

SPECIFICATIONS
FOR
WATERMAIN AND APPURTENANCES

CITY OF EDINA, MINNESOTA

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Revised January 2016

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FOR
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Revised January 2016

1.0 **GENERAL**

The General Conditions and the Special Provisions and Conditions as embodied in these Contract Documents shall be applied to all work and materials to be furnished and installed under these Specifications.

2.0 **LOCATION**

The Water Main and appurtenances to be constructed and installed under this contract are located in the City of Edina, Hennepin County, Minnesota, as shown on the plans and drawings.

3.0 **SCOPE OF WORK**

The work to be done under this contract shall include the furnishing of all material, labor, tools, and equipment to construct, complete and in place, the watermain and all appurtenances as shown on the drawings and as specified herein and in accordance with all pertinent requirements of the Minnesota Pollution Control Agency and Minnesota Department of Health for the conveyance of potable water.

This Contractor shall perform the excavating of all kinds of materials encountered, furnish or compact foundations where required, furnish and install all timbering, sheeting and bracing necessary or proper to safely support all work, remove all water, protect, repair, relocate, maintain and restore all sub-surfaces, surface and overhead structure directly or indirectly disturbed, injured or affected by his/her operations, provide all backfilling and furnish all other appurtenant items and services necessary or specified.

4.0 **METHOD OF PROCEDURE**

The Contractor shall perform his/her work in such a manner as to cause the least interference and delay to such other work as may be in progress at the time by other Contractors. The Contractor shall notify the Engineer in writing of his/her intentions to commence work at least five (5) days prior to moving onto the site.

Prior to the start of any work, the Contractor shall submit in writing to the Engineer for approval a schedule of procedure and, once approved, the Contractor shall not deviate

from it without written permission from the Engineer. The schedule of procedure shall essentially indicate the number of crews to be employed, locations of work for each crew, time schedule and sequence of moves and other pertinent information as required by the Engineer.

The Contractor shall notify the Engineer/City Water Department and the affected property owners before shutting off water mains. The Contractor must plan his/her operation to cause the least amount of disruption of water service in the affected area.

The Contractor shall be responsible for the operation of all existing and new gate valves required for the installation of water main and other appurtenances. City and on-site inspection staff must be present during the operation of all gate valves. If proper staff is present during gate valve operation, the Contractor shall not be responsible for malfunctioning gate valves. If Contractor fails to have appropriate staff present or by negligent acts a gate valve mal-functions, it is the Contractor's responsibility to remedy the situation to the satisfaction of the Engineer. If the Contractor fails to take appropriate action, the Engineer shall have the corrections made and assess \$500.00 for damages plus costs incurred.

5.0 MATERIALS

All materials required for this work shall be new material conforming to requirements of the reference specifications for the class, kind, type, size, grade, and other details indicated in the Contract. Unless otherwise indicated, all required materials shall be furnished by the Contractor and be approved by the engineer. The Contractor shall submit in writing a list of materials to be furnished showing the manufacturer and designation of all items, said list to be approved by the Engineer prior to installation. If any options are provided for, as to type, grade, or design of the material, the choice shall be limited as may be stipulated in the Plans, Specifications, or Special Provisions.

All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Plans. Otherwise, the Owner may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

All products shall be manufactured in the United States of America unless approved by the Engineer.

5.1 Ductile Iron Water Pipe and Fittings

Ductile Iron Pipe

Ductile iron pipe shall be made in accordance with ANSI Specification A21.51 (AWWA C151).

16" D.I.P.	Class 51
12" D.I.P.	Class 52
10" D.I.P.	Class 52
8" D.I.P.	Class 52
6" D.I.P.	Class 52

Table 1. D.I.P. Size Classification

If requested by the Engineer, the pipe manufacturer shall furnish a certified copy of all tests run on the pipe. All tests shall be observed and certified by an independent testing laboratory. Such laboratory shall be a member of the American Council of Independent Laboratories, Inc. The Engineer must approve the pipe based on the test results before any pipe may be shipped to the job. The decision of the Engineer shall be final with regard to the approval or disapproval of the test reports.

The cost of conducting the above tests, the observing and certification of same by an independent testing laboratory shall be paid for by the Contractor.

Ductile cast iron pipe shall be cut only by sawing, milling or torch cutting in accordance with the manufacturer's recommendations.

All pipe joints shall be an approved slip type joint with rubber gasket, or mechanical joint. Mechanical joint pipe shall comply with ANSI Specification A21.11. Slip joint gaskets shall be molded rubber rings made expressly for the joint used. Mechanical joint gaskets shall be made from vulcanized crude rubber compound. All surfaces shall be smooth, free from imperfections and free from porosity. Electrical conductivity for slip joint pipe must be provided by a metal cable or strap, capable of withstanding 600 amperes of current, fastened across the pipe joint.

Every pipe and fitting shall be cement lined on the inside. Cement mortar lining for ductile iron pipe and fittings shall be in conformance with ANSI Specification A21.4, except that the lining shall be half thickness (Standard Enameline). The pipes exterior shall have a bituminous seal coating at least one mil thick. It shall adhere tenaciously to the cement mortar and pipe. Spotty or thin coating, or poor adhesion, shall be cause for rejection of the pipe.

When so directed by the Engineer, the Contractor shall provide accurate scales near the site of the construction. The Contractor shall weigh a sufficient number of pipes and fittings from each shipment to verify weights. Should the weights prove inconsistent, the Engineer may require the weighing of all materials delivered. The cost of all weighing shall be at the Contractor's expense.

Ductile Iron Fittings

Ductile iron fittings shall be approved by the engineer and Class 350 for sizes up to and including twelve inches (12") diameter and shall conform to ANSI Specification A21.53 (AWWA C153) covering short body fittings and shall be mechanical joint. Ductile iron fittings over twelve inches (12") in diameter shall comply with the above specifications and shall be Class 150.

Cor-Blue T-bolts with Protecto Caps shall be used on all mechanical joints. No other type of bolts shall be allowed unless approved by the Engineer.

5.2 Valves and Boxes

Gate valves to be installed on water lines smaller than twelve inch (12") diameter shall be installed in a vertical position and provided with boxes. Butterfly valves shall be used on water lines twelve inches (12") or greater diameter.

The gate valves shall be iron body, bronze mounted non-rising stem with "O" ring seals designed for a minimum of 150 psi working pressure with mechanical joints and shall conform to AWWA Specification C509 with the modification that they must meet Edina water test specifications (resilient wedge type).

Butterfly valves and boxes shall conform and be in accordance with AWWA C504. Butterfly valves shall be American Flow Control, Kennedy, Mueller, Dresser "450", Pratt "Ground Hog" or approved equal and shall be suitable for a working pressure of 1030 Kpa (150 psi).

All valves shall have openings through the body of the same circular area as that of the pipe to which they are attached.

Valves shall be provided with a two inch (2") square operating nut and shall open in a counter-clockwise direction.

Valve boxes shall be cast iron of the two piece type suitable for a depth of seven and one half feet (7 1/2') of cover over the top of the pipe or to a depth as shown on the plans.

Shafts shall be five and one quarter inch (5 1/4") inside diameter, bases shall be round and length adjustment shall be screw type.

Valve boxes shall be sufficient length to provide for adjustment above and below grade of not less than six (6) inches when the pipe is laid to the specified depth in accordance with the following table.

Valve boxes shall be set on valves with use of gate valve adaptors as manufactured by Adaptor, Inc., or approved equal.

Drop covers on valve boxes shall bear the word "water" on the top. Valve boxes shall be approved by the Engineer. Valves and boxes shall be considered integral units and the bid price shall include both items.

5.3 Hydrants

New Hydrants installed on jobsites may either be the Waterous Classic Pacer Model WB 67-250 or Clow Medallion, unless specified by the Engineer.

