

CITY OF BAY CITY
SPECIAL PROVISION
FOR
WATER MAIN

1 of 20

10/22/2020

DESCRIPTION

The work consists of installing new or replacing existing water mains, water service leads and appurtenances. Work includes furnishing all labor, material, and equipment required to complete the work in accordance with the plans, standard plans, and specifications, and as specified herein.

The Contractor must protect existing utilities during construction whether the existing utilities are shown on the plans or not. Utilities damaged by construction must be repaired in a manner satisfactory to the Engineer and at the Contractor's expense. The Contractor must call MISS DIG, 1-800-482-7171 for staking and locating the existing utilities.

The Bay City Water Department will assist the Contractor in locating existing water services and water mains provided they are given 24-hour advanced notice.

The Contractor must contact the Bay City Water Department 48 hours in advance of any work that may interfere with existing water service to customers.

Water used for flushing, testing, and other construction activities, must be purchased from the City of Bay City Water Department. The City of Bay City charges the current water and sewer rates listed in the City's fee schedule.

The Bay City Water Department reserves the right to require higher strength and/or quality and will compensate the Contractor for the additional cost.

A. **Submittals.** The Contractor must submit the following to the Engineer for review and comment prior to construction:

1. Valves and valve boxes
2. Hydrants
3. Castings
4. Pipe, including fittings, joints
5. Corporation stops, curb stops, curb stop boxes, and K type copper

B. **Codes, Standards, and Permits.** The Contractor must complete all work in accordance with and using materials in compliance with applicable AWWA standards, DIPRA "Installation Guide for Ductile Iron Pipe", NSF standards and regulations of the Office of Drinking Water and Municipal Assistance of the Michigan Department of Environmental Quality.

MATERIALS

All materials supplied by the Contractor must be new and made in America, meeting the specifications contained herein.

All materials shall conform to the "Reduction of Lead in Drinking Water Act of 2011", which modifies Section 1417 of the Safe Drinking Water Act. Materials must be certified by ANSI accredited third-party certification bodies that materials are in compliance with NSF/ANSI 372. Products must have certification marks and identifier text that indicate a product meets the lead-free requirement of section 1417 of the Safe Drinking Water Act.

A. **Pipe.** Water main must be constructed of ductile iron pipe or PVC pipe.

Ductile iron pipe must conform to ANSI/AWWA C151.51. Ductile iron pipe must be cement lined in accordance with ANSI/AWWA C104/A21.4 or A21.50. Pipe wall thicknesses must conform to ANSI/AWWA C150/A21.50, and pipe must be of the following classes:

<u>Pipe Size</u>	<u>Pipe Class</u>
4"	52
6"	52
8"	52
10"	54
12"	56
16"	56
20"	56
24"	56
30"	56
36"	56

Pipe manufacturer, pipe weight, class, and year of casting must be marked on each length of pipe.

All ductile iron pipe, valves and fittings shall be poly-wrapped, with a polyethylene wrapper AWWA C105/A21.5-99.

Joints must be either mechanical type or push-on type in accordance with ANSI/AWWA C111/A21.11. Working pressure rating must be 350 psi. Make provisions at each joint for electrical conductivity.

PVC pipe shall comply with AWWA C909, ASTM Cell Classification 12454 and shall have DR equal to 18 unless thicker pipe wall is required for directional drilling purposes. Joints shall be push-on or fused. Restrained Joints shall be fused or EBBA Iron Series 200PV or Series 1500 or equal product of Romac Industries. PVC pipe shall be installed with trace wire of #12 AWG Copper Clad Steel, extra high strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.

B. **Fittings.** Fittings must be cast iron, full body ductile iron, or compact ductile iron with mechanical joints and must be in accordance with ANSI/AWWA C110/A21.10, ANSI/AWWA C111.A21.11, and ANSI/AWWA C153/A21.53. Fittings must be cement lined in accordance with ANSI/AWWA C104/A21.4. Joints must be provided with an electrical conductivity device.

C. **Gaskets.** Water main gaskets must meet the requirements of ANSI/AWWA C111/A21.11. For soils contaminated with volatile organic compounds, as determined in the field by the

Engineer, nitrile gaskets must be used.

D. **Steel Casing.** Steel pipe used for casing must be ASTM A-139 Grade B, furnished in 20' lengths. Steel pipe must have a minimum yield strength of 35,000 psi. Casing pipe must meet or exceed the diameters and wall thickness listed below.

<u>Water Main Dia.</u>	<u>Minimum Nominal Casing Dia.</u>	<u>Minimum Nominal Casing Wall Thickness</u>
4"	12.75"	0.375"
6"	16"	0.375"
8"	18"	0.375"
10"	20"	0.375"
12"	22"	0.375"
16"	24"	0.500"
20"	30"	0.500"
24"	36"	0.500"
30"	42"	0.500"
36"	48"	0.500"

Joints in steel pipe used for casing must be continuous, welded, and watertight. Casing spacers must be stainless steel manufactured by CCI Pipeline (Model CSS), Cascade Waterworks, or approved equal. Casing spacers must be provided at 8' maximum spacing (2 per pipe).

