWA C116/A21.16-09 as well as the coating, surface preparation and application requirements of ANSI/AWWA C550.

E. The device shall be used with standard mechanical joint fittings (AWWA C110 or C153) and valves. Acceptable Manufacturers are Infact Corporation FOSTER ADAPTOR or prebid BMU Engineer approved equal.

2.8 ANCHOR COUPLING ADAPTOR

A. Where indicated on the project plans, provide anchor coupling adaptor to positively restrain all valves to fittings. Fabricated fitting shall utilize a "PLAIN END" mechanical joint fitting with an integral follower gland.

B. The protruding plain end, when fitted with a gasket, is inserted into a standardized mechanical joint bell and bolted together. All bolts and securing hardware shall meet the requirements for these specifications.

C. Anchor coupling shall utilize an epoxy or fusion bonded epoxy coating for corrosion protection.

D. Acceptable Manufacturers of Anchor Coupling Adaptors are Tyler Union, Clow Water System Company, FabPipe or prebid BMU Engineer approved equal.

2.9 BOLTS, NUTS, GASKETS AND OTHER HARDWARE

A. Bolts shall be fluorocarbon coated (Cor-Blue) low alloy corrosion-resistant high-strength steel manufactured in full conformance with the most current edition of ANSI/AWWA C111/A21.11.

B. Gaskets shall SBR rubber and shall be resistant to water containing normal concentrations of chloramine. Gaskets shall meet NSF/ANSI Standard 61: Drinking Water System Components-Health Effects and NSF/ANSI 61 Annex G, NSF/ANSI 372 approved for contact with drinking water.

2.10 COUPLING ADAPTORS

A. Coupling adaptor shall be suitable for all pipe materials including Ductile Iron, Cast Iron, Steel and PVC. Provide a long body design that provides extra flexibility and allows connecting pipe of two different pipe materials.

B. Coupling adaptor shall meet AWWA C219 and NSF 61 requirements. Gaskets shall be provided with Ethylene Propylene Monomer Rubber (EPDM) compound suitable for water and sewer service in accordance with ASTM D2000 and NSF 61.

C. Product shall be available in pipe nominal diameter ranging from 1.5-inch to 24-inch. Coating on coupling adaptor shall be 100% fusion bonded epoxy for corrosion protection. Minimum coating thickness shall be 12 mils.

D. Coupling shall be provided with integral AISI 3054 Stainless steel all thread, bolts, washers and nuts.

E. Acceptable Manufacturers are Krausz Hymax Long Body, Romac Macro or prebid BMU Engineer approved equal.

2.11 MECHANICAL JOINT RESTRAINER DEVICES

A. 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.

B. 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 and shall be manufactured in full conformance with the most current edition of ASTM A536.

C. Restrainer devices shall be coated with 12-mil 100% fusion bonded epoxy body with fluorocarbon coated ring/wedge.

D. Appropriate restrainer devices shall be supplied for the specific type of piping material being used on the project.

E. Acceptable Manufacturers are EBAA Iron Inc., Megalug Flanges, Romac Industries, RomaGrip DI Grip Rings, Star Products Starggrip, Tyler Union TuFGrip Series 2000 or prebid BMU Engineer approved equal.

2.12 BELL RESTRAINER DEVICES

A. Restraint for PVC pipe (AWWA C900 or C905 CI O.D.) at the bell shall consist of the following:

1. The restraint shall be manufactured of ductile iron conforming to ASTM A536. A solid, non-split, backup ring shall be used behind the PVC bell.

2. A 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 bell ring and the gripping ring.

3. Restrainer devices shall be coated with 12-mil 100% fusion bonded epoxy body with fluorocarbon coated ring/wedge.

B. Acceptable Manufacturers are for bell restrains shall be EBAA Iron Series 2800, or prebid BMU Engineer approved equal.

2.13 WATER SERVICE PIPE (1-INCH, 1.5-INCH OR 2-INCH)

A. Crosslinked Polyethylene (PEX)

1. Crosslinked Polyethylene (PEX) shall be a minimum pressure class of 200 psi, and shall conform to the most current edition of ANSI/AWWA C904.
2. Pipe shall have a co-extruded UV Shield made from UV-resistant high-density polyethylene, color blue. Fittings and valves shall meet the requirements of AWWA C800 and ASTM B62.
3. PEX pipe shall be provided with 304 stainless steel inserts conforming to NSF61 and AWWA C901. Inserts shall be dimpled and flanged to retain placement within service line.
4. PEX pipe shall be either 1-inch, 1.5-inch or 2-inch nominal diameter. No other size is acceptable and shall not be provided.
5. Acceptable Manufacturers are Rehau-Municipex or prebid BMU Engineer approved equal.

B. Copper

1. Copper pipes shall be U.S. Government Type K soft copper tubing. Fittings and valves shall meet the requirements of AWWA C800 and ASTM B62.
2. Type K Copper pipe shall be either 1-inch, 1.5-inch or 2-inch nominal diameter. No other size is acceptable and shall not be provided.
3. Acceptable Manufacturers are Cambridge-Lee Copper, Cerro, Halstead, Mueller Copper Company, and Wolverine or prebid BMU Engineer approved equal.

2.14 CURB STOPS (1-INCH, 1.5-INCH OR 2-INCH)

A. No lead brass curb stop with copper tub size (CTS) compression connection shall be Minneapolis pattern valves, conforming to the latest revision of the ANSI/AWWA C800 Standard for Underground Service Line Valves and Fittings, or prebid BMU Engineer approved equal.

B. All brass valves, fittings and appurtenances used in underground service shall conform to ANSI/AWWA C800 (latest revision), ASTM B584 Brass components in contact with potable water, identified with “NL”, UNS C89833 (latest revision). Brass components not in contact with potable water, 85-5-5-5, UNS C83600 (latest revision). NSF/ANSI 61 and NSF/ANSI 372. ASTM/UNS Materials exceptions: Brass alloys containing greater than 6% zinc shall not be allowed. Brass alloys containing less than 84% copper shall not be allowed.

C. Curb stops shall not be the drain back type.

D. Acceptable Manufacturers are A.Y. McDonald 76104, A.Y. McDonald 76104-22, Ford B-44 (Compression), Ford B-22 (Flare), Mueller B-25154 or prebid BMU Engineer approved equal.

2.15 CURB STOP BOX

A. Curb stop box shall be adjustable and include a base tapped to attach to the threaded top of a Minneapolis pattern curb valve. The upper part of the box is adjustable and telescopes in the base to allow for grade adjustments.

B. Box shall be furnished with a cast iron lid and brass pentagon plug. Lid shall be provided with a stainless-steel screw for attaching tracer wire to the lid.

C. Curb box shall be provided with an electrostatically applied, cationic epoxy coating system that provides complete corrosion protection.

1. If an epoxy coating cannot be provided on the curb stop box, the cast iron curb stop box shall be furnished and installed with a 5 lb anode bag.

D. All curb stop boxes shall be provided with 60" steel stationary rod with ductile iron tee head socket and brass cotter pin.

E. Acceptable manufacturers for curb boxes shall be Ford EM2-XX-56-XXR-TW Series, A.Y. McDonald 5614TW Series or BMU Engineer approved equal.

2.16 DOUBLE CHECK VALVE BACKFLOW ASSEMBLY (1/2-INCH TO 2-INCH)

A. Double check valve assembly shall be designed to protect drinking water supplies from dangerous cross-connection in accordance with national plumbing codes. The assembly shall consist of two (2) positive seating check modules with captured springs and rubber seat discs.