All hydrants shall be of uniform make with one (1) five and one quarter inch (5 ¼") Storz pumper nozzle and two (2) two and one half inch (2 ½") threaded nozzles that conform to dimensional requirements for "non-threaded connections" in accordance with NFPA 1963 Standard for Fire Hose Connections.

Hydrant length shall be suitable for a depth of cover of seven and one half feet (7 ½') over the top of pipe. Hydrant shall open in a counter-clockwise direction by means of a one inch (1") pentagon one piece operating nut with weathershield.

The Contractor shall supply hydrants of the break away flange model. These hydrants shall be installed so that the break away flange is located 3" above the finished grade. Hydrants shall be close coupled with six inch (6") mechanical joint base elbow and six inch (6") mechanical joint gate valve with box, or approved equal.

The Contractor shall state weight of hydrants complete and shall furnish detail working drawings, specifications and description of hydrants which he proposes to furnish.

All parts of hydrants furnished must be interchangeable for the hydrants proposed and for hydrants of similar make now in use in Edina and failure to fulfill this requirement in any hydrant will cause said hydrant to be unconditionally rejected and no payment will be made for said hydrant.

A positively operated, non-corrodible drip valve shall be provided to drain the hydrant when valve is closed and shall prevent leakage when valve is open.

The drip mechanism shall be removable with the main valve and seat. In areas where the hydrant base is installed below ground water, the drain shall be plugged and the hydrant marked with a metal tag to indicate the requirement to pump the hydrant after use.

The hydrant valve shall be the compression type to open against main pressure. The valve shall be faced with high grade neoprene rubber and shall have a tapered seat for positive closure. This entire mechanism shall be removable for repairs or replacement through the barrel without excavating.

"O" ring seals shall be provided to prevent water from reaching operating mechanism. Operating mechanism shall be lubricated through an opening in the operating nut. All moving parts are to be bronze or a non-corrodible metal.

All parts of hydrants furnished shall be interchangeable with all other hydrants of the same size and make without special fittings. Hydrant barrels shall be two-piece with flanged joint above grade and shall be non-jacket type. All material shall be in accordance with AWWA specifications. Hydrants shall be Waterous Classic Pacer Model WB 67-250 with sixteen inch (16") break off or the Clow Medallion Hydrant. The hydrants shall be painted red in conformance with existing City of Edina requirements at the factory. All hydrants furnished must be of the same design and be approved by the Engineer.

Care must be taken when handling hydrants to protect the paint. Whenever the paint is chipped or scratched, the Contractor shall repaint the hydrant.

The Contractor shall furnish one adjustable Storz hydrant wrench per project and provide a Storz adaptor reducing to a 2 ½" threaded connection. The hydrant wrench and Storz adaptor shall be delivered to the Edina Public Works building.

Hydrants shall be furnished with two "candy cane" type hydrant flags. One flag shall be attached to the hydrant and one flag shall be delivered to the Edina Public Works building.

5.4 Corporation Stops

All corporation stops shall be Mueller Co. H-15000 or approved equal with Mueller thread flare type joint. Corporation stops shall be for sizes as specified for copper service pipe.

All corporations shall be installed using an all stainless steel saddle, Smith Blair Type #317 or approved equal.

5.5 Tapping Sleeves (Wet Taps)

All tapping Sleeves shall be Smith-Blair Model No. 662 or approved equal. The tapping sleeve body shall be a full circumference band, 18-8 type 304 stainless steel. The flange shall be in accordance with specifications of AWWA C207 Class D, and shall conform and meet ANSI 1030 Kpa (150 psi) drilling with an epoxy coated finish. The Gasket shall be Grade 60 concave wedge steel. The bolts, nuts, and washers shall be 18-8 type 304 stainless steel. Nuts and studs shall be coated to prevent galling.

5.6 Curb Stops

All one inch (1") curb stops shall be Mueller H-15154-Minneapolis Pattern or approved equal. All stops shall be for flared copper inlet and outlet. If a curb stop falls in a paved area such as a driveway or walkway a Ford A-1 meter box

will need to be installed. Any adjustments to bringing curb stops to grade and the Ford A-1 meter box or approved equal are incidental.

5.7 Curb Boxes

Curb boxes shall be Mueller 10300 curb service box Minneapolis pattern or approved equal with one and one quarter inch (1 1/4") stack for use with a one inch (1") curb stop or larger. These shall come complete with top, bottom section and stack for seven and one half feet (7 1/2) feet of cover, and shall be adjustable for grade up and down as manufactured by Mueller Company. Stationary rods are required on all curb boxes.

5.8 Copper Service Pipe

Copper service pipe shall be soft type seamless tubing suitable for underground service and shall conform to the following standards:

Federal Specification WW-T-799a Type K
ASTM Specification B-88 Type K
Manufactured in the United States of America.

If necessary, connecting the existing service pipe to the new curb stop box using a "pig-tail" of new 1" copper service pipe using one of the following couplings:

1. Ford Quick Joint coupling with stainless steel gripper ring.
(a) Model No. C44-34-Q or C44-44-Q for 3/4" to 1" and 1" to 1" connections respectively.
2. AY McDonald 3-Part Union with stainless steel gripper ring.
(a) Model No. 4758Q 3/4 x 1 or 4758Q 1 for 3/4" to 1" and 1" to 1" connections respectively.

5.9 Select Granular Material

Backfill material which the Contractor is directed to purchase shall meet the requirements of Select Granular Borrow, 100% passing a #4 sieve and not more than 10% passing a 200 sieve.

5.10 Polyethylene Wrap

Polyethylene wrap shall be 8 mil thick tubes and shall conform to ANSI/AWWA C105/A21.5 AND ASTM A674. The material shall be of virgin polyethylene as produced from Dupont Alathon resin or approved equal. The wrapping tape shall be Scotchrap No. 50 (Polyvinyl) or approved equal, and shall be 10 mils thick (ASTM-D-1000).

5.11 Tracer Wire

A tracer wire shall be laid with all pipes and shall be incidental to pipe installation. The conductor insulator shall consist of a high molecular weight-high density blue polyethylene jacket complying with ASTM-D-1248, 30 volt rating.

For pipe bursting operations, tracer wire shall be Copperhead SoloShot Extreme Strength 7x7 stranded copper clad steel part #PBX-50 , minimum 50mil HDPE insulation thickness with minimum breaking strength of 4,700 pounds, or approved equal as approved by the Engineer.

For horizontal directional drill operations, tracer wire shall be Copperhead Extra High Strength steel #12 AWG copper clad steel part #1245-EHS, minimum 45mil HDPE insulation thickness with minimum breaking strength of 1,150 pounds, or approved equal as approved by the Engineer.

For all installations excluding pipe bursting and horizontal directional drill, tracer wire shall be Copperhead High Strength Tracer Wire, part # 1230-HS, direct burial #12 AWG Solid (0.0808" diameter), 21% conductivity copper-clad hard drawn high carbon steel extra high strength horizontal directional drill tracer wire, 452 pound average tensile break load, 30mil HDPE insulation, or approved equal as approved by the Engineer.

Termination of the tracer wire shall be at all fire hydrants. The terminations shall reflect Standard Plate 110 Tracer Wire Access Box. The Contractor shall provide Drainage and Water Solutions type tracer wire access box model #TRWAB or approved equal. Tracer wire access box shall be installed 2"-3" below finish grade elevation and include connection to a magnesium grounding anode rod. This work shall be considered incidental.

Tracer Wire shall be tested for electrical continuity. The electrical test shall be made after the entire watermain has been installed and connected at both ends. If the test is a failure the contractor shall make the corrected measures as directed by the engineer and be at no cost to the owner.