E. **Gate Valves.** Gate valves must be iron body, non-rising stem, and resilient wedge seat type design. Gate valves must meet or exceed the latest revision of AWWA C-509.

Gate valves must be direct buried, with a 2-inch operating nut, and open to the right.

The stem must be sealed by two "O" rings; one located above the thrust collar, the other located below. The area between the "O" rings must be filled with a lubricant for providing proper lubrication to all working parts.

The disc shall have an integrally cast ASTM B-621 Bronze Stem Nut. Loose or otherwise non-integral stem nuts or guides are not acceptable. The valve shall have a maximum of two moving parts.

The seat ring must seat into a fully machined seat and be made of natural rubber.

Internal ferrous metal surfaces must be fully coated to a minimum of 4 mil thickness with a two-part thermosetting epoxy.

Valves must have full opening flow ways, of the same diameter as the adjacent piping.

Valve ends must be suitable for mechanical joint connections. Valves to be used for pressure tapping must have end connections suitable for use with a tapping tee and tapping machine.

Test valves in accordance with AWWA C-509.

Gate Valves must be Made in America resilient seat gate valves.

F. Valve Boxes for Gate Valves. Water valve boxes for gate valves must be 5 1/4", three-piece screw type, with "Water" cover and a round or oval base as necessary, of cast iron in accordance with ASTM A 48 Class 25. Boxes must be adjustable, both 6" above and below grade. Risers will not be allowed on new boxes.

G. Butterfly Valves. Butterfly valves must be of the rubber-seated tight closing type. They must meet or exceed AWWA Standard C504.

1. **Valve.** Valve body must be high-strength cast iron ASTM A126 Class B with 18-8 Type 304 stainless steel body seat. Valve vane must be high-strength cast iron ASTM A48 Class 40, having rubber seat mechanically secured with an integral 18-8 stainless steel clamp ring and 18-8 stainless steel self-locked screws.

Rubber seat must be a full-circle, 360-degree seat not penetrated by the valve shaft. Valve shaft must be one piece, extending full size through the entire valve and operator with no neck-down, keyways, or holes to weaken it. Valve shaft must have 304 stainless steel journals rotating in reinforced Teflon bearings. Valves must have permanently set two-way thrust bearing. Packing must be "triple-seal" rubber designed for permanent duty in underground service.

2. **Operator.** Valve operator must be of the traveling-nut type, sealed, gasketed and lubricated for underground service. It must be capable of withstanding an overload input torque of 450 ft. lbs. at full-open or full-closed position without damage to the valve or valve operator. It must be designed to resist submergence in water of 25 ft. head pressure.

A 20" valve must require 72 turns to close.

Valves must be capable of easy closure by one person using standard valve key, even under emergency line-break conditions as severe as those that may require a valve maximum opening torque requirement of as much as two times AWWA Class 150B.

All valves must open to the right and be equipped with a 2" square AWWA operating nut.

3. **Tests.** All valves must be tested bottle tight at rated working pressure of 150 psi by the manufacturer. In addition, a hydrostatic test with vane partially open must be given at a pressure of 300 psi.

4. **Manufacturer.** The valve must be made in America and must be Mueller, East Jordan, Clow, American Flow Control, Dresser, Valve-Matic or approved equal.

H. Fire Hydrants. Fire hydrants must equal or exceed AWWA C502 and its latest revision. The manufacturer must furnish certification that all tests and provisions of AWWA C502 have been met.

Hydrants must be equipped with two 2-1/2" hose nozzles and one 4-1/2" pumper nozzle, National Standard, with all nozzles located at least 18" above the ground line and at the same heights.

The grade line on the hydrant standpipe must be set such that the large nozzle is at least 18" above the finished ground and top of curb and must meet the manufacturer's standpipe height requirements for the actual burial depth. Where required, standpipe extensions must be installed incidental to the hydrant.

Hydrants must be 6'-0" bury/trench depth and must be provided with a 6" mechanical joint inlet complying with ANSI A21.11. The Contractor must provide the necessary bends to ensure a 6'-0" bury in case the existing water main is not at the proper depth. The cost of all necessary bends will be included in the hydrant pay items and will not be paid for separately.

Hydrant caps must be securely chained to the barrel.

Hydrants must be of the breakable flange type designed such that neither the barrel nor the stem is damaged upon vehicle impact and that no water is lost. Repairs are to be made without any excavation. Operating stems must be at least 1-1/4" diameter with a breakable section at the ground line.

Hydrant barrels and shoes must be manufactured with integral cast flanges of either ductile iron or Class B gray iron. The barrel and the shoe must be cast of the material.

Hydrant flow loss must not exceed 1.35 psi at 500 gpm through the two 2-1/2" hose nozzles flowing simultaneously and 5.0 psi at 100 gpm through the 4-1/2" pumper nozzle.

The main valve must be special molded rubber. The upper valve plate and all other bronze parts in the water way must be cast of ASTM B62 bronze and capable of withstanding operating torques of 200 ft-lb applied to the operating nut/or stem assembly in the fully opened or fully closed position. The seat ring, stem and main valve assembly must be removed through the upper barrel.

