

SECTION 33 10 00

WATER UTILITIES

PART 1- GENERAL

1.01 WORK INCLUDED

- A. Work may include installation of various water mains, water services, fire services, fire hydrants, tracer wire, water valves and boxes, elbows, and all related equipment, appurtenances, and fittings in accordance with the requirements of the Contract Documents.
- B. Contractor, when installing new services, shall be responsible for bringing the house line at meter connection to grade, as per applicable City Standard Drawings.

1.02 RELATED REQUIREMENTS

City Standard Detail Drawings for Water System.

1.03 REFERENCE STANDARDS

- A. American Water Works Association (AWWA)
- B. American Society for Testing and Materials (ASTM)
- C. State Specifications
- D. National Fire Protection Association (NFPA)
- E. Uniform Plumbing Code (UPC)
- F. Uniform Building Code (UBC)
- G. San Mateo County Ordinance Code, Title 4 Sanitation and Health

1.04 QUALITY ASSURANCE

- A. All materials and equipment furnished under this Section shall:
 - 1. Be of a manufacturer who has been regularly engaged in the design and manufacture of the materials and equipment for at least five (5) years meeting the standards of the American Water Works Association; and

2. Be demonstrated to the satisfaction of the Engineer that the quality is equal to the materials and equipment made by those manufacturers specifically named herein, if an alternate product manufacturer is proposed.

1.05 SUBMITTALS

A. Shop Drawings

1. Layouts and Schematics: Contractor shall submit detailed installation drawings to the Engineer of all piping and connected equipment for pump stations, valve pits, reservoirs and tanks. The drawings shall include all pipes, fittings, valves, and other appurtenances.
2. Layouts for all main connections after verification of field conditions and utility locations. USA notifications must be submitted.

B. Shutdowns and Connections

1. Contractor shall submit to the Engineer a list and schematics of all required water system connections and shutdowns for the project.
2. For all shutdowns, the Water Division shall receive 48-hour (minimum) prior notice.

C. Compliance

1. Submit data and affidavits to show that each water system component conforms to the specification requirements.
2. Submit certified test reports as required by these specifications.
3. Disinfection Schedule and Procedures including:
 - a. Disinfection schedule, including number and type of services and length of disruption of service.
 - b. Procedures to be followed, including list of equipment to be used and disinfecting agent to be used.

D. Manuals

1. The Contractor shall furnish manufacturer's installation and operation manuals, bulletins, and spare parts lists for all operating components of the water system project, including:
 - a. All valves
 - b. Air release valves

E. Materials

1. Submittals shall be approved before the installation of the materials.

1.06 POTHOLING (CHECKING ON UTILITY LOCATIONS)

- A. Potholing is to be done by hand or vacuum type equipment.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Pipe and valve sizes are nominal inside diameter unless otherwise noted.
- B. All materials delivered to the job site shall be new, free from defects, and marked to identify the material, class, and other appropriate data such as thickness for piping. All materials shall be properly and safely stored to protect from damage, vandalism and contamination.
- C. Acceptance of materials shall be subject to strength and quality testing in addition to inspection of the completed product. Acceptance of installed piping systems shall be based on inspection and leakage and bacteriological tests as specified hereinafter.
- D. Only the products listed under the specified material for hydrants, buried iron-body gate valves or butterfly valves will be accepted.

2.02 PIPELINE MATERIAL

- A. Water mains shall be **US Pipe "TYTON JOINT" Ductile-Iron Pipe**.
- B. Exterior coating for all water main ductile iron pipe, tees, bends, crosses, and other fittings shall be bituminous asphalt coating. Exterior of all buried gate valves and butterfly valves shall be fusion epoxy coated. All fittings on fire hydrant assembly (excluding tee at main) shall be epoxy coated per City Standard Drawing **W-08 "Fire Hydrant"**.
- C. Ductile iron pipe, four inch (4") and larger, shall be Pressure Class 350, meeting AWWA C 150, "Thickness Design of Ductile-Iron Pipe," and shall be furnished with mechanical joints or push-on joints. Pipe shall be cement-lined conforming to AWWA C 104, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water." All pipes shall be tested according to ANSI/AWWA specifications. The pressure class, net weight of pipe without lining, length of pipe, and name of manufacturer shall be clearly marked on each length of pipe, and shall conform to AWWA C 151, "Ductile-Iron Pipe, Centrifugally Cast for Water and Other

Liquids," and AWWA C 104, "Cement- Mortar Lining for Ductile-Iron Pipe and Fittings for Water".

1. Joints: Pipe shall be mechanical joint or restrained push-on joint. Restrained Push-on joint gaskets shall be **US Pipe "FIELD-LOK 350" Gasket**.
 2. Fittings: Fittings shall be mechanical or flanged joints, Class 125, conforming to AWWA C 110, "Ductile-Iron and Gray-Iron three inch (3") through forty-eight inch (48") for Water and Other Liquids," or AWWA C 153 "Ductile-Iron Compact Fittings, three inch (3") through twenty-four inch (24") for water and other liquids," and AWWA C 104, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water." All fittings shall be marked in accordance with Section 10-11 of AWWA C 110.
 - a. Flanged bolts and hex nuts shall be of a minimum 304 stainless steel, and conform to AWWA C 115.
 - b. Mechanical joint T-bolts and hex nuts shall conform to AWWA C111, except material shall be 304 stainless steel.
 - c. Mechanical joints fittings shall be **Series 1100 MEGALUG** restrain as produced by EBAA Iron, Inc. or approved equal that has a pressure rating suitable for the thickness of pipe specified by the manufacturer.
 - d. In addition, to provision of mechanical joint restraints, all fittings and bends shall be restrained by poured in-place concrete thrust blocks.
 3. Polyethylene Encasements are required. Pipe, fittings, and valve encasements shall be polyethylene film conforming to AWWA C 105 "Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids".
- D. Maximum joint deflection in constructed pipeline shall not exceed 50% of the manufacturer's recommended maximum deflections.
- E. Warning Tape and Tracer Wire: Installation shall be in accordance with City Standard Drawing **ST-06B "Trench Construction for Water Mains"**.
1. Warning Tape shall be 3-inch wide "**Blue**" color for with an overall minimum thickness of 6 mil and a solid aluminum foil core with minimum thickness of 3 mil. The solid foil core shall be encased between two clear layers of 100% virgin polypropylene or polyethylene film. Warning Tape shall be permanently printed on both sides with a repeating warning "**Caution: Water Pipe Below**" at maximum interval of 2 feet. Warning Tape shall be placed 1 foot above the top of pipe.
 2. Tracer wire shall be 8 AWG **Solid** Copper conductor with a 45 mil thick, high-density, high molecular weight polyethylene (HDPE) insulation and rated for 600 volts. Insulation shall be RoHS compliant and utilize virgin

grade material. Jacket shall be “**Blue**” color for water utilities application. Tracer wire should be placed in the same orientation to all installed pipe, and taped to the pipe using a spacer every 8-10 feet on top of the pipe.

