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The City of Southfield

WATER MAIN SPECIFICATIONS

REV: May 04, 2022



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Purpose

The purpose of these Water Main Construction Specifications is to provide clear and concise guidance on the constructions methods and materials to be followed/utilized during the construction of any public water main within the City of Southfield. As a secondary purpose, this document also seeks to set in stone the means and methods of water main installation that satisfy the Michigan Department of Environment, Great Lakes, and Energy (EGLE) requirements for act 399 Permitting.

If you have any questions, please feel free to reach out to me at (248)796-4812 or by email at <u>lschultz@cityofsouthfield.com</u> of MIC.

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Division 1 - General

1.01 Work Included

This work shall consist of furnishing and installing water main, appurtenances and water services. All work shall be performed in accordance with these Southfield Construction Specifications, current City of Southfield Standard Water Main Details, and as shown on the plans.

1.02 Work Within City Right-of-Way

Water main work completed within public rights-of-way shall be done so in a clean and professional manner. Work within the roadway and pedestrian pathways must be signed, barricaded, and closed per current MDOT Maintaining Traffic Typicals. Clean-up and safety checks shall be performed at the end of each working day. Clean-up and safety standards shall be the responsibility of the contractor and include, but not be limited to:

- Removing and hauling all excess fill, broken concrete, miscellaneous debris, and other material generated by the project out of the Right-of-Way.
- Obtaining rough grade in all lawn areas in preparation for lawn restoration.
- Backfilling and barricading all open excavations.
- Watering street pavement and sweeping with a mechanical pick-up type street cleaner approved by the City's Representative.
- Sweeping public sidewalks.

Division 2 - Removals

2.01 Abandoning Water Main

This work shall consist of abandoning water mains within the project by pressure filling them with cement grout as shown on the plans or as directed by the City's Representative.

The Contractor shall neither disturb nor cut into any existing water main in service. Once pressure and bacteriological testing of new water main and appurtenances has passed, the connection of the new water main to the existing has been made, and any services have transferred, the existing water mains to be abandoned shall be cut, drained, capped, and grouted as noted on the plans or as directed by the City's Representative. This may include the removal of water main and thrust blocks, and the cutting and capping of water mains. The Contractor shall pump grout into the water main to be abandoned until all voids have been removed. The maximum length of pipe that can be grouted at once is 500 feet unless approved by the City's Representative. It is anticipated that the Contractor may need to install temporary pipe connections or caps, to install the grout and remove the air from the water main as it is being filled. Do not place grout on materials that are below 40°F. Provide protection to maintain a temperature of 45°F or higher during curing. Once the water main has been filled with grout, the excavation shall be backfilled with MDOT Class II sand backfill compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. The material shall be placed in maximum 12-inch lifts or as directed by the City's Representative.

2.02 Removing Water Main

This work shall consist of removing existing water main where shown on the plans.

The Contractor shall remove the water main, including thrust block, and appurtenances that are located within the required excavation. The Contractor shall backfill the resulting excavation with MDOT Class II sand, compacted to at least 95% of its maximum unit weight as determined by

ASTM D1557. The material shall be placed in maximum 12-inch lifts or as directed by the City's Representative.

A contractor may encounter asbestos concrete water main in service within the City's system. According to classification guidelines set forth in the National Emission Standards for Hazardous Air Pollutants (NESHAP), the asbestos-containing concrete water main is classified as a non-friable Category II material, as defined in 40 CFR Part 61.

The non-friable Category II concrete water main is likely to become friable during excavation and removal activities and therefore shall be removed by a licensed asbestos abatement contractor or Contractor's own properly trained personnel, using special abatement techniques and engineering controls as defined in Subsection 7 of Section g of Part 602 of Section 24 of 1974 PA 154. Standard work practices providing these techniques and controls include:

The quantity of asbestos-containing concrete water main will exceed the Michigan Department of Licensing and Regulatory Affairs (LARA) notification limits (10 linear feet/15 square feet); therefore, removal activities for the concrete water main will require a 10-calendar day notification to LARA:

- The material shall be thoroughly wetted prior to and during its removal.
- The material shall be removed intact unless the Contractor demonstrates that intact removal is not possible.
- Cutting, abrading, or breaking of the material shall be prohibited unless the Contractor can demonstrate that such methods are less likely to result in an asbestos release.
- The material shall be immediately wrapped in plastic or kept wetted until transferred to a closed receptacle no later than the end of the work shift; and
- All wastes generated from the material removal shall be transported to a Type II landfill for proper disposal.

According to part VI of subsection 7 of Section g of Part 602 of Section 24 of 1974 PA 154, alternative work practices shall be preceded by:

- Contractor shall demonstrate by data representing employee exposure during the use of such method under conditions which closely resemble the conditions under which the method is to be used, that employee exposure will not exceed permissible exposure limits (PELs) under any anticipated circumstances.
- A competent person shall evaluate the work area, the project work practices and the engineering controls, and shall certify in writing that the different or modified controls are adequate to reduce direct and indirect employee exposure to below PELs under all expected conditions of use and that the method meets the requirements of the standard.

2.03 Gate Valve and Well Removal and Abandonment

This work shall consist of removing or abandoning gate well structures from existing water mains where shown on the plans or as directed by the City's Representative.

The Contractor shall remove the entire structure, including, but not limited to the casting and cover, portions of water main and valve that is located within the required excavation. The Contractor shall dispose of the valve, frame, and casting. The Contractor shall backfill the resulting excavation with MDOT Class II sand, compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. The material shall be placed in maximum 12-inch lifts or as directed by the City's Representative.

For gate well abandonment, the Contractor shall carefully demolish and remove the structure to an elevation that is 3 feet below the existing or proposed finished grade, whichever is lower in elevation. The removal shall include the casting, cover, and portions of the gate well structure. The valve shall be left in place, in the closed position, with the operating nut removed or stem cut. The Contractor shall be responsible for disposal of any leftover equipment.

Once demolition work has been completed, the existing main shall be capped as close to the valves as possible and the structure shall be cleaned of water, soil, and debris if present. The remaining void shall be filled with cement grout to the top of the structure or as directed by the City's Representative.

Once the cement grout has sufficiently cured to support traffic loading, the remaining excavation shall be filled with MDOT Class II sand and compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. The material shall be placed in maximum 12-inch lifts or as directed by the City's Representative.

2.04 Hydrant Removal

This work shall consist of removing fire hydrants that are connected to existing water mains where shown on the plans or as directed by the City's Representative.

The Contractor shall remove the hydrant, including thrust block and portions of water main and service valve and box that are located within the required excavation. The Contractor shall dispose of the hydrant. The Contractor shall backfill the resulting excavation with MDOT Class II sand, compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. The material shall be placed in maximum 12-inch lifts or as directed by the City's Representative.

Division 3 - Construction

3.01 Alignment and Grade

The water mains shall be laid and maintained to the required lines and grades with fittings, valves, and hydrants at the required locations. Valves and hydrants shall be set plumb.

A minimum alignment separation of 10 feet must be maintained between storm and sanitary sewer and all proposed water mains. If this is not feasible, and with approval from the City Engineer, the water main shall be installed with at least 1.5-foot vertical and horizontal clearance from all sewers and shall be installed within a separate trench.

If no cover or grade is shown on the plans, the top of the pipe shall be placed 5.5 feet below the final surface of the ground or pavement, except where abrupt changes occurring the surface of the ground.

Water main installation shall maintain 1.5-foot minimum vertical clearance when crossing existing sanitary and storm lines. Separation between water main and all other utilities shall have adequate separation to allow for rehabilitation, maintenance, and repair of the main. This separation shall be at the discretion of the City Engineer.

3.02 Responsibility for Materials

All materials delivered to the project are subject to inspections and tests by the City's Representative. All material rejected shall be removed by the Contractor within 14 calendar days after receiving notifications of rejection. Test certificates in accordance with the current requirements of these Construction Standards shall be provided upon request of the City's Representative. The Contractor shall be responsible for all material furnished by them and shall replace all such material found to be defective.

The Contractor shall be responsible for the safe storage of all materials furnished by or to them and intended for this work. Interior of pipe and other materials shall be kept free from dirt and foreign matter. Pipes shall be stacked in safe rows / levels and properly secured against collapse. Height of stacking shall not exceed 4 feet. Plastic materials shall be covered by an opaque material to prevent UV damage. Valves and hydrants shall be stored so that they will drain and be protected from damage by freezing. The Contractor shall not store or place materials in City right-of-way or property without obtaining permission from the City's Representative.

3.03 Handling Materials

Pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded to avoid shock or damage either to the castings, or to the pipe, or pipe coating, or pipe lining. Under no circumstances shall such material be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground. If any part of the lining or coating is damaged, the repairs shall be made by the Contractor at his expense in a manner satisfactory to the City's Representative.