Hydrants must be designed so that the direction of nozzles can be changed by rotating the above ground section. The section above ground must be painted Safety Red B66R38. Apply two coats of asphalt varnish to the section below the ground line.

Hydrants must be subjected to hydrostatic tests by the manufacturer in accordance with AWWA C502 psi, or the hydrant rated working pressure. No leakage will be permitted through castings, joints, main valves, or stem packing during each test.

Hydrants opening against the pressure are to be of the "dry top" design to prevent water from emulsifying the lubricant and causing freezing in cold weather.

If removal of the valve and valve seat requires the use of special seat wrench, said wrench must be of the lightweight type that does not require contact at the valve seat to function. The seat wrench is to operate by contact with the valve stem at the point of removal of the bonnet or top section of the barrel.

Hydrants to be used in Bay City must also meet the following requirements:

Location

Hydrants on east side of Saginaw River

Operating nuts and cap nuts shall be 7/8 inch square. Hydrant shall open to the right.

Hydrants on west side of Saginaw River

Operating nuts and cap nuts shall be 1-1/2" pentagon. Hydrant shall open to the left

The Contractor must submit shop drawings to the Engineer for approval prior to ordering hydrants. Hydrants must be Mueller Super Centurion 200, East Jordan 5-BR or Waterous Pacer WB 67-250.

I. **Water Services.**

1. **Copper Pipe.** Water service leads must be copper water tube, Type K, soft temper, for underground service in accordance with ASTM B-88 and B-251. The pipe must be marked with the manufacturer's name or trademark and a mark indicative of the type of pipe. The outside diameter of the pipe and minimum weight per foot of the pipe must not be less than that listed in ASTM B-251, Table II. Copper pipe installed from the water main to the service box must be 1-inch diameter, unless otherwise noted.

2. **Stops and Fittings.** All fittings and stops must be manufactured in accordance with the latest revision of AWWA Standard C-800. Any brass part of the fittings or stops in contact with potable water must be made of a "No-Lead Brass", defined as UNS Copper Alloy C89520 or C89833 in accordance with chemical and mechanical requirements of ASTM B584.

Any brass part of the fitting or stop not in contact with potable water must be made of 85-5-5-5 brass as defined for this specification as UNS Copper Alloy C83600 per ASTM B62, ASTM B584 and AWWA C-800.

All brass fittings and stops must be certified by an ANSI accredited test lab per NSF/ANSI Standard 61, Drinking Water Components – Health Effects, Section 8. All brass parts in contact with potable water must be certified by an ANSI accredited test lab for lead content not to exceed 0.25% lead. Proof of certification is required.

Brass fittings and stops must comply with the Safe Drinking Water Act and the USA Environmental Protection Agency.

All brass fittings and stops must have the manufactures name or trademark integrally stamped or cast on it. Another marking identifying the "no lead" brass alloy must be cast or stamped on the fitting.

Corporation stops and curb stops must be Ford, Mueller, or approved equal. Miscellaneous fittings for connection to an existing water service must be approved by the Engineer.

3. **Service Boxes.** Water service boxes must be cast iron, Buffalo type. Boxes must be adjustable both 6" above and below grade. Boxes must be 3" in diameter.

J. **Miscellaneous Materials.**

1. **Steel for Strapping.** Steel for strapping must be Grade 60 deformed bars meeting ASTM Specifications A615 or A617 for billet-steel reinforcement bars or axle steel bars.

2. **Valve Manholes.** Valve manholes must be constructed of precast concrete manhole sections, in accordance with ASTM C478.

3. **Concrete.** Concrete must be grade 35S. The concrete must contain at least six (6) sacks of cement per cubic yard of concrete. Air content must be four to six percent, slump must be 1" to 4", and compressive strength must be at least 3500 psi after 28 days.
4. **Reinforcement.** Reinforcement must be Grade 60 steel bars for ASTM A615, A616, or A617.
5. **Flowable Fill.** Flowable fill must be a mixture of Portland cement, fly ash, sand, and water in the following proportions. Submit mix design to the Engineer for review and approval.

Portland Cement:	Type I or IA	50 lb/cyd
Fly Ash:	ASTM C618, Class C or F	500 lb/cyd
Sand:	MDOT 2NS	2850 lb/cyd
Water:	Approximately 376 lb/cyd	(sufficient to produce desired flowability)

CONSTRUCTION

Install pipe materials required by the contract in accordance with AWWA standards.

- A. **Excavation.** The Bay City Water Department must be notified 48 hours in advance of a Contractor request for water shut down.

The Contractor must excavate all material to the depths necessary to construct the water main as shown on the plans. Excavation must include the removal of rock, dirt, abandoned pipelines, old foundations, stumps and roots and similar materials encountered. Excavation, of whatever material encountered, must be included in the contract unit prices for water main installation and will not be paid for separately. Pavement removal and restoration will be paid for at the contract unit prices for the appropriate item in accordance with the Standard Specifications and Supplemental Specifications. Trench width must be limited to eight feet for payment for pavement removal, pavement replacement, and restoration.