2.03 FIRE HYDRANTS

- A. Hydrant shall be manufactured in accordance with AWWA Standard C-503. Hydrant head shall be made of gray cast iron, meeting ASTM A126 Class B specifications. It shall be capable of withstanding a hydrostatic test pressure of 4 (four) times the working water pressure without stressing the material beyond its yield point per Section 4.6.3.2 of AWWA C-503. The working parts shall be engineered to function as a unit and to give trouble-free service over 200 pounds working pressure and tested to 400 pounds hydrostatic pressure.
- B. Hydrants shall be wet-barrel with independently valved ports, with one four and one-half inch (4-1/2”) outlet and two (2) two and one-half inch (2-1/2”) outlets. Hydrants shall have the proper color-coded caps to conform to NFPA Standard 291. **Nylon Hydrant Caps shall have Permanent Color Coding** - permanent color pigments are added to the plastic resin for through color. A choice of color code is determined by hydrant flow. Hydrant caps are to be enhanced with the addition of adhesive reflective trim of same cap color for improved nighttime visibility Caps shall be securely chained to the hydrant barrel and furnished with an inner gasket.
- C. All hydrants shall be permanently marked to identify the model number of the hydrant, the manufacturer and the year in which the hydrant was manufactured.
- D. Hose and pumper nozzle threads shall be in conformance with the standard for fire hose connections, NFPA 1963, unless otherwise specified.
- E. Standard nut size of valve/stem and protector caps shall be of pentagonal shape and furnished with a nut of one and one-eighth inch (1 1/8”) measured from point to flat of the pentagon.
- F. Hydrant installation shall include “Break-off” spool and “Break-off” bolts.
- G. Exterior of hydrants shall receive a primer coat and furnished with a high gloss “**Safety Yellow**” industrial enamel finish coat.
- H. Acceptable Model
 - 1. Residential and Commercial Applications
 - Clow Model No. 960**, Two (2) two and one-half inch (2-1/2”) outlets and One (1) four and one-half inch (4-1/2”) outlet.

2.04 VALVES

A. General

1. All valves, shall be non-rising stem (NRS), opening left (counter-clockwise), and the stem shall be fitted with a two inch (2") square operating wrench nut made of **BRONZE** material with 304 stainless steel cap screw. The operating nut shall be within eighteen inches (18") to twenty-four inches (24") below the final grade utilizing stem extensions, as required.
2. Valves in pump stations and other special facilities shall be an Operating Stem and Yoke (OSY) equipped with hand wheels.
3. Each valve shall have the maker's initials, pressure rating, and year of manufacture cast on the body. Furnish affidavit of compliance.
4. Bolts, nuts and T-bolts for connecting valves to pipe shall be the same as for pipe and fittings and shall be 304 stainless steel.
5. In addition to thrust blocks, all mechanical joint fittings shall be restrained with an approved joint restraint device, "**MEGALUG**" by EBAA or approved "equal" that has a pressure rating suitable for the thickness of pipe specified.

B. Buried Iron-Body Gate Valves (Sizes from four inch (4") to eight inch (8")):

1. Gate valves shall be conforming to all applicable requirements of AWWA C 509 "Resilient Seated Gate Valves for Water Supply Service".
2. Gate valves shall have iron body with fusion epoxy coated interior and exterior surfaces of a nominal thickness of ten mils (0.010") meeting the applicable requirements of AWWA C 550 "Protective Epoxy Interior Coatings for Valves and Hydrants."
3. Gate valves shall have a maximum working pressure of 250 psig.
4. The City will accept only the **Mueller "Resilient Wedge" Model A-2361** gate valve for water utilities application. Gate valves shall have the following connections:
 - a. Sizes less than four inch (4"):
 - Flange x Flange
 - Threaded x Threaded.
 - b. Sizes four inch (4") inch to eight inch (8"):
 - Flange x Flange.
 - Flange x Mechanical Joint.
 - Mechanical Joint x Mechanical Joint.
 - c. Tapping valves sizes four inch (4") to eight inch (8"):
 - Flange x Mechanical Joint

C. Butterfly Valves, sizes greater than eight inch (8”):

1. Butterfly valves shall conform to AWWA C 504, "Rubber-Seated Butterfly Valves," Class 150B (maximum flow of sixteen feet (16') per second – one hundred fifty (150) psig upstream/150 psig downstream) rated for a minimum working pressure of one hundred fifty (150) psig. Valve shall be short-body type of cast iron with an epoxy coating on the interior waterway, and exterior, including the disc, of at least ten mils (0.010"). Disc shall be of cast iron, disc edge to be 316 stainless steel, and it shall have a rubber seat provided on the valve body. Valve shaft shall be Type 304 stainless steel. Actuator must be rated for minimum foot-pound torque rating in AWWA C 504 - Table 4. Butterfly valves in pump stations and other special facilities shall be equipped with a position indicator and hand wheel.
2. Butterfly valves shall be the following:
 - Mueller B-3211 - 16 Flanged
 - Mueller B-3211 - 19 Flange x M.J.
 - Mueller B-3211 - 23 M.J. x M.J.

D. Meter Bypass Valves shall be **Mueller “Resilient Wedge” Model A-2361** gate valve for water utilities application. Gate valves shall have the following connections:

1. Sizes less than four inch (4”):
 - Flange x Flange
 - Threaded x Threaded.
2. Sizes four inch (4”) inch to eight inch (8”):
 - Flange x Flange.
 - Flange x Mechanical Joint.
 - Mechanical Joint x Mechanical Joint.

