S.P. 027-622-003
CSAH 22 ; C.P. 0403
June 28, 2011

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SPECIAL PROVISIONS

DIVISION "WM"

SPECIAL REQUIREMENTS

WM-1 SCOPE OF WORK UNDER THIS CONTRACT

The Contractor shall:

Determine the proposed horizontal and vertical location of the directional drilled water main and submit the plan to the Engineer for review and approval.

1. Remove existing water main in the project area that will be abandoned.
2. Coordinate with City of Minneapolis Water Works, who will shut off the existing main and make connections from existing water system to the directional drilled main.
3. Install new water main by directional drilling under Minnehaha Creek.

WM-2 WORK BY OTHERS

Required surveying to be performed by Hennepin County.

1. Minneapolis Water Works will operate all valves required to complete water main work on this project. Under no circumstance shall water valves be operated by anyone other than City of Minneapolis Water Works personnel.
2. Minneapolis Water Works will furnish and install all connections to the existing water main system from the approved plan end of the Contractor installed HDPE adapter to the existing system including valve manholes. The City's work shall be completed before the Contractor may begin removal of the existing water main. The current assumption is that the City will accomplish the following work efforts for connection of the existing water main to the Contractor installed 14" HDPE.

   North side of Bridge – Furnish and install 12"-1/8 Bend on 12" x 8" Tee, 12" DIP to a 12" Gate Valve in a Manhole, and 12" DIP to another 12"-1/8 Bend to which the Contractor will connect 14" HDPE.

   South side of Bridge – Furnish and install 12" Gate Valve in a Manhole just north of existing 12" cross and 12" DIP stub to outside of Manhole where Contractor will connect 14" HDPE.
3. Water quality samples shall be taken by the Minneapolis Water Works Quality Laboratory personnel for laboratory analysis.

4. One full-time inspector for the installation of the water main will be provided by the City of Minneapolis.

WM-3 COORDINATION AND STAGING OF WATER WORK

WM-3.1 Removal of Existing Water Main and Installation of New Main

The existing water main may be removed at the beginning of the project after the Contractor has provided and obtained Engineer's approval of a plan indicating the proposed locations where connections to the City's system will be made. Installation of the new main may not occur until the installation of new piling for foundations on either side of centerline has been completed and any required temporary sheet piling on either side of centerline that would prevent installation by directional drilling has been removed.

WM-3.2 Disinfection, Sampling, and Testing of Water Mains

The Contractor shall always be mindful that the safety of the residents of Minneapolis is the first priority of the City Water Department. Adequate time and deference to the judgement of the Superintendent of Water Distribution in matters of, and related to, disinfection and sanitary practices involving water main work and the placing into service of water mains shall at all times be required.

During flushing operations, the Contractor will be strictly required to cooperate with the City Water Department with regard to placement of hoses required to flush sections of water main that have been restored to service. The hoses must remain intact *continuously* until such time that the City Water Department removes them. **Under no circumstances shall the Contractor or any other unauthorized personnel remove flush hoses.**

WM-4 SUBMITTALS

WM-4.1 Required Submittals

1. A list of similar projects completed in the last 3 years. Include pipe material, pipe diameter, project length, typical length of pull, including typical thrust and pullback requirements, soil conditions, project owner, and owner's contact information.
2. Names and project lists for key directional drilling equipment operators and supervisors, including list equipment each operator is certified to operate and their years of experience with the equipment.
3. A layout plan showing proposed stationing and elevations.
4. Size, location, and design calculations for any entry and exit pits, including pit supports that are proposed.
5. Grout mix design.

6. Description of system to be used for handling and disposal of drilling mud and cuttings.

7. Results of alignment plans superimposed on a copy of the design alignment for comparison to verify compliance with alignment tolerances.

8. Results of all quality control tests.

WM-5 MATERIALS:

The Contractor shall provide the water main pipe and all other materials as specifically required for the completion of the work.

A. All materials required for completion of the work as specified shall be new material conforming to the requirements referenced herein and, unless otherwise indicated herein, all of the materials used shall be furnished by the Contractor. Any options provided for herein, or in any of the referenced Specifications, shall be subject to any selection restrictions imposed by other Contract Documents and only those options which are left unspecified shall be subject of choice by the Contractor, and then only to the extent that other limitations or rights are not indicated.