Excavated material that is suitable for backfill material must be neatly piled adjacent to the excavation to prevent cave-ins of the excavation and damage to adjacent trees, shrubs, fences and other property.

The excavated area must be kept free of water at all times. Sheet piling and shoring must be provided, if necessary, for the protection of the workers.

Excavated material that is not to be used as backfill and must be disposed of by the Contractor.

Backfilling must follow immediately behind trench excavation and pipe laying operations. In no case must more than 100 ft. of trench excavation be open at any one time. Any excavation left open and unattended must be protected with lighted Type II barricades and a "snow fence" constructed around the perimeter of the excavation.

The Contractor must excavate to the depths required to construct the water main and appurtenances as described on the plans. For water main construction, trench excavation must be to a depth sufficient to provide at least 6' cover over the top of the pipe and a 4" sand cushion below the pipe. Over excavation will be at the Contractor's expense. The trench width at a level of 12" above the pipe must be no greater than 32" in width.

In areas where the proposed construction may interfere with existing utilities, additional excavation may be required to determine the exact location of said existing utilities. This work will be incidental to the Contractor and no additional compensation will be due to the Contractor for this work.

In some cases, the plans call for removing an existing water main or sewer to construct a new water main. Once the existing sewer and water main are removed it must become the property of the Contractor and disposed of properly at his expense. Open ends of an abandoned pipeline that is to be left in the ground must be bulk headed with one course of brick and mortar.

B. Pipe Handling. Pipe must be handled in such a manner as to prevent the ends from splitting, damages to the protective coatings and other undesirable conditions. Lifting pipes by inserting forks or booms inside of a pipe are strictly prohibited. Pipe must not be dropped, skidded or rolled into another pipe. Repairs to damaged pipe must be approved by the Engineer.

C. Pipe Cutting. Pipe cutting must be done in a neat and workmanlike manner without damage to the pipe or lining and as to leave a smooth end at right angles to the axis of the pipe. Cutting must be done by an approved mechanical saw or cutter. Hydraulic squeeze cutters are not acceptable.

D. Pipe Laying. Pipe located inside structures must be rigidly supported as shown on the plans.

Pipe laid underground must be uniformly supported through its entire length on a four-inch cushion of sand. A depression must be carved out of the sand cushion to accommodate the pipe bells.

Pipe must be inspected for defects, debris or dirt while suspended in a sling prior to lowering it into the trench. Defective pipe must be removed from the project site, immediately. Lumps, blisters and excess coal tar coating must be removed from inside the bell and outside the spigot. These areas must be wire-brushed and wiped clean with a dry oil-free rag. No debris, tools, clothing, or other materials must be allowed in the pipe.

Pipe must be laid in a dry trench with bell ends facing in the direction of laying. After placing a length of pipe in the trench, and after installing the gasket and applying the gasket lubricant, the spigot end must be centered in the bell and the pipe pushed home and brought to the correct line and grade. The pipe must be secured in place by tamping Granular Material Class II, "maximum size, around it. Precautions must be taken to prevent soil from entering the joint space.

A watertight plug must be inserted in the open end(s) of the pipe to prevent water, soil, animals, or other foreign matter from entering the pipe.

When it is necessary to deflect pipe from a straight line, either horizontally or vertically, the deflection must not exceed the following values:

Nominal Pipe Size	"Push On" Joint Maximum Deflection (Inch per 18-foot length)	Mechanical Joint Maximum Deflection (Inch per 18-foot length)
4"	19	31
6"	19	30
8"	19	22
10"	19	22
12"	19	22
16"	19	13
20"	19	-
24"	19	-
30"	19	-
36"	17	-

E. **Jointing.** Mechanical and "push on" joints must be installed in accordance with the joint manufacturer's recommendations. Copies of such recommendations must be furnished to the Engineer prior to the start of construction.

Flange faces of flanged joints must be thoroughly cleaned with a wire brush and the pipe carefully aligned. The gasket must then be inserted between the flanges and the bolts and nuts installed. Tightening of the bolts must be done evenly around the flange to uniformly distribute the stress carried by the bolts.

F. **Backfilling.** Backfilling must be in accordance with the trench detail called for on the plans or as directed by the Engineer in accordance with the following:

Trench Detail F must be used where the excavated area is not within the 1 on 1 influence of an existing or proposed roadway, sidewalk, driveway, building or similar structure. That portion of the excavation outside the 1 on 1 influence of an existing or proposed roadway or railroad and at least 6 inches above the pipe may be backfilled with suitable excavated material, compacted to not less than 90% of the maximum unit weight.

Trench Detail G must be used when part of the trench is within the 1 on 1 influence area of an existing or proposed roadway, sidewalk, driveway, building or similar structure. The trench must be backfilled with Granular Material Class II, 1/2" maximum size, in lifts of ten inches and mechanically tamped to 95% of maximum unit weight.