E. Backflow Prevention Devices

1. Backflow devices shall be Febco "Reduced Pressure Principle Type" or equivalent and approved by the Engineer before installation. All backflows to be owned by the City of San Bruno shall be caged. If chain link is to be used, number nine (#9) green epoxy coated mesh fabric shall be used. All posts and hardware shall be hot dipped galvanized finish.

F. Check Valves

Check valve selection shall be approved by City’s Water Division.

G. Pressure Reducing/Regulating/Relief Valves (PRV) Valves

PRV valves shall be approved through the submittal process and will be addressed on a case-by-case basis.

H. Air/Vacuum Relief Valves

Air/Vacuum Relief Valves shall be approved through the submittal process and will be addressed on a case-by-case basis.

2.05 VALVE BOXES

- A. Each valve shall be equipped with a valve box, complete with cover. Boxes shall be extension type with a slide type adjustment. The word "**WATER**" shall be cast on the cover. The boxes shall be adapted without full extension to the depth of cover required over the pipe at the valve location. Christy #G-5 traffic valve box shall be used in streets and sidewalks ". Valve boxes and valve box lids shall be of matching brand, type and model.
- B. Sleeves or tubes for all valve and valve box identifications shall be six inch (6") PVC, Schedule 40, one piece, and shall rise to six inches (6") below street, sidewalk or finish grade.

2.06 RAISING RINGS FOR TRAFFIC VALVE BOXES

- A. Adjusting rings shall not be used. Valve boxes must be raised to grade. Risers are to be replaced if and when necessary to comply with Paragraph 2.05 above.

2.07 CONCRETE FOR THRUST BLOCKS

- A. Concrete for thrust blocks shall not be hand mixed.

2.08 WATER SERVICE TWO INCH (2") OR LESS

- A. Connections to existing mains shall be by the hot-tap method.
- B. Water service assembly shall include pipe, fittings, corporation stops, service saddle, curb stops, and meter boxes conforming to City Standard Drawings. Two inch (2") copper pipe shall be **Type K**, conforming to the requirements of ASTM B 88, "Specification for Seamless Copper Water Tube." Copper tubing shall be continuous with no joints.
- C. Commercial water services two inches (2") and greater shall incorporate Mueller A-2361 resilient wedge type gate valve (corporation stop) at the connection to the main.
- D. Customer's pipe shall be adjusted, relocated and/or realigned at least six inches (6") beyond the new meter box (customer's side) in order to set the water meter at the proper depth with only the following materials:

1. Brass pipe and nipples (ASTM B 43) bronze fittings (low lead).
 2. Copper tubing and fittings (ASTM B 88).
- E. Compression fittings for copper pipe and tubing shall have complete full-circle type compression nuts and one-piece companion ring-seal. Setscrew and/or adjusting screw type of compression fitting nuts are not acceptable. Compression fittings shall be Mueller #110 series,
- F. Commercial and multi-story buildings shall incorporate a Reduced Pressure Principle backflow device in the water service design. Additional requirements may be necessary upon review by the Engineer. The backflow device shall be installed immediately after the water meter.

2.09 WATER SERVICE THREE INCHES (3") AND LARGER

- A. Connections to existing mains shall be by the hot-tap method using tapping sleeves. Service piping shall be ductile iron; copper pipe may be used with prior approval of the Engineer. New service pipe and existing mainline pipe shall not be of similar size. A tee must be cut into the line and the work performed during a scheduled shut down. In some cases, additional valves may be required, and installation will be at the cost of the applicant.
- B. Commercial buildings shall incorporate a Reduced Pressure Principle backflow device in the water service design. The backflow device shall be installed immediately after the water meter.

2.10 FIRE SERVICE AND BACKFLOW DEVICE

- A. Fire service shall include fittings, service tap, gate valve(s), and valve box with extension, backflow device and protective cage, if required. Detector meter connection shall be plumbed for three-quarter inch (3/4") size and adapted for a meter purchased through the City. Backflow device shall be epoxy coated in accordance with AWWA C550, "Protective Epoxy Interior Coatings for Valves and Hydrants". Meter trim shall be in copper or brass/bronze and meter set to dimensions for residential services.
- B. Approved backflow devices for City-owned projects only:
1. Febco 825 - 876v
- C. Commercial and multi-story (multi-family residential) buildings shall incorporate a Reduced Pressure Principle Detector Assembly type backflow device in the fire service design. The backflow device shall be installed immediately after the water meter.
- D. Fire systems are to be designed based on a public water main supply pressure not greater than sixty-five (65) psi, regardless of static pressures found to be

greater. In cases where a fire flow is performed and the static pressures are found to be lower than sixty-five (65) psi, the lower pressure shall be used in the design of the fire system.

2.11 COMBINATION AIR RELEASE/VACUUM VALVES

- A. Combination air release/vacuum valves with one inch (1") iron pipe thread inlet.
 - 1. Materials: Cast-iron body, epoxy coated, Buna-N set, and stainless steel float.
 - 2. Operating Pressure: Under one-hundred-fifty (150) psig, or as specified on the plans.
 - 3. ValMatic #201C

2.12 BOLTED (SLEEVE-TYPE) COUPLINGS

- A. Couplings shall conform to AWWA C 219, "Bolted, Sleeve-Type Couplings for Plain-end Pipe," and to AWWA C 111, "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings".
- B. Couplings shall be made of ductile iron conforming to ASTM A536. Gasket shall be of virgin compounded rubber. Couplings shall have low-alloy steel bolts with hexagonal nuts supplied by manufacturer.
- C. Couplings shall be Tyler/Union Ductile Iron C153 Full Body Mechanical Joint Solid Sleeve or equal and shall incorporate an approved restraint.

2.13 TAPPING SLEEVE

- A. Tapping sleeve shall have a stainless steel body with a flat-faced flanged outlet recessed for a standard tapping valve, conforming to AWWA C 207, "Steel Pipe Flanges for Waterworks Service" - sizes four inch (4") through one hundred forty-four inch (144"), Class D (150-175 psig). Drilling boltholes shall straddle the pipe centerline. For tap sizes, fourteen inch (14") and above, flange shall accommodate the valve requirements.
- B. Sleeve shall have a 3/4" N.P.T. test plug, and a roll-resistant gasket resistant to oil, water and most hydrocarbon fluids.
- C. Sleeve shall be with Type 304 stainless steel bolts and nuts.
- D. Sleeves shall be Smith-Blair #663.