3.04 Backfilling

When backfilling water main or water main appurtenances, the Contractor shall protect backfill, trench, and pipe material against freezing or shall thaw out the material before using. Backfill shall be in accordance with the most current Michigan Department of Transportation Standard Plan Series R-83 for Trench Detail F or G, as applicable. Upon installing the water main or appurtenances and making the necessary connections, the Contractor shall backfill the excavation with MDOT Class II sand, compacted to at least 95% of its maximum unit weight. The material shall be placed in maximum 12-inch lifts or as directed by the City's Representative.

3.05 Open Cut Installation

This work shall consist of installing water main via open cut construction.

Pipe shall be carefully laid to line and grade and shall have bearing over its entire length except at joints where the joint hole shall be of such size as to give adequate room for working. Pipe installation shall be in accordance with the manufacturer's recommendation. PVC or ductile iron may be used in open cut applications, see materials section of these specifications and for more information.

Trench bottom preparation and backfilling shall be as follows: The trench width shall be a minimum 2 feet in width or as called for in the City of Southfield Water Main standard details. Trench depths shall be as shown on the plans and shall provide not less than 5.5 feet of cover from top of water main to final surface grade above such mains. The bottom of trench in rock or cohesive soil shall be excavated neatly to the required grade. The trench bottom shall be filled with approved granular material for bedding and shall be thoroughly compacted by tamping before the pipe is laid. The bedding shall be dug out at each bell end of the pipe to conform to the shape of the bell. Blocking under pipe is strictly prohibited.

All pipes and castings shall be unloaded and distributed along the line of work in such manner and with such care as will effectually avoid damage to any pipe or fitting. Dropping pipe or fittings directly from delivery equipment will not be permitted. Pipe must be handled per the manufacturer's direction. Care must also be taken to prevent abrasion of the pipe coating, especially on the inside of the pipe. When the pipe is damaged more than 10% of the pipe thickness and at the City's Representative's discretion, the pipe shall not be used.

Installation of water main shall be made in accordance with the published installation guide of the pipe manufacturer except as otherwise specified herein. Whenever instructions given by the manufacturer are at variance with the provisions specified herein, the open cut installation standards provided herein shall govern. Proper tools, including pipe pullers, special cutters, spacing yokes, machining tools, test caps, ring feeler gauges, etc. shall be provided at the site of the work for installation of the pipe. Immediately before laying each section of pipe or fitting, it shall be thoroughly cleaned of all debris, dirt, or other accumulated foreign material. It shall be inspected for damage to the coating or pipe material and repairs shall be made where required. If deemed irreparable by the City's Representative, then it shall be removed from the job site. Care shall be taken to keep the interior of previously laid pipe clean and free from dirt and other foreign material. Bulkheads or other means shall be used at the open end of the previously laid pipe for this purpose.

After a length of pipe is placed in the trench, the spigot shall be centered in the bell of the adjacent pipe, the pipe shoved into proper position in the collar or bell and brought into true alignment. The pipe shall then be secured with earth that is carefully tamped under and on each side of the pipe.

Proper support of all pipes, including the full length of the barrel, shall be made by constructing of specified bedding as shown on the City of Southfield Water Main Standard Details or as detailed herein. Special care shall be taken to avoid excessively loading the bell section of the bell and spigot pipe. Each pipe shall be pushed firmly against the previous section of laid pipe and carefully aligned. Pipe is not to deflect through the body of the pipe and may only deflect with the manufacturer's tolerances at each bell joint. Bending or putting the pipe in torsion or tension is strictly forbidden.

Ledge rocks and large stones shall be removed from the trench to provide a clearance of at least 6 inches below and around all parts of the pipe, valves, or fittings. A clearance of at least 9 inches below and on each side of the pipe shall be provided for 12-inch diameter pipe and larger. For pipe with a diameter less than 12 inches, the required clearance shall be 6 inches. Temporary support blocks shall be removed prior to backfilling water main.

3.06 Directional Drilling

The work specified in this Section documents the approved construction methods and procedures for Directional Boring, also commonly called Horizontal Directional Drilling (HDD). Fusible or restrained joint PVC as well as ductile iron may be used in HDD applications, see materials section of these specifications for more information.

Site Requirements:

Excavation for entry, recovery pits, slurry sump pits, or any other excavation shall be carried out as specified in the current Michigan Department of Transportation (MDOT) Standard Specifications for Construction. Sump areas are required to contain drilling fluids. Pits proposed by the contractor shall be approved by the City's representative prior to excavation.

After completing installation of the product, the work site shall be restored. The work site shall be cleaned of all excess slurry left on the ground. Removal by Vactor truck or other approved methods and final disposition of excess slurry or spoils as the product is introduced, shall be the responsibility of the Contractor.

The Contractor shall be responsible for contacting MISS DIG to arrange for staking of all existing underground utilities that are in the vicinity of the proposed horizontal directionally drilled hole.

The Contractor shall be responsible for potholing and locating existing utilities and leads, public and private that cross the bore path. The Contractor shall adjust the bore path based on the depth and location of existing utilities and leads.

Quality Control:

A representative of the Contractor must be always in control. The representative must have a thorough knowledge of the equipment and the procedures to be performed and be present at the job site during the installation.

The City's Representative must be notified at least 72 hours in advance of starting work. The installation shall not begin until the City's Representative is present at the job site and agrees that proper preparations have been made.

Specific Requirements:

Pipe Fusing: Where applicable, fusion technicians shall be qualified by the pipe supplier to install fusible polyvinylchloride pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

When there is any indication a pipe has sustained damage and may leak, the work is to be stopped and the damage investigated. The City's Representative may require a pressure test. The testing must be performed per the standards set forth herein.

Locating and Tracking:

The Contractor shall describe the method of locating and tracking the drill head during the pilot bore. The intended tracking system such as walkover, wire line, and wire line with surface grid verification (i.e., True-Trac) must be approved by the City's Representative. The locating and tracking system shall be capable of ensuring that the proposed pipe is installed as intended. Before commencement of a directional drilling operation, proper calibration of the equipment shall be undertaken, if required. If an area of radio signal interference is expected to exceed 5 feet, the City's Representative may specify the use of a suitable tracking system. The locating and tracking system shall provide information on:

- Clock and pitch
- Depth
- Transmitter temperature
- Battery status
- Position (x,y)
- Azimuth, where direct overhead readings (walkover) are not possible (such as underwater or major roadway).
- Alignment readings or pilot points shall be taken and recorded every 5 feet.

All facilities shall be installed in such a way that their location can be readily determined by electronic designation after installation. For nonconductive installations, this shall be accomplished by attachment of a continuous conductive material, either externally, internally, or integrally with the product. Either a copper wire line or a coated conductive tape for this material may be used. Any break in the conductor must be connected by electrical clamp of brass or solder and coated with a rubber or plastic insulator to maintain the integrity of the connection from corrosion.

Drilling Fluids:

The Contractor shall identify the source of fresh water for mixing the drilling mud. Approvals and permits are required for such sources as streams, rivers, ponds, or fire hydrants. Water shall be clean and fresh, with a pH of 8.5-10. Any water source other than potable water may require a pH test.

Monitoring of the drilling fluids such as the pumping rate, pressures, viscosity, and density is required during the pilot bore, back reaming, and pipe installation stages, to ensure adequate removal of soil cuttings and the stability of the borehole. Relief holes can be used as necessary to relieve excess pressure down hole. A pull-back rate is to be determined to maximize the removal of soil cuttings without building excess down-hole pressure and minimizing heaving. Excess drilling fluids shall be contained at entry and exit points until they are recycled or removed from the site. Entry and exit pits shall be of sufficient size to contain the expected return of drilling fluids and soil cuttings.

The Contractor shall ensure that all drilling fluids are disposed of or recycled in a manner acceptable to the appropriate local, state, or federal regulatory agencies. Drying pits within the Project Site are not permitted. Drilling fluids shall not be disposed of on site. When drilling in suspected contaminated ground, the drilling fluid shall be tested for contamination and disposed of appropriately. Any excess material shall be removed upon completion of the bore.

Restoration of any existing structures that are damaged due to heaving, settlement, escaping drilling fluid, or the directional drilling operation is the responsibility of the Contractor. Any pavement heaving or settlement damage requires restoration/replacement of the affected pavement areas.

Maximum Back-Ream Hole Diameter		
Nominal Inside Pipe Diameter (Inches)	Back-Ream Hole Diameter (Inches)	
2	4	
3	6	
4	8	
6	10	
8	12	
10	14	
12 and greater	Maximum Product OD plus 6-inches	

Back ream holes shall be in accordance with the following table:

Equipment Requirements:

The Contractor shall ensure that appropriate equipment is provided to facilitate the installation as follows:

HDD Equipment				
System	Pipe (1)	Bore Length	Torque	Thrust/Pullback
Description	Diameter (in.)	(feet)	(ft./lbs.)	(lbs.)
Maxi-HDD	18 & greater	1,000+	10,000+	70,000+
Midi-HDD	Up to 16	Up to 1,000	1,900 to	20,001 to 69,000
			9,999	
Mini-HDD	Up to 6	Up to 600	Up to1,899	Up to 20,000

Equipment shall be matched to the size of pipe being installed. Installations differing from the above chart must be approved by the City's Representative. The Contractor is responsible for ensuring that the drill rod can meet the bend radius required for the proposed installation.

