SECTION 02071

WATER MAINS AND SERVICES

1.0 GENERAL

1.1 SCOPE OF WORK

The work shall include the furnishing of all labor, materials, tools, equipment, and incidentals required to construct and complete in an efficient and workmanlike manner the installation of public water mains and related facilities in accordance with the Plans and Specifications. Public water facilities include but are not limited to all those facilities including the water main, valves, fittings and appurtenances complete in-place to the back of meters and/or backflow prevention devices. All materials to be domestic made.

1.2 ADDITIONAL DEFINITIONS AND TERMS

Refer to Section 00050 of the General Provisions for definitions and terms. In addition, the following definitions and terms are used herein.

A. "A.S.T.M." shall mean the American Society for Testing and Materials.

B. "AWWA" shall mean the American Water Works Association, and it is intended that the current requirements of their standards shall govern throughout, unless otherwise herein specified. Such AWWA requirements shall be used in their entirety unless otherwise noted.

C. "DPH" shall mean California Department of Public Health.

D. "Engineer" shall mean the Director of Water & Sewer Utilities of the City of Santa Clara, or designee.

2.0 MATERIALS

2.1 DUCTILE IRON PIPE

Ductile iron pipe shall be Pressure Class 350 conforming to AWWA Standards C150 and C151.

Unless otherwise specified in the special provisions, ductile iron pipe shall receive an asphaltic coating as specified in AWWA Standard C151 and a cement lining conforming AWWA Standard C104. Ductile iron pipe and fittings shall be wrapped with an approved polyethylene encasement per AWWA Standard C105.

All ductile iron pipe joints shall be mechanically restrained. Mechanically restrained joints shall be “TR FLEX” Restrained Joint or Tyton pipe with Field-Lok gaskets by U.S. Pipe, Flex-Ring or Lok-Ring Restrained joints by American Ductile Iron Pipe, or equal. As an alternative, joints may be restrained with EBAA Iron Megalug restraints, Tyler MJ field loc restraints or equal.

Mechanical joint bell, flange, bolts, follower gland-sealing gasket and accessories shall conform to the requirements of AWWA Standard C-111. Bolts shall be Type 316 stainless steel, Class 2, conforming to ASTM A193 for bolts and ASTM A194 for nuts.

All rubber gaskets and rings shall be ethylene propylene diene monomer (EPDM).

2.2 POLYVINYLCHLORIDE PIPE

Polyvinylchloride pipe (PVC) shall conform to the requirements of the latest revision of the AWWA Standards C900 and C905, and shall be minimum of Pressure Class 200 psi and dimension ratio of 14, ductile iron pipe equivalent outside diameter and rubber ring mechanical joints. Recycled water pipes shall be purple or wrapped with purple polywrap.

2.3 DUCTILE IRON FITTINGS

Ductile iron compact mechanical joint fittings shall be used on all ductile iron and polyvinylchloride pipelines and shall conform to AWWA Standard C153, latest revision, in material, body thickness, and radii of curvature. Mechanical joint fittings shall be cement-lined in accordance with AWWA Standard C104, latest revision. Flange ends, except as required by the Plans or the Water Department Standard Drawings, may be substituted only after approval of the Engineer. Ductile iron fittings shall be wrapped with an approved polyethylene encasement per AWWA Standard C105.

2.4 GATE VALVES

Gate valves shall be interior and exterior epoxy-coated, resilient seat gate valves with 316 stainless steel fasteners and trim, non-rising stem, open left, two-inch (2") square wrench nut and with 316 stainless steel retainer nut inside, in accordance with AWWA Standards C509 and C550. All rubber material shall be EPDM. The valves shall have ends designed to join directly with the type of pipe or fitting being used or with ends called for on the Plans.

2.5 VALVE BOXES

Gate valve boxes shall be per the Water Department Standard Drawings. Covers shall be marked "Water" for potable water boxes or “CSC-RW” for recycled water boxes. Valve risers shall be a single length of eight-inch (8") diameter polyvinylchloride pipe - SDR 35.