2.14 FULL CIRCLE REPAIR CLAMPS

A. Repair clamps for repair and/or abandonment shall be full-circle type and have the following stainless-steel components: band, lugs, bridge-late, and manufacturers' standard high-strength, low-alloy steel nuts and bolts. The inner gasket shall be compounded rubber of all new materials and gridded for greater bonding to the main.

B. Clamps shall be:

<u>Manufacturer Model</u>	<u>Minimum Length Size</u>
Smith-Blair #226	7-1/2" up to 2-1/2"
Smith-Blair #227	7-1/2" 3" to 12"
Smith-Blair #228	10" to 16"

2.15 VALVE STEM EXTENSIONS

Stem extensions shall be steel. Minimum effective length of the three-piece extension shall be eight inches (8").

2.16 APPURTENANCES

Provide all necessary assembly bolts, washers and nuts, thrust blocks, supports, gaskets, flanges, and all other appurtenant items shown on the drawings, specified or required for the proper installation and operation of the piping, and devices included in or on the piping, equipment, and piping accessories.

2.17 SADDLES

A. Service saddles shall be cast bronze ASTM B 584, 85-5-5-5 with Buna-N gasket. The straps shall be flattened silicon bronze and the nuts shall be silicon bronze. Saddles shall conform to applicable parts of AWWA C 800, "Underground Service Line Valves and Fittings," and for a working pressure of 200 psig.

B. Saddles shall be double-strapped (continuous U-bolt style) with FIPT (female iron pipe thread) outlet:

Smith-Blair #323 (3" to 16")
Ford #202B (4" to 16")
Mueller BR2B Series (4" to 12")

2.18 FLANGED COUPLING ADAPTOR

A. Underground installations: Adaptor shall be ductile iron with flange and mechanical joint ends.

- B. Above ground installations: Body and follower shall be of ASTM A 536 ductile iron with standard compounded rubber gasket, grade 30, and O-ring, grade 60. Adaptor shall have manufacturers' standard steel bolts and nuts:
 - Smith-Blair #912 (3" to 12")
 - Smith-Blair #913 (14" to 16")
 - Smith-Blair #916 (3" to 16") asbestos cement pipe
 - EBAA Mega-Flange

2.19 ITEMS FURNISHED BY THE CITY

The following items will be furnished to the Contractor upon payment of the applicable fees to the City:

- A. Water meters - all sizes
- B. Detector check water meters – three-quarter inch ($\frac{3}{4}$ ”).

2.20 METER BOXES AND VAULTS

- A. Fiberlite/composite boxes shall not be used.
- B. Meter boxes for water meters and specialty valves shall be approved in advance by the Engineer and shall be furnished by the Contractor.
- C. Vaults for large meters or specialty valves furnished by the Contractor shall be approved in advance by the Engineer.

2.21 BACKFLOW PREVENTION DEVICES

The installation, testing, and maintenance of all Cross Connection Control and Backflow Prevention Devices shall be in compliance with San Mateo County Ordinance Code, Title 4 Sanitation Health, Chapter 4.72 Backflow Prevention.

2.22 SPECIALTY ITEMS

Specialty items such as, but not limited to, blow-offs, pressure reducing valves, pressure relief valves, altitude valves, and automatically operated valves shall be approved in advance through the submittal process by the Engineer.

PART 3 – EXECUTION

3.01 TRENCH EXCAVATION AND BACKFILL

Trench excavation and backfill shall be in accordance with City Technical Specifications **Section 31 23 33 "Trench Excavation and Backfill"** and City

Standard Drawing **ST-06B "Trench Construction for Water Mains"**, or as noted on the contract documents and plans.

3.02 SEPARATION OF WATER MAINS AND SEWER MAINS

Criteria for separation of water mains and sewer mains, and other non-potable pipelines shall be in accordance with **City Technical Specifications Section 33 10 50 "Criteria for Separation of Water Mains and Non-Potable Pipelines"**.

3.03 PIPE LAYING

- A. Pipe delivery, handling and laying shall be in accordance with AWWA C 600, "Installation of Ductile-Iron Water Mains and Their Appurtenances."
- B. The interior of the pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or by other approved methods. The full length of each section of pipe shall rest solidly upon the pipe bed with recesses excavated to accommodate the joints. Any pipe that has the grade or joint disturbed after laying shall be taken up and replaced. Before installation, the pipe shall be inspected for defects. Any defective pipe shall be set aside and marked.
- C. Except where necessary in making connections with other lines, or as authorized by the Engineer, pipe shall be laid with the bells facing the direction of laying.
- D. Poured-in-place concrete thrust block shall be provided at all fittings wherein a change of direction occurs, where a pipe dead ends, and at other places shown on the plans. The thrust blocks shall be poured between the fittings and firm undisturbed soil in the trench wall and shall be as shown on the applicable City Standard Drawings or as approved by the Engineer. Concrete shall be placed in a manner which will not prevent bolts and nuts from being removed or replaced.
- E. Polyethylene encasement shall be in accordance with Method A of AWWA C 105, "Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids".
- F. New and existing fire hydrants not in service shall be wrapped or sacked with burlap to indicate their non-availability for service. Upon being placed in service, hydrants are to be flushed per NFPA 24.

3.04 WATER MAIN TAPPING

- A. A certified Distribution System Operator must be present for all hydrostatic testing, chlorination, flushing, bacteria testing and connections to the existing system per California Department of Health Services, Operator Certification Regulations, Section 63770. The Engineer must receive the request for the

certified Operators to be present for these operations in writing no less than six (6) working days prior to the anticipated date of work.

- B. A water main shall be tapped using a full diameter pressure tap connector and only by persons having experience and skill in that type of work, and approved by the Engineer. Tapping shall be done only in the presence of City's Water Division Staff.
- C. The tapping tool to be used shall be one specifically designed for hot tapping potable water mains. Acceptable brands of tapping machines are Mueller, Romac and Reed. Improvised tapping machines shall not be allowed for use to tap potable water mains.
- D. The minimum distance between the tap and the pipe bell coupling shall be eighteen inches (18"); and between services shall be twenty-four inches (24").
- E. The minimum distance between a tap and adjacent taps shall be twenty-four inches (24").
- F. Service taps on ductile-iron mains encased in polyethylene may be accomplished by making an X-shaped cut in the polyethylene and temporarily folding back the film or by tapping directly through the polyethylene. After the tap has been completed, cuts in the polyethylene and any other areas of damage to the film shall be repaired with tape as described in AWWA C 105, "Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids." Service lines of dissimilar metals also shall be wrapped with polyethylene or a suitable dielectric tape for a minimum clear distance of three feet (3') away from the ductile-iron main.
- G. All tools and materials used to perform the tapping operation shall be disinfected by a twelve and one-half percent (12.5%) solution of sodium hypochlorite approved for use in potable water supply systems.