Multiple pipe or conduit installations shall not exceed the total outside pipe diameters stated above.

Documentation Requirements:

The Contractor shall furnish a Bore Path Report to the City's Representative within 14 days after completion of each bore path. A completed record plan shall be made for directional boring work and shall be finalized after the Bore Path Record has been delivered to the City's Representative. The report shall contain:

- Location of project and project number including the permit number when assigned.
- Name of person collecting data, including the title, position, and company name.
- Investigation site location (contract plans station number or reference to a permanent structure within the project right-of-way).
- Identification of the detection method used.
- Record Plan drawings showing roadway plan and profile, cross section, boring location, and subsurface conditions as defined in Bore Path Drawings below. Plan elevations shown shall be referenced to the NAVD88 datum. These drawings shall be done to the same scale as the contract plans. Submittal of electronic plans data in lieu of hard-copy plans may be approved by the City's Representative if compatible with the Owner's software.

Water main has specific radius tolerances that must be followed during installation and in final placement. Elevation and slope in 10-foot increments will be provided as part of the boring report to ensure the final placement is not at radii more the pipe manufacturer recommends or authorizes.

Boring Path Drawings shall be dimensionally correct copies of the contract plans. Notes shall be included on each drawing stating the final bore path diameter, facility diameter, drilling fluid composition, composition of any other materials used to fill the annular void between the bore path and the facility, as well as the facility placed out of service. If the facility is a casing, this shall be noted, as well as the size and type of carrier pipes to be placed within the casing as part of the contract work. The drawings shall be produced as follows:

- The contract plan view shall show the center-line location of each facility that is installed to an accuracy within 1 inch.
- As directed by the City's Representative, a profile drawing for each bore path shall be provided. They shall show the existing ground or pavement surface as well as the crown elevation of each facility installed. Bore path profile information shall be referenced to the project plan stationing.
- If an obstruction is encountered during installation, which prevents installation of the pipe in accordance with this specification, the pipe may be left in place and abandoned with cement grout at the discretion of the City's Representative. A new installation procedure and revised plans must be submitted to and approved by the City's Representative before work can resume. If a bore path is abandoned without installing a facility, the drawings shall show the abandoned bore path along with the final bore path. The abandoned bore path shall be noted as "Abandoned Bore Path." They shall also show the location of the drill head and any drill items not removed from the bore path. If conditions warrant removal of the materials installed in the abandoned bore path, as determined by the City's Representative, the cost and responsibility shall be borne by the Contractor.
- On all drawings, include the crown elevation, diameter, and material type of all utilities encountered and physically observed during the subsoil investigation. For all other obstructions encountered during a subsoil investigation or the installation, show the type of

material, horizontal and vertical location, top elevation, and lowest elevation observed, and note if the obstruction continues below the lowest point observed.

3.07 Pipe Bursting

General:

The work specified in this Section documents the approved construction methods, procedures, and materials for an approved pipe bursting method installation by the pre-chlorination method. All work shall be completed in accordance with the City of Southfield Water Main Standards, Michigan Department of Environment, Great Lakes, and Energy (EGLE) Standards and requirements, or as specified herein. Fusible PVC or Ductile Iron may be used in Pipe Bursting applications, see materials section of these specifications for more information.

Qualifications:

The Contractor shall furnish all labor, materials and equipment required to construct water main by pipe bursting method, and all necessary appurtenant work as herein specified.

No water mains shall be accepted until the water mains have passed the system acceptance tests as herein specified and described. The pre-chlorination method for water main to be installed by pipe bursting method shall follow the requirements of this Special Provision, as well as any other requirements of the EGLE that may be required as part of the EGLE PA 399 Permit approval.

There are strict requirements and timelines as part of the pipe bursting procedure. Acceptable time frame for pipe bursting installation is 7:00 am - 5:00 pm, Monday through Friday only, no exceptions. Water service must be restored by 5:00 pm daily to all residents/businesses.

The Contractor shall be trained by the respective manufacturer of the pipe bursting equipment in the use of that machinery. The Contractor shall provide verification from the manufacturer that the Contractor has been trained and is proficient in the use of the equipment. Only the Contractor 's employees trained and verified by the manufacturer shall be allowed to operate the equipment during the project.

The pipe bursting Contractor shall have actively engaged in the installation of pipeline using pipe bursting for a minimum of 5 years with at least 20,000 feet of pipe sized 8-inch diameter or greater installed. Contractor shall submit proof of projects and references. Information submittal shall include, but not be limited to, date and duration of work, location, pipe information (i.e., length, diameter, depth of installation, pipe material, etc.), project Owner information (i.e., name, address, telephone number, contact person, etc.), and the contents handled by the pipeline (water, wastewater, conduit, gas, etc.).

Contractor must submit references for the above projects.

Documentation Requirements:

Shop Drawings, catalog data and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of pipe and fittings. Also, the manufacturer's recommendation for handling, storage and repair of pipe and fittings if damaged.

Detailed Drawings and written descriptions of the entire pipe bursting procedure to install pipe, including pit locations and sizes, pit construction and shoring, bursting tool sizes and capacities, traffic control, adjacent utilities, and dewatering. This written description shall also include the complete pre-chlorination procedure to be utilized prior to installing pipe by the pipe bursting method and shall be approved by City's Representative prior to any pipe bursting operation commencing on this project by the Contractor.

Certification of workmen trained for installing pipe by pipe bursting method by an authorized representative of the equipment manufacturer.

If the Contractor determines that modification to the method and equipment as stated in the original submittal is necessary during construction, the Contractor shall submit a plan describing such modifications, including the reasons for the modification.

Fusion technician requirements and fusion joint data shall be submitted as required per the Specification for Directional Drilling.

Methods of construction, reconnection, and restoration of existing service laterals. Contingency plans for the following potential conditions:

- Loss of water service to residents/businesses as part of the pre-chlorination and pipe bursting installation procedure. In no case shall water service be absent to residents/businesses after 5:00 pm of any calendar day when pipe bursting is allowed. Contractor shall be responsible for providing potable water to all residents/businesses after 5:00 pm at Contractor cost, to the satisfaction of the City's Representative. If acceptable potable water service cannot be provided to the resident, the Contractor shall provide at Contractor expense, alternate living quarters to the resident that are acceptable to the City. Any loss of potable water service to businesses shall be subject to liquidated damages based on actual damages to business.
- Unforeseen obstructions causing burst stoppage, such as unanticipated changes in host pipe material, repair section, concrete encasement (or cradles), buried or abandoned manholes, or changes in direction not depicted on maps/plans provided.
- Any surface heaving or settlement caused by pipe bursting operation.
- Damage to existing service connections and to the replacement pipeline's structural integrity and methods of repair.
- Damage to other existing utilities.
- Loss and return to line and grade.

Emergency response plan including contact information for utility owners.

Safety Plan as it related to pipe bursting operation (unless submitted as part of an overall safety plan for entire project).

Contractor's 24-hour emergency contact person.

Testing Procedures:

Hydrostatic pressure testing shall be conducted in conformance with the Specification for Directional Drilling. Hydrostatic pressure testing shall be completed on the surface prior to the installation of the new pipe by pipe bursting procedure.

Initial Chlorination Procedure and Bacteriological Testing shall be conducted in conformance with the Specification for Directional Drilling.

Once testing noted above have been satisfactorily completed and accepted by the City's Representative, install the section of pipe-by-pipe bursting procedure. After the pipe has been installed by the pipe bursting procedure, the pipe shall be re-chlorinated using a slug method where 300 mg/l of chlorine will be slowly moved through the new pipe. After the chlorine solution has been removed from the pipe, another bacteriological sample must be collected and tested at a certified laboratory.

Once the new section of installed pipe is connected to an adjacent water main already in service (on one side only), and the water services for houses/businesses are connected, precautionary boil water advisories shall be issued to all residents/businesses in the affected area. Each of the boil water advisories must be hand delivered, and all reasonable efforts to contact each house/building owner must be performed. The boil water advisory must remain in effect until the result of the additional bacteriological sample is reported as non-detected from a certified laboratory.

Prior to the time that any boil water advisory is rescinded, connection of the water main on only one side of the newly installed section can be completed and opened (no dual feed). A final connection on the other side of the newly installed water main can only be connected and opened once the additional bacteriological sample is reported as non-detected from a certified laboratory.

Equipment:

The pipe bursting tool shall be designed and manufactured to force its way through existing pipe materials by fragmenting the pipe and compressing the old pipe sections into the surrounding soil as it progresses. The bursting unit shall be pneumatic with rear mounted expander and shall generate sufficient force to burst and compact the existing pipeline fragments into the surrounding soil. Manufacturer's recommendations shall be followed for what size tool should be used to allow insertion of the proposed pipe and minimize surcharging or settlement of existing soils.