5.12 High Density Extra-High Molecular Weight Polyethylene (HDPE) Pipe

- a) AWWA C901 and C906.
- b) DIPS: DR 11-160 psi water pressure.
- c) Thermal Butt-Fusion Method of joining.
- d) NSF: Standard No. 14 and No. 61 (by size and order).
- e) PPI Designation: PE 3408.
- f) Cell Classifications: ASTM D3350-PE 345444C.
- g) Material Description: ASTM D3350-Type III, Grade PE 34.

- h) Color: Black
- i) Continuously mark pipe with the following information.
 - (1) Size and dimensions
 - (2) Name of manufacturer
 - (3) Cell class
 - (4) ASTM basis
 - (5) Pipe test category
 - (6) Plant identification
 - (7) Production data
 - (8) Operator number
 - (9) Resin supplier code
- j) Manufacturer
 - (1) All HDPE pipe shall be as manufactured by Rinker Materials “CSR PolyPipe”, Gainesville, Texas; Phillips “Driscopipe”, Richardson, Texas; Chevron “Plexco”, Bensenville, Illinois, or approved equal.

5.13 HDPE Fittings

- 1. HDPE Mechanical Fittings
 - a) When utilizing a mechanical fitting to join HDPE to HDPE or HDPE to DIP an appropriately sized pipe stiffener shall be used.
 - b) The stiffener must be sized to encompass the entire bearing length of the restraint device.
- 2. HDPE Fusion Fittings
 - a) Standard commercial products manufactured by injection molding or by extrusion and machining.
 - b) Fittings shall be fully pressure rated by the manufacturer to provide working pressure equal to the pipe, for 50 years of service at 73.4 degrees Fahrenheit.
 - c) Manufactured from the same resin type, grade and cell classification as the pipe.
 - d) Manufacture of the fittings shall provide fittings homogeneous throughout and free from cracks, holes, inclusions, voids or other defects.

- e) Fittings shall be uniform in color, capacity, density and other physical properties.
 - (1) Minimum “quick-burst” strength of fittings shall not be less than that of the pipe with which the fitting is being used.

5.14. Polyvinyl Chloride (PVC) Pressure Pipe

- a) AWWA C900 SDR18
- b) Produced by continuous extrusion process.
- c) Grade used shall be resistant to aggressive soils or corrosive substances in accordance with ASTM D-543.

Dimensions and tolerances of the pipe barrel shall conform to ductile iron equivalent outside diameters.

6.0 CONSTRUCTION STAKES, ALIGNMENT AND GRADE

All work under this contract shall be constructed in accordance with lines and grades shown on the drawings and as established by the Engineer. These lines and grades may be modified by the Engineer as provided in the contract. The Contractor shall furnish at his/her own expense such materials and render such assistance as may be required for setting lines and grade stakes, batter boards, templates, patterns, platforms, reference points, or other marks or points of line or grade.

The Contractor shall give the Engineer 48 hour notice of the Contractor’s need for the establishment of line and grade. After lines and grades for any part of the work have been given by the Engineer, the Contractor shall be held responsible for the proper execution of the work to be protected and preserved until removal is authorized by the Engineer. The Contractor shall at his/her own expense correct any mistakes that may be caused by their unauthorized disturbances or removal. The Engineer may require that work be suspended at any time when for any reason such marks cannot be properly followed.

No additional compensation shall be allowed by the Contractor for any claims of crews being held up because of lack of line and grade stakes.

The Contractor shall remove all survey stakes and lath from the job site upon completion of the project.

7.0 EXCAVATION AND PREPARATION OF TRENCH

The trench shall be dug to the alignment and depth required and only so far in advance of pipe line as the Engineer shall permit. The sides of the trench shall be sloped and/or braced and the trench drained so that workers can work safely and efficiently. It is essential that discharge pumps be laid to natural drainage channels or to storm sewers.

All trenches shall be excavated so that the pipe may be laid accurately to grade with a minimum of seven and one half feet (7 ½') of earth to cover over the top of twelve inch (12") water mains or smaller.

The trench width, at the top of the trench, may vary depending on the depth of the excavated material encountered.

The trench width at pipe grade shall be ample to permit the proper laying and jointing of the pipe and fittings and for proper backfilling and compaction. The maximum clear width of trench at the top of the pipe shall be not greater than the outside diameter of the pipe plus two feet (2').

The trench shall have a bottom conforming to the grade to which the pipe is to be laid. The pipe shall be laid upon sound soil, cut true and even so that the barrel of the pipe will have a bearing for its full length. If excavation is made below grade, it shall be backfilled with well tamped pit run sand or fine gravel as approved by the Engineer at no additional expense to the City.

Bell holes shall be dug at the ends of each length of pipe to permit proper jointing. Excavations for manholes and other structures shall have two foot minimum clearance on all sides.

The Contractor shall provide without additional compensation suitable temporary channels for any water that may flow along or across the site of the work. The excavated material shall be placed on one side of the trench except when permitted by the Engineer to use both sides. All material shall be so placed as not to obstruct any drain or gutter, or to unnecessarily obstruct any passageway.

8.0 PIPE FOUNDATIONS

If the Contractor encounters unstable soil not suitable for bedding of pipe, the Contractor shall notify the Engineer. As directed by the Engineer, the Contractor shall remove and replace all unstable material with stabilization material as ordered by the Engineer. The Contractor shall not be paid extra for such additional excavation, but shall be paid for additional base stabilization material at the unit price bid. Material for base stabilization shall be two inch (2") binder stone or pit run gravel, as determined by the Engineer.

If the Engineer shall order piling to be placed, the Contractor shall furnish, drive and place all said piles as specified below.

8.1 Piling

Norway Pine, Jack Pine, Douglas Fir (Coast Region) or Southern Yellow Pine, may be used under these Specifications. Balsam, Fir, Hemlock, Soft Maple, Poplar, Slippery or Swamp Elm, or any other wood which would not stand driving shall be rejected.

All piles shall have a butt diameter of not less than twelve inches (12"). Piles less than forty feet (40') in length shall have a tip of not less than eight inches (8") diameter and piles over forty feet (40') long shall have a tip not less than seven inches (7") in diameter.

Piles shall be sound and solid and free from any defects which may materially impair their strength or durability. They must be so straight that when a line is drawn from the center of the butt to the center of the tip, the line will be within the body of the pile and shall have a uniform taper from the tip to the butt.

Piles shall be capped and cradles provided in accordance with the detailed drawings.

All piles, caps, and ties shall be treated in conformance with Minnesota Department of Transportation Specification 3491.

The Contractor shall furnish, place and drive piles as directed by the Engineer. All piling shall be driven to substantial refusal as defined by Minnesota Department of Transportation Specification 2452.3. Piles shall be driven vertically in exact position at locations given by the Engineer. Piles which may become shifted, must be removed and good piles driven in their places, or additional piles put in as directed by the Engineer without additional expense to the City.

9.0 PUMPING, BAILING, AND DEWATERING

The Contractor shall, at his/her own expense, pump or otherwise remove any water which may exist in the trenches and shall form all dams or other works necessary for keeping the excavation clear of water during progress of the work. This work may be required to proceed for 24 hours as directed by the Engineer.

The dewatering item shall only be used for additional dewatering needs above and beyond normal construction practices as described herein. Normal construction practices include use of up to two 3" trash pumps in the excavation in crushed rock sumps. The dewatering item shall only include the additional pumps, well points, manifolds, and other materials required.

10.0 ROCK EXCAVATION

When the trench is carried through rock, the depth of excavation shall be six inches (6") below the outside barrel of the pipe, fittings, and other appurtenances for pipe of sixteen inch (16") diameter or less and shall be nine inches (9") below the outside barrel of the pipe, fittings and other appurtenances for pipe of eighteen inch (18") diameter or greater. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes. Sand shall be backfilled and tamped to proper grade before the pipe is laid. Width of excavation shall be computed on a basis of a uniform width twelve inches (12") greater than the outside diameter of the hubs or bells of pipe.