3.05 WATER SERVICE

- A. There shall be a minimum one service per lot, and each unit on the lot shall have a separate water meter. The service shall be sized to accommodate domestic and fire flows. No service shall be located in a driveway.
- B. Location of all water service laterals shall be permanently marked by imprinting or chiseling the letter "W" four inches (4") in height on top of the curb above the lateral.
- C. Water meters shall be located in landscaped areas.

3.06 SERVICE REPLACEMENT

Contractor shall install new water services parallel to the existing ones that are to be replaced. Following the inspection, testing of the pipe, flushing, disinfection etc., as described in the specifications, the Contractor shall connect the new mains to the existing ones shown on the plans. After that, the old services may be disconnected and the new copper service laterals shall be connected to the meters and the meter boxes.

The service on the property side of the meter may need to be adjusted, if necessary, with the use of approved materials. New meters will be provided by the City, and meter boxes will be provided by the Contractor. After all services in a street have been transferred to the new system, the old pipe shall be disconnected by closing the respective valves. The old pipe shall then be cut and abandoned. The Contractor shall set the new boxes in the location of the existing boxes and connect the new meter in place of the old meter. As part of this work, the Contractor shall be responsible for the proper setting and installation of both Contractor furnished meter and meter box; and the Contractor shall install the connection from the "touch read" meter to the box cover.

3.07 COMBINATION AIR RELEASE VALVES

Installation shall conform to **Standard Detail Drawing W-10 "Air Relief Valve"**.

3.08 HYDROSTATIC TESTING

A. General

1. A certified Distribution System Operator must be present for all hydrostatic testing, chlorination, flushing, bacteria testing and connections to the existing system per California Department of Health Services, Operator Certification Regulations, Section 63770. The Engineer must receive the request for the certified Operators to be present for these operations in writing no less than six (6) working days prior to the anticipated date of work.
2. The Contractor shall give a minimum of six (6) working days written notice to both the Engineer and the City Water Division to schedule filling and testing of the pipeline.
3. Testing shall be in accordance with AWWA C600. Selected requirements of AWWA C600 are repeated below:
 - a. Test pressure shall not exceed pipe or thrust-restraint design pressures.
 - b. The hydrostatic test shall be of at least a 2-hour duration.

- c. Test pressure shall not vary by more than +/- 5 psi for the duration of the test.
- d. No piping shall be accepted if the leakage is greater than that determined by the following formula:
 - $L = (S \times D \times P^{1/2}) / 133,200$
 - L = Allowable leakage, gallons per hour.
 - S = Length of pipe tested, feet.
 - D = Nominal diameter of pipe, inches.
 - P = Average test pressure during the leakage test, psig.
4. Valves shall not be operated in either direction at a differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double-disc gate valve.
5. The test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient-seated gate valves or butterfly valves.

B. Before Testing

1. The interior of the pipeline shall be thoroughly cleaned, and the trench backfill, except permanent pavement, shall be completed.
2. The concrete thrust or reaction blocks shall be cured for at least seven (7) calendar days.

C. Test Equipment Set-Up

1. Contractor shall furnish hoses, pumps, pressure gauges, leakage-measuring device, connections, relief valves, other necessary apparatus, and personnel required for making the tests.
2. The pressure gauge shall register pressure in pounds per square inch gauge (psig). The range of the gauge shall be from zero to three hundred pounds per square inch gauge (0-300 psig). The gauge face shall have a five (5) psig increment inscribed. The gauge shall have been calibrated within forty-five (45) calendar days of the hydrostatic test and the calibration tag shall be affixed to the gauge.
3. The gauge assembly shall be equipped with three-quarter inch (3/4") IPT nipple and isolation valve to allow the Engineer to install a second gauge.
4. The City may test pressure gauges for accuracy.

D. Pressurization.

1. After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to a hydrostatic pressure of at least 1.5 times the working pressure with a minimum of 200 psig at the point of testing.
2. Test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section.
3. Each valve section of pipe shall be slowly filled with water.
4. Before applying the specified test pressure, air shall be expelled completely from the section of pipe under test. If permanent air vents are not located at all high points, corporation cocks shall be installed at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied.
5. Allow water to stand in the pipe for 24 hours before test pressure is applied.
6. During this period, valves and exposed connections shall be examined for leaks, and all visible leakage shall be repaired.

E. Hydrostatic Pressure and Leakage Test

1. The specified test pressure (based on the elevation of the lowest point of the line or section under test and corrected to the elevation of the test gauge) shall be applied by means of a pump connected to the pipe.
2. Maintain the test pressure, +/- 5 psi, for a minimum of two (2) hours.
3. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test.
4. Measured leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within +/- 5 psi of the specified test pressure during the test duration. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
5. For successful completion of the test, the measured leakage shall not exceed one-quarter (1/4) gallon per inch of diameter per one thousand feet (1,000') within a period of two (2) hours.
6. An inspection for leaks along the pipeline shall be made by the Contractor while pipe is under pressure. Any leaks found shall be recorded by the Contractor and the record provided to the City.

F. Repairs and Retests

1. Repair all known leaks and retest the pipe until the hydrostatic pressure and leakage test is successfully completed.
2. Any damage to the protective lining and coating of the pipe and to the jointing material after the testing shall be repaired.
3. Repairs shall be made subject to the approval of the Engineer.
4. Excavate where required to locate and repair leaks or other defects that develop under the test.
 - a. Remove backfill and paving already placed.
 - b. After repairs, backfill and pave in same manner as initial work.