Launching and Receiving Pits:

The location and number of launching and receiving pits shall be proposed by the Contractor and approved by the City's Representative prior to excavation. The pits shall be located such that their number shall be minimized, and the footage of the new pipe installed in a single pull shall be maximized.

Any damage to adjacent properties that are not part of this work shall be repaired and restored to its original condition at the Contractor's expense.

Where it is necessary to excavate to an additional depth for the placement and use of a fusion machine, or any other cause, the Contractor shall furnish and install trench shoring or bracing in compliance with Michigan Occupational Safety and Health Administration (MIOSHA) standards.

Pipe Insertion:

All buried utilities adjacent to the pipe operation shall be reviewed, and where necessary be excavated to relieve transient loading during the insertion operation. If any utilities are within 24-inch of the pipe to be burst, the Contractor shall excavate a pit at the location to check clearance. If adequate clearance does not exist between the existing water line and the subject utility, the Contractor shall employ substitute means to rehabilitate the existing water line or relocate conflicting utility as necessary.

For utilities crossing within 6 inches of the existing water line to be burst, soil shall be excavated and removed to relieve loading during the bursting operation.

Any concrete encasements shall be excavated and fractured prior to the bursting operation to allow the steady and free passage of the pipe bursting head. All in-line valves and fittings shall be removed prior to the bursting operation.

The new pipe shall be inserted immediately behind the bursting head in accordance with the manufacturer's recommended procedures. The bursting tool shall be specifically designed and manufactured for the type of insertion process being used. It shall be utilized to guide and assist the

bursting head during the operation. A pushing machine may be utilized to aid pipe insertion from the rear.

Monitoring of Settlement and Heaving:

The Contractor shall monitor his pipe bursting operations to avoid/minimize road impacts such as heaving or settlement. Costs for repair or replacement of existing structures or pavement damaged resulting from the pipe bursting operation will the responsibility of the Contractor. This will include pavement heaving or settlement damage that impacts drainage.

3.08 Water Main Jacking and Boring

This work shall consist of installing a water main within a carrier pipe, via jacking and boring said carrier pipe. Water main shall be jacked and bored when required by the entity having jurisdiction over the right-of-way the main is to be placed in.

Excavation:

During excavation by boring, the opening shall not exceed the maximum diameter of the casing pipe, including protective coating, as required for jacking the casing pipe through the hole. The Contractor shall be held responsible for any settlement of street surfaces, railroad tracks, or damage to pavement, sidewalk, curbing, or public utilities caused by boring activities and shall repair any damage resulting from their operations.

Drainage:

The Contractor shall furnish, install, and maintain all facilities for collecting, conveying, and disposing of water in borings and shafts until the completion of the work. The Contractor shall always have on hand sufficient machinery for all emergencies that are likely to arise on work of this character, and such machinery shall be kept in good working order. The pumping and power supply to the pumps shall be under the direct charge of competent mechanics who are available on a 24-hour basis until their operation can be safely halted as deemed acceptable by the City's Representative.

Effective and continuous control of water during the casing pipe installation will be required, and the Contractor shall maintain the ground water table to a level 2 feet below the casing invert.

Boring and Jacking Pits:

The Contractor shall construct, maintain, and refill all boring or jacking pits where required. The Contractor shall also remove other temporary construction materials and equipment as required to carry out the work specified.

The Contractor shall provide suitable access ladders in accordance with MIOSHA requirements.

All fences and appurtenant temporary structures shall be of neat appearance and shall be properly maintained until completion of the work.

Power and Lighting:

All power machinery and tools used in shafts shall be operated by electricity or compressed air. No electric voltage more than 440 volts will be permitted. Transformers, if used, shall be mounted on platforms or in an approved enclosure. The use of gasoline in shafts is prohibited.

Jacking Pipe:

Each jacking/boring pit shall be completely sheeted to provide proper support for the banks and adequate support for reaction blocks. The shaft shall be constructed long enough to provide room for the jacking head frame, reaction blocks and two sections of pipe. The width shall be sufficient to

allow ample working room. Backstops or reaction blocks shall be placed absolutely perpendicular in all directions to the axis of the pipe and the guide timbers shall be carefully installed to the proper line and grade.

Jacking pressure must be applied by a pushing frame at right angles to the line to avoid breaking the pipe or forcing it out of alignment. The first section of pipe shall be equipped with a steel cutting shield placed over the upper one-third of its circumference and securely bolted to the pipe. Excavation ahead of pipe shall be done by boring from the inside the pipe.

All work shall be performed from jacking/boring pits adequately sheeted to prevent damage to the roadway. Unless otherwise required by the agency having control of the right-of-way, the minimum distance between the edge of pavement and the jacking/boring pit shall be 10 feet. The minimum distance from the edge of pavement to the trench and jacking/boring pipe and for dual highway and interstate routes shall be 30 feet. For a curb or guard rail section, railway track or two-lane highway, the minimum distance will vary from the shoulder point to the toe of slope as shown on the plans or as directed by the City's Representative.

When installing pipe under railway tracks, the Contractor shall submit sheeting and bracing plans of the jacking/boring pit to the City's Representative for approval by the railroad company. The equipment should be in good condition and capable of providing a minimum thrust of 198,000 lbs.

Depending on the size and length of casing, the jacking equipment will be required to develop a minimum of 49,600 to 97,400 psi of torque. The installation procedure must be such that the casing pipe is placed concurrently with the removal of the soil. The outside diameter of the lead auger section must be not less than 0.5 inch smaller in diameter than the casing pipe inside diameter.

The jacking operation shall be continuous insofar as possible to prevent seizure of the pipe. However, if the operation is discontinued for any time, the excavation shall be safely supported.

The casing shall be installed for the full distance between jacking pits.

Installation of casing pipe by the jetting method will not be permitted.

Where shown on the drawings, steel casing pipe shall be provided with cathodic protection as required by the facility owner.

Placing Carrier Pipe:

Pipes shall be placed in casing pipe in the locations shown on the plans. Carrier pipe shall be fusible or restrained joint PVC or restrained joint DI. DI water main shall be encased in polyethylene. Under this work, the Contractor shall furnish and attach skids to the pipe, place the carrier pipe, fill the annular space between the casing pipe and the carrier pipe (where required), place bulkheads, and complete all backfilling. The skid length shall extend to 12 inches from the end of the casing pipe to allow for bulkheading of the pipe.

The skids shall be placed to prevent the carrier pipe from rolling over or shifting. In addition, the four skids will prevent a plastic carrier pipe from floating inside the casing pipe in the event that groundwater seeps into the casing pipe. Both ends of the casing pipe shall be bulk headed with a minimum 8-inch-thick solid masonry wall. A 0.5-inch fiberboard cushion shall be provided between the masonry and carrier pipe.

Grouting of Exterior Voids:

When excavating, voids outside of the pipe and disturbances of the surrounding material shall be kept to a minimum. All void spaces between the casing pipe and the ground shall be filled by pressure grouting.

Grouting pressure shall be sufficiently high to fill all voids. Necessary grouting holes shall be installed as required to insure complete filling of void spaces. A grout pipe at least 2-inches in diameter with a control valve attached thereto shall be inserted and securely caulked to the grout hole or a half coupling welded to the casing pipe. Couplings shall be fitted with a threaded cast iron plug.

Grout shall consist of a mixture of Portland cement that is thoroughly mixed with sand and sufficient water to permit steady flow through the grout pipes. The mix shall be two parts sand to one part cement, but the proportions may be varied at the City's Representative order to the extent of enriching the mix to neat cement. If necessary to speed up the setting of grout, approved admixtures of quick-setting cement shall be used as directed by the City's Representative.

Following satisfactory pipe grouting operations, the grout pipe shall be removed from the grout hole after the grout has taken its initial set. The space occupied by the grout pipe shall be filled with stiff mortar and troweled smooth at the inner face.

3.09 Water Main Lining

This work shall include pertinent specifications and installation methods for the installation of cured in place pipe lining. Installation shall be performed in accordance with the following reference standards:

- ASTM F1743: Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-In-Place Thermosetting Resin Pipe (CIPP).
- ASTM F1216: Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
- AWWA Manual M28
- NSF/ANSI Standard 61 Drinking Water System Components.

Construction Methods:

The work shall include several steps to ensure proper installation of the CIPP liner. This shall include the following:

- Cleaning: The method of cleaning utilized shall remove all tuberculation, deposits, and loose or deteriorated remains of any original coating and other foreign materials from inside the pipe.
 - Settling tanks of a suitable size and capacity shall be used to remove a minimum of 85% of the suspended iron oxide solids from the discharge water before it is disposed of. Discharge of water must be to a sanitary sewer, in accordance with the requirements of the local environmental authority. Prior to disposing of any water or debris generated from the cleaning process into the sanitary sewer, the Contractor must obtain approval from the Owner. The surplus water will be disposed of in an approved manner and the settled solids should be disposed of at an approved waste disposal location. Under no circumstances will the Contractor be permitted to discharge any cleaning water into the storm sewer.
 - The Contractor shall clean the water main by power boring using a suitable rackfeed borer. Boring shall be against a full flow of water and not against a clean capped off water main. The interior of the pipe shall be cleaned to a smooth, dry surface.