B. The check module seats and seat disc shall be replaceable single cover, top entry cover that allows for convenient access for maintenance.

C. The assembly shall also include two (2) resilient seated, quarter turn isolation ball valves and four (4) top mounted resilient seated test cocks.

D. The assembly shall meet the requirements of latest revision of the ASSE STD 1015 and AWWA C510

E. Acceptable manufacturers for double check valve backflow assembly are: Watts Series LF007, or BMU Engineer approved equal.

2.17 PIPE INSULATION

A. 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.

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

2.18 ENCASEMENT PIPE - PVC

A. PVC encasement pipe shall meet the requirements of the "RESTRAINT JOINT PVC WATER MAIN PIPE" specification included in this specification.

2.19 ENCASEMENT PIPE - STEEL

A. Steel casing pipe shall be ASTM A53 or ASTM A139 welded pipe with a minimum yield strength of 35,000 psi.

B. Pipe shall be full circumference welded joint in accordance with AWS D1.1 to withstand excavation forces.

C. Minimum wall thickness and diameter shall be provided as shown in the following table:

Table 6- Steel Encasement Pipe Material

Casing Pipe Size	Wall Thickness
16”	0.281”
18”	0.312”
20”	0.344”
24”	0.375”
30”	0.469”
36”	0.531”
42”	0.625”

2.20 CASING SPACERS

A. Casing spacers shall be constructed of circular T-304 stainless steel segments, which bolt together forming a shell around the carrier pipe. T-304 stainless steel bolts and nuts shall be supplied with the spacers.

B. 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 clearance of 1/2-inch to 1-inch maximum between the casing pipe inside diameter (ID) and the spacer outside diameter (OD).

C. 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).

D. 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:

1. compression strength of 25,000-psi,
2. flexural strength of 32,000-psi, and
3. tensile strength of 22,000-psi.

E. 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.

F. On carrier pipes with an OD of 16-inches or less, each spacer shall have four riser/runner combinations-two on each half. On carrier pipes with an OD of 20-inches and greater, the number of riser/runner combinations shall be as recommended by the Manufacturer, with four being the minimum.

G. 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 1-foot on each side of the bell joint and one every 6 to 8-feet thereafter.

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

2.21 CASING END SEALS

A. 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.

B. End seals shall be Model AW Wraparound casing end seals as manufactured by Advance Products & Systems, Inc., Lafayette, LA, or prebid BMU Engineer approved equal.

2.22 TEMPORARY WATER MAIN BYPASS PIPE

A. Temporary water/water main bypass pipe and associated appurtenances that may come into contact with water shall meet the requirements of NSF/ANSI Standard 61: Drinking Water System Components-Health Effects and NSF/ANSI 61 Annex G, NSF/ANSI 372.

B. All PVC piping systems shall be manufactured in full conformance with the most current edition of AWWA C900 and C905 Standards.

C. Temporary water main shall be a minimum of 2-inch diameter unless otherwise specified.

D. Approved Products are CertainTeed-Certa-Lok Yelomine or prebid BMU Engineer approved equal.

2.23 GALVANIC ANODES

A. Anodes utilized for typical galvanic anode system installation are prepackaged magnesium style anodes weighing five (5) or eighteen (18) pounds. Anode composition is to be in accordance with ASTM B843-2003 Table 1, Grade HP, M1C.

B. Anodes are to be packaged in a low resistive backfill consisting of seventy-five percent (75%) gypsum, twenty percent (20%) bentonite, and five percent (5%) sodium sulfate.

C. Anodes shall be provided with #10 AWG stranded copper, single-conductor cable with HMWPE insulation. Lead wire cable shall be rated for six hundred (600) volts and designed for direct burial applications.

D. Lead wires must be of sufficient length for splice-free routing between the anode and the pipe and is to be #10 AWG stranded copper, single-conductor cable with HMWPE insulation. Lead wire cable must be rated for six hundred (600) volts and designed for direct burial applications.

1. Equipment and materials used to bond the #10 AWG HMWPE to the pipeline is of the "CADWELD" type as manufactured by ERICO Products, Inc. of Cleveland, Ohio, or approved equal.

2. Thermite weld caps, designed to protect the CADWELD bonds from corrosion, is to be Royston "Handy Cap 2" or approved equal.

2.24 TAPPING (SERVICE) SADDLE

A. Saddle body, lifter bar and outlet shall be all Type 304 Stainless Steel used for tapping a pipe for branch connection. Saddle shall utilize a two (2) bolt design to conform around the pipe.

B. Stainless steel tap shall be TIG welded to band and be available with AWWA/CC Taper threads in ½" through 2".

C. All bolts, nuts, and lugs shall be Type 304 Stainless Steel per ASTM A193 and A194. Hex nuts shall be furnished with fusion bonded coating to prevent seizing and galling.

D. Gaskets shall be NBR (Buna-N) per ASTM D2000 with dual ring o-ring design incorporating both hydrostatic and mechanical forces to affect a dynamic seal.

E. Water service saddles shall be intended for use on C900 PVC water main.

F. Tapping saddles shall have a maximum nominal outlet diameter of 2".

G. Acceptable Manufacturers for tapping saddle are Ford Meter Box FS313, A.Y. McDonald 8403-ANPG, Powerseal 3412AS, Romac 304/305/306 or prebid BMU Engineer approved equal.

2.25 TAPPING SLEEVE WITH VALVE (WET TAP)

A. Tapping sleeve shall be fabricated from 304 stainless steel with full circumferential seal, triangular side-bars, drop-in bolts and MJ outlet and removable bolts.

B. Sleeve shall be provided with a SBR rubber compounded gasket suitable for water and sewer service in accordance with ASTM D2000.

C. GMAW welded tapping sleeve shall be provided with a test outlet welded to the outlet of the sleeve.

D. Valve used for tapping sleeve shall meet the requirements identified in SECTION 33 1419 " VALVE AND FIRE HYDRANTS (BMU)", with the exception that the valve be provided with a mechanical joint (MJ) by mechanical joint (MJ) connection.

E. Bolts and hardware shall meet the requirements identified in the previous section titled "BOLTS, NUTS, GASKETS AND OTHER HARDWARE".

F. Acceptable Manufacturers for tapping sleeve are Romac SSTIII-MJ, Smith Blair 665-MJ, JCM Model 439 or prebid BMU Engineer approved equal.

2.26 CORPORATION STOPS

A. Corporation stops shall be a quarter turn (1/4) ball type, full 100% flow opening valve with compression outlet. Corporation stop shall be rated for 300 psi working pressure. Corporation Stop shall be provided as the same size as service piping.

B. All brass valves, fittings and appurtenances used in underground service shall conform to ANSI/AWWA C800 (latest revision), ASTM B584 Brass components in contact with potable water, identified with "NL", UNS C89833 (latest revision). Brass components not in contact with potable water, 85-5-5-5, UNS C83600 (latest revision). NSF/ANSI 61 and NSF/ANSI 372. ASTM/UNS Materials exceptions: Brass alloys containing greater than 6% zinc shall not be allowed. Brass alloys containing less than 84% copper shall not be allowed.

C. Inlet Threads are to be AWWA/CC Taper. Outlets shall utilize a EPDM rubber gasket to provide hydraulic seal and pack joint compression nut to secure outlet pipe.

D. Acceptable Manufacturers for corporation stops are Ford Meter Box FB1000, AY McDonald 74701B-22 or prebid BMU Engineer approved equal.