B. Material acceptance shall be on the basis of Certificates of Compliance furnished by the Contractor's supplier or the material manufacturer in accordance with the provisions of MN/DOT Standard 1603, except in the case of natural materials which will be accepted on the basis of the Department's tests.

HIGH DENSITY POLYETHYLENE PIPE

Manufactured in accordance with AWWA C906 and ASTM F714, designation code PE 3408, meeting ASTM D3350 cell classification 345464C, DIPS (Ductile Iron Pipe Size).

FITTINGS

Contractor to provide HDPE mechanical joint adapters to make connections between HDPE and DIP and/or DIP/CIP fittings that are furnished and installed by Minneapolis Water Works.

GRANULAR MATERIALS

Granular backfill materials furnished for foundation, bedding, cover, fill or other backfill construction shall consist of any natural or synthetic material aggregate such as sand, gravel, crushed rock, crushed stone, and be free of all organic materials; that shall be so graded as to meet the gradation requirements specified for each particular use.

PITOT-TAPS FOR CHLORINATION

Pitot Taps shall be installed on both sides of line gates for pressure testing, flushing, chlorination, and for taking bacteriological samples. The taps shall be housed inside of the pre-cast manholes required for all gate valves. Taps shall be made within 9" of the gate valve flange. Pitot tap size to be specified by Minneapolis Water Works.

DRILLING FLUID

Shall be bentonite slurry, when used or required in the design prepared by the Contractor. It shall meet API Specification 13A, high swelling montmorillonite, capable of mixing with water to form a stable homogeneous suspension. Water shall be clean, potable, containing no more than 500-ppm chlorides.

SAND FOR CONTACT OR CONSOLIDATION GROUTING

Shall be clean, natural silica sand graded such that all of the material passes the No. 20 sieve and not more than 20 percent passes the No. 200 sieve.

CONTROLLED LOW STRENGTH FILL (FLOWABLE FILL)

Shall be a mixture of Type I or II Cement (ASTM C150), Fly Ash (ASTM C618, Class f), and clean, potable water containing less than 500 ppm of chlorides. The ingredients shall be proportioned to obtain a compressive strength between 25 and 75 psi at 28 days in accordance with ASTM D4832.

TRACER WIRE

Shall be Underwriters Laboratories (UL) listed for use in direct burial applications (e.g. USE, UF, or tracer wire) and conform to the applicable requirements of NEMA WC3, WC5, and WC7. Conductor shall be minimum AWG No. 8 in copper or AWG No. 12 stainless steel rated to 30 volts.
Wire identification shall be Volts (or V), AWG size, UL and designation (example: "tracer wire").

DIRECTION DRILLING EQUIPMENT

Shall be certified by manufacturer for intended purpose, diameter of pipe, and expected loadings.

WM-6 CONSTRUCTION REQUIREMENTS

WM-6.1 GENERAL PROVISIONS

Water main construction shall be performed in accordance with the applicable requirements of MN/DOT Standards 2451, all pertinent Minneapolis Ordinances, and all relevant AWWA Standards as required by the Minnesota Department of Health, and as follows:

1. OPERATION OF EXISTING GATES

The Minneapolis Water Works shall open or close all gates as necessary for the construction and disinfection of the water main. **The Minneapolis Water Works neither implies nor guarantees that the shut-offs will be watertight.**

2. ESTABLISHING LINE AND GRADE

The Minneapolis Water Works Engineer and Hennepin County will work with the Contractor to establish the primary line and grade unless stated otherwise in Section S. For trench installation, line and grade stakes will be set parallel to the proposed pipeline at the appropriate offset therefrom as will best serve the Contractor's operations wherever practical. Grade and line stakes will be set at 50 foot intervals along the pipeline, at each change in line or grade, and as needed for pipeline appurtenances.

The Contractor shall arrange its operations to avoid unnecessary interference with the establishment of the primary line and grade stakes; and shall render whatever assistance may be required by the Engineer in accomplishing the staking. The Contractor shall bear the full cost of any re-staking necessitated by the Contractor's negligence.

The Contractor shall be solely responsible for the correct transfer of the primary line and grade to all working points and for construction of the work to the prescribed lines and grades as established by the Engineer.

3. PROTECTION OF SURFACE STRUCTURES

All surface structures and features located outside the permissible excavation limits for underground installations, together with those within the construction areas which are shown in the Plans as being saved, shall be properly protected against damage and shall not be disturbed or removed without approval of the Engineer. Within the construction limits, as required, the removal of improvements such as paving, curbing, walks, turf, etc., shall be subject to acceptable replacement after completion of underground work. All expense of removal and replacement shall be borne by the Contractor to the extent that separate compensation is not specifically provided for in the Contract.