Rock excavation shall be defined as removal of all boulders larger than 1/3 cubic yard in volume and of ledge rock, concrete, or masonry structures that require an air hammer or blasting to remove. Loose, soft or disintegrated shale or rock in its natural state, masonry or concrete which can be economically removed without air hammer or blasting shall be classified as "loose rock". No additional compensation shall be provided for excavation of this character.

11.0 UNFORESEEN UNDERGROUND OBSTRUCTIONS

The removal of old timber, artificial loose stone or concrete fill or other man made obstructions that hinders the normal progress of the excavation, other than utility lines, shall be classified as "Removing Unforeseen Obstructions". The removal shall be paid for at actual cost plus 15 percent, as provided in the General Conditions.

12.0 BLASTING

Explosives shall be kept in a safe place marked "Dangerous", remote from buildings, structures or places where an explosion could endanger life or property. Caps or exploders shall be kept in a different location. All work with explosives shall be done in such a manner as not to endanger life or property. The method of storing and handling explosive and inflammable materials shall conform with all Federal, State and local laws, by-laws and regulations. Existing sewers, water mains and other structures shall be protected from the effect of blasts. Heavy mats must be used if needed to prevent flying of rock or frozen earth. The Contractor shall, at his/her own expense, restore to its original condition any property or utilities damaged by blast.

13.0 SHEETING AND BRACING

The Contractor, to prevent the disturbing or settlement of adjacent road surfaces, foundations, structures, or railroad tracks or other improvements, shall furnish and place all sheeting and bracing necessary to good working conditions acceptable to the Engineer and to prevent damage and delay to the work. The Contractor shall be responsible for the strength and sufficiency of all sheeting and bracing. Should the Engineer decide that the sheeting and bracing at any point is inadequate or improperly constructed, the Engineer may order additional sheeting or bracing to be placed at the Contractor's expense.

Bracing shall be so arranged as to provide ample working space and so as not to interfere with the work and so as not to place any strain on the structures being constructed until such structures are, in the opinion of the Engineer, of ample strength to withstand such strain. All sheeting and bracing, unless otherwise specified or ordered to be left in place by the Engineer, shall be installed and removed from the work at no additional compensation. No sheeting and bracing shall be removed until the construction has proceeded far enough to provide ample strength in the opinion of the Engineer.

Any damage to the work under this contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, caves or other causes due to failure or lack of sheeting and bracing or improper bracing or through negligence or fault of the Contractor in any manner shall be repaired by the Contractor without delay at his expense.

Where the trench is not located near existing utilities, buildings or other structures and where water and other conditions permit, the Contractor may with the approval of the Engineer, omit sheeting and bracing of the excavation. In this event, the Contractor shall excavate a space of sufficient size to provide adequate room for the construction work so as to prevent sliding or caving of the banks into the area within the lines of structures.

The Contractor shall leave in place to be imbedded in the backfill of the trench all sheeting and bracing, etc., which the Engineer may direct in writing to be left in place for which the Contractor shall be paid.

In addition to that sheeting and bracing mentioned above, the Contractor may also leave in place, to be imbedded in the backfill of the trench, any sheeting and bracing which he/she may consider necessary to prevent injury to persons, structures, corporations or property, whether private or public, for which he/she assumes the entire and sole liability for any damage which may be caused by the installation, and for which he may receive no payment or extra compensation.

No sheeting and bracing which is within three feet (3') of the surface of the ground may be left in place in the trench without written permission from the Engineer. When sheeting and bracing have been ordered left in place, payment for same shall include the upper 3 feet or "cut-off" section of the sheeting. This upper three feet (3') or "cut-off" shall be Contractor's responsibility to dispose of at no additional cost.

14.0 TEMPORARY BRIDGES AND CROSSINGS

The Contractor shall construct and maintain temporary bridges and crossings, complete with flaggers, wherever necessary to expedite the work or to maintain traffic. Temporary bridges or crossings shall be of ample size to safely carry the load which may come upon them as determined by the Engineer. The cost of all labor, material, tools and equipment for temporary bridges and crossings shall be borne by the

Contractor, and no separate or additional payment shall be made therefore. All bridges and crossings whether manufactured or built onsite must have prior approval from the Engineer before installation.

15.0 RAILROAD AND HIGHWAY CROSSINGS

During the construction of work underneath and alongside railroad tracks and County or State Highway, the Contractor shall conduct all his/her operations with due caution in regard to the safety of lives and property and for the maintenance of railroad and highway traffic. The method and construction required for any work under or adjacent to railroad tracks and highways shall be in accordance with the respective railroad or highway department involved. The railroad and/or highway department may provide such inspectors or watchpersons as, in their opinion, are required, the expense of which shall be paid for by the Contractor. The Engineer shall make all arrangements therefore with the above named concerns, and the Contractor shall notify the Engineer in writing at least fifteen (15) days before proceeding with any work on or under said property concerned, stating the time and place where the Contractor shall interfere with the above company's property. In those cases where the issuance of a permit to do work in the above designated right-of-ways requires cash deposit or bond, the Contractor shall furnish said cash deposit or bond.

16.0 INSTALLATION OF WATERMAIN AND APPURTENANCES

Proper implements, tools and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work.

Pipe and other materials shall be unloaded and distributed on the job in a manner approved by the Engineer. In no case shall materials be thrown or dumped from the truck. All materials unloaded in an unsatisfactory manner shall be rejected and work shall be stopped until such materials have been examined by the Inspector and approved. The Contractor shall furnish the necessary assistance in such examination of materials.

Water main materials shall be carefully lowered into the trench by suitable tools or equipment in such a manner as to prevent damage to materials and protective coatings and lining. Under no circumstances shall water main materials be dumped into the trench.

Watermain removals under 10-ft in length are considered incidental to the valve, hydrant and water service pay items. Watermain removals greater than 10-ft in length will be paid by the linear foot of watermain removals above 10-ft and the appropriate length of each new watermain pipe greater than 10-ft by size. This work shall include, but not limited to, all equipment, excavation, all fittings, sleeves, glands, gaskets, bolts, and connections to existing and new watermain pipe whether less than or greater than 10-ft in length. Backfilling, labor and other materials necessary are incidental to the work.

The Contractor shall coordinate watermain shut offs with the Engineer.

16.1 Laying of Pipe and Fittings

All foreign matter or dirt shall be removed from the inside of the pipe and fittings before it is lowered into its position in the trench, and shall be kept clean by approved means during and after laying. All openings along the line of the main shall be securely closed as directed. In the suspension of work at any time, suitable stoppers shall be placed to prevent earth or other substances from entering the main.

Every pipe shall be bedded uniformly throughout its entire length.

No pipe shall be laid in water or when the trench conditions are unsuitable for such work, except by written permission of the Engineer.

16.2 Jointing of Ductile Iron Pipe and Fittings

For approved slip-on joints, the jointing shall be done strictly in accordance with approved methods. Proper assembly tools shall be used.

Both the spigot and socket must be thoroughly clean, free from tar or other coatings and rust.

For mechanical joint pipe, the last eight inches (8") outside the spigot end of the pipe and the inside of the bell, fittings, and gate valves shall be thoroughly cleaned to remove oil, grit, tar (other than standard coating) and other foreign matter from the joint and then painted with a soap solution of 1/2 cup of granulated soap in one (1) gallon of water. The gland shall then be slipped on the spigot end of the pipe with the lip extension of the gland toward the socket or bell. Paint the rubber gasket with soap solution and place on spigot end of pipe with thick edge toward gland. A standard solution furnished by pipe manufacturers may be used instead of the soap solution.