2.27 PACK JOINT COUPLING

A. Coupling shall include pack joint nuts for CTS. Provide a beveled EPDM rubber gasket to provide hydraulic seal on pipe material. Coupling shall have anti-friction washer, integral clamp containing machined grooves for axial restraints and stainless steel screw to activate clamp.

B. All brass valves, fittings and appurtenances used in underground service shall conform to ANSI/AWWA C800 (latest revision), ASTM B584 Brass components in contact with potable water, identified with "NL", UNS C89833 (latest revision). Brass components not in contact with potable water, 85-5-5-5, UNS C83600 (latest revision). NSF/ANSI 61 and NSF/ANSI 372. ASTM/UNS Materials exceptions: Brass alloys containing greater than 6% zinc shall not be allowed. Brass alloys containing less than 84% copper shall not be allowed.

C. Manufacture shall provide pack joint to match a wide variety of pipe materials including, PVC, PEX, Copper, and HDPE and a variety of different sizes.

D. Acceptable Manufacturers for corporation stops are Ford Meter Box C44-XX-NL AY McDonald 74758-22 or prebid BMU Engineer approved equal.

2.28 BLOW-OFF ASSEMBLY

A. Blow-off assembly shall consist of a restrained cap that installs on a plain-end piece of pipe, galvanized piping isolation valve and fittings necessary to route flow to surface.

B. Restrained cap shall be fusion bonded epoxy, ductile iron material meeting ASTM A536 and utilize integral gripper rings to grip the pipe. Draw hooks shall be fabricated from 304 stainless steel . Cap shall have a threaded 2-inch bung to allow connection of piping. Restrained cap shall be Alpha EC as manufactured by Romac.

C. Provide 2-inch galvanized piping and fittings to plumb water from the restrained cap to the surface. Include 2-inch curb stop and box to isolate flow.

PART 3.0 - EXECUTION

3.1 OWNER OPERATE

A. No valve, hydrant or other controls on the existing water distribution system shall be operated for any purpose by the Contractor. BMU staff shall be the only authorized operator of existing valves and hydrants.

3.2 NOTIFICATION OF INTERRUPTION OF SERVICE

A. The Contractor shall coordinate with BMU staff of any interruption of water service at least 24-hours before the interruption of water service. BMU Staff shall notify all customers affected by any the water outage.

B. BMU is providing a courtesy to the Contractor by notifying the customers of a schedule interruption of service. It is the Contractor sole responsibility to develop, communicate and adhere to the schedule that is communicated to the BMU staff. Under no condition does BMU contacting and communicating directly with the customers relieve the Contractor of the requirements of the General Conditions of any other requirements identified in the Contract Documents.

C. Customers shall be verbally notified and provided an interruption of service notice. In the event a consumer cannot be notified, the Contractor may need to reschedule their work until the customers are notified.

D. The Contractor shall communicate and initiate operation of valve and/or fire hydrant requests with BMU staff.

3.3 ALIGNMENT AND GRADE

A. The Engineer of Record shall furnish all the necessary line and grade stakes, benchmarks, or other necessary control.

B. It is the responsibility of the Contractor to protect these stakes, and any replacement of stakes shall be at the expense of the Contractor.

C. The Contractor shall carry alignment and grade into the trench by means of an approved laser beam system and by a surveying level instrument. At no time shall the Contractor change the grade without Engineer of Record and/or BMU Staff approval.

D. If underground interference is encountered at the assigned grade, the Contractor shall notify the Engineer of Record and wait until the revised grade for the water system has been determined, if necessary. As a secondary check to the laser beam device, the Contractor shall check the grade from the grade stake to pipe invert a minimum of every 100-feet using a surveying level instrument.

3.4 WATER PIPE MATERIAL HANDLING & STORAGE

A. All pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by a means to prevent shock or damage. Under no circumstances shall such material be dropped.

B. Materials, if stored, shall be kept safe from damage. The interior of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage by freezing.

C. Piping shall not be stacked higher than Manufacturers' recommendations according to size. The bottom tier of piping shall be kept off the ground on timbers, rails, or concrete. Pipe in tiers shall be alternated: bell, plain end; plain end, bell. At least two rows of timbers shall be placed between tiers, and chocks shall be affixed to each timber in order to prevent movement. The timbers shall be large enough to prevent contact between the pipes in adjacent tiers.

D. PVC piping and Crosslinked Polyethylene (PEX) piping that has been exposed to more than the Manufacturers' maximum allowed UV exposure (sunlight) shall be rejected.

E. Gaskets for mechanical and push-on joints shall be stored in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

F. Mechanical-joint bolts shall be handled and stored in a dry location in a manner that will ensure proper use with respect to types and sizes.

3.5 MATERIAL INSPECTION

A. All pipe and appurtenances are subject to inspection by the Engineer of Record and/or BMU staff. Material found to be defective due to manufacture or damage in shipment shall be rejected and removed from the job site.

B. 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 having minor flaws not serious enough to cause rejection shall be installed so as to bring such flaws in the top half of the sanitary sewer. Pipe shall be protected during handling against impact, shocks, and free fall.

C. The Engineer of Record and/or BMU staff may perform tests as specified in the applicable AWWA standard to ensure conformance with the standard. In case of failure of the pipe or appurtenance to comply with such specifications, responsibility for replacement of the defective materials becomes that of the Contractor or Manufacturer, even if piping and appurtenance has already been installed.

D. The Engineer of Record and/or BMU staff 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.

3.6 BMU ACCESS TO PROJECT SITE

A. The BMU Engineer or Engineers' Representative shall have access to all parts of the job at all times. The Contractor shall furnish personnel, facilities, equipment, tools, and materials as are necessary to make whatever tests and inspection that are required by the Contract Documents.

B. The BMU Engineer reserves the right to inspect and/or reject any part of, or all unsatisfactory work performed by the Contractor. Rejected or unapproved work shall be promptly replaced or modified to comply with these specifications.

3.7 REMOVAL OF WATER MAIN AND WATER MANHOLES AND SALVAGING VALVES AND FIRE HYDRANTS

A. Water main, water manholes, unsalvageable valves, and unsalvageable hydrants shall be removed at the locations shown on the plans or as directed by the BMU Engineer.

B. Water manholes shall be entirely removed and disposed of by the Contractor.

C. Valves and fire hydrants shall be salvaged at the locations shown on the plans or as directed by the BMU Engineer. Any salvaged items shall be properly disconnected and transported to Brookings Municipal Utilities (BMU) at 525 Western Avenue and neatly stockpiled. The Contractor shall contact BMU prior to delivery of the materials.

3.8 TRENCH EXCAVATION

A. Reference Section 31 2333 – TRENCHING AND UTILITY BACKFILLING (BMU), for trench excavation requirements.

3.9 DEWATERING

A. Reference Section 31 2319 – DEWATERING (BMU), for trench dewatering requirements.

3.10 WATER MAIN PIPE INSTALLATION

A. Installation of PVC water main shall conform to the latest revision of AWWA C605 "UNDERGROUND INSTALLATION OF POLYVINYL CHLORIDE (PVC) AND MOLECULARLY ORIENTED POLYVINYL CHLORIDE (PVCO) PRESSURE PIPE AND FITTINGS", and BMU Standard Plates.

B. Water main shall be installed in the locations shown on the plans or as directed by a BMU representative or Engineer of Record. 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 the 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.

C. Water main pipe which is stubbed for future extension shall end with a bell end with a short pipe with cap installed in the bell end which can be removed for future pipe extension.