Where the proposed water main crosses under an existing utility, the proposed water main must be deflected above or below the existing utility in accordance with the following:

1. Maintain 6' cover over top of proposed water main.
2. Maintain at least 2' of vertical separation between the outside of the proposed water main and the outside of a sewer, drainpipe, or catch basin lead.
3. Maintain at least one foot of vertical separation between the outside of the proposed

water main and the outside of an existing utility other than a sewer, drain or catch basin lead.

4. When crossing an existing sewer, drainpipe, or catch basin lead, construct the proposed water main so that its joints are equidistant from the utility being crossed.

When crossing under any existing pipeline, Trench Detail H must be used, whether specifically called for on the plans or not. Trench Detail H will not be paid for separately but will be paid for at the contract unit price as Trench Detail F or G, whichever would have normally been required, provided that the crossing has not been required.

Where Trench Detail H is required, the trench width must be backfilled to a height of 8" above the pipe with a dry mix of one bag cement to one cubic yard of Granular Material Class II. The trench must then be backfilled to 12" above the existing pipe with Granular Material Class II, "maximum size and compacted to 95% of maximum unit weight. The remainder of the trench must be backfilled as required for Trench Detail F or G, whichever is appropriate.

Protect all trench backfill material against freezing, or thaw frozen material before using.

G. Water main Constructed in Steel Casing. Where called for on the plans, water main must be installed in a steel casing. The steel casing must be joined by continuous, watertight welds. The casing must be bedded on a four-inch cushion of sand and backfilled in accordance with the requirements of Trench Detail G.

The water main to be installed in the casing must be assembled in the trench adjacent to the casing. Stainless steel casing spacers must be provided at 8' maximum spacing (2 per pipe).

The pipe must be skidded into place through the casing by using pipe bars, jacks, or another approved method. Once in place, the space between the casing pipe and the carrier pipe must be filled with sand, pea stone, flowable fill or another approved materials. The ends of the casing pipe must be closed with one course of bricks mortared in place.

H. Water Main Freebore. Freeboring of water main will be a method in which the Contractor will advance the water main by pushing it along by mechanical means through the soil (no trench, boring without the use of a casing by use of hydraulic excavator or other mechanical means). Freebore will be as directed by the Engineer in the field only. The method of freebore will be used to advance the water main past trees, utility poles and other obstacles which may be difficult to trench around.

I. Hydrants and Valves. Hydrants and valves must be located as shown on the plans or as otherwise directed by the Engineer. Failure by the Contractor to locate said hydrants or valves as called for, will require that the Contractor correct the error at his own expense.

1. **Setting Hydrants.** Hydrant shoe must be set on a 1'6" x 1'6" x 4" concrete slab and braced to undisturbed soil with a concrete thrust block with a bearing area as called for on the plans. Hydrants must be set perfectly plumb. Hydrant auxiliary valves must be located 2'0" from the hydrant, unless otherwise directed by the plans or Engineer.

Excavations for the construction of hydrants and hydrant leads must be backfilled with Granular Material Class II, 1/2" maximum size, compacted to not less than 95% of maximum unit weight. That portion of the excavation outside the 1 on 1 influence of an

existing or proposed roadway or railroad and at least 6 inches above the pipe may be backfilled with suitable excavated material, compacted to not less than 90% of the maximum unit weight.

2. Removal of Hydrants. Where shown on the plans or otherwise directed by the Engineer, the Contractor must remove existing hydrants. The ground must be excavated to the depth of the hydrant lead. The water main must be "shut down" by the Bay City Water Department. The Contractor must remove the hydrant, lead, valve, and box. The fitting on the main must be removed. If the main is to remain in service a sleeve must be installed in place of the existing fitting on the main. Ownership of the salvaged hydrant and valve must be retained by Bay City Water Department including removal from the project site.

3. Setting Valves. Valves must be examined by the Contractor prior to lowering in the trench. Check all nuts and bolts to assure tightness.

Valves must be installed with the valve closed, supported on two 6" x 18" x 4" concrete blocks and vertically plumb. The valve box must be set plumb, and its axis must be in line with the stem. Valve boxes must have the ability for future adjustments of up to 6 inches, above or below grade. Provide firm support for valve boxes.

4. Cutting in Valves. Where shown on the plans or directed by the Engineer, the Contractor must install a new valve on an existing line. The existing main must be uncovered by the Contractor. A section of the existing main must then be cut out. The length will vary depending on the valve and sleeve dimensions. A mechanical joint cutting in sleeve must be slid over one end of the pipe, a gate valve over the other end. After the gate valve is in the "home" position, slide the sleeve into the gate valve. Position the gaskets and tighten the three mechanical joints to the manufacturer's specifications. The valve must be plumb. Provided support under the valve by placing two 6" x 18" x 4" concrete blocks. Inspect for leaks. Place valve box over gate valve and adjust to proposed grade. Backfill with Granular Material, Type II, 1/2" maximum size, compacted to not more than 95% of maximum unit weight. That part of the excavation that is not within the 1 on 1 influence of an existing or proposed roadway or railway and at least six inches above the water main may be backfilled with suitable excavated material, compacted to not less than 90% of maximum unit weight.