3.09 FLUSHING AND CHLORINATING

- A. A certified Distribution System Operator must be present for all hydrostatic testing, chlorination, flushing, bacteria testing and connections to the existing system per California Department of Health Services, Operator Certification Regulations, Section 63770. The Engineer must receive the request for the for these operations in writing no less than six (6) working days prior to the anticipated date of work.
- A. Flushing and chlorinating shall be conducted only after the successful completion of the hydrostatic pressure and leakage test. Flushing from the City's water system shall only be performed by using an approved Reduced Pressure (RP) type backflow device with current certification. Water shall be discharged to a sanitary sewer or an approved de-chlorination process.
- B. Contractor shall:
 1. Provide a minimum of six (6) working days written notice to both the Engineer and the City Water Division to schedule flushing and chlorinating operations. Schedule shall allow delivery of samples to the approved laboratory before 2:00 p.m., Monday through Friday, the same day samples are taken. All procedures shall conform to applicable requirements of NFPA 24.
 2. Make necessary piping connections.
 - a. Install chlorinating taps at locations designated by the Engineer.
 - b. Install temporary blow-offs at locations designated by the Engineer.

- c. Temporary blow-offs shall permit adequate flushing of the main. The minimum size of blow-offs and minimum number of outlets shall be:

Main Diameter (inches)	Blow-Off Diameter (inches)	Outlets Required
2"	2"	1
4"	2"	1
6"	2"	1
8"	4"	2
12'	4"	3
16"	6"	4
20"	6"	8

Use two and one-half inch (2-1/2") fire hose and dissipater on each outlet. Chlorine must be removed before water enters storm system.

- d. All sample taps shall be copper to FIP smooth bore.
- e. Remove temporary flushing assemblies when test results are satisfactory to the Engineer.
3. Flush and chlorinate the pipeline in accordance with AWWA C 651, "Disinfecting Water Mains." Only personnel certified to perform that operation shall perform chlorination.
- a. Use Sodium Hypochlorite per Section 2.2 of AWWA C 651. Available chlorine shall be twelve and one-half percent (12-1/2%) to thirteen percent (13%) by volume. Chlorine tablets shall not be used. Chlorine shall be of the type approved for the purpose of disinfection of potable water supply systems. Chlorine for use in swimming pools shall not be allowed.
- b. Use Continuous Feed Method of Section 5.2 of AWWA C 651, except the maximum allowable volume of water available for the preliminary flushing shall not exceed twice the volume of pipe to be flushed. Chlorine shall be fed through an approved flow regulated chlorine injection machine. The contractor shall, at the request of the City's Project Inspector, provide calculations showing the amount of chlorine introduced.
- c. Document flushing and chlorination in a manner acceptable to the Engineer. Chlorine must be removed before water enters the storm system.

4. Connect to water source, convey to piping, and dispose of water during flushing without flooding, inundating or damaging any property, or harming the environment with the chlorinated water. Discharge shall be made by a hose into a sanitary sewer.
 - a. Provide personnel at the job site at all times during flushing, chlorinating, and sampling.
 - b. Operate valves, under City direction, and provide other necessary assistance to the City.
- C. Upon completion of disinfection, the flushed section of main shall remain isolated from the existing water system and allowed to sit undisturbed for a minimum of twenty-four (24) hours prior to sampling for bacteriological contamination.
- D. Water samples shall be taken by a State-certified laboratory for bacterial examination. Such samples shall be taken, examined, and reported on by a recognized laboratory accustomed to this work. Examination shall be conducted according to the latest edition of "Standard Methods for the Examination of Water and Wastewater", American Public Health Association. Test results shall conform to the latest edition of U.S. Public Health Service Drinking Water Standards, and so attested by the examining laboratory prior to acceptance of the water line. Costs for the above tests shall be included in the contract bid prices.
- E. The above tests shall apply to each unit or branch of the water main and all of its services up to the curb stops.
- F. The bacteriologically treated unit or batch may be put into service only after written City approval of test results.
- G. Neutralized disinfection water shall be disposed in the City's sanitary sewer system, provided forty-eight (48) hours prior written notice has been given to the Engineer. As required, the Contractor shall provide pumping facilities for this disposal.

3.10 CONSTRUCTION PROCEDURE, CONNECTIONS AND WATER SYSTEM SHUTDOWNS

- A. A certified Distribution System Operator must be present for all hydrostatic testing, chlorination, flushing, bacteria testing and connections to the existing system per California Department of Health Services, Operator Certification Regulations, Section 63770. The Engineer must receive the request for the for these operations in writing no less than six (6) working days prior to the anticipated date of work.

- B. Construction involves expansion and/or modification of the existing water system with the minimum possible service interruption during construction.
- C. Connections and utility changes must be programmed to provide the least possible interruption of service. Prior to any shutdown, all labor, materials, fittings, supports, equipment and tools needed for the scheduled work as well as emergency work shall be on the site.
- D. The Contractor shall not cause any contamination of the existing water system.
- E. Following testing and disinfection, the pipeline shall be connected to existing mains as indicated on the drawing. Each connection shall be made at a time and in a manner that will result in the least interruption of service.
- F. The Contractor shall not operate any valve controlling the flow of water in the City's existing system.
- G. All connections involving shutdown of City's existing facilities shall be done in the presence of the Engineer and the Certified Distribution System Operator. The Contractor shall complete the connection work without interruption.
- H. Planned Shutdowns
 - 1. Shutdowns are subject to the following scheduling constraints:
 - a. Shutdowns shall not be performed on a Monday, Friday nor on the first workday following a City holiday. (It is preferred that shutdowns also not be performed on the day preceding a City holiday, if possible.)
 - b. Under special circumstances, and only upon approval by the City, shutdowns may be scheduled on a weekend or during non-working hours.
 - c. No more than two shutdowns will be performed in any two consecutive workdays.
 - d. All shutdowns shall be scheduled to be performed between the hours of 9:00 a.m. and 3:00 p.m., inclusive, unless prior approval for deviation from these hours has been granted by the Engineer. Shutdowns are scheduled for four (4) hour durations. Additional time may be granted on a case by case basis.
 - e. Prior to the start of any construction, Contractor shall submit a schedule of all planned shutdowns required for completion of project and shall indicate anticipated date, work to be performed, and estimated duration of work. In any case, the Water Division

will receive a minimum of 48 hours prior notice before a shut down.