Obstructions such as street signs, guard posts, small culverts, and other items of prefabricated construction may be temporarily removed during construction provided that essential service is maintained in a relocated setting as approved by the Engineer and that non-essential items are properly stored for the duration of construction. Upon completion of the underground work, all such

items shall be replaced in their proper setting at the sole expense of the Contractor.

In the event of damage to any surface improvement, either privately or publicly owned, the Contractor shall replace or repair the damaged property to the satisfaction of the Engineer and without cost to the Owner.

4. INTERFERENCE OF UNDERGOUND STRUCTURES

When any underground structure interferes with the planned placement of the pipeline or appurtenances to such an extent that alterations in the work are necessary to eliminate the conflict or avoid endangering effects on either the existing or proposed facilities, the Contractor shall immediately notify the Engineer of the affected structure. When any existing facilities are endangered by the Contractor's operations, the Contractor shall cease operations at the site and take such precautions as may be necessary to protect the in-place structures until a decision is made as to how the conflict will be resolved.

Without specific authorization from the Engineer, no essential utility service shall be disrupted, nor shall any change be made in either the existing structures or the planned installations to overcome the interference. Alterations in existing facilities will be allowed only to the extent that service will not be curtailed unavoidably and then only when the encroachment or relocation will satisfy all applicable regulations and conditions.

Whenever alterations are required as a result of unforeseen underground interference's, not due to any fault or negligence of the Contractor, any alterations ordered by the Engineer will be paid for as Extra Work. Any alterations made strictly for the convenience of the Contractor shall be subject to prior approval and shall be at the Contractor's expense. No extra compensation will be made for unavoidable delays caused by the interference of existing underground structures shown in the Plans.

WM-6.2 EXCAVATION AND PREPARATION OF TRENCH

1. OPERATIONAL LIMITATIONS AND REQUIREMENTS

Excavation operations shall proceed only as far in advance of pipe laying as will satisfy the needs for coordination of work and permit advance verification of unobstructed line and grade as planned. Where interference with existing structures is possible or in any way indicated, and where necessary to establish elevation or direction for connections to in place structures, the excavating shall be done at those locations in advance of the main operation so actual conditions

will be exposed in sufficient time to make adjustments without resorting to Extra Work or unnecessary delay.

All installations shall be accomplished by open trench construction except for short tunnel sections approved by the Engineer and with the exception that boring and jacking or tunnel construction methods shall be employed where specifically required by the Plans or Special Provisions. Installation of pipe through excavations will be allowed only where the surface structure can be properly supported and the backfill restored to the satisfaction of the Engineer.

The excavating operations shall be conducted so as to carefully expose all in place underground structures without damage. Wherever the excavation extends or approaches so close to an existing structure as to endanger it in any way, precautions and protective measures shall be taken as necessary to preserve the structure and provide temporary support. Hand methods of excavating shall be utilized to probe for and expose such critical or hazardous installations as gas pipes, electric power, fiber optics or telephone cables.

The Engineer shall be notified of any need for blasting to remove materials which can not be broken up mechanically, and there shall be no blasting operations conducted until the Engineer's approval has been secured. Blasting will be allowed only when proper precautions are taken to protect life and property, and then shall be restricted as the Engineer directs. The Contractor shall assume full responsibility for any damage caused by blasting, regardless of the requirements for notification and approval. The Contractor shall secure required permits for blasting and shall conduct blasting operations in conformance with all applicable State and local laws, regulations and ordinances.

2. EXCAVATION AND DISPOSITION OF MATERIALS

Excavation shall be incidental work to the installation of the water main except that the removal of materials classified by the Engineer as rock will be paid for as Extra Work.

Rock excavation is hereby defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; and any boulder stone, masonry or concrete fragments exceeding one-half cubic yard in volume. Materials such as shale, hard pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power operated excavator will not be classified as Rock Excavation.

Excavated materials will be classified for reuse as being either Suitable or Unsuitable for backfill or other specified use, subject to selective controls. All suitable materials shall be reserved for backfill to the extent needed, and any surplus remaining shall be utilized for other construction of the Project as may be specified or ordered by the Engineer. To the extent practicable, granular materials and topsoil shall be segregated from other materials during excavating and stockpiling operations so as to permit the best use of available materials at the time of backfilling.