5. Reconnection of Existing Hydrants. Where the plans call for reconnection of an existing hydrant to a new main, the Contractor must excavate as necessary to locate the existing hydrant lead. The lead must be cut in a location directed by the Engineer. The Contractor must then connect the hydrant to the new main using sleeves, tees, elbows, 6" ductile iron pipe and a 6" gate valve and box as conditions require. The excavation must be backfilled with Granular Material Class II, 1/2" maximum size, to not less than 95% of maximum unit weight. That portion of the excavation outside of the 1 on 1 influence of an existing or proposed roadway or railroad may be backfilled using suitable excavated material, compacted to not less than 90% of maximum unit weight

When reconnecting an existing hydrant to a new water main, the hydrant tee and fitting must be tilted and/or manipulated as necessary to obtain at least 6' minimum bury depth.

6. Pressure Connections. Where called for on the plans, proposed water mains must be connected to existing water mains by means of a pressure connection. The existing main must be thoroughly cleaned and brushed with a wire brush at the location of the proposed connection. Prior to tapping sleeve installation, the pipe outside diameter (O.D.) must be measured using an OD tape to confirm OD range compatibility of the tapping sleeve. A one-piece stainless-steel tapping saddle must be installed over the existing main and tightened in accordance with manufacturer's recommendations. A tapping valve suitable for use with the tapping sleeve, must be bolted to the sleeve. Hand –chlorinate tapping sleeves and tapping valves before installation. Once installed, a pressure test must be performed on the tapping sleeve and valve prior to tapping the pipe. The tapping machine must be attached to the open tapping valve and the tap made. Remove the tapping machine and the "cut-out" pipe wall or pipe coupon and close the valve. Inspect for leaks.

7. Thrust Restraint. All tees, plugs, bends, hydrants, offsets, and similar fittings must be braced to undisturbed ground by use of concrete thrust blocks. Redundant thrust restraint (restrained joints) must also be provided in addition to thrust blocking.

Concrete for use as thrust blocks must have a 28-day compressive strength of not less than 3500 psi. The thrust block must be placed so that the pipe, valve, hydrant, or fitting joints are accessible for repair. Details of placement of thrust blocks are shown on the plans.

Horizontal concrete thrust blocks for water mains 12-inch diameter and smaller may be poured concrete or solid concrete block. Horizontal concrete thrust blocks for water mains larger than 12-inch diameter must be poured concrete thrust blocks.

All vertical bends must have poured concrete thrust blocks with #5 double anchor rods.

Thrust blocks and strapping are included in the water main construction and separate payment will not be made to the Contractor for this work.

Restrained joints must be designed in accordance with DIPRA Thrust Restraint Design for Ductile Iron Pipe. The following restraint joint systems are approved for ductile iron pipe, when observed by the Engineer.

<u>Pipe Size</u>	
12 inch or less	Field Lok, Fast Grip
16 inches or larger	FlexRing, TR Flex

Restrained joints are considered included in work of water main construction and will not be paid for separately.

J. Water Services.

1. New Services and Reconnections. Water services must be constructed where shown on the plans or where directed by the Engineer.

Water services must be constructed according to the water main detail sheet in the plans.

Each water service pipe must be connected to the water main through a no-lead brass corporation stop. The water main must be drilled and tapped under pressure by use of a tapping machine with a combination drill and tap of the appropriate size for the connection being installed.

After tapping the main and installing the corporation stop, the tap must be tested by turning the corporation on and off. Any leakage detected visually must be corrected by the Contractor. All operating nuts must be positioned at 12:00

The service lead must be constructed of Type K copper pipe. Service leads must be 1" diameter unless otherwise called for on the plans or directed by the Engineer. The copper pipe must be laid such that there is at least 18" of slack in the service line at the main. In other words, the first 3' of trench adjacent to the main must have at least 4-1/2' of copper pipe laid in it.

All joints of copper pipe must be flared joints. After the copper pipe is in place and connected to the curb stop, the line must be visually checked for leaks by closing the curb stop and opening the corporation stop.

The Contractor must leave the corporation stop in the open position and close the curb stop unless directed otherwise by the Engineer. The curb box must be installed on the curb stop such that its height is adjustable at least six inches above and below grade. The curb stop operating nuts must be positioned at 12:00 and positioned at a 90-degree angle to the sidewalk. Provide firm support for curb stop boxes.

Where an existing water service pipe is to be reconnected to a new main, new copper pipe must be placed to the right-of-way line or to the point directed by the Engineer. At this point, a curb stop, and box must be installed to a depth bury of 6 feet. The existing water service, of whatever size and material and depth of bury that may be encountered must then be reconnected to the curb stop. The cost of the reconnection to the curb stop must be included in the project. The new copper pipe must be no less than the size of the existing water service, 1" diameter must be a minimum.

The excavation resulting from water service construction or reconnections must be backfilled by the Contractor with Granular Material Class II, 1/2" maximum size, compacted to not less than 95% of maximum unit weight.