2.6 BLOWOFF BOXES

Valve boxes for manual blowoff assemblies shall be the same as item number 2.5 VALVE BOXES. Covers shall be marked "Water" for potable water boxes or “CSC-RW” for recycled water boxes.

2.7 FIRE HYDRANTS

Fire hydrants shall be furnished with buries with inlets that shall be mechanical joint. All hydrants shall be fusion epoxy-lined interior and the exterior shall be coated pursuant to Water Department Standard Drawings. All hydrants shall have National Standard hose threads on outlets and 1-1/8" pentagonal tips on caps and valve stems. Hydrant bury shall be 30" to 48" long with 6" inlet.

2.8 HYDRANT RISER (EXTENSION)

Hydrant risers or extension shall be with localized breakoff scoring on the exterior near each flanged end. Break-off bolts shall be hollow.

2.9 FLANGES

Steel pipe flanges shall conform to the requirements of AWWA Standard C207, Class D. Bolts shall be Type 316 stainless steel, Class 2, conforming to ASTM A193 for bolts and ASTM A194 for nuts. Flange and bolt coatings shall match adjacent pipe. Gaskets shall be full face rubber.

2.10 INSULATING FLANGED JOINTS

Each insulating flange set shall consist of a full-face central gasket, a full length sleeve for each flange bolt, and two insulating washers with two steel washers for each bolt. The ring type central gasket shall be 1/8" thick sheet packing, having a high dielectric constant. Bolt sleeves shall be plastic (polyethylene) and insulating washers shall be constructed of fabric reinforced phenolic resin. The complete assembly shall have an ANSI pressure rating equal to that of the flanges between which it is installed.

2.11 CASINGS FOR WATER MAINS

Steel casings utilized for boring and jacking for water mains shall be smooth steel pipe conforming to AWWA C200, fabricated in sections for welded field joints and be the size shown on the Plans. Field joints shall be full circumferencial welded butt joints.

2.12 CASING INSULATORS

Insulators utilized for electrical isolation shall be 12" wide, two-piece steel band type. Each insulator shall have an insulating liner with a thick retainer type edge to isolate the steel bands from the carrier pipe. Insulating runners shall be 1" wide steel capped with molded rubber or polyester fiberglass. Insulator spacing shall be determined by the Contractor according to manufacturer's recommendations for each pipeline alternate and approved by the Engineer. The outside diameter of the casing insulator skids shall be sufficient height to isolate all portions of the carrier pipe from the casing.

2.13 CASING END SEALS

After installation of the carrier pipe and sand is blown to fill the annular space, the ends of the casing shall be sealed. End seals shall be pull-on type, S-shaped, constructed of 1/8" minimum highly flexible synthetic rubber. Each end

seal shall be furnished with two 1/2", 14-gauge stainless steel bands for banding the seal to the casing and carrier pipe.

2.14 EPOXY COATINGS

Epoxy coatings for fittings when required in the project Plans and Specifications shall be 8 mils minimum thickness fusion epoxy and shall be subjected to thickness and discontinuity (holiday) testing at the discretion of the Engineer. The application of the coating and preparation of the substrate shall be in accordance with the manufacturer's recommendations.

2.15 PORTLAND CEMENT CONCRETE

Portland cement concrete for hydrant bases; thrust blocks and anchors shall conform to the requirements of Section 90, "Portland Cement Concrete," of the Standard Specifications and specified herein. The concrete shall be Class "B" containing six (6) sacks of Portland cement per cubic yard of concrete. The grading of the combined aggregate shall conform with the requirements of three quarter inches (3/4") maximum. The addition of calcium chloride for high early strength concrete shall not be permitted. See standard details for required slump.

2.16 BITUMASTIC

Bitumastic for coated couplings, rods, fittings and joints shall conform to the requirements of Bureau of Reclamation Specification CA-50.

2.17 TRACER WIRE

Tracer Wire for all pipes shall be RHW #12 AWG solid, taped to the top of the water main with 12” min. slack inside all valve boxes. For connection to existing trace wires, place wires in water-proof direct bury wire connector, 3M #9756 or bulk pack #dbr-6.