All excavated materials reserved for backfill or other use on the Project shall be stored at locations approved by the Engineer that will cause a minimum of inconvenience to public travel, adjacent properties, and other special interests. The material shall not be deposited so close to the edges of the excavation as would create hazardous conditions, nor shall any material be placed so as to block access by emergency services. All materials considered unsuitable by the Engineer, for any use on the Project, shall be removed from the Project and shall be disposed of as arranged for by the Contractor in accordance with the provisions of 2104.3C3.

3. EXCAVATION LIMITATIONS AND REQUIREMENTS

Trench excavating shall be to a depth that will permit preparation of the foundation as specified and installation of the pipeline and appurtenances at the prescribed line and grade, except where alterations are specifically authorized. Trench widths shall be sufficient to permit the pipe to be laid and joined properly and the backfill be placed and compacted as specified. Extra width shall be provided as necessary to permit convenient placement of sheathing and shoring and to accommodate placements of appurtenance.

Excavations shall be extended below the bottom of structure grade as necessary to accommodate any required aggregate bedding and, when rock or any unsuitable material such as clay, silt, or organic materials are encountered at the established grade, additional materials shall be removed for a distance of one foot beyond the outside wall of the pipe in all directions.

4. SHEATHING AND BRACING EXCAVATIONS

All excavations shall be sheathed, shored, and braced as will meet all requirements of the applicable safety codes and regulations; comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces foundations, structures, utilities and other properties. Any damage to the work under Contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, cave-ins, bracing or through

negligence or fault of the Contractor in any manner shall be repaired by the Contractor at his expense and without delay.

Where conditions warrant extreme care, the Contract may require special precautions to protect life or property, or the Engineer may order the installation of sheet piling of the interlocking type or direct that other safety measures be taken, as he deems necessary. Failure of the Engineer to order corrections of improper or inadequate sheathing, shoring, or bracing shall not relieve the Contractor of his responsibility for protection of life, property, and the work.

The Contractor shall assume full responsibility for proper and adequate placement of sheathing, shoring, and bracing, wherever and to such depths that soil stability may dictate the need for support to prevent displacement. Bracing shall be so arranged as to provide ample working space and so as not to place stress or strain on the in place structures to any extent that may cause damage.

Sheathing, shoring and bracing materials shall be removed only when and in such manner as will assure adequate protection of the in place structures and prevent displacement of supported grounds. Sheathing and bracing shall be removed as the backfilling reaches the level of respective support.

All costs of furnishing, placing and removing sheathing, shoring and bracing materials, including the value of materials left in place as required by the Contract, shall be included in the prices bid for pipe installation and will not be compensated for separately. When any sheathing, shoring, or bracing materials are left in place by written order of the Engineer, in the absence of specific requirements of the Contract to do so, payment will be made for those materials as Extra Work, including waste materials resulting from upper cut-off requirements.

5. PREPARATION AND MAINTENANCE OF FOUNDATION

Foundation preparations shall be conducted as necessary to produce a stable foundation and provide continuous and uniform pipe bearing between bell holes. The initial excavating or backfilling operations shall produce a subgrade level slightly above finished grade as will permit hand shaping to finished grade by trimming of high spots and without the need for filling of low spots to grade. Final subgrade preparations shall be such as to produce a finished grade at the centerline of the pipe that is within 0.03 foot of a straight line between pipe joints and to provide bell hole excavation at each joint as will permit proper joining of pipe and fittings.

In rock foundations and when unsuitable materials such as clay, silt, and organic materials are encountered, they shall be removed and

selected backfill material shall be installed one foot around the pipe. In other excavations below grade, the backfilling to grade shall be made with Bedding Aggregate except where the use of Filter Aggregate is shown in the Plans or ordered by the Engineer as Extra Work. The backfill material shall be placed and compacted thoroughly as will provide uniform pipe support. Placement of the backfill shall be in relatively uniform layers not exceeding 8" in loose thickness. Compaction shall be achieved by means of mechanical compaction equipment as approved by the Engineer.

Where the foundation soil is found to consist of materials that the Engineer considers to be so unstable as to preclude removal and replacement to a reasonable depth to achieve solid support, a suitable foundation shall be constructed as the Engineer directs in the absence of special requirement therefor in the Contract. The Contractor may be required to furnish and drive piling and construct concrete or timber bearing supports or other work as may be directed by the Engineer. Any work so directed by the Engineer will be paid for as Extra Work.