D. 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.

E. Water main shall have a minimum of 6.0-foot of cover. If 6.0-foot of cover to the top of the pipe cannot be achieved or maintained, the BMU Engineer shall be notified. In special circumstances that 6.0-foot of cover cannot be obtained over the water main, the BMU Engineer may require the use of insulation over or insulation wrapped around the water main pipe.

F. Pipe shall be carefully installed to line and grade in accordance with line and grade stakes set by the Engineer of Record so that the finished water system will present a uniform alignment. Any noticeable variations from true alignment or grade will be cause for rejection of the work.

G. The bottom of the trench shall be freed of all rocks and stones and shall be hand shaped and bedded with bedding material as hereafter specified, and the pipe shall be in firm contact with the bedding material for its entire length. At each joint of bell and spigot pipe, a hole shall be dug of sufficient size so that the weight of the pipe will rest on the barrel of the pipe and not on the bells, and the bell hole shall not be compacted. Pipe must be properly fitted together.

H. A suitable plug or cap shall be kept in the end of the pipe so as to prevent any dirt or water from entering during the progress of the work at all times. Any dirt, loose material, or cement mortar which may accumulate in the pipe shall be removed as the work progresses.

I. Standard length pipe shall be utilized for all installations. Shorter lengths will only be allowed for use at fitting locations.

3.11 WATER MAIN CONNECTIONS

A. To keep interruption of service to surrounding properties at a minimum when making a water main connection, the Contractor shall have all materials for the connection on site, and to the extent possible, have fittings assembled and restrained prior to cutting the existing water main and making the connection.

B. Pipe cutting shall be neat and completed in a manner so that 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.

C. Where indicted on plans, 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.

D. Where indicted on plans, the Contractor shall cut into an existing water main, prepare the ends of the existing water main, and complete the new water main connection.

E. Where indicted on plans, the Contractor shall excavate a trench at the water main to install a smith tap into the existing water main. The Contractor will be required to furnish and install the valve box.

3.12 TRACER WIRE SYSTEM FOR WATER MAINS

A. Tracer wire system, including ground rods and all appurtenances, shall be installed with PVC 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.

B. 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.

C. Tracer wire shall be installed on all water services. Additional requirements for the installation of the tracer wire on services can be found in the "WATER SERVICES" section.

D. All underground splices shall be inspected by the Engineer of Record and/or BMU representative prior to backfilling.

E. Prior to the road surfacing be placed and after the water service connections made, BMU shall be responsible for testing and verifying that the tracer wire has been installed and operates correctly. If the tracer wire system does not function as intended, the Contractor shall repair the system to the satisfaction of the Engineer of Record or BMU representative. Any costs associated with making the repairs to the tracer wire shall be at the Contractor's expense.

3.13 CONCRETE THRUST BLOCKS

A. The Contractor shall brace all valves, hydrants, fittings, plugs and caps 12-inch in diameter and smaller by means of restrain joint glands and precast concrete thrust blocks.

B. No wood shimming or bracing will be allowed in conjunction with the concrete blocks.

3.14 FITTINGS

A. Fittings shall be installed at the locations shown on the plans or as directed by the Engineer of Record. Fittings shall be installed in accordance with the most current edition of AWWA C600.

B. Fittings shall remain exposed until the BMU Engineer or Representative has visually inspected and measured the as-built locations.

C. All mechanical joint fittings shall be installed with two restrainer devices per valve.

D. All mechanical joint fittings connections shall not exceed a horizontal or vertical deflection of 5-percent. In no case shall valves be used to bring misaligned pipe into alignment during installation.

E. All new dead-end water mains shall be closed with plugs or caps that are suitably restrained to prevent blowing off under test pressure. All dead-end water mains shall be equipped with suitable temporary fire hydrant or blow-off assembly.

F. All fitting bolts shall be torqued to manufacturer’s recommendation for torque. Contractor shall use torque wrench to ensure compliance with the manufacture’s requirements.

3.15 GALVANIC ANODES

A. Anodes are to be installed eighteen to thirty-six inches (18" to 36") from fitting and/or the curb box, to a centerline depth in line with the approximate depth of the curb stop.

B. The #10 AWG HMWPE lead wires must be attached to the fitting and/or the curb box. Lead wire connections to the fitting and/or the curb box are to utilize exothermic weld connection methodology and follow the manufacturer's instructions for use.

C. Extreme care shall be taken not to damage the anodes or direct buried lead wires during backfill procedures.

3.16 BEDDING, BACKFILL, COMPACTION AND COMPACTION TESTING

A. Reference Section 31 2333 – TRENCHING AND UTILITY BACKFILLING (BMU), for trench excavation requirements

3.17 UNDERGROUND INTERFERENCE

A. The location of underground public or private utilities may be shown on the plans, as reported by the various utility companies and BMU, but this does not relieve the Contractor of the responsibility of contacting SD ONE CALL and determining the accuracy or completeness of said locations. The Contractor shall determine the location of all underground ducts, conduits, pipes, cables, or structures which will be affected by the work, and shall take steps necessary to support and protect said structures by any means suitable to the Owners of the structure involved and the Engineer of Record.

B. When necessary, the Contractor shall conduct operations as to permit access to the work site and provide time for utility work to be accomplished during the progress of the work.

C. Portions of utilities which are found to interfere with the alignment and grade of the water main will be relocated, altered, or reconstructed by the Owners, or the Engineer of Record may direct changes in the work to avoid interference.

D. Temporary or permanent relocation or alteration of utilities requested by the Contractor for the Contractor's convenience shall be the Contractor's responsibility, and the Contractor shall make all arrangements and bear all costs. In those instances where utility relocation or reconstruction is impractical, the Engineer of Record may order a deviation from alignment and grade.

3.18 WATER MAIN AND SANITARY SEWER MAIN SEPARATION

A. Horizontal Pipe Separation

1. Water main shall be laid at least 10-feet horizontally from any existing or proposed sanitary sewer mains. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot pipe separation, BMU may allow deviation on a case-by-case basis, if supported by data from the Engineer of Record. Such deviation may allow installation of the water main closer to a sanitary sewer main, provided that the water main is in a separate trench or on an undisturbed earth shelf located on one side of the sanitary sewer main with the bottom of the water main 18-inch above the top of the sanitary sewer.

B. Vertical Pipe Separation for Sanitary Sewer Crossings

1. The vertical separation between the water main and sanitary sewer main shall be constructed to provide a minimum of 18-inches of vertical separation from the outside of the sanitary sewer main to the outside of the water main. This shall be the case

where the water is either above or below the sanitary sewer with preference to the water main located above the sanitary sewer.

2. The crossing shall be constructed so that a full-length water main pipe be used and the pipe joints will be equidistant and as far as possible from the sanitary sewer main.

3. In the event 18-inches of vertical pipe separation cannot be maintained, adhere to one of the following:

   a. Use vertical bends to lower the water main under the sanitary sewer main.

   b. Install an encasement pipe around the water main. The encasement pipe shall be 20-foot minimum in length, centered where the pipes intersect, and sealed at both ends with end seals.

3.19 WATER MAIN AND STORM SEWER SEPARATION

A. Horizontal Pipe Separation

1. Water main shall be laid at least 10-feet horizontally from any existing or proposed storm sewer mains. The distance shall be measured edge to edge. In cases where it is not practical to maintain a 10-foot pipe separation, BMU may allow deviation on a case-by-case basis, if supported by data from the Engineer of Record. Such deviation may allow installation of the water main closer to a storm sewer main, provided reinforced concrete pipe (RCP) storm sewer pipe be assembled with either:

   a. A gasket that conforms to ASTM C443 specifications (generally available for round RCP pipe up to 72-inches), OR:

   b. A watertight sealant meeting ASTM C990, AASHTO M 198, and Federal Specification #SS-S-210-A.