After the spigot end of a pipe is placed into the bell and pulled home, the gasket shall be pressed into place within the bell evenly around the entire joint. After the gland is positioned behind the gasket, the Contractor shall install all bolts and nuts and tighten them with a torque wrench. Nuts spaced 180 degrees apart shall be tightened alternately to produce equal pressure on all parts of glands.

Jointing shall be done, unless specifically excepted above, in accordance with "Notes on Method of Installation" included in ANSI Specification A.21.11 for a mechanical joint for pressure pipe and fittings.

When pipes are cut in the field, or when slip-on joints are joined to mechanical joint spigots, or spigots with straight ends, the cut or straight end shall be beveled

and all sharp or rough edges shall be removed. Megalugs are approved for jointing pipes and fittings.

16.3 Setting Hydrants

Hydrants shall be placed where shown on the plans or where directed by the Engineer.

Hydrants shall be supported upon a concrete base eighteen inches (18") square and a minimum of eight inches (8") thick. Each hydrant is to be braced against the far end of the trench by an eight inch (8") thrust block placed against the base of the hydrant and an eight inch (8") thrust block placed against the back of the trench against undisturbed soil. Hydrants shall be rod tied back to the main line using 5/8" minimum sized tie rods with a non-corrosive coating. Megalugs are allowed in lieu of tie rods for joint restraint.

Hydrants of sufficient length shall be installed as to provide a minimum of seven and one half feet (7 1/2') of ground cover over the top of the lead pipe and the lowest outlet nozzle on the hydrant shall be not less than twenty-one inches (21") nor more than twenty four inches (24") above the ground line.

Hydrants shall be adjusted to the proper elevations at the time of the initial hydrant installation. The Contractor shall obtain proper adjustments using ductile iron pipes, water main fittings, swing arm fittings, short vertical depth type hydrants, or other methods as approved by the Engineer. All material and fittings used to attain proper elevation will be considered incidental.

If a short vertical depth type hydrant is determined to be the appropriate adjustment method by the Engineer, the normal depth type hydrant supplied by the Contractor may be exchanged for the short vertical depth type hydrant provided by the Owner.

Wherever a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the bottom of the trench to at least six inches (6") above waste openings in the hydrant and to a distance of one foot (1') around the base elbow.

Wherever a hydrant is set in clay or other impervious soil, a drainage pit two feet (2') in diameter and three feet (3') deep shall be excavated below each hydrant base and filled compactly with coarse gravel or crushed stone and coarse sand, under and around the elbow and concrete base to a level of six inches (6") above the waste opening. Hydrants where the groundwater table is above the drain outlet shall have the outlet drain hole plugged or the drain tube cut off to prevent draining. They hydrant will then be equipped with a tag stating "Pump After Use."

Cover all material placed for drainage with a minimum of two layers of four (4) mil polyethylene. No drainage system shall be connected to a sewer.

Hydrants must maintain their position and must not be displaced out of plumb during backfilling. Any hydrant out of plumb shall be excavated, reset, (including blocking) and re-backfilled.

16.4 Valves and Fittings

Gate valves and fittings shall be placed where shown on the plans or as designated by the Engineer. Jointing shall be done as previously specified herein.

Valve boxes shall be firmly supported to maintain a centered and plumb alignment over the wrench nut of the gate valve, with box cover flush with the surface of the finished pavement or at such other level as may be directed by the Engineer.

All fittings shall be approved by the engineer. Ductile iron mechanical joint fittings, having a minimum working pressure rating of 150 PSI and shall conform to the requirements of AWWA C153 compact fittings. Valves, valve boxes, tees, crosses, saddles or any other fittings shall be wrapped with a flat sheet or split length polyethylene tube by passing the sheet under the appurtenance and bringing it up around the body. Make seams by bringing the edges of the polyethylene sheet together, folding over twice and taping down.

16.5 Reaction Blocks

All plugs, caps, tees and bends deflecting more than 12 degrees shall be provided with reaction backing. Concrete, suitable metal rods or harness, which are rust-proofed and/or retainer glands may be used subject to the Engineer's approval. Reaction blocking shall be so placed that all pipe and fitting joints are accessible for repair, and in such a manner as to provide bearing against undisturbed ground.

Testing of lines shall not proceed until concrete thrust blocks have attained their design strength.

16.6 Polyethylene Wrapping

Polyethylene wrap shall be required on all new installations.

The polyethylene wrap tubing shall be cut to provide for a minimum of one foot (1') of lap over both the adjoining pipes. The ends of the tubing shall be wrapped using 3 circumferential turns of plastic adhesive tape.

The loose wrap on the barrel is to be pulled snugly around the barrel of the pipe and the excess folded over at the top. This fold will be held in place by means of

six inch (6") strips of the plastic tape, placed at intervals of three feet (3') along the pipe barrel.

Bends, reducers and offsets shall be wrapped in the same manner as pipe.

Valves shall be wrapped by bringing the tube wrap on the adjacent pipe over the bells of the valve and sealing with adhesive tape. The valve bodies are then wrapped with flat sheets passed under the valve bottom and brought up around the body to the stem, and fastened with the tape.

16.7 (2504) Polystyrene Insulation:

This work shall consist of furnishing and installing four inch (4") thick insulation board above the watermain and sewer pipe at the locations designated in the Plan. This work shall be performed in accordance with the details shown in the Plans, the applicable MnDOT Standard Specifications, and the following:

The insulation board shall be rigid expanded polystyrene conforming to the material requirements of MnDOT 3760. Styrofoam S.M. and Styrofoam TG brand insulation is an approved insulation material.

The insulation material shall be furnished in panels 50 mm [2 inch] thick and shall be placed on a smooth level foundation in a staggered manner that will provide joint overlaps a minimum of 150 mm [6 inches] on the underlying sheets and the edges shall be trim and square. A minimum of two (2) wood skewers per board in each layer driven flush with the surface of the material shall be utilized to hold the insulation material in place during the backfill operations.

The placement of the backfill material over the insulation board and compaction thereof shall be accomplished in a manner that will preclude damage to the insulation material. Construction equipment of any kind shall not operate directly on the insulation board. Sections of insulation board damaged by the Contractor's construction operations shall be replaced at the Contractor's own expense.

Measurement will be made by the area insulated as specified. Payment will be made under Item 4" Polystyrene Insulation at the Contract bid price per square meter [square yard], which shall be compensation in full for all costs incidental thereto.

16.8 Water Service Complete

Water services shall be located at least ten feet (10'), measured horizontally, away from existing sanitary sewer services and for the most convenience to the benefited property.

Water services shall be of a size as specified in the proposal from the water main to the curb stop for normal domestic service. Services shall have a minimum of seven and one half feet (7 ½') of cover and placed as shown on the detail drawings.

All service taps shall utilize the Smith-Blair 317 Service Saddle with double stainless steel strap. Any substitution must be approved in writing by the Engineer.

The Contractor shall make all taps into the watermain at an angle of 45 degrees from horizontal and install corporation stops. Copper service pipe shall be installed continuous without joints between the corporation stop on the watermain and the curb stop, allowing approximately one foot (1') of slack for possible settlement.

All copper service taps shall be made with main line under normal static pressure ("wet").

No water service shall be installed within ten feet (10') horizontally from a manhole. Water service piping, no matter the size, shall be installed in one continuous piece without intermediate joint couplings between the corporation and the curb stop box.

Select Granular Borrow for backfilling copper water services shall be paid at contract unit price placed.

16.9 Horizontal Directional Drill (HDD)

High-density, extra-high molecular weight polyethylene (HDPE EHMW) pipe shall be used for the HDD installations.