2. The Engineer must receive the water shutdown request in writing from the Contractor at least six (6) working days prior to the anticipated date of the water shutdown.
3. The City will review the request to ensure that the Contractor will have all materials available, and that the request complies with all provisions of the City's procedures, including the submission of required information and scheduling requirements.
4. Upon completion of the City's review of the shutdown request, the Contractor will prepare the required number of door hanger notices supplied by the City and distribute the notices. Completed door hangers must be posted forty-eight (48) hours prior to scheduled shutdown in order to proceed.
5. All excavations required to make the connection must be completed and approved at least twelve (12) hours prior to the scheduled shutdown. The City will not perform the actual shutdown until the Contractor is on-site and ready to work. If the Contractor is not on-site and ready to proceed within sixty (60) minutes of the scheduled start, the shutdown will be canceled. The Contractor will be billed for the City's work on a time and materials basis.
6. If the shutdown is canceled or cannot be performed, the Contractor will notify the Engineer at least twenty-four (24) hours in advance of the requested shutdown date. If the new date of shutdown is known and the area remains the same, notice of the new date can be given at this time followed by written confirmation by Contractor. Re-notification to the public must be performed by the Contractor per Paragraph 4 above.
7. Upon completion and approval of the work, the Contractor shall notify the Engineer to reactivate the water system.

3.11 VALVE BOXES

- A. Valve boxes in the street shall be set in a poured concrete collar, at least nine inches (9") wide by six inches (6") deep. The top of the concrete shall be covered by one and one-half inches (1-1/2") of asphalt concrete.
- B. Extension tubes are to be centered over the operating nut and brought to 6 inches (6") of final grade.
- C. Set boxes to grade within five (5) working days after paving of streets. Boxes are to be set flush with the road surface.

- D. Valve stem extensions shall be assembled and installed as per manufacturer's recommendation.
- E. All new and adjusted valve box covers for isolation of fire hydrants shall be primer-painted and coated with Dunn-Edwards "Safety Red #221" or matching permanent red paint.
- F. The City's Water Division shall be notified no less than ten (10) working days prior to the start of resurfacing roadways, parking lots or private streets. The Contractor shall supply new valve boxes and covers. The Contractor shall install the new box and cover per these specifications. This section shall apply to all types of asphalt overlay as well as grind and pave work.

3.12 ABANDONMENT OF EXISTING FACILITIES

- A. Valve Boxes
 - 1. Planted areas: Remove box and cover. Fill any hole or depression with similar type of dirt at the specific location.
 - 2. Sidewalk areas: Remove box. Remove full flag of affected sidewalk. Pour concrete and finish to match that of the existing sidewalk.
 - 3. Street areas (AC): Remove box. Neatly sawcut appropriate area that shall be determined by the Engineer in the field. Restore subgrade, base and pavement according to City specifications.
- B. Two-Inch (2") and Three-Inch (3") Steel Pipes as Local Feeders/Services
 - 1. Remove old fittings, pipe, and saddle at main pipe or fitting.
 - 2. Install specified full circle clamp coupling over former tap on pipe, or install new plugs in tapped tee or cross.
 - 3. Restore street and/or sidewalk to its former condition or better.
- C. Four-Inch (4") and Larger Connections
 - 1. Remove tee from existing main and replace it with same diameter ductile-iron pipe, two feet (2') longer than existing tee. Use specified restrained sleeve type couplings.
 - 2. Removal may include an adjacent in-line valve, which the Contractor shall replace with a valve.
 - 3. Restore street and/or sidewalk to its former condition or better.

D. Fire Hydrants

1. Remove hydrant and bury. Plug remaining pipe with concrete.
2. Remove tee from existing main and replace it with same diameter ductile iron pipe, two feet (2') longer than existing tee. Use specified restrained sleeve type couplings, or approved equal.

3.13 REPAIR/RESTORATION OF PROPERTY

- A. Any repair or restoration work resulting from Contractor's activity shall be completed within twenty-four (24) hours. Contractor may use the sod saved from the existing lawn or use new sod/seed to match existing lawn. Any concrete or other repair shall match existing. Contractor shall maintain the new planting for a minimum thirty (30) day period.
- B. All new or relocated fire hydrants shall be provided with one new finish coat of paint and a blue reflective indicator securely fastened by two-part epoxy in the center line of the street and aligned with the hydrant for ease of Fire Department locating prior to the Contractor making a request for "punch list" preparation by the City.

3.14 PIPE ABANDONMENT

Where an existing line is to be abandoned, pipe shall be cut and pipe ends shall be plugged with concrete. If portions of the line to be abandoned are depressurized only by the closure of a valve or valves, then the line shall be capped with appropriate sized restrained Mechanical Joint caps and a thrust block shall be poured.

3.15 AS-BUILT DRAWINGS

As-built drawings for all City projects shall be updated daily and shall be made available to the Engineer upon request. Location of all valves and other water system appurtenances, as specified by the Engineer, shall be verified by a licensed surveyor and shall be incorporated into the as-builds at the expense of the Contractor. At the completion of the project, the as-built drawings shall be submitted to the Engineer together with an electronic copy of the as-builds in a form acceptable to the City of San Bruno Public Services Department, Engineering Division.

PART 4 - MEASUREMENT AND PAYMENT

4.01 WORK INCLUDED

- A. This work shall include furnishing of all labor, materials, equipment, and incidentals required to construct and complete all the work, including all appurtenances necessary for the water system improvements. The work shall be ready for connection to the City's potable water system network as designated on the plans and these specifications in compliance with all applicable codes and regulations.

4.02 PIPE

- A. The quantity of pipe to be paid for will be the length placed (including fittings) and accepted by the Engineer, measured to the nearest foot, except that no payment will be allowed for pipe placed in excess of the length specified or shown on the plans.
- B. The price per linear foot of pipe shall constitute full compensation for furnishing all labor, materials, tools, and equipment, and doing all work involved in furnishing and installing the pipe, complete in place, as specified and shown on the plans, and include the following:
 - 1. Probing and locating other utilities.
 - 2. Excavation
 - 3. Mechanical restraint systems and thrust blocks.
 - 4. Connecting rods.
 - 5. Elbows, tees, crosses.
 - 6. Valve boxes for identification of horizontal bends.
 - 7. Backfill, base aggregate, pavement restoration, sidewalk restoration.
 - 8. Sheeting and shoring, ditching, diking.
 - 9. Pumping, bailing, draining.
 - 10. Testing, inspection, disinfection.
 - 11. Furnishing and maintaining all traffic barricades, signs, lights.
 - 12. All other work and materials required but not included in other bid items to complete the work in accordance with the Project Plans & Specifications, the City's Standard Drawings and these Specifications.