- Prior to the structural lining, the Contractor shall insert a suitable power/plunger into the water main to ensure free passage of the structural liner and complete removal of residual debris and water. If the method involves propelling pigs or swabs with compressed air the Contractor shall ensure that filters are fitted to the compressor to remove oil and other containments and that they are regularly checked and maintained in working order. Swabs shall be passed through the pipe until the recovered swab is clean and dry.
- Existing Water Service Tap: Prior to the structural lining, the Contractor shall by way of mechanical robot plug each water service (ranging in sizes from ½-inch to 2-inch) using an approved "plug" system. The service plugs used in this process shall be able to withstand temperatures of up to a minimum of 149 degrees Centigrade or 300 degrees Fahrenheit and must be NSF 61 approved for potable water systems.
- Field Measurements:
 - o Existing Pipeline:
 - The internal pipe diameter should be obtained at various locations to determine the internal diameter variance.
 - Measurements should be determined prior to fabrication of the proposed liner.

Water Main Taps:

Where called for on the plans, the water service connections shall be tapped from inside of the structurally lined pipe, using a mechanical robot equipped with a camera and activated by an operator using a remote control and television unit. The robot shall be equipped with a drilling tool that allows the operator to drill a hole in the liner at the precise location of the connection. After opening the connections, the rehabilitated pipe is flushed clean and restored to service.

The Contractor will be fully responsible to locate and successfully tap the existing service connection, without damaging the lining. Any damage to the service connection or the lining caused by the reinstatement process will require immediate corrective action at the Contractor's expense.

If the Contractor is unable to tap, reconnect a service connection from the inside, a suitable excavation will be required to access the water main tap and to disconnect the existing copper pipe and reconnect the copper piping with approved fittings. If the Contractor is unable to effectively reconnect the service connection, the Contractor shall be required to re-tap the water main using an approved service saddle.

Final Acceptance: Prior to final acceptance, the Contactor shall perform pressure testing and chlorination in accordance with AWWA requirements. A CCTV inspection of the completed work is required.

3.10 Joints, Fittings, Bends, etc.

Joints:

Joints shall be push-on type. Mechanical Joints will be allowed for special applications subject to the approval of the City's Representative. Sealing gaskets, retainer glands and lubricants for joints shall meet the pipe manufacturer's specifications.

All ductile iron pipe shall be furnished in 18-foot or 20-foot lengths, unless otherwise specified. Joints shall be push-on type conforming to AWWA-C111 (ANSI A21.11). Mechanical or flanged joints will be allowed for special applications subject to the approval of the City's Representative.

Sealing gaskets, retainer glands and lubricants for joints shall meet the pipe manufacturer's specifications.

Fittings:

All PVC pipe deflections shall be made using ductile iron fittings. PVC pipe shall not be placed or connected by "breaking" or "opening" joints. Pipe deflections are allowed when within the manufacturer's parameters. Physically bending the pipe is not allowed either. Each individual length of PVC pipe shall be placed in a straight line.

Extreme care must be used when attaching fittings. Mechanical joints to PVC pipe must distribute the loading evenly to avoid damage, potential breaks, or weak points in the pipe.

All bolts on mechanical fittings shall be domestic origin high strength, low alloy COR-BLUE steel bolts or approved equal. Bolts shall meet the current provisions of ANSI A21.11-90 (AWWA C111). Bolt manufacturer's certificate of compliance must accompany each shipment.

3.11 Water Main Conflicts

The Contractor shall install all pipe materials required for the contract according to AWWA Standards.

The time during which existing mains are out of service must be kept to a minimum. It is anticipated that the connections may have to be made at night or on a Sunday or holiday. The abandonment of existing water mains and the incorporation of new water mains into the water system shall be without excessive interference with the water supply. Scheduling of connections is to be approved by the City's Representative and/or the Department of Public Works at (248)796-4850.

The Contractor shall protect backfill, trench, and pipe material against freezing or shall thaw out the material before using. Backfill shall be in accordance with the most current Michigan Department of Transportation Standard Plan R-83 Series Trench Detail F or G, as applicable. The excavation shall be backfilled with MDOT Class II sand backfill compacted to at least 95% of its maximum unit weight as determined by ASTM D1557.

The Contractor shall install, and later remove, all temporary bracing as required for work done on new or existing water mains to prevent movement or damage to these water mains. During the operation of backfilling of an excavation that is sheeted and braced, earth supports shall be removed in such a manner as to prevent earth banks or adjacent streets to give way. Sheeting and bracing may be left in place during backfilling and pulled when backfilling is completed. Sheeting and bracing impossible to remove may be left in place, provided it is cut off 5 feet below ground surface.

Disinfection. - Calcium hypochlorite shall be of the high-test type, powder form, and shall have from 65 to 70 percent available chlorine. The hypochlorite solution shall be made into a paste.

The interior of the fittings and existing pipe ends near the cut shall be brushed with the paste. The fittings shall then be installed and the water main flushed through the new pipe installation to the nearest existing hydrant.

During the flushing each joint shall be carefully examined. Any joint showing visible leakage shall be repaired to produce a tight joint. Any faulty fittings, or other fittings shall be replaced with sound material at the contractor's cost.

The flushing operation shall continue until the replacement water in the main shall upon test, both chemically and bacteriologically be proven equal to water quality in the source water supply system.

The water shall be tested again, after a 24-hour period. If the results are unsatisfactory, the Contractor shall repeat the flushing and chlorination procedures until acceptable tests are obtained. Method of chlorination to be approved by the City of Southfield and the Michigan Department of Public Health.

3.12 Setting Valves, Hydrants and Wells

This work shall consist of installing gate valves in wells and hydrants for the proposed water main.

Gate Valves in Wells:

Upon excavating to place the gate well base, the Contractor shall compact the earth grade to receive the base. The Contractor may use MDOT 6A stone to level the base, provided that it is compacted. The base and subsequent structure must be level and placed to a true vertical position. Valves shall be placed per City of Southfield Standard Water Main Details. Upon installing the water main and making the necessary connections, the Contractor shall backfill the excavation with MDOT Class II sand, compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. The material shall be placed in maximum 12-inch lifts or as directed by the City's Representative.

Fire Hydrants:

Hydrants shall be carefully examined, cleaned, and placed in a true vertical position and shall be located as shown on the plans, but in any case, shall be located as to be convenient for access and to avoid obstruction to traffic. When placed between the sidewalk and the curb, the hydrant barrel shall be set so that no portion of the nozzle caps shall be located closer than 18 inches from the gutter face of the curb.

The ground shall be excavated to a depth of at least 12 inches below the hydrant base and over an area of approximately 9 sq. ft. The excavation shall be backfilled with clean coarse gravel or crushed stone up to the elevation of the hydrant base and compacted. After the joint has been made, adequate thrust blocking shall be placed on the side opposite the branch connection from the hydrant to the solid undisturbed earth of the excavation wall, keeping below the hydrant drain. After the thrust block has been placed, an additional 12-inch lift of gravel shall be spread and tamped around the hydrant.

In some cases, a hydrant extension may be necessary to bring the hydrant to the proper grade.

The entire hydrant assembly shall be encased in polyethylene. This includes 6-inch pipe, valve assembly (not including valve box) and hydrant including the barrel to ground level.

Hydrant Testing - Each hydrant and lead shall be tested by the Contractor in conjunction with the constructed water mains in accordance with the testing requirements of the City of Southfield.

The contractor shall affix tracer wire to all hydrants utilizing a hydrant tracer bracket per the City of Southfield Water Standard Main Details.

Bollards, if used, shall have a 4-foot clearance from proposed hydrants.

3.13 Tapping Water Main

The Contractor shall not disturb nor cut into any existing water mains in service. Taps to existing mains shall be made by cut-in-tee where possible. Tapping Sleeves shall only be used when approved by the City Engineer. Once pressure and bacteriological testing of the water main and appurtenances have been successfully completed and authorization has been received from the City's Representative, the Contractor shall contact the City Department of Public Works at (248)796-4850 48 hours in advance to schedule the connection to the existing water main.

The Contractor will not be allowed to open or close valves. When the operation of valves in any existing mains is required, the Contractor shall notify the City of Southfield 48 hours in advance of the work to be done. The water main tie-ins may have to be made after 8:00 p.m. and be completed by 4:00 a.m. the following morning at the request of the City's Representative to minimize the disruption of water service.

Once the water main connection(s) has been completely, the excavation shall be backfilled with MDOT Class II sand backfill compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. The material shall be placed in maximum 12-inch lifts or as directed by the City's Representative.

3.14 Thrust Blocks/Joint Restraint

Water main joints, where required, shall be restrained by a mechanical retaining gland or concrete thrust block. The restraint shall be applied to joints each way from the deflection or tee an adequate distance to resist the axial thrust of the test pressure (150 PSI). Mechanical retaining glands shall be placed as shown on the plans and submitted to the City Representative for review prior to construction. Thrust blocks shall be placed per City of Southfield Water Main Details.