All piping system components shall be the products of one manufacturer.

Both pipe and fittings shall carry the same pressure rating. All fittings shall be pressure rated to match or exceed the system piping to which they are joined.

The pipe shall have a minimum SDR (Standard Dimension Ratio) wall thickness, nominal size and pressure rating as specified on the Plans.

Connection to non-HDPE fittings or pipe shall have HDPE PVC transition fittings.

Polyethylene pipe and fittings may be rejected for failure to meet any of the requirements of these specifications. No compensation will be given the Contractor for rejected materials.

The Contractor shall be responsible for pipe refusal, lost heads, mud loss, heaving of surface features, etc. that may result from the operation of directional

drilling. The means and methods for rectifying the drilling concerns shall be approved by the Engineer.

17.0 RELOCATE CURB STOP BOXES AND HYDRANTS

17.1 General

The Contractor must plan their operation to cause the least amount of disruption of water service in the affected area. The Contractor shall notify the Engineer and the affected property owners before shutting off water-main. All hydrants shall be plumb and all curb stop boxes shall be to grade, plumb and concentric about the operating nut after relocation.

17.2 Relocate Curb Stop Boxes

This work shall consist of relocating water service line stop boxes as indicated on the plans from their present location to a location 15' behind the proposed curb line or to the right-of-way line. The Contractor shall not be permitted to shut off the water in the main in conjunction with this work. In moving the stop box, new copper water pipe of the same diameter as the existing pipe shall be furnished and installed between the old and new valves.

17.3 Relocate Hydrants

This work shall consist of relocating hydrants from their present location to a new location as shown on the plans and staked in the field by the Engineering Department. All materials and fittings used to attain proper elevation will be considered incidental.

17.4 Backfilling Trenches

Backfilling of all trenches shall be accomplished in layers or lifts. Under no circumstances shall the trench be backfilled in a single lift by pushing the material into the trench. The trench shall be compacted with a vibratory compactor in one (1) foot lifts up to finished grade elevation. Compacting shall continue on each lift until no further settlement occurs.

17.5 Payment

Relocating stop boxes and hydrants shall be measured by the structures relocated and paid for at the contract price per stop box or hydrant relocated, which price shall be compensation for all costs incidental thereto, including but not limited to new material.

18.0 ADJUST CURB STOP STAND PIPE, HYDRANTS, AND WATER VALVE BOXES

18.1 General

The Contractor is responsible for the protection of all underground utilities which are located in the field or are shown on the plans, and shall adjust all water valve boxes and curb stop boxes which require such adjustment. After adjustment, all valve boxes shall be ¼" to ½" below finished grade and shall be in proper working order. Asphalt used to adjust manholes is incidental to the adjustment. All hydrants shall be plumb and all curb stop boxes and valve boxes shall be plumb and concentric about the operating nut after adjustment.

18.2 Adjust or Repair Existing Gate Valve Box

The adjustment of existing valve boxes in accordance with the general conditions of this section shall include replacing the top section. Repair of existing gate valve boxes shall include any work and materials necessary to repair the damaged sections of the box and adjust repaired box to finished grade.

18.3 Adjust Curb Stop Stand Pipe

This work shall consist of adjusting the standpipe to 1" below finished sod line. If the existing standpipe cannot be adjusted to the proper elevation, then the top of the pipe shall be cut and re-threaded or the setscrew type of top may be used. All interim adjustments are considered incidental.

18.4 Adjust Hydrants

This work shall consist of installing hydrant extensions at locations shown on the plans or as directed by the Engineer in even 0.5' or 1.0' increments. All hydrants shall be adjusted to finish grade at the time of installation. Refer to Water main Specs for more information.

18.5 Payment

Payment shall be at the contract unit price, which price shall be compensation in full for all costs incidental to the adjustment.

19.0 BACKFILLING AND GRADING

Backfilling and grading shall be performed in accordance with the provisions of MnDOT 2503 and as amended and modified herein.

All excavation in trenches shall be backfilled to the original ground surface or to such grades as specified or shown on the drawings. The backfilling shall begin as soon as practical after the pipe has been placed. Backfilling shall be done as completely as possible so as to prevent after settlement. The materials shall be compacted to attain complete filling by using the best materials available for this purpose, free from boulders

or stones. Depositing of the backfill shall be done so the shock of falling material will not injure the structure. Grading over and around all parts of the work shall be done as directed by the Engineer.

Complete cleanup shall proceed directly behind the backfilling to accommodate the return to normal conditions. The Contractor shall have sufficient equipment on the job to assure timely backfill and cleanup at all times. No trenches shall be left open over night. The Contractor shall take full responsibility for any mishaps that might occur for non-compliance of this requirement.

The lower portion of the trench around the pipe shall be backfilled in accordance with the requirements for Class C Bedding. Granular material, free from rocks and boulders, shall be carefully placed by hand simultaneously on both sides of the pipe to a height of at least one foot (1') above the top of the pipe to completely fill all spaces under and adjacent to the pipe. Backfill shall be tamped thoroughly on each side and under the pipe as far as practicable in layers not exceeding six inches (6") in thickness. In the event that suitable, granular material is not encountered during the normal excavation of the water trench or when the material encountered is determined unsuitable by the Engineer for backfilling around the conduit as required above, the Contractor shall provide and place such approved material (sand fill) as required at the unit price bid. All copper services shall have six inches (6") of clean sand (under #4 sieve) under and on the sides and one foot (1') above before other backfilling can proceed.

Succeeding layers of backfill may contain coarse materials, but shall be free from pieces of rock, frozen material, concrete, roots, blacktop chunks, stumps, tin cans, rubbish and other similar articles whose presence in the backfill, in the opinion of the Engineer, would cause settlement of the trench, or damage to the pipe. No black dirt, loam or other unsuitable materials shall be used as backfill in the top four feet (4') of the water trenches lying in the paved portion of the street. Under no condition shall lumps of broken blacktop or other such material of a size larger than two inches (2") in diameter be placed in the upper one foot (1') of the finished grade.

Backfilling of trenches in the traveled portions of the streets and under the curbs shall be accomplished in one foot (1') lifts. Where there is granular soil, compaction shall be obtained in each lift using a vibratory compactor. Where there are cohesive soils, the compaction of each lift shall be obtained using a sheep's foot roller. No peat or other organic soils shall be backfilled under the traveled portions of streets.

Backfilling of all trenches other than the traveled portions of streets shall be accomplished in three foot (3) layers or lifts. Compacting shall be obtained using the appropriate type of compactor depending on the type of soil encountered. Compaction shall continue on each lift until no further settlement occurs.

Where, in the opinion of the Engineer, the native soil is unsuitable for backfill material, it will be the Contractor's responsibility to excavate the trench, haul away all unsuitable backfill material to such locations as designed by the Engineer, and backfill the trench in accordance with the specifications with all acceptable excess material which may be

obtained from other trenches or excavations within the project area. Payment for truck hauling this material will be made at the contract unit price bid for common excavation (vehicle measure). In the event that deficiencies still exist in the backfill of the trench, after all available excess material has been utilized as described above, the Contractor shall provide additional approved material as may be authorized and verified by the Engineer. Such material shall be furnished and placed at the contract unit price per cubic yard. Unsuitable material that is loaded in trucks and hauled away to the dump areas will be paid for at the contract unit price bid for common excavation (vehicle measure). There will be no pay for unsuitable material that is excavated and wasted in the immediate area.

Rubber-tired equipment shall be used to backfill trenches where other equipment will damage existing bituminous surfaces or sod.