B. Vertical Pipe Separation for Storm Sewer Crossings

1. The vertical separation between the water main and storm sewer main shall be constructed to provide a minimum of 18-inches of vertical separation from the outside of the storm sewer main to the outside of the water main.

2. The minimum vertical separation of the water and the storm sewer is dependent on the size of the storm sewer pipe. Larger diameter storm sewer pipes have a greater minimum clearance to prevent water mains from freezing.

3. In the event that vertical pipe separation cannot be maintained, adhere to one of the following:

   a. Use vertical bends to lower the water main under the storm sewer main and install rigid insulation between the storm sewer and water main.

   b. Install an encasement pipe around the water main. The encasement pipe shall be 20-foot minimum in length, centered where the pipes intersect, and sealed at both ends with end seals and install rigid insulation between the storm sewer and water main.

3.20 WATER SERVICES

A. Water services, corporation stops and curb stops for house connections, multiple dwellings, and commercial connections shall be installed as shown on the project drawings or as directed by the Engineer of Record.

B. Water service pipe shall be bedded in accordance with the requirements of Section 31 2333 – TRENCHING AND UTILITY BACKFILLING (BMU), for trench excavation requirements

C. BMU Inspector's role during service line installation:

1. The BMU Inspector shall observe the backfill and compaction of the water service. If the BMU Inspector questions the licensed Plumbing Contractor's means and methods for backfill and compaction, BMU will coordinate and hire a SD licensed Geotechnical Engineer to perform a compaction test to determine if the backfilled trench meets the compaction testing requirements.

a. If the compaction test meets the compaction requirements of these specifications, BMU will pay the Geotechnical Engineer for all the associated costs.

b. If the compaction test fails, the licensed Plumbing Contractor shall be responsible for reimbursing BMU for the Geotechnical Costs. BMU will pay the Geotechnical Engineer and bill the licensed Plumbing Contractor directly for the costs of a failed tests.

- Upon a failed test, the Geotechnical Engineer shall provide a recommendation to the Contractor as to how the trench shall be backfilled and compacted to meet the requirements set forth in these standard specifications.

- The Contractor shall be responsible for all costs associated with backfilling the trench, including but not limited to, removing the failing material, drying, importing and installing dry material, removing failing material from site, compaction and re-testing by the Geotechnical Engineer.

D. For new construction, splices on the water service will not be allowed from the corporation to the curb stop, and from the curb stop to the meter for new construction. Splice locations for rehab or water service replacement shall be prior approved by BMU Inspector.

E. All water services shall be installed with tracer wire from the water main to the curb stop box and from the curb stop box to the structure.

1. Contractor shall provide a loop or slack in the tracer wire at each proposed water service. The loop shall be configured to allow for excess tracer wire to be used to connect the water service tracer wire to the tracer wire installed with the water main.

2. Contractor shall splice the water service tracer wire to the main line by using a moisture displacement connector kit.

3. Tracer wire shall be terminated on the curb stop box lid from both the main line and the wire extending to the structure.

4. Tracer wire shall be terminated immediately adjacent to the structure foundation with a grounding road and associated connectors.

5. BMU shall verify the installation of the tracer wire by energizing and locate the water service via the tracer wire prior to backfilling of the water service.

F. All curb stops that are installed without a valve box shall be marked to help locate them and prevent breakage when excavating.

1. Water services shall be marked by a vertical section of PVC pipe or an approved marker. The PVC pipe shall be painted blue on the top 1-foot portion of the marker.

2. The marker should be placed near the curb stop or at the termination point of the water service stub-in.

3. The water service marker shall remain in place and be maintained by the Developer or Property Owner until the water service is extended into the property to serve a house, building, or other structure.

G. Contractor shall coordinate with BMU to installed service connections or disconnections with BMU crews. Water service connections or taps to new or existing water main will not be permitted until the water main has passed the necessary pressure testing and disinfection requirements. All service taps/saddles must be adequately supported prior to backfilling.

H. Water saddle and taps shall be installed by BMU, using a service saddle and located at 10 o'clock or 2 o'clock on the circumference of the pipe. If cover over a service line is shallow and frost may become a factor, corporations may be installed at 3 o'clock or 9 o'clock on the water main to get additional cover over the water service.

I. Service connections or disconnects are made using one of the following methods, unless otherwise specified:

1. The Contractor shall excavate a trench to allow BMU crews to install saddles and connect (tap) the water main with a water service corporation stop. The trench shall then be backfilled by the Contractor.

2. The Contractor shall excavate a trench and disconnect the water service at the water corporation stop in the presence of BMU personnel. The trench shall then be backfilled by the Contractor.

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

K. Curb stops shall be located directly on the right-of-way/property line. It is acceptable to be installed outside of the right-of-way/property line on private property as long as it is within 18-inches of the right-of-way/property line. Curb stop valve and boxes SHALL NOT be located within in the public right-of-way. Curb stops installed within the right-of-way or outside of the 18-inch designated area, shall be removed and relocated at no expense to BMU.

1. Curb stops installed short of the property line shall be relocated to the property line by removing the entire water service back to the corporation stop and reinstalled to prevent the installation of a splice on the water service.

2. Curb stops installed long of the property line shall be relocated by isolating the water service and cutting the water service back to the property line.

3.21 CASING PIPE VIA BORING (JACKING)

A. Additional technical specifications shall be included with project plans and specification to ensure correct installation of the bore and casing.

B. It shall be the responsibility of the Contractor to maintain the alignment and grade specified. The boring (jacking) specifications shall be in accordance with these specifications, plan sheets, plan notes and Standard Plates.

3.22 TEMPORARY WATER MAIN BYPASS SYSTEM

A. A minimum of 1-weeks prior to operation of the water bypass system, the Contractor shall submit a water main layout and sequence of operations for the temporary water main bypass system for BMU Engineer approval. The BMU Engineer shall be given written notice, at least 2-days in advance, of intent to commence water bypass operations.

B. The Contractor shall provide a 24-hour contact person who has adequate parts and equipment readily accessible to make necessary repairs to temporary water bypass system or temporary water service in a timely manner.

C. The Contractor shall notify BMU staff at least 24-hours prior to the planned outage. The Contractor shall inform BMU staff of the estimated time that the water service will be disrupted. BMU shall coordinate with all property Customers for the planned disruption of water service or accessibility issues created by the temporary water main bypass system.

D. The BMU shall contact customers (that are at the property at the time of service interruption) along the water main project where the customers will have a disruption of water service.

E. BMU shall furnish and install door hangers on each affected property Customers door. The door hanger shall indicate the time when the property will not have water service.

F. Bypass piping required for an extended period of time, if directed, shall be buried or covered by granular material ramps where the pipe crosses bike trails, sidewalks, driveways, roads, pedestrian crossings, entrances, etc.

G. Contractor shall make water service connections either during the day or at other suitable times to minimize the Customers disruption of water service.

H. Contractor shall provide all chlorinating, testing, pipe, necessary isolation valves, bends, fittings, hydrants, all necessary appurtenances, gravel ramp construction, maintenance and removal, and all other materials and labor necessary to construct the temporary water main and flush each individual service before connection to the BMU water system.