Water services must be buried 6'-0" deep, unless otherwise directed by the Engineer. When directed otherwise by the Engineer to a bury depth of less than the city standard depth of 6', a minimum of 2" of rigid styrofoam insulation must be used to protect the pipe from freezing at no additional cost.

Where the excavated area is not within the 1 on 1 influence of an existing or proposed roadway or railroad track suitable excavated material may be used as backfill, compacted to not less than 95% of maximum unit weight.

2. Water Service Abandonments. Where called for on the plans or directed by the Engineer, existing water services must be disconnected from the existing main. The Contractor must excavate as necessary to locate the point at which the service connects to the existing main. At that point, the Contractor must disconnect the service and close

the corporation. Any leakage visually detected must be corrected by the Contractor. The excavated area must be backfilled by the Contractor with Granular Material Class II, (1/2") maximum size, compacted to not less than 95% of maximum unit weight.

Where the excavated area is not within the 1 on 1 influence of an existing or proposed roadway or railroad tracks and at least 6" above the main, suitable excavated material may be used as backfill, compacted to not less than 90% of maximum unit weight.

The Bay City Water Department will assist the Contractor in locating existing water services, provided they are given 48 hours' notice. Service abandonment will be considered incidental to the water main items and will not be paid for separately.

K. Testing and Disinfecting.

1. **Hydrostatic Pressure Test.** All new construction must be subjected to a hydrostatic pressure test in accordance with AWWA Standard C600 or its latest revision. Testing should be performed as soon as possible after construction on a section is complete.

The Contractor must provide all equipment, materials, and labor necessary to perform the tests, including pumps, gauges, plugs, corporations, excavation and backfill, water, miscellaneous piping and fittings, and a means of measuring the volume of water lost.

The Contractor must fill the main with water through hydrants or corporation stops. Air must be bled off at the ends and at high points through corporations or hydrants. The Contractor must plug all taps made solely for the pressure test by inserting no-lead brass plugs.

Water must be added until the hydrostatic pressure at the highest point of the main is at least 150 PSI.

The Engineer must be notified four (4) hours prior to testing and must witness the test and determine the leakage over a two-hour period.

Chlorinated water must be added as necessary throughout the two-hour test period to maintain a uniform pressure as required.

At the end of the two-hour period, the total volume of water added to maintain the required test pressure will be determined and will be the actual leakage in a two-hour period.

The allowable leakage rate will be determined by the following formula:

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

Where:

L = allowable leakage, in gallons per hour

S = length of pipe tested, in feet (*1,200' maximum regardless of actual test length)

D = nominal diameter of the pipe, in inches

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

The Contractor is free to pressure test any length of pipe in any given pressure test however, the maximum amount of allowable leakage will be based on a 1,200' long pressure test zone.

If the actual leakage rate exceeds the allowable leakage rate, the Contractor at his own expense must locate and repair the leak(s). The test process must be repeated until satisfactory results are obtained.

The cost of pressure testing must be included in the unit price for water main construction of the applicable sizes and details. No additional compensation will be due to the Contractor for this work.

2. Temporary Blowoffs. In instances where a dead-end main will be constructed or where a phased project will periodically place partial lengths of completed water main in service, a temporary blowoff assembly may be specified in lieu of a hydrant. The temporary blowoff assembly may be used to permit flushing of newly constructed water main. No additional compensation will be due to the Contractor for using temporary blowoffs.

Disinfection and Bacteriological Testing of Water Lines. Before any new or repaired water main is put into service, (except where a repair sleeve is installed on a main which has maintained pressured), at least two samples must be collected by City of Bay City Water Department staff and analyzed by Bay Area Water Treatment Plant staff. On any new main installations, provisions must be made to allow thorough flushing of all portions of the main at a velocity of 3.0 fps. Special care must be taken to also assure that all dead-ends can be flushed, disinfected, and sampled. Corporation stops must be installed at each end of the water main construction, 1,200' maximum between corporation stops, or as directed by the Engineer, to provide points for chlorine injection and water sampling. Continuous feed method for chlorination is the preferred method for disinfection, other chlorination methods must get prior approval from the Engineer. Prior to sampling, water mains must be flushed, disinfected, and flushed again in accordance with AWWA Standard C651 or its latest revision. The Contractor must provide a means of de-chlorinating flushed water as it is discharged to the environment. At least sixteen (16) hours must elapse after final flushing before the first sample is taken and the line must not be flushed between the two final samples. Two consecutive samples (at least 24 hours apart) must be analyzed and found to be free of bacteria. Additionally, the dual samples will be tested for Heterotrophic Plate Count (HPC) bacteria which requires 48 hours for the test period. The HPC must not exceed the distribution system HPC. To confirm this, the distribution system HPC a sample point must be installed on the distribution side of control valve adjacent to the new watermain in conjunction with the other noted samples.

The bacteriological quality of the water coming out of the main must be at least as good as the bacteriological quality of the water going into the main. High turbidity may also be cause for rejection and may require re-flushing and disinfection. If, during construction, trench water has entered the main, bacteriological samples may be required to be collected at intervals of approximately 300 ft.