2.18 POLY WRAP

Poly Wrap shall be 8 mil low-density or 4 mil high-density polyethylene film installed per AWWA Standard C105. Purple poly wrap shall be used for recycled water pipes.

2.19 PIPE MARKING TAPE

3” width, 4 mil, non-detectable
- For potable water mains and services, use blue tape.
- For recycled water mains and services, use purple tape.

2.20 NUTS, BOLTS & WASHERS

Use 316 stainless steel bolts, nuts, and washers for all bolted connections. Bolts shall be Type 316 stainless steel, Class 2, conforming to ASTM A193 for bolts and ASTM A194 for nuts.

2.21 CHLORINE

Hypochlorite shall conform to AWWA Standard B300.

2.22 MISCELLANEOUS SERVICES

Material for water services shall comply with the Water Department Standard Drawings.

2.23 APPROVAL OF EQUIVALENTS

If materials other than those specified on the Plans or these Specifications are to be considered, a description, including manufacturer's specifications, shall be supplied to the Engineer or Water Department Inspector for evaluation. Only those materials which are compatible with the existing water system and have the City's written approval will be allowed.

3.0 CONSTRUCTION METHODS

Trench excavation, backfill, imported bedding material, imported backfill, drainage and water, pavement replacement shall be as specified in Section 02062: FURNISHING AND INSTALLING PIPE of the Technical Provisions except that there shall be four inch minimum sand bedding in the bottom of the trench and a minimum of twelve inches of sand over the top of the water pipe.

The Contractor shall give two (2) working days' notice to the City's Water Department when making connections to existing water facilities. At all times, the manipulation of existing valves shall be done by City Water Department personnel.

3.1 HANDLING OF MATERIALS

Water pipe, fittings, hydrants and valves must be carefully handled at all times. Only suitable and proper equipment and appliances shall be used for the safe loading, hauling, unloading, handling and placing of materials. Special care shall be exercised so that the coating on pipe, valves and fittings will not be damaged. If such damage should occur, the coating shall be repaired to the satisfaction of the Engineer or Water Department Inspector. Chain slings will not be permitted. Pipe loaded on trucks or stacked one upon another shall be supported on wooden blocking. Pipe handled on skidway shall not be skidded or rolled against pipe already on the ground.

3.2 PIPE LAYING

All pipes shall be laid to conform to AWWA Standards C600 and C603. All pipes shall be laid true to line and grade as shown on the Plans or as directed by the Engineer to pass existing obstructions. Before any length of pipe is laid, it shall be carefully inspected for defects. No pipe or other material which is cracked or shows other defects shall be installed.

<u>Clearances</u>

A. One foot minimum vertical clearance between water and recycled water mains and services and other facilities unless otherwise noted on the plans.

B. Ten feet minimum horizontal clearance between water and recycled water mains and services and sanitary mains and services and trees.
C. Five feet minimum horizontal clearance between water and storm mains and laterals and other general utilities or facilities.

All pipe valves and fittings must be carefully wiped out and cleaned, as they are being laid so that no earth or rubbish may become lodged inside. Every open end of installed pipe shall be capped or plugged with an approved fitting at all times when work is suspended, at the close of the workday and as directed by the Engineer or Water Department Inspector.

Pipe must be given a solid, uniform bearing in the bottom of the trench. Blocking or supporting pipe on earth mounds will not be permitted. Whenever it is necessary to use a short length of pipe at a fitting or valve, the minimum length shall be thirty-two inches (32"). If it is necessary to cut pipe, said cut shall be made with an approved pipe cutter.

No deflection will be permitted at joints where water pipe is joined to cast iron fittings or valves. In all other cases, deflections will be permitted up to the maximum allowed by the manufacturer's recommendation.