   1. Temporary water main is required to be disinfected, flushed, and sampled (Two consecutive coliform bacteria tests shall be taken 24-hours apart) prior to any service connections being made. The temporary water main shall be tested at static main pressure for a period of 2-hours.

3.23 SURFACE RESTORATION

A. The Contractor shall replace all surface material and shall restore paving, curb and gutter, sidewalks, lawn irrigation, fences, trees, sod, topsoil, and other items disturbed to a condition equal to or better before the work began; furnishing all labor, materials, and equipment necessary to do this work. Surface restoration shall conform to all City or DOT right-of-way requirements.

3.24 WATER MAIN TESTING SEQUENCE

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

   1. Contractor shall furnish and place granular chlorine in the water main as the pipe is constructed.

2. Once water main construction is complete, the Contractor shall request to have the pipe segment filled by BMU personnel.
    a. Contractor shall make their request during normal business hours, between 8 a.m. to 5 p.m., Monday-Friday. Filling of the pipe segment will be done by BMU at a time determined by the BMU to have minimal impacts to the existing customers.
3. Contractor shall disinfect the water main as indicated in Section 3.25 -WATER MAIN DISINFECTION.
4. Once the water main has been disinfected, the line segment shall be hydrostatically tested in accordance with Section 3.26 - HYDROSTATIC TESTING.
    a. 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.
    b. Should the repair of the damaged or defective material compromise the integrity of the water main, the water main shall be disinfected again to ensure sanitary conditions exist by going back to step 3.26.A.1 as indicated above.
    c. The test shall be repeated until the leakage is within the permitted allowance.
5. Once a passing hydrostatic test has been obtained, the water main shall be adequately flushed by BMU personnel.
6. Once flushing is complete, the line segment shall be bacteriological tested in accordance with Section 3.27 -BACTERIOLOGICAL TESTING.

3.25 WATER MAIN DISINFECTION

A. Water mains shall be disinfected in accordance with by one of three acceptable methods as described in the most current addition of AWWA C651 DISINFECTING WATER MAINS. The three acceptable methods are:
    1. Tablet/Granule Method of Chlorination
    2. Continuous-Feed Method of Chlorination
    3. Slug Method of Chlorination
B. Water Mains 12-inch diameter and smaller shall utilize the Tablet/Granule Method of Chlorination. The following specifications and previous Section 3.26 - WATER MAIN TESTING SEQUENCE is based on this method of chlorination.
    1. The Contractor shall place sufficient granular chlorine in the water main as construction progresses. Granules shall be placed at the upstream end of the first section of pipe, at the end of each branch main and at 500 feet intervals.
        a. The quantity of granular chlorine shall be placed in accordance with AWWA C651 to provide a minimum chlorine dose of 25 mg/L.
    2. Once the water main installation is complete, the water main shall be slowly filled with water such that the full pipe velocity is not greater than 1.0 feet per second.
        a. Fill rate must be carefully controlled to ensure that chlorine granules do not migrate throughout the water main.
        b. Precautions shall be taken to ensure that air pockets are eliminated

3. 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 verify that a detectable free chlorine residual is present at each sampling point.
    a. In order to prevent damage to the pipe and/or pipe lining, heavily chlorinated water shall not remain in contact with the water main for more than 72-hours.
4. The Contractor shall request to have the water main flushed by BMU personnel. The water main shall be adequately flushed to remove all heavily chlorinated water and remaining particulates.
    a. BMU 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 State.

C. Disinfection of 14-inch diameter and larger water mains shall be chlorinated by any one of the three acceptable methods previously indicated.
1. If the Contractor chooses a method other than the Tablet/Granule Method for Chlorination, the Contractor must submit a detailed plan showing compliance with AWWA C651.
2. Plan shall include the following information at a minimum;
    a. Type and concentration of chlorine,
    b. Calculation showing fill and flushing flowrates, dosage, duration of time for fill and flush,
    c. And sequence

3.26 HYDROSTATIC TESTING

A. The Contractor shall furnish all pumping equipment, labor, gauges, and other appurtenances required for the pressure test.

B. Upon completion of the water main installation, the water main shall be hydrostatically tested using the following guidelines:
1. For water mains, a pressure of 120 psi shall be maintained for a period of 2-hours. The BMU Engineer or his appointed representative shall observe the pressure gauge readings before acceptance of the test.
2. If after 2-hours the pressure has dropped less than 2.0 psi, the test shall be considered acceptable. If the pressure dropped greater than 2.0 psi, the volume of water needed to re-pressurize the water main shall be calculated and the Contractor shall be responsible for re-pressurizing the main.

C. BMU Engineer or his appointed representative shall observe the pressure gauge readings before acceptance of the test. The BMU representative shall verify that the test hydrant lead valve(s) is in the open position prior to initiating the pressure test.

D. If at any time during the test the pressure drops below the specified test pressure, the Contractor shall re-pressurize the pipe by pumping in potable water in sufficient quantity to bring the pressure back to the original test pressure. Accurately measure the amount of water required to re-pressurize the system to the initial test pressure.
1. Maximum allowable leakage rate:

$$Q = \frac{L\ D\ \sqrt{P}}{148{,}000}$$

Where:
Q = Allowable makeup water, gallons per hour
L = Length of pipe section being tested, in feet
D = Nominal Diameter of pipe, in inches
P = Avg Test Pressure, PSI Gauge
(?120psi=10.95)

E. 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.

3.27 BACTERIOLOGICAL TESTING

A. One set of bacteria tests is required for every 1,200 lineal feet of water main installed.

B. Once flushing is complete, BMU personnel will collect a water sample(s) from the water main at an acceptable location for coliform bacteria testing. Contractor shall deliver the water sample(s) to the lab for analysis.

C. After collection of the first water sample(s), the water shall remain in the water main for an additional 24-hours. After a minimum of 24 hours, BMU personnel will collect a second water sample(s).

D. Two consecutive passing samples (coliform bacteria absent), at all of the sample location(s), shall be required for a passing bacteria test. Upon receiving notification of the second sample passing, the water main can be put into service and service lines tapped.

E. If one of the two consecutive coliform bacteria test fails (coliform bacteria present), the Contractor must request that the water main be re-flushed. After the water main is re-flushed, a water sample(s) will be taken and second water sample(s) shall be taken a minimum of 24 hours later than the first re-sample.

F. If one of the two consecutive re-test samples fails, the Contractor is required to re-chlorinate the water main by the AWWA continuous feed or slug method (liquid chlorine injection through a service tap). The sample testing and retesting protocol established in the previous section will be required until consecutive coliform bacteria test passes.

G. Contractor shall be responsible for paying, shipping, delivering and/or transporting all samples to the appropriate testing laboratory. Contractor shall provide Engineer of Record and BMU staff a copy of the successful bacterial testing results.

PART 4.0 - MEASUREMENT AND PAYMENT

4.1 X” PVC WATER MAIN PIPE

A. Water main shall be measured to the nearest lineal foot for each size of PVC water main pipe furnished and installed. Measurement shall be from center of fitting to center of fittings or to the end of pipe. The measured length shall be rounded up to the nearest 1-foot increment.

B. Payment will be at the contract unit price per lineal foot of PVC water main. Payment will be full compensation for all materials, excavation, backfilling, hydrostatic testing, bacteriological testing, concrete blocking, tracer wire system with ground rods, materials, labor, equipment, and incidentals necessary to complete the work.

C. No measurement or individual Bid Item payment will be made for extra depth water main unless otherwise noted on the Bid Form.