3.15 Flushing, Sterilization, Bacteriological/Pressure Testing Requirements Water for Testing, Chlorination, and Flushing:

The Contractor will need to obtain a meter from the City of Southfield Department of Public Works for the use of public water during the construction. They can be reached at (248)796-4850.

Water for testing, chlorinating, and flushing shall be obtained from the most convenient potable water supply. The Contractor shall provide at his sole expense, all the water required and shall make all necessary arrangements with the authority that controls the source water system and shall be governed in the use of water by all rules and regulations imposed there on by said authority.

If there may be isolated water main segments, such as hydrant leads, where a potable water source is not readily available for water main flushing and testing, the Contractor may be required to provide trucked-in potable water or have taps made in existing water mains that are called for abandonment and provide piping and fittings to provide a water source for the flushing and testing of water mains.

The Contractor shall not operate any existing gate valves or tapping valves or valves that he constructs that control the flow of water from the existing mains without prior authorization. All tieins and shutdowns shall be coordinated with the City of Southfield Department of Public Works a minimum of 48 hours in advance.

Flushing of Water Mains:

Prior to disinfection and hydrostatic testing, newly constructed water mains less than 24 inches in diameter shall be thoroughly flushed to remove all accumulated debris that may have entered the line during construction. Flushing shall include the use of a "polly pig" or approved equal equipment at the discretion of the City's Representative, to remove accumulated deposits. The frequency of running the "polly pig" through the water mains shall be determined by the debris discharging from the effluent. Several passes with the "polly pig" through the newly constructed system may be required before the main is acceptable. Procedures for use of the "polly pig", or City's Representative approved equal equipment, shall be per the manufacturer's specifications. Mains 24 inches in diameter and larger shall be manually cleaned and inspected during construction.

Water for testing, chlorinating, and flushing shall be obtained from the most convenient potable water supply. The Contractor shall provide at his own expense all the water required and shall make

all necessary arrangements with the City of Southfield as to the source water system. The Contractor shall not operate any existing gate values or tapping values he constructs which control the flow of water from the existing mains but shall contact the City of Southfield Department of Public Works at least 48 hours in advance of the work. for their personnel to operate the values when necessary.

Hydrostatic Testing of Water Mains:

Within a reasonable length of time following pipe laying and backfilling, the Contractor shall complete all work necessary to perform hydrostatic testing.

The hydrostatic testing shall be conducted in accordance with current AWWA standards for the pipe material used in construction. The test shall be conducted at 150 psi for a minimum of 2 hours. Pressure during the test phase must remain steady (within 5 psi of the test phase pressure) for the full 2-hour test phase period. The maximum test length of pipe shall be 1000 feet unless prior approval by City's Representative is granted. Allowable leakage shall be based on the following formula:

$$L = \frac{SD\sqrt{P}}{133.200}$$

In which:

L = the allowable leakage, in gallons per hour S = the length of pipe tested, in feet D = the nominal diameter of the pipe, in inches P = the average test pressure during the leakage test, in pounds per square inch gauge.

The Contractor shall perform all necessary preliminary hydrostatic tests and shall make all necessary repairs, including the repair of all visible leaks and cracks, and retest with his own forces to ready the water mains for final hydrostatic inspection and testing. Immediately after the water mains have passed such preliminary tests, the Contractor shall submit a written request to the City's Representative for final hydrostatic inspection and test.

The hydrostatic test shall be conducted before the new water main is connected to the existing water system. The Contractor shall furnish all necessary personnel, temporary blow-offs, plugs, bracing, test pumps and all other necessary apparatus for conducting the test. Testing shall be conducted under the supervision of the City's Representative.

At the option of the City's Representative, the Contractor may test against closed valves providing that the new main to be tested and the testing apparatus shall have first been flushed and chlorinated in accordance with accepted procedure. After chlorination and subsequent flushing, a sample of water must show safe bacteriological results through a test by the Southeastern Oakland County Water Authority's Laboratory. In the event of an unsatisfactory hydrostatic test the Contractor will cut the new main, install caps or plugs, pressure test and re-chlorinate.

Before applying test pressure, all air shall be expelled from the pipe. If necessary to accomplish this, taps shall be made at points of highest elevation in the pipe and such openings subsequently closed, prior to test, with tight threaded brass plugs.

Minimum size pressure gauge is to be 3-1/2 inch in 1-pound increments. Any faulty pipe, fittings, gate valves or other accessories disclosed by testing shall be replaced with sound materials and the test shall be repeated as often as necessary until the specified requirements have been met.

The Contractor shall complete the water main work in a manner that minimizes the disruption of water service.

Sterilization of Mains:

After a satisfactory hydrostatic test is obtained, the new main shall be chlorinated following AWWA C651 with one of three methods, Tablet, Continuous feed, or slug method. The Contractor shall work with the City Representative to show chlorination has occurred per AWWA C651 before flushing and Bacteria testing will occur.

Following chlorination, all treated water shall be thoroughly flushed from the main until the replacement water, both chemically and bacteriological, has been proven equal to the water quality in the source water supply system. The contractor shall make arrangements with the Southeastern Oakland County Water Authority to perform Bacteriological Analysis. Once this has been completed and passed, the City of Southfield Department of Public Works and the City's Representative shall be copied on the results.

Should the initial treatment of all or any section of the mains, in the opinion of the City's Representative, prove ineffective, the chlorination procedure shall be repeated until confirmed tests show that water sampled from the new main conforms to the foregoing requirements.

3.16 Cold Weather Protection

This work shall consist of placement of protective material on water main that is buried with less than 5 feet of cover above or below due to conditions outside the control of the contractor. Main shall be allowed to have less than 5 feet cover only with written approval from the City Engineer.

Prior to placement of water main to the appropriate grade, Extruded Polystyrene (XPS) material no less than 2-foot in width shall then be placed below the pipe. Two layers of boards shall be placed such that joints overlap by at least 1-foot to provide suitable stability for backfill. After placing boards, a minimum of 4 inches of Class II Granular Material will then be placed as a bedding for the proposed water main. The water main will then be installed, and the trench shall be backfilled as described in these specifications.

XPS boards shall be placed beginning at a vertical deflection where the cover for the water main becomes less than 5 feet. XPS boards will end when the water main regains sufficient cover both above and below the pipe as described in the plans or as directed by the City's Representative.

3.17 Water Services & Curb Stops

Water Services:

This work shall consist of furnishing and installing water services to supply water to buildings. All taps shall be completed as recommended by the manufacturer.

As a result of the Contractor's construction procedure or where excavation has not uncovered a stable foundation subgrade at depth of 6 inches below the bottom of pipe, the Contractor shall continue to excavate downward to a maximum distance of 18 inches below the bottom of pipe to reach stable foundation soil. The space resulting from such excavation and the pipe beddings shall be filled and constructed in the same manner.

The City's Representative shall investigate the soils conditions and may direct the Contractor to continue excavating if it appears that a stable subgrade can be obtained. If soil conditions are extremely severe, then the City's Representative shall investigate the site conditions and shall prescribe the appropriate pipe support system to be used.

Service Connection and Taps:

Water mains shall be tapped for corporation stops where shown on the plans or required for testing and sterilization of completed water mains. Taps shall not be made on PVC water main that is bent, or otherwise in tension. Taps shall be made with a shell cutter capable of making a 'clean' cut. Taps shall not be closer than 24 inches from both the back of the bell and spigot insertion line. Stagger multiple taps and keep them at least 18 inches apart lengthwise.

Water services shall meet the requirements of AWWA C800, latest revision. For water service connections to pipe that are 2 inches and smaller, a saddle style band with two bolted connections shall be used. For water services larger than 2 inches, the service shall begin as a 6-inch tee off of the main followed by a 6-inch gate valve in a well, then a reducer to the desired size.

Upon completion of service connections, the Contractor shall properly backfill impacted areas with suitable job excavated backfill (greenbelt areas) or MDOT Class II Granular material to a grade suitable for proper surface restoration by means of vegetation or pavements.

Curb Stops and Boxes:

This work shall consist of installing curb stops and boxes for the proposed services off the proposed water main.

When curb stop boxes are to be placed in concrete or asphalt surfaces, they shall be placed in a standard hydrant valve box centered in a 2-foot x 2-foot x 6-inch concrete slab. Curb stop boxes shall be placed within City of Southfield right-of-way or within the limits of an easement.

Upon installation of the new curb stop and box, the Contractor shall place the curb stop on a concrete brick and then backfill the excavation, including locations where existing curb stops and/or boxes are to be removed, with MDOT Class II sand, compacted to at least 95% of its maximum unit weight as determined by ASTM D1557. The material shall be placed in maximum 12-inch lifts or as directed by the City's Representative.

3.18 Adjusting Gate Valves or Boxes

This work shall consist of adjusting an existing gate well and gate box cover by removing and setting it to the proper elevation.