In addition to the blading and maintenance requirements specified under this article, the Contractor shall also be required to adequately control dust on the streets after compaction and grading when directed by the Engineer. When so directed by the Engineer, the Contractor shall provide one tank truck of adequate size with spray bar or other suitable equipment for sprinkling streets which shall be available at all times for street maintenance. If in the opinion of the Engineer, the Contractor is not maintaining adequate dust control with one tank truck, the Contractor shall provide additional tank trucks at no additional compensation.

All deficiencies in the quantity of material for backfilling trenches or for filling depressions caused by settlement shall be supplied by the Contractor. Any excess material shall be hauled away and disposed of by the Contractor at no additional compensation.

When the trench excavation for the water mains and appurtenances is within the right-of-ways of State or County, the backfilling of the trench, compaction of materials and subgrade preparation shall be done in strict accordance with the existing requirements and specifications of the State or County Highway Department at no additional compensation.

The Contractor shall provide one motor grader which shall be available at the project at all times for surface maintenance. If in the opinion of the Engineer, the Contractor is not maintaining the street surfaces sufficiently with one motor grader, the Contractor shall provide additional blades at no additional compensation.

In all cases, the Contractor shall blade the roadway after the trench has been backfilled, so that it shall provide full and adequate drainage and shall be passable to traffic at all times. Existing roadway material shall be adequately salvaged, stockpiled, placed and graded to cap off the backfilled areas for purposes of maintaining access and providing a drivable surface free of rutting and ponding of water. Segregating soils during these operations is a specific requirement to prevent contamination of the soils that are needed for these purposes. The Contractor shall maintain the roadway in a condition acceptable to the Engineer at all times until final acceptance of the entire work by the City. This work shall be considered incidental.

Additional import material needed for purposes of maintaining traffic shall only be authorized and used for the specific purpose of maintaining traffic when full and proper measures have been taken to salvage and use the existing roadway base materials and all on-site material has been exhausted. Payment for additional material shall only be upon specific approval by the Engineer and shall be included for payment under the bid item of similar material.

20.0 TESTING AND DISINFECTING MAINS

20.1 Hydrostatic Testing of Water Mains

After the pipe has been laid including fittings, valves, services and hydrants and the line has been backfilled in accordance with these specifications, all newly laid pipe, or any section thereof, unless otherwise directed by the Engineer, shall be subjected to hydrostatic pressure of 150 pounds per square inch. The duration of each such test shall be at least two hours. No water will be allowed to be added to the watermain to maintain the required pressure during water main pressure testing.

The test gauge shall be certified accurate by accredited testing agency within one year from date of test to be performed. The gauge shall be minimum four inch (4") diameter; readings marked in minimum one pound increments and have a mirrored band on the dial face using a knife-edge pointer accurate to $\pm 0.25\%$ over full scale.

The City shall not pay any additional amount to the Contractor for time spent in pressure testing mains and correcting leaks. In order to insure that no test need be made against an existing gate valve, the Contractor shall install either a temporary gate valve or a blocked plug to test against.

The installation of such temporary fittings and sleeves on the main after the test will be at the Contractor's expense. All sleeves will be air pressure tested 150 pounds for two hours before being installed in the already tested main.

Each section of pipe shall be slowly filled with water and the specified test pressure, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges and all necessary apparatuses shall be furnished by the Contractor. Gauges and measuring devices must meet with the approval of the Engineer and the necessary pipe taps made as directed. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points at highest elevations, and afterward tightly plugged. All taps made for testing shall be at the Contractor's expense.

Any cracked or defective pipes, fittings, valves or hydrants discovered in consequence of the pressure test shall be removed and replaced by the Contractor with sound material in the manner provided and the test shall be repeated until satisfactory to the Engineer.

After the installation has been tested, the Contractor shall follow the disinfection procedures as described in paragraphs Nos. 1227 and 1228 of Section XII, "Manual of Water Supply Sanitation", of the Minnesota Department of Health. The Contractor shall become thoroughly informed on the requirements of the above mentioned manual.

The Contractor shall furnish facilities for the introduction of either chlorine or heavily chlorinated water directly into the mains on their completion.

Table 2 indicates the amount of calcium hypochlorite (65% available chlorine) that shall be added to each 100 feet of pipe to furnish a solution containing the minimum amount of free chlorine.

Pipe Size	Calcium Hypochlorite (65% Available Chlorine)
6"	2.1 oz.
8"	4.0 oz.
12"	8.0 oz.
16"	14.4 oz.

Table 2. Watermain Disinfectanting

Only fresh disinfectants shall be used and the main filled with water and flushed not later than one week after the disinfectant has been added. The water (containing chlorine) shall be left in the pipe, being disinfected, for a minimum of twenty-four (24) hours. All water must pass all specified bacteria tests and be completely flushed prior to being returned to operation.

20.2 Electric Continuity for Slip Joint Pipe

The system (pipeline and hydrants) shall be tested for electrical continuity and current capacity. The electrical test shall be made after the hydrostatic pressure and while the line is at normal operating pressure. Backfilling shall have been completed. The line may be tested in sections of convenient length as approved by the Engineer. The electrical continuity test should be performed no more than one week after the hydrostatic pressure test.

Direct current of 350 amperes, approximately 10%, shall be passed through the pipe line for 5 minutes. Current flow through the pipe shall be measured continuously on a suitable ammeter and shall remain steady without interruption or excessive fluctuation throughout the 5-minute test period.

Insufficient current or intermittent current or arcing, indicated by large fluctuation of the ammeter needle, shall be evidence of defective electrical contact in the pipe line. The cause shall be isolated and corrected. Thereafter, the section in which the defective test occurred shall be retested as a unit until it meets the requirements. All such equipment shall be furnished by the contractor, subject to the approval of the Engineer.

Sources of D.C. current for these tests may be motor generators, batteries, arc welding machines, etc. (D.C. arc welding machines will probably be the usual source.) These machines are available in adequate capacity for these tests and are equipped with controls for regulating the current output.

Cables from the power source to the section of the system under test should be of sufficient size to carry the test current without overheating or excessive voltage drop. Usable sizes will probably be in the range of 2/0 to 4/0 A.W.G.

Connections for the test shall be made at hydrants. The hydrants shall be in the open position with the caps on during the test. The cable shall be clamped to the top operating nut. Note: After the test the hydrant shall be shut off and a cap loosened to allow hydrant drainage. The cap shall be tightened after drainage.

A hook-on type D.C. ammeter placed on one of the cables leading to the hydrant is a convenient method of measuring current.

In using arc welding machines, the current control should be set at minimum before starting. After starting the machine, advance the control until the current indicated on the ammeter is at the desired test value. Caution: in case of open circuits at joints or connection, the voltage across the defective joint or connection will be in the order of 50-100 volts.

All testing shall be completed with acceptable test results prior to connecting any services.

21.0 SURVEY QUALITY LOCATES

This work shall consist of the Contractor providing survey quality XYZ locates of the water corporation stops and curb stops, bends, tees, sleeves, plugs, and each end of each abandoned pipe prior to backfilling operations with the intent being that the locations can be inserted into the City of Edina coordinate system for ease of relocation if so required.

Locates must be shot using ground-based survey equipment with a tolerance of +/- 0.03 feet. GPS-based surveying equipment may not be used for locates. Horizontal and vertical control will be provided by the Engineer.

The Contractor shall provide a spreadsheet with the information in the following column headings:

1. Address

2. Item Located
3. X Coordinate
4. Y Coordinate
5. Z Coordinate

22.0 RESTORATION OF GROUND AND ROAD SURFACES

Wherever the surface of the ground is removed or disturbed by the Contractor's operation the Contractor shall restore, replace or rebuild all such surfaces to a condition at least equal to its condition at time of removal. Maintenance of streets and traffic shall comply with Article 5 "Maintenance of Traffic", Edina Specifications for Plant Mixed Bituminous Construction and with Article 17 hereinbefore.