4.2 X" RJ PVC WATER MAIN PIPE

A. Restrained joint PVC water main shall be measured to the nearest lineal foot for each size of restrained joint PVC water main pipe furnished and installed. Measurement shall be from center of fitting to center of fittings or to the end of pipe. The measured length shall be rounded up to the nearest 1-foot increment.

B. Payment will be at the contract unit price per lineal foot of restrained joint PVC water main. Payment will be full compensation for all materials, excavation, backfilling, hydrostatic testing, bacteriological testing, concrete blocking, tracer wire system with ground rods, materials, labor, equipment, and incidentals necessary to complete the work.

C. No measurement or individual Bid Item payment will be made for extra depth water main unless otherwise noted on the Bid Form.

4.3 X" DI WATER MAIN PIPE

A. Water main shall be measured to the nearest lineal foot for each size of ductile iron water main pipe furnished and installed. Measurement shall be from center of fitting to center of fittings or to the end of pipe. The measured length shall be rounded up to the nearest 1-foot increment.

B. Payment will be at the contract unit price per lineal foot of ductile iron water main. Payment will be full compensation for all materials, excavation, backfilling, hydrostatic testing, bacteriological testing, concrete blocking, tracer wire system with ground rods, materials, labor, equipment, and incidentals necessary to complete the work.

C. No measurement or individual Bid Item payment will be made for extra depth water main unless otherwise noted on the Bid Form.

4.4 X" RJ DI WATER MAIN PIPE

A. Restrained joint ductile iron water main shall be measured to the nearest lineal foot for each size of restrained joint ductile iron water main pipe furnished and installed. Measurement shall be from center of fitting to center of fittings or to the end of pipe. The measured length shall be rounded up to the nearest 1-foot increment.

B. Payment will be at the contract unit price per lineal foot of restrained joint ductile iron water main. Payment will be full compensation for all materials, excavation, backfilling, hydrostatic testing, bacteriological testing, concrete blocking, tracer wire system with ground rods, materials, labor, equipment, and incidentals necessary to complete the work.

C. No measurement or individual Bid Item payment will be made for extra depth water main unless otherwise noted on the Bid Form.

4.5 TRACER WIRE FOR WATER MAINS

A. No measurement or individual bid Item payment will be made for tracer wire. Tracer wire and all appurtenances shall be considered incidental to the installation of the PVC water main and/or water services.

OR

A. Tracer wire, for water main and water services, shall be measured to the nearest lineal foot where tracer wire is deemed necessary.

B. Payment will be at the contract unit price per foot for tracer wire furnished and installed. Payment shall be full compensation for tracer wire, grounding rods, splices, connectors, labor, equipment, and incidentals necessary to complete the work.

4.6 X" WATER MAIN FITTINGS

A. Fittings shall be measured per each type and size of fitting furnished and installed. Payment will be at the contract unit price per each type and size of fitting. Payment for fittings shall full compensation for fitting, restrainer devices, bolts, nuts, gaskets, fusion bonded epoxy exterior coating, blocking, materials, labor, equipment, and incidentals necessary to complete the work.

B. Mechanical joint restrainer devices shall be considered incidental to the furnished and installed fitting which requires restraint.

4.7 X" FOSTER ADAPTER

A. Payment for coupling adapters shall be at the contract unit price per each size of foster adapter. Payment shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the work, included but not limited to foster adaptor, integral glands, restraints, bolts, gaskets and incidentals necessary to complete the work.

4.8 X" x X" ANCHOR COUPLING ADAPTOR

A. Payment for anchor coupling adaptor shall be at the contract unit price per each size and length of anchor coupling adaptor. Payment shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the work, included but not limited to anchor coupling adaptor, integral glands, restraints, bolts, gaskets and incidentals necessary to complete the work.

4.9 BOLTS, NUTS, GASKETS AND OTHER HARDWARE

A. No measurement or individual bid Item payment will be made for bolts, nuts, gaskets or other associated hardware used to install mechanical joint fittings and/or valves. Bolts, nuts, gaskets or other associated hardware and labor shall be considered incidental to the installation of the valve, hydrant, and/or fittings.

4.10 X" COUPLING ADAPTOR

A. Payment for coupling adapters shall be at the contract unit price per each type and size of coupling adaptor. Payment shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the work, included but not limited to coupling/long body sleeve, restraints, bolts, and gaskets.

4.11 MECHANICAL JOINT RESTRAINER DEVICES

A. No measurement or individual bid Item payment will be made for mechanical joint restrainer device (glands) for fittings and/or valves. Restrainer gland, bolts, nuts, gaskets or other associated hardware and labor shall be considered incidental to the installation of the valve, hydrant, and/or fittings.

4.12 BELL RESTRAINER DEVICES

A. No measurement or individual bid Item payment will be made for bell restrainer devices for restraining PVC bell and spigot joints. Bell restrainer devices, bolts, nuts, gaskets or other associated hardware and labor shall be considered incidental to the installation of the PVC water main and/or RJ PVC water main.

4.13 X" WATER SERVICE

A. Water service pipe shall be measured to the nearest lineal foot for each size of water service pipe furnished and installed. Payment will be at the contract unit price per foot for each size of water service pipe. Payment shall be full compensation for water service pipe, materials, labor, equipment, and incidentals necessary to complete the work.

OR

A. Water service pipe shall be measured to the nearest lineal foot for each size of water service pipe furnished and installed. Measurement will normally be from the water main to the curb stop and shall include any applicable tapping fee. Refer to BMU annually published "SERVICE CHARGES – WATER/SEWER" rate sheet for water service tapping fee costs, corporation info and curb stop info.

B. Payment will be at the contract unit price per foot for water service pipe. Payment shall be full compensation for tapping fee, tapping saddle, corporation stop, water service pipe, curb stop, curb stop box, stub marker, materials, labor, equipment, and incidentals necessary to complete the work.

4.14 X" CURB STOP

A. Payment for curb stops shall be at the contract unit price per each size of curb stop indicated on Bid Form. Payment shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the work, included but not limited to curb stop valve, stub marker and incidentals necessary to complete the work.

OR

A. Payment for curb stops shall be at the contract unit price per each size of curb stop indicated on Bid Form. Payment shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the work, included but not limited to curb stop valve, curb stop box, stationary rod, pvc sleeve, and incidentals necessary to complete the work.

OR

A. No measurement or individual bid Item payment will be made for each curb stop. Labor, equipment and materials, including but not limited to curb stop, curb stop box, stationary rod, pvc sleeve or other associated hardware shall be considered incidental to the installation of the water service.

4.15 X" CURB STOP BOX

A. Payment for curb stop box shall be at the contract unit price per each size of curb stop box indicated on Bid Form. Payment shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the work, included but not limited to curb stop box, stub marker, stationary rod, pvc sleeve, and incidentals necessary to complete the work.

OR

A. No measurement or individual bid Item payment will be made for curb stop box. Labor, equipment and materials, including but not limited to curb stop box, stub marker, stationary rod, pvc sleeve, or other associated hardware shall be considered incidental to the installation of the water service and/or curb stop.

4.16 X" DOUBLE CHECK VALVE BACKFLOW ASSEMBLY

A. Payment for the double check valve backflow assembly shall be at the contract unit price per each size of valve assembly indicated on Bid Form. Payment shall be full compensation for all materials, labor, equipment, and incidentals necessary to complete the work, included but not limited to double check valve backflow valve, bolts, nuts, gaskets, isolation valves, and incidentals necessary to complete the work.