All work shall be performed in accordance with the applicable portions of Section 403 of the current MDOT Standard Specifications for Construction and the City of Southfield Water Main Construction Details included in the plans, and as directed by the City's Representative.

Final adjustment of the gate well within proposed pavement limits shall be made immediately before placement of the top course for HMA and before placement of concrete. Adjust the cover within the proposed pavement limits to the required elevation by supporting it in a full concrete bed. Adjusted cover shall be held firmly in place with cement.

3.19 Tracer Wire

All plastic water main shall be installed with a continuous tracer wire for pipeline location purposes by means of an electronic line tracer. Tracer wire shall be installed per City of Southfield Standard Details and shall be installed along the entire length of the pipe, attachments to curb stops, curb boxes, on water services and at hydrants shall be made per the City of Southfield Standard Details. Grounding shall be provided per the City Details. The contactor shall confirm the traceability of the tracer wire prior to project closeout. The City's Representative shall be onsite to witness these tests. Any wire that cannot be traced shall be replaced and retested.

3.20 Polyethylene Encasement

All ductile iron water main and appurtenances to be buried shall be wrapped in polyethylene. Polyethylene encasement shall be installed in accordance with the requirements of AWWA C105 (ANS1 A21.5) and the manufacturer's specifications. The encasement shall overlap the joint by approximately 12 inches on either side and be secured to the pipe with polyethylene adhesive tape. Poly wrap on DI water main installed via trenchless methods shall be tightly secured to the pipe and is subject to inspection by the City's Representative. Any polyethylene wrapping found to be deficient after water main is installed shall be replaced by the contractor.

3.21 Line Stops

Line-stops may be used when needed to facilitate connections of proposed water main to existing. No line stops shall be performed without prior approval and coordination with the City Department of Public Works and the City Engineer.

Division 4 - Materials

4.01 General

All water main and appurtenances shall meet all applicable American Water Works Association (AWWA), American Society for Testing and Materials (ASTM) and American National Standards Institute (ANSI) standards outlined in these Water Main Construction Standards and shown on the City of Southfield Water Main Standard Details.

All materials to be installed within easement or public right-of-way are subject to inspections and tests by the Owner, or authorized representative. All material rejected shall be removed from the job site by the Contractor within 14 calendar days after receiving. Test certificates in accordance with the current requirements of these Construction Specifications shall be provided upon request of the City Engineer or City's Representative.

PVC Standards for Open Trench Installation			
Material Type	Standards		
PVC, C909	AWWA C909		
Ductile Iron Pipe Size	ASTM F477		
Pressure Class 235	ASTM D3139		
	ASTM D1784, Cell Classification 12454		
	AWWA C605		
	Compound Formulation PPI TR-2/2006		
	ANSI/NSF 14 & NSF 61		
	The exterior wall print line of all PVC water main shall have		
	NSF-pw identification.		
PVC Standards for Horizontal Directional Drilling Installation			
Material Type	Standards		
Fusible C900 PVC	AWWA C900		
DR-14	ASTM D1784, Cell Classification 12454		
	ASTM D2241		
	Compound Formulation PPI TR-2/2006		
	ANSI/NSF 14 & NSF 61		

4.02 PVC Water Main

Polyvinyl chloride (PVC) water main shall meet or exceed the following:

	The exterior wall print line of all PVC water main shall have	
	NSF-pw identification.	
Spline Restrained Joint C900	AWWA C900	
PVC	ASTM D1784, Cell Classification 12454	
DR-14	ASTM D2241	
	Compound Formulation PPI TR-2/2006	
	ANSI/NSF 14 & NSF 61	
	The exterior wall print line of all PVC water main shall have	
	NSF-pw identification.	
PVC Standards for Pipe Bursting Installation		
	F B B B B B B B B B B B B B B B B B B B	
Material Type	Standards	
Material Type Fusible C900 PVC	Standards AWWA C900	
Material Type Fusible C900 PVC DR-14	Standards AWWA C900 ASTM D1784, Cell Classification 12454	
Material Type Fusible C900 PVC DR-14	Standards AWWA C900 ASTM D1784, Cell Classification 12454 ASTM D2241	
Material Type Fusible C900 PVC DR-14	StandardsAWWA C900ASTM D1784, Cell Classification 12454ASTM D2241Compound Formulation PPI TR-2/2006	
Material Type Fusible C900 PVC DR-14	Standards AWWA C900 ASTM D1784, Cell Classification 12454 ASTM D2241 Compound Formulation PPI TR-2/2006 ANSI/NSF 14 & NSF 61	
Material Type Fusible C900 PVC DR-14	Standards AWWA C900 ASTM D1784, Cell Classification 12454 ASTM D2241 Compound Formulation PPI TR-2/2006 ANSI/NSF 14 & NSF 61 The exterior wall print line of all PVC water main shall have	

4.03 Ductile Iron Water Main

Ductile iron (DI) water main shall meet or exceed the following:

DI Standards for Open Cut			
Material Type	Standards		
Ductile Iron	AWWA C151		
Thickness Class 54 minimum	AWWA C150		
"Tyton", or Approved Equal	AWWA C104		
Push-on type connection	AWWA C111		
	AWWA C600		
	ANSI 1-A21.51		
	ANSI/NSF 14 & NSF 61		
	The exterior wall print line of all DI water main shall have		
	NSF-pw identification.		
DI Standards for Horiz	ontal Direction Drilling or Pipe Burst Installation		
Material Type	Standards		
Ductile Iron	AWWA C151		
Thickness Class 54 minimum	AWWA C150		
"Fastite", "TR Flex", or	AWWA C104		
Approved Equal Restrained	AWWA C111		
Push-on type connection	AWWA C600		
	ANSI 1-A21.51		
	ANSI/NSF 14 & NSF 61		
	The exterior wall print line of all DI water main shall have		
	NSF-pw identification.		

4.04 HDPE Water Main

The use of high-density polyethylene (HDPE) water main is prohibited in the City of Southfield.

4.05 Water Main Lining

CIPP liners shall consist of a woven hose system comprised of seamless, polyester fiber. They shall be coated on one outer face with a layer of elastomer and shall be impregnated with resin. Materials shall comply with ASTM – F1743, ASTM - F1216, AWWA Manual M28, and NSF/ANSI – Standard 61.

4.06 Polyethylene Encasement

Polyethylene encasement shall consist of tube or sheet material of minimum 8 mil thickness Class C (Black) polyethylene and shall meet all the requirements of AWWA C105 (ANSI A21.5).

4.07 Mechanical Joints, Bends, Tees, Caps & Bulkheads, Etc.

Joints:

Joints shall be push-on type conforming to AWWA C111, ASTM D3139, and ASTM F477. Sealing gaskets, retainer glands and lubricants for joints shall meet the pipe manufacturer's specifications. Flanged joints will be allowed for special applications subject to the approval of the City Engineer.

All bolts on mechanical fittings shall be domestic origin high strength, low alloy COR-BLUE steel bolts or approved equal. Bolts shall meet the current provisions of ANSI A21.11-90 (AWWA C111). Bolt manufacturer's certificate of compliance must accompany each shipment.

Bends, Tees, Caps & Bulkheads:

Fittings for all pipes shall be ductile iron with 350 psi working pressure rating, meeting the requirements of AWWA C110 (ANSI A21.10) or AWWA C153 (ANSI 21.53) for compact fittings with cement mortar lining. Cement mortar lining shall meet the requirements of AWWA C104 (ANSI A21.4) for a double thickness lining and the exterior shall be seal-coated with an approved bituminous seal coat. Where special adapters and fittings are necessary for connections to existing water mains, the Contractor shall submit shop drawings of such special adapters and fittings to the City Engineer for approval.

4.08 Joint Restraint & Thrust Blocks

Joint Restraint:

Details of all proposed joint restraint, showing type and locations, shall be submitted to the City Engineer for approval prior to water main installation. Restraint shall be achieved by mechanical retaining gland or concrete thrust block. If mechanical retaining glands are used, twist-off nuts shall be used to ensure proper actuating. Details of the proposed joint restraint design shall be prepared in accordance with the recommendations of the pipe manufacturer and the current edition of the Thrust Restraint Design Procedure for Ductile Iron published by the Ductile Iron Pipe Research Association (DIPRA).

4.09 Cold Weather Protection

Protective insulation shall be extruded polystyrene (XPS) board conforming to ASTM C578, Type VI. Boards shall be 2 inches in thickness, minimum.

4.10 Fire Hydrants

Fire hydrants shall be in accordance with the current edition of AWWA C502 and City of Southfield Standard Details. Drain holes shall be plugged and watertight.

All hydrants shall be EJ #5BR-250 and shall conform to AWWA Spec. C-502 as amended and shall have a minimum 5-1/4 inch valve opening that closes with the water pressure. Hydrants shall be traffic style with breakable flange and coupling.

Hydrants shall include a Cobra[™] Access Point by Copperhead Industries or approved equal.