Flushing is no substitute for preventive measures during construction. Certain

contaminants, such as caked deposits, may resist flushing at any feasible velocity and pigging may be required. The Contractor may be required by the city to pig the water main, at the Contractor's expense, when repeated attempts to disinfect the water main remain ineffective. Failed attempts to disinfect a water main will not be accepted as a basis for Contractor claims or time extensions.

Connections to existing water mains greater than 10' in length must be treated as new water main installations and as such must be flushed, pressure tested, disinfected, and bacteriologically tested in accordance with these specifications prior to placing water main into service unless otherwise authorized in writing by the Engineer. Connections to existing water mains less than 10' in length must be completely disinfected by thoroughly swabbing the pipe and fittings with a strong chlorine solution (10% concentration minimum).

If the initial disinfection fails to produce satisfactory bacteriological results, the main may be re-flushed and resampled. If check samples show the presence of bacteria, then the main must be re-chlorinated until satisfactory results are obtained.

A fee, as established by the City of Bay City Fee Schedule or Bay Area Water Treatment Plant, will be charged to Contractors for each sample analyzed. This will not prevent a Contractor from having samples analyzed by another lab if he desires, however, the final two samples must be collected, analyzed, and approved by Bay Area County Water Treatment Plant or City of Bay City Water Department staff before the line can be put into service. Labs must employ approved and accepted testing methods in accordance with AWWA C651.

More than one new water main connection is strictly prohibited prior to final approval of disinfection and bacteriological testing results. Special care must be taken to assure that two or more ends of the new water main are never connected at the same time, since this condition could allow contaminated water to enter the rest of the water system.

Chlorine injection points, sample points including HPC distribution sample point, and blow-off lines or hydrants as directed by the Engineer must be installed so that all sections of the mains can be properly flushed, disinfected, and sampled.

Bay Area Water Treatment Plant staff will provide a written certification of bacteriological quality on each of the final two samples including HPC results. Approval to put the line into service must not be given until these two samples, including HPC, are certified, by Bay City Area Water Treatment staff to be safe.

The cost of equipment, labor and materials necessary for disinfection and bacteriological testing of water lines, regardless of the number of tests required to achieve satisfactory results, must be included in the contract unit prices for water main, of the size and detail called for. No additional compensation will be due to the Contractor for this work.

L. Miscellaneous.

1. **Restoration.** After construction and backfilling of an area is complete, the Contractor must immediately restore it. Restoration of areas affected by water main

construction must be restored in coordination with the construction and restoration of other elements of the project.

2. Abandoning Water Mains with Flowable Fill. Mix flowable fill in automated batch plant and deliver it to site in ready-mix trucks. Performance additives may be added at placement site if required by mix design. Use concrete or grout pumps capable of continuous delivery at planned placement rate.

Abandon existing water mains underneath roadways and paved areas by completely filling pipes with flowable fill. Abandon manholes and other structures by filling with flowable fill, together with ballast as applicable, within depth of structures left in place.

Place flowable fill to fill volume between manholes or valves. Continuously place flowable fill from manhole to manhole or valve to valve with no intermediate pour points, but not exceeding 500 feet in length.

Filling operation must be performed by experienced crews with equipment to monitor density of flowable fill and to control pressure.

Pump flowable fill through bulkheads constructed for placement of two 2-inch PVC pipes or use other suitable construction methods to contain flowable fill in lines to be abandoned. These pipes will act as injection points or vents for placement of flowable fill.

Place flowable fill under pressure flow conditions into properly vented open system until flowable fill emerges from vent pipes. Pump flowable fill with sufficient pressure to overcome friction and to fill pipes from downstream end, to discharge at upstream end when applicable.

Inject flowable fill through replaced ballast using grouting equipment and series of grout pipes discharging at bottom of placement, allowing fill to rise through ballast effectively filling all voids. Alternatively, sequentially place individual pieces of ballast at same time as flowable fill is placed. Do not fill with ballast more than 50 percent of volume at any level, to prevent nesting and void formation.

Remediate placement of flowable fill which does not fill voids in pipe and in manholes or other structures, or where voids develop due to excessive shrinkage or bleeding of fill, by using pressure grouting either from inside sewer or from surface.

Clean inside surface of pipes at least 12 inches from ends to achieve firm bond and seal grout plug or manufactured plug to pipe surface. Similarly, clean and prepare exterior pipe surface if manufactured cap is to be used.

When using grout plug, place temporary plug or bulkhead approximately 12 inches inside pipe. Fill pipe end completely with dry-pack grout mixture.

When using manufactured plug or cap, install fitting as recommended by manufacturer's instructions, to form watertight seal.

Backfill to surface, above pipe or structures left in place, with flowable fill in restricted

areas, compacted bank run sand in unrestricted areas to be paved or select fill in unrestricted areas outside of pavement.

Remove portions of valve boxes to at least 3 feet below the pavement surface under the road, and to at least 12 inches below the planned grade outside the road.

Collect and dispose of excess flowable fill material and other debris in accordance with local requirements or as directed by the Project Manager.