4.17 PIPE INSULATION

A. No measurement or individual bid Item payment will be made for water pipe insulation. Labor, equipment and materials, including but not limited to insulation, or other associated hardware shall be considered incidental to the installation of the water main.

4.18 X" RJ PVC CASING PIPE VIA BORING

A. Casing pipe shall be measured by the lineal foot for casing pipe with carrier pipe supported by casing spacers and capped with end seals, all furnished and installed. The measured length of casing pipe shall be rounded up to the nearest 1-foot increment.

B. Payment will be at the contract unit price per lineal foot for the type and size of casing pipe. Payment for casing pipe shall be full compensation for excavating and backfilling of bore pits, bore pit dewatering, casing pipe by directional boring or jacking, welding, carrier pipe supported by casing spacers, end seals, materials, labor, equipment, and incidentals necessary to complete the work.

4.19 X" STEEL CASING PIPE VIA BORING

A. Casing pipe pipe shall be measured by the lineal foot for casing pipe with carrier pipe supported by casing spacers and capped with end seals, all furnished and installed. The measured length of casing pipe shall be rounded up to the nearest 1-foot increment.

B. Payment will be at the contract unit price per lineal foot for the type and size of casing pipe. Payment for casing pipe shall be full compensation for excavating and backfilling of bore pits, bore pit dewatering, casing pipe by directional boring or jacking, welding, carrier pipe supported by casing spacers, end seals, materials, labor, equipment, and incidentals necessary to complete the work.

4.20 CASING SPACERS

A. No measurement or individual bid Item payment will be made for casing spacers. Labor, equipment and materials, including but not limited to casing spacers, nuts, bolts, gaskets, banding, or other associated hardware shall be considered incidental to the installation of the (RJ or Steel) Casing Pipe or Restrained Joint PVC Water Main.

4.21 CASING END SEALS

A. No measurement or individual bid Item payment will be made for end seals. Labor, equipment and materials, including but not limited to end seals, nuts, bolts, gaskets,

banding, or other associated hardware shall be considered incidental to the installation of the (RJ or Steel) Casing Pipe or Restrained Joint PVC Water Main.

4.22 TEMPORARY WATER MAIN BYPASS PIPE

A. Temporary water main bypass system shall include furnishing and installing a complete temporary water main bypass piping system with temporary service connections with all apparatus.

B. Payment will be at the contract lump sum price for a temporary water main bypass system. Payment shall be full compensation for furnishing and installing the bypass tie-ins, bypass piping, pressure testing, bacteria testing, temporary water service connections, removing and repairing the bypass tie-in locations, material, labor, equipment, and incidentals necessary to complete the work.

4.23 GALVANIC ANODES

A. No measurement or individual bid Item payment will be made for galvanic anodes. Labor, equipment and materials, including but not limited to anode bag, cad welding, wires, splices, caps, connections, or other associated hardware shall be considered incidental to the installation of the curb stop box, valve, hydrant and/or fittings.

4.24 X" x X" TAPPING SADDLE

A. Tapping saddle shall be measured for per each type and size of tapping saddle furnished and installed. Payment shall be full compensation for BMU tapping fee, tapping saddle, corporation stop, materials, labor, equipment, and incidentals necessary to complete the work.

B. Refer to BMU annually published "SERVICE CHARGES – WATER/SEWER" rate sheet for water service tapping fee costs, corporation info and curb stop info.

OR

A. Tapping saddle shall be measured for per each type and size of tapping saddle furnished and installed. Payment shall be full compensation for tapping saddle, corporation stop, materials, labor, equipment, and incidentals necessary to complete the work.

OR

A. No measurement or individual bid Item payment will be made for each type and size of tapping saddle. BMU Tapping fee, Labor, equipment and materials, including but not limited to tapping saddle, corporation stop or other associated hardware shall be considered incidental to the installation of the water service.

4.25 X" x X" TAPPING SLEEVE WITH VALVE (WET TAP)

A. Tapping sleeve with valve shall be measured for per each type and size of tapping sleeve with valve furnished and installed. Payment shall be full compensation for tapping sleeve, tapping valve, bolts, nuts, gaskets, other hardware, materials, labor, equipment, and incidentals necessary to complete the work.

4.26 X" CORPORATION STOP

A. No measurement or individual bid Item payment will be made for each type and size of corporation stop. Labor, equipment and materials, including but not limited to corporation

stop or other associated hardware shall be considered incidental to the installation of the water service and/or tapping saddle.

4.27 X" x X" PACK JOINT COUPLING

A. No measurement or individual bid Item payment will be made for each type and size of pack joint coupling. Labor, equipment and materials, including but not limited to pack joint or other associated hardware shall be considered incidental to the installation of the water service and/or water service reconnect.

4.28 X" BLOW-OFF ASSEMBLY

A. Blow-off assembly shall be measured for per each type and size of blow-off assembly furnished and installed. Payment shall be full compensation for restrained cap, pipe, fittings, isolation valves, curbstop, nipples, materials, labor, equipment, and incidentals necessary to complete the work.

4.29 WATER SERVICE RECONNECT

A. Payment for water service reconnect shall be for at the contract unit price per each location indicated. Payment shall be full compensation for disconnecting the existing water service and reconnecting the existing water service to the new water main. Labor, equipment and materials, including but not limited to compression coupling or other associated hardware to complete the work.

4.30 WATER SERVICE DISCONNECT

A. Water service disconnects at the water main location shall be measured per each trench excavated and backfilled. Measurement will be made only once if more than one disconnect can be performed in one common trench.

B. Payment for water service disconnect will be at the contract unit price per each water service disconnect trench. Payment shall be full compensation for trench, backfill, road topping, labor, equipment, and incidentals necessary to complete the work.

4.31 REMOVE WATER MAIN

A. The removal of water pipe shall be measured as lineal foot of water pipe removed, unless otherwise noted. The removal footage shall be rounded up to the nearest 1-foot increment. 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, sanitary sewer main or other utilities.

B. Payment for removal of water main shall be paid at the contract unit price for each foot of water main removed. Payment for removal of water main shall be full compensation for all disposal costs, labor, equipment, and incidentals necessary to complete the work.

OR

A. Where indicated on the plans or where deemed necessary to install the new pipe, the removal of water pipe shall be considered incidental to the installation of the new water main. 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, sanitary sewer main or other utilities.

4.32 REMOVE WATER MANHOLE

A. Removal of water manholes shall be measured as a unit for each water manhole removed. The frame and lid shall be salvaged and delivered to BMU at 525 Western Avenue by the Contractor, delivery of the frame and lid shall be incidental to the water manhole removal.

B. Payment for removal of water manhole shall be paid at the contract unit price for each water manhole removed. Payment for removal of water manhole shall be full compensation for frame & lid delivery to BMU, disposal costs, labor, equipment, and incidentals necessary to complete the work.

4.33 REMOVE FIRE HYDRANT/REMOVE VALVE & BOX

A. No measurement or individual bid Item payment will be made for the removal of fire hydrants or valves. Removed valves and fire hydrants shall be incidental to the water main installation. The Contractor shall be responsible for all removal costs.

OR

A. Payment for valve and hydrant removals shall be paid at the contract unit price for each salvaged item removed and delivered. Payment for salvaged removals shall be full compensation for valve and/or hydrant delivery to BMU, labor, equipment, and incidentals necessary to complete the work.

B. Removed valves and fire hydrants shall be measured per each valve or fire hydrant salvaged. Removed valves and fire hydrants shall be delivered to Brookings Municipal Utilities at 525 Western Avenue.

END OF SECTION 33 1000