Unless otherwise specified or shown on the plans, the Contractor shall not be required to replace bituminous paving on City streets or State and County Highways when the alignment of the water main and its appurtenances, as shown on the plans, requires the Contractor to remove such paving during the phase of excavation. However, if the alignment of the watermain and its appurtenances, as shown on the plans, is alongside or parallel to a paved roadway, but the proximity of such alignment to the paving does not warrant any damage or removal of such paving, the Contractor shall replace or repair the paving which the Contractor has removed or damaged at no additional compensation.

When a failure has occurred during construction it is at the Contractors expense to retest the failures until they pass and submit the results to the City for verification.

23.0 GAS SERVICE

Whenever, during excavation for the watermain, a house gas service line, which is part of the gas system, is encountered, the cost of cutting service, providing temporary service and reconnecting house service shall be borne by the Contractor.

The Contractor shall cooperate with the gas utility on this phase of the work. If any expense is incurred by the gas utility in connection with such cutting and replacement of gas service lines it shall be chargeable to the Contractor.

It shall be the Contractor's responsibility to notify the gas utility sufficiently in advance of the Contractor's proposed construction. The Owner shall not be responsible for any delay that the Contractor may encounter due to the failure on the part of the Gas Company to promptly do the necessary work.

The Contractor shall be held liable for any damage to gas mains and house services because of carelessness or negligence on the Contractor's part.

24.0 WORKMANSHIP AND CLEANUP

Upon completion of the contract, the Contractor shall dismantle and remove all construction plant, equipment, appliances, barricades and surplus materials; shall clean the sewers and other structures and all streets or other services used by the Contractor; and shall do such incidental work as may be necessary to leave the work or any premises occupied by the Contractor in a neat workable condition. This work shall be done with a minimum of inconvenience to the public or public travel.

When defective work on utilities; watermain, storm and sanitary that is a danger to the public's wellbeing or health has been noticed, the Contractor has 4 hours to respond to the Engineer with detailed information on how and when they are going to fix the defective work. If the contractor does not repair the defective work within 24 hrs of written or verbal notice, the City has the right to repair and bill the contractor for the work. If the City deems the defective work a public hazard, the City has the right to immediately repair the defective work and bill the contractor.

25.0 OPERATIONAL INSPECTION

At the completion of the project, and in the presence of the Engineer, the Contractor shall operate all valves, hydrants and water services to ascertain that the entire facility is in good working order; that all valve boxes are centered and valves are opened; that all hydrants operate and drain properly; that all curb boxes are plumb and centered; and that water is available at all curb stops.

26.0 DAMAGE TO SANITARY SEWER SERVICES DURING WATERMAIN INSTALLATION AND WATER CORPORATION STOPS LEFT TURNED OFF

During the watermain installation, all of the sanitary sewer services shall be staked on the watermain side of the street. Contractor will need to give the city 48 hrs notice before needing any sanitary services staked. If any sanitary sewer service or main is damaged during the watermain installation, it shall be repaired immediately by the Contractor at no cost to the Owner.

If any corporation stops are not turned on, it shall be the Contractor's responsibility to turn them on when the faulty work is discovered at no cost to the Owner.

The Contractor who is awarded this contract shall remedy the two above mentioned situations for a period of ten years following the date of contract.

27.0 METHODS OF MEASUREMENT AND PAYMENT

27.1 Ductile Iron Pipe

Ductile iron pipe shall be paid for at the contract price per lineal foot for each diameter of pipe furnished, which shall include the cost of furnishing the pipe, rubber gasket, joints and other material and of delivering, handling, laying,

trenching, backfilling, testing, and shop inspection when required and all material or work necessary to install the pipe complete in place at the depth specified.

The length of ductile iron pipe for which payment is made shall be the actual overall length measured along the axis of the pipe without regard to intervening valves or specials.

Lengths of branches shall be measured from the centers of connecting pipes to centers of valves or hydrants.

27.2 Ductile Iron Fittings

Ductile iron fittings and appurtenances shall be considered incidental to installation of pipe.

27.3 Hydrants

Hydrants shall be paid for at the Contract unit price per hydrant installed complete with 6" gate valve and box, drainage pit, gravel, concrete base, and bracing. Proper elevation of the hydrant shall be achieved using fittings underground. Hydrant extensions can only be used when approved by the Engineer. All materials and fittings used to attain proper elevation of the hydrant will be considered incidental.

27.4 Gate Valves and Boxes

Gate valves and boxes (including covers, extensions and gate valve adaptors) shall be paid for at the unit price bid for each size valve and box furnished and installed complete.

27.5 Copper Water Service Pipe

Copper water service pipe shall be paid for at the Contract unit price per lineal foot, for each diameter of pipe furnished, measured from the centerline of pipe to the centerline of curb box plus one foot (1') for loop. Payment for augered water service will include only the footage augered.

27.6 Corporation Stops

Corporation stops shall be paid for at the Contract unit price for each size furnished and installed and shall include the tap or saddle connection to the water main.

27.7 Curb Stops and Boxes

Curb stops and boxes including extensions shall be paid for at the Contract unit price for each size furnished and installed. Stationary rods are required on all curb stops.

27.8 Cutting into Existing Mains

Payment for cutting into existing mains shall be included in the unit price bid for each cut-in fitting including sleeve if needed. Wet taps shall be paid for as complete installation including sleeve, valve, box and cover.

27.9 Sheeting

Sheeting ordered left in place shall be paid for at the unit price bid per thousand board feet for wood sheeting and square feet as measured/sheet installed for steel sheeting. This will include all overlapping sheets. No payment will be made for installing sheeting.

27.10 Rock Excavation

Rock excavation shall be measured by volume in cubic yards and shall be measured from the top of the rock to a point below and on each side of the outside barrel of the pipe as specified and shall be paid for in accordance with MnDOT Specification 2451.

27.11 Material for Stabilizing Grade

Material used for refilling to pipe foundation grade to assure firm foundation for pipe shall be paid for at the Contract unit price per measured cubic yard in place.

27.12 Piling

Pile bents shall be paid for at the Contract unit price.

27.13 Polyethylene Wrap

Polyethylene wrap shall be inclusive in the costs bid for the lineal footage of each size of water line wrapped, including all fittings wrapped.

27.14 Select Granular Borrow

Select Granular Borrow for backfilling copper water services shall be paid at contract unit price/ton, placed.

27.15 SURVEY QUALITY LOCATES

Survey Quality Locates shall be measured on a lump sum basis based on a percent complete of the project and shall include all labor and equipment associated with gathering and tabulating survey quality locates for watermain, sanitary sewer, and storm sewer required items.

28.0 SPECIAL REQUIREMENTS OF MINNESOTA DEPARTMENT OF HEALTH
DIVISION OF ENVIRONMENTAL HEALTH

Water mains crossing house sewers, storm sewers, or sanitary sewers shall be laid to provide a separation of at least 18 inches between the bottom of the watermain and the top of the sewer. When local conditions prevent a vertical separation as described, the following construction shall be used:

28.1 Sewers passing over or less than 18 inches below water mains shall be constructed of materials equal to watermain standards of construction.

28.2 In addition, sewers passing over water mains shall be protected by providing:

- A vertical separation of at least 18 inches between the bottom of the sewer and the top of the watermain.
- Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains.
- That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

28.3 Water mains shall be laid at least ten feet (10') horizontally from any sanitary sewer, storm sewer, or sewer manhole, whenever possible. When local conditions prevent a horizontal separation of ten feet (10'), a watermain may be laid closer to a storm or sanitary sewer provided that:

- The bottom of the watermain is at least eighteen inches (18") above the top of the sewer.
- Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to watermain standards of construction and shall be pressure tested to assure water tightness prior to backfilling.

[End of Watermain & Appurtenances]