A minimum of type RHW insulated #12 AWG solid copper wire shall be installed in the trench with non-metallic pipe and spliced to any existing tracer wire. For connection to existing trace wires, place wires in water-proof direct bury wire connector, 3M #9756 or bulk pack #dbr-6. The wire shall be insulated and shall be laid along the top of the pipe. The wire shall be installed so that there is no direct contact between the copper and any other metal in the trench.

3.3 JOINTS

All joints shall be assembled to conform to AWWA Standards C600 and C603. All joints shall be water tight and shall be made by competent workers. Unless otherwise specified on the Plans or in these Specifications, joints may be of any of the types listed below which are consistent with the type of pipe being used, except that joints shall in no case be caulked with cement.

3.4 WORKING INVOLVING ASBESTOS-CEMENT PIPE

Field cutting and machining operations involving asbestos-cement pipe shall be in compliance with OSHA Asbestos Standards.

Power-driven saws and abrasive discs shall not be used for the dry cutting or beveling of asbestos-cement pipe.

Pressure or "wet" tapping of asbestos-cement pipe shall be positive purge, blowoff or other type that allows pipe cuttings to be flushed from the pipe.

3.5 MECHANICAL JOINTS

The last eight inches (8") of the outside of the spigot and inside of the bell of mechanical joints shall be thoroughly cleaned of all foreign material. Mechanical joints shall be installed according to the manufacturer specifications.

3.6 SETTING VALVES, FITTINGS AND HYDRANTS

Gate valves shall be set with stems in vertical position and provided with valve boxes. Gate valves shall be anchored as shown on the Plans or the Water Department Standard Drawings.
Fire hydrants and fire hydrant connections shall be installed where indicated on the Plans, except where the Engineer directs that they shall be relocated to avoid an obstruction. The Contractor shall make such relocations at the time of reconstruction and without additional compensation. Each hydrant shall be installed in accordance with the Water Department Standard Drawings for hydrants or as shown on the Plans.

3.7 CONNECTION TO EXISTING MAINS

The Contractor shall make connections to existing mains where indicated on the Plans. The newly installed facilities are to be kept isolated from the City system until bacteriologically acceptable. If isolation is provided by a closed gate valve, pressure testing for leakage in the new facilities shall only be conducted after bacteriological acceptance.

The Engineer shall designate method and sequence of connecting to existing mains to minimize contamination danger. Connections to existing valves prior to obtaining satisfactory leakage and pressure tests of the new facilities shall be at the Contractor's risk.

The City will assume no responsibility for the water tightness of existing valves.
Service in existing mains can be interrupted only upon authorization of the Engineer, who will specify time and duration of the outage. The Contractor shall notify all affected users in writing at least forty-eight (48) hours in advance of service interruption using printed forms provided by the City. The Contractor shall notify the City's Water Department personnel at least four (4) business days in advance to schedule valve closing for service interruption. Manipulation of new or existing valves shall only be done by City Water Department personnel.

3.8 AIR RELIEFS AND BLOWOFFS

Air relief and blowoff assemblies shall be located as shown on the Plans and installed in accordance with the Water Department Standard Drawings.

3.9 PAINTING

All metals anodic to ductile iron that are not adequately protected against corrosion by a suitable protective coating shall be carefully cleaned and given a suitable protective coating of a good quality bitumastic coating. This coating shall be allowed to cure before the material is covered with polyethylene wrap or backfill material.

All valves, flexible coupling adapters, and flexible couplings shall be fusion epoxy coated pursuant to Section 2.14 and shall be subjected to thickness and discontinuity (holiday) testing at the discretion of the Engineer.

Bolts, nuts, washers, and any other metallic elements exposed to the soil shall be coated with bitumastic in accordance with Paragraph C-20, entitled "Bitumastic", of these Standard Provisions.

3.10 THRUST BLOCKING OR JOINT THRUST RESTRAINTS

Thrust blocks and anchor blocks shall conform to Water Department Standard Drawings or as directed by the Engineer or Water Department Inspector. The Contractor shall be required to install thrust blocking in addition to the use of joint thrust restraints.