Hydrants shall have a swivel flange to allow bonnet to be turned 360 degrees without removing the bonnet, and barrel flanges shall be integrally cast with the barrel. Inlet shoe shall have a bronze valve seat, which can be removed without digging.

Inlet connection shall be 6" mechanical joint, ASA-A21-11. Stem threads shall be sealed with double "0" rings and shall be permanently lubricated with all-weather grease.

Hose connections: 1 3-3/4-inch DFD pumper hose nozzle and 1 with Harrington 5-inch Integral Hydrant Storz nozzle. HJHS-EJIW-50-45.

Operating Nut: Detroit 1-1/8-inch pentagon, open left, 5.5 feet of cover or specified on plans. A suitable nozzle lock shall be in place to prevent inadvertent nozzle removal. Wedge locks and/or ductile iron retainer rings to secure nozzles shall not be allowed.

Hydrant piping shall by CL 54 Ductile Iron and be poly wrapped in accordance with the special provision for Water Main Installation.

Hydrants shall be painted Fire Hydrant Red.

If hydrants are furnished with drain outlets, the outlets shall be plugged.

Hydrants shall be set such that grade ring is 0.1-foot above finished grade at the hydrant base.

The contractor is responsible to winterize all hydrants if work extends past October 1.

Retainer glands are to conform to series 1100 "megalug" type fittings. Twist-off nuts shall be used to ensure proper actuating of the restraining devices. All fittings shall conform to the current revisions of AWWA C153.

All hydrants shall be painted and are to be 5.5-foot bury unless otherwise specified.

4.11 Gate Valves

Gate Valves shall be Detroit Water and Sewerage Department Standard, and shall be installed in gate wells with cast iron frames and covers. Gate valves shall be Mueller 2360 or EJ Co resilient wedge or equal approved by the City Engineer, non-rising stem, opening clockwise conforming to current Detroit Water Sewerage Department Standards and to AWWA C509 or C515.

All castings shall be coated with a coal tar pitch varnish, with sufficient oil added to produce a smooth coating, tough and tenacious when cold, and not brittle nor with any tendency to scale off.

All gate valves with operating nuts at a distance greater than 5 feet below ground surface shall be provided with an extension stem. The length of the extension shall be such that it will be within 5 feet of ground surface when an extension stem is used. It shall be held in place with two extension stem guide assemblies. Each assembly shall be comprised of a "J" bracket and "L" bracket supplied by Mueller. The stem guides shall be located opposite from each other and shall be suitably fastened to the wall of the gate well. In addition, a "stop" shall be welded to the extension stem in a location that will prevent the extension stem from slipping off the operating nut.

Wall thickness shall meet or exceed AWWA Standard C509 or C515 & C153.

The body, bonnet and seal plate shall be fusion bonded epoxy coated surfaces inside and out per AWWA C550 & NSF 61. The body, bonnet, seal plate and wedge shall be ductile iron that meets or exceeds ASTM A536.

All bolts shall be stainless steel, full-diameter waterway, low torque operation, fully encapsulated Ductile Iron Wedge that meets or exceeds ASTM D429.

Gate wells shall be of the precast concrete type with an EJ model 1040 frame with an "A" cover that is embossed with "WATER" with Raised letters, or an approved equal.

4.12 Gate Wells

All precast concrete gate well sections shall be manufactured to conform with ASTM C478, standard specifications for precast reinforced concrete manhole sections, except wall thickness shall be as shown on the City of Southfield Standards Details. All joints for precast concrete gate well sections shall be "modified grooved tongue" with gasket manufactured to conform with ASTM C443, standard specification for joints for circular concrete sewer and culvert pipe using rubber gaskets.

Base slab for structures shall be precast reinforced concrete, ASTM C478. When approved by the City Engineer, poured-in-place concrete may be used. Base slab shall conform to City of Southfield Standard Water Main Details.

Manhole steps shall be steel reinforced polypropylene plastic No. PS- 2PFS as manufactured by M.A. Industries, Inc. of Peachtree, GA, cast iron No. 8500 as manufactured by EJ, or approved equal.

Grade rings shall conform to ASTM C478 and shall have a minimum thickness of 3 inches. Concrete brick shall conform to section 913 of the current MDOT Standard Specifications for Construction.

Mortar, type R-2, for use in gate well structures shall conform to section 1005 of the current MDOT Standard Specifications for Construction. Concrete for poured in place construction and blocks shall be of the grade 3000 called for on the plans and shall conform to Section 1004 of the current MDOT Standard Specifications for Construction.

Pipe openings shall be flexible rubber joints such as Press Wedge II, Res-Seal, Link-Seal or Kor-N-Seal. All openings for pipe shall be fabricated at the time of manufacture. No gate wells will be accepted where openings have been made in precast units at the site of the works. MDOT Class II sand shall be used as backfill and shall meet the requirements of Section 902 of the current MDOT Standard Specifications for Construction.

4.13 Gate Boxes

Gate boxes shall not be used without approval from the City Engineer. If used, they shall confirm to the City of Southfield Water Main Standard Details.

4.14 Gate Well and Gate Box Cover Adjustments

The materials required to accomplish this work shall be in accordance with the applicable portions of Section 403 of the current MDOT Standard Specifications for Construction and the City of Southfield Water Main Standard Details.

4.15 Line-Stops

Hydra-stops or approved equal may be used only when authorized by the City Engineer and City Department of Public Works.

4.16 Tapping Sleeves

Tapping sleeves shall be manufactured in accordance with the applicable sections of AWWA C111, C500 and C509.

Tapping Sleeves shall conform to AWWA C223 and shall be full length of heavy-duty stainless steel construction designed for use with the type of pipe to be tapped. Tapping sleeve body shall be type

18-8 type 304 stainless steel with mechanical joint. Bolts shall be 304 stainless steel. Gaskets shall be full circumferential SBR compounded for water service. Tapping sleeves shall contain a test plug to assure seal prior to tapping.

4.17 Water Services & Curb Stops

Pipe for water services shall be copper and be "Type K" seamless tubing and shall meet the requirements of the current ASTM D 2737. Piping shall meet Copper Tube Sizing (CTS) standards. Pipe shall meet NSF 61 standards. Plastic water services shall not be used without permission from the City Engineer.

When joining copper, flared fittings shall be used. Fittings shall meet all the requirements of the current ASTM B62 and AWWA C800-14. Mueller fittings and corporation stops shall be used, or approved equal.

Water service connections shall be performed through use of saddle style tapping devices. Service connections to ductile iron water main shall be performed using Mueller Model BR2B or approved equal. Service connections to PVC water main shall utilize a seamless saddle band style held in place with two bolted connections. All metallic parts for the PVC saddle shall be manufactured from Type 304 Stainless Steel.

All water parts used in service connections shall comply with AWWA C800 and NSF 61 certification requirements. All wetted parts shall be "lead-free".

Curb stop box shall be Mueller H10300 with Minneapolis pattern for a typical water service, including support/base and lid. Curb stop box shall be an arch pattern for a typical water service, including support/base, lid and 42-inch rod. All curb stop valves shall be brass, ball valve, copper flare, Minneapolis Pattern, by Mueller or approved equal.

4.18 Cement Grout for Water Main Abandonment

All materials shall meet the requirements as specified in Division 9 and 10 of the current MDOT Standard Specifications for Construction as follows:

Mortar Type II	Section 1005
Grout	Section 702
MDOT Fine Aggregate, 2NS, 2MS	Section 902
Masonry Units	Section 913

The cement grout shall have a minimum 28-day compressive strength of 300 psi.

4.19 Tracer Wire

All piping shall be installed with a continuous, Copperhead Steel core, copper sheathed wire, part #1245-EHS-500/1000/2500, or approved equal, for pipeline location purposes by means of an electronic line tracer. Splices, Test Pits, Connectors, Tracer Boxes, and any other part of the tracer wire installation shall conform to the City of Southfield Standard Water Main Details and the following:

- The insulation/jacket color shall follow AWWA guidelines.
- Sections of wire shall be spliced together using approved splice caps and waterproof seals. Twisting the wires together is not acceptable.
- Tracer wire to be brought to grade at all boxes, wells, and hydrants per the City of Southfield Standards Details. Tracer wire shall be electrically connected to each service connection through the use of approved underground connectors.

• Grounding shall be provided per City of Southfield Water Main Standard Details.

4.20 Casing Pipe

Steel casing pipe in the 6-inch to 24-inch diameter size shall meet requirements of ASTM Designation A139, Grade B material. Pipe ends shall be prepared for field welding of circumferential joints. Outside diameter and wall thickness of the pipe will be as shown below:

Casing Pipe for Water Main:

	Min. Inside	
Dia. of Water	Diameter of Casing	Minimum Wall Thickness
Main, (in)	Pipe (in)	(in)
8	16	0.375
12	20	0.375
16	24	0.375
20	30	0.375
24	36	0.375

Skids used for placement of carrier pipe shall be wolmanized lumber or polyethylene. See the Southfield Water Main Details for more information.