4.03 FIRE HYDRANTS

- A. Fire hydrants will be paid for at the unit price bid per hydrant assembly including bury, hydrant extension, valve, hydrant, hydrant caps, thrust block, pipe, bollards, connection to the main, replacement of pavement, sidewalk, curb and gutter, and landscaping.
- B. Payment will constitute full compensation for furnishing all labor, materials, tools, and equipment, and doing all work involved in furnishing and installing the pipe, complete in place, as specified and shown on the plans, including

probing and locating other utilities, valve, valve box and cover, valve tube, hydrant, hydrant bury, break-off riser, excavation and backfill thrust blocks, connecting rods, elbows, tee, backfill, base aggregate, pavement restoration, sidewalk restoration, sheeting and shoring, ditching, diking, pumping, bailing, draining, testing, inspection, disinfection, furnishing and maintaining all traffic barricades, signs, lights, and all other work and materials required but not included in other bid items to complete the work as per applicable City Standard Drawings and these specifications.

4.04 WATER SERVICES

- A. The number of water services including pipe, fittings, corporation stop, connection to main, curb stop, saddle, bypass valve and piping, pavement, sidewalk, curb and gutter, driveway replacement, and landscaping, will be measured and paid for at the unit price bid per linear foot of pipe installed.
- B. Payment will constitute full compensation for furnishing all labor, materials, tools, and equipment, and doing all work involved in furnishing and installing the pipe, complete in place, as specified and shown on the plans, including the following:
 - 1. Probing and locating other utilities.
 - 2. Excavation
 - 3. Elbows, tees, crosses.
 - 4. Valve boxes for identification of horizontal bends.
 - 5. Backfill, base aggregate, pavement restoration, sidewalk restoration.
 - 6. Sheeting and shoring, ditching, diking.
 - 7. Pumping, bailing, draining.
 - 8. Testing, inspection, disinfection.
 - 9. Furnishing and maintaining all traffic barricades, signs, lights.
 - 10. All other work and materials required but not included in other bid items to complete the work in accordance with the Project Plans & Specifications, the City's Standard Drawings and these Specifications.

4.05 FIRE SERVICES

- A. The number of fire services will be measured and paid for at the unit price bid per service including supply backflow assembly (including valves), pipe, fittings, valves, valve boxes, saddles, connection to main, bypass valve and piping, detector check, box with extension or vault, and required meter trim, pavement, sidewalk, curb and gutter, driveway replacement, and landscaping.
- B. Payment will constitute full compensation for furnishing all labor, materials, tools and equipment, and doing all work involved in furnishing and installing the pipe, complete in place, as specified and shown on the plans, including the following:
 - 1. Probing and locating other utilities.

2. Excavation.
3. Thrust blocks, connecting rods, elbows, tees, crosses.
4. Backfill, base aggregate, pavement restoration, sidewalk restoration, sheeting and shoring, ditching, diking.
5. Pumping, bailing, draining, testing, inspection, disinfection.
6. Furnishing and maintaining all traffic barricades, signs, lights, and all other work and materials required (but not included in other bid items) to complete the work as per applicable City Standard Drawings and these specifications.

4.06 VALVES AND VALVE BOXES

- A. Payment for each valve will constitute full compensation for furnishing all labor, materials, tools and equipment, and doing all work involved in furnishing and installing the specified valve type, including valve box and cover, valve tube and valve stem extension, if necessary, complete in place, as specified and shown on the plans, including the following:
1. Probing and locating other utilities, excavation.
 2. Removal of existing valve(s), pipe line, appurtenances, thrust blocks, connecting rods.
 3. Backfill, base aggregate, pavement restoration, sidewalk restoration
 4. Sheeting and shoring, ditching, diking.
 5. Pumping, bailing, draining.
 6. Testing, inspection, disinfection.
 7. Furnishing and maintaining all traffic barricades, signs, lights, and all other work and materials required (but not included in other bid items) to complete the work as per applicable City Standard Drawings and these specifications.

4.07 TAPPING SLEEVES AND TAPPING GATE VALVES

- A. Full compensation will be considered included in other bid prices if the Special Provisions have no specific bid item for tapping sleeves and tapping gate valves.

4.08 BLOW-OFF

- A. This installation will be measured and paid for at the unit bid price for complete installation, including connection to and/or tapping of the main, valve boxes, pipe saddle, valve and all necessary appurtenances, complete in place.
- B. Payment will constitute full compensation for furnishing all labor, materials, tools and equipment, and doing all work involved in furnishing and installing the pipe, complete in place, as specified and shown on the plans, including the following:

1. Probing and locating other utilities.
2. Excavation.
3. Thrust blocks, connecting rods, elbows, valve or meter boxes, valve stem extensions, if necessary.
4. Backfill, base aggregate, pavement restoration, sidewalk restoration.
5. Sheeting and shoring, ditching, diking.
6. Pumping, bailing, draining.
7. Testing, inspection, disinfection.
8. Furnishing and maintaining all traffic barricades, signs, lights, and all other work and materials required but not included in other bid items to complete the work as per applicable City Standard Drawings and these specifications.

4.09 COMBINATION AIR RELEASE VALVE

- A. This installation will be measured and paid for at the unit bid price for a complete installation, including the tapping of the main, service and fittings, valve, valve box, and all appurtenances.
- B. Payment will constitute full compensation for furnishing all labor, materials, tools and equipment, and doing all work involved in furnishing and installing the pipe, complete in place, as specified and shown on the plans, including the following:
 1. Probing and locating other utilities.
 2. Excavation.
 3. Thrust blocks, connecting rods, elbows, valve or meter boxes, valve stem extensions, if necessary.
 4. Backfill, base aggregate, pavement restoration, sidewalk restoration.
 5. Sheeting and shoring, ditching, diking.
 6. Pumping, bailing, draining.
 7. Testing, inspection, disinfection.
 8. Furnishing and maintaining all traffic barricades, signs, lights, and all other work and materials required but not included in other bid items to complete the work as per applicable City Standard Drawings and these specifications.

4.10 ABANDONING OF EXISTING FACILITIES

This work will be measured and paid for as stated in the bid schedule either for each location or lump sum for the total job; with payment including all necessary salvage, excavation, backfill, surface restoration, removal of old tap, valve, tee, installation of new pipe, clamp couplings and all appurtenances, and incidental work necessary to complete the work as specified and shown.

-END OF SECTION-