3.11 INSULATING FLANGED JOINTS

All insulating components of the insulating flanged gasket set shall be cleaned of all dirt, grease, oil and other foreign materials immediately prior to assembly. Bolt holes in mating flanges shall be properly aligned at the time bolts and insulating sleeves are inserted to prevent damage to the insulation. After flanged bolts have been tightened, each insulating washer shall be inspected for cracks or other damage. All damaged washers shall be replaced. After assembly, resistance between each bolt and flange shall be measured with an approved ohmmeter, and the minimum resistance shall be 50,000 ohms. Where the insulating joint is assembled in the shop and shipped as a unit, resistance shall be measured in the shop between the flanges and between each bolt and flange, and shall meet the above requirements. All insulating flanged joints shall be coated as shown on the Water Department Standard Drawings and specified herein.

3.12 PRESSURE TESTS

Each run of pipe between two (2) sectionalizing valves or between a valve and a cap or plug or as directed by the Engineer shall be tested for leakage. Only one (1) run of pipe shall be tested at a time, but the pressure may be applied through sections of pipe already tested. Services and fire hydrant runs may be tested individually or with the sections of water main. It is the intention of these tests to test the water tightness of the closed gate valves as well as the piping.

The Contractor shall furnish all necessary equipment and labor to perform the pressure tests.

The hydrostatic test pressure shall be two hundred (200) pounds per square inch, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge.

The test pressure shall be maintained for not less than two (2) hours. No pressure drop is permissible. The Contractor shall at his own expense take whatever steps are necessary to eliminate the leakage, after which the test shall be repeated as often as necessary until acceptable results are obtained.

3.13 DISINFECTING AND FLUSHING WATER LINES

Disinfecting of the completed work, including all pipelines, valves, and fittings, shall be performed by the Contractor, who will supply all materials, equipment, supplies and labor required for the operation. The required concentration of

chlorine throughout the main is fifty (50) parts per million. The pipe line shall be disinfected in accordance with AWWA Standards B300 and C651, and as specified as follows:

A. LIQUID CHLORINE SOLUTION METHOD

Flush all foreign matter from mains, branch runs, hydrant runs and installed services. Introduce liquid chlorine solution at appropriate locations to assure uniform distribution through the facilities at the proper concentration. The sanitizing solution shall be retained in the facilities for a period of twenty-four (24) hours, after which each service, hydrant run, branch run and dead end shall be flushed until the residual chlorine is less than one (1) part per million or is no greater than the concentration of chlorine in the water supplied for flushing.

B. HTH TABLET METHOD

Tablets are to be fastened to the inside top surface of each length of pipe using a food-grade adhesive at time of pipe laying. Tablets shall not be available at any time for casual pilferage by the general public or by children. The new facilities are to be slowly filled with water. Air is to be exhausted from each dead end, branch run, hydrant run and installed service. Retain water for a period of twenty-four (24) hours, after which each service, hydrant run, branch run and dead end shall be thoroughly flushed to clear foreign matter and until the residual chlorine concentration is less than one (1) part per million or is no greater than the concentration of chlorine in the water supplied for flushing.

It shall be unlawful to discharge any chlorinated water from the flushing operations into any storm drain or natural outlet or channel without a valid National Pollution Discharge Elimination System permit. The Contractor shall discharge the chlorinated water into a sanitary sewer manhole or other approved opening in a City sanitary sewer collection system. No person shall discharge any liquid having a pH lower than six (6) or more than twelve and one-half (12.5) into the sanitary sewer system.

3.14 BACTERIOLOGICAL TESTING

Samples shall be gathered and tests conducted by City. Samples shall be taken at representative points as required by the Engineer.

The new facilities shall remain isolated and out of service until satisfactory test results have been obtained which meet the requirement of the California Department of Public Health and the Engineer has accepted the results as indicative of the bacteriological condition of the facilities. If unsatisfactory or doubtful results are obtained from the initial sampling, the disinfection process shall be repeated until acceptable test results are reported. The follow-up sampling costs shall be borne by the Contractor.

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