Care shall be taken during final subgrade shaping to prevent any over-excavation. Should any low spots develop, they shall only be filled with approved material, which shall have optimum moisture content for thorough compaction. The finished subgrade shall be maintained free of water and shall not be disturbed during pipe lowering operations except as necessary to remove pipe slings. The discharge of trench dewatering pumps shall be directed to natural drainage channels or storm drains.

All costs of excavating below grade and placing foundation or bedding aggregate as required shall be included in the bid prices for pipe items to the extent that the need for such work is indicated in the Contract and the Proposal does not provide for payment therefor under separate Contract Items. Any excavation below grade and any foundation or bedding aggregate required to achieve the foundation and isolating conditions as specified above will be considered to be incidental work and no direct compensation will be made therefor.

WM-6.3 INSTALLING PIPE AND FITTINGS IN TRENCH

1. INSPECTION AND HANDLING OF PIPE

Proper and adequate 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. All pipe and fittings shall be handled carefully and in such manner as will prevent damage to protective coatings and linings; preclude the entrance of foreign materials into the inner areas of the pipe and fittings; and avoid piece to piece contact of parts that may be damaged by jolting.

Before being lowered into laying position, and while the pipes are suspended, the Contractor shall make a thorough visual inspection of each pipe section and of each fitting unit to detect cracking and other damage that may need corrective action or be cause for rejection. In addition, other crack revealing methods of inspection (hammer ringing or kerosene coating) shall be employed as directed by the Engineer to check out possible or suspected defects more definitely. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective action or rejection.

Immediately before placement, the joint surfaces of fittings shall be inspected for the presence of foreign matter, coating blisters, rough edges and projections, and any imperfections so detected shall be corrected by cleaning, trimming or repair as needed

2. LOWERING AND SETTING OF PIPE

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. Every precaution shall be taken to prevent foreign materials from entering the pipe while it is being placed and before any length of pipe is lowered into the trench, it should be inspected for damage and the inside of the pipe must be swabbed to remove loose dirt and foreign objects. If mud and trench water have been permitted to stand or flow through the pipe, the inside shall be scrubbed with a strong chlorine solution. The water main materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.

At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe. No pipe material shall be laid in water nor when the trench or bedding conditions are otherwise unsuitable or improper.

When placement or handling precautions prove inadequate, in the Engineer’s opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of an adjoining unit.

At all times while pipe laying is in progress or during noon hour and overnight periods, all open ends of the pipeline in the trench shall be closed by watertight plugs or other means approved by the Engineer.

If water is present in the trench, the seals shall remain in place until the trench is pumped completely dry.

WM-6.4 INSTALLING PIPE BY DIRECTIONAL DRILLING

1. GENERAL

Water Control: Drilling pit subgrades shall be kept continuously free from ground and surface waters during operations. Implement additional groundwater controls on short notice as required. Observed water levels prior to construction are to be below the invert elevation of the pits. Direct discharge from dewatering operations into approved receiving basins in accordance with all applicable regulatory requirements as required.

Operations: It is not necessary to complete drilling work in 1 continuous, non-stop, operation. If work is interrupted or stopped prior to completion at the Contractor's discretion without prior Engineer's approval, the Contractor shall bear all costs related to the stoppage and restarting operations without additional payment.

Operate to prevent settlement, movement, or cracking of adjacent structures. If any movement or settlement occurs which causes or might cause damage to the structures over, along, or adjacent to the work, stop drilling operations immediately, except for those activities which will assist in making the work secure and prevent further movement, settlement, or damage.

Resume drilling operation only after all necessary precautions have been taken to prevent further movement, settlement, or damage.

2. INSTALLATION

1) Preparations: Locate positions of entry and exit pits, establish elevation and horizontal datum for bore head control, and lay out pipe assembly area.

2) Lay out and assemble pipe in manner that does not obstruct adjacent roads and commercial or residential activities adjacent to construction easements. Elevate pipe over streets as necessary to avoid disruption to traffic.

3) Drilling Pilot Hole: Drill pilot hole from entrance point to exit point as determined in coordination with Engineer and Minneapolis Water Works.

As pilot hole is advanced, plot actual horizontal and vertical alignment of pilot hole at intervals not exceeding 25 feet. Provide the Engineer with position and inclination of pilot bore.

Use drilling fluid under pressure or other method designed by the Contractor to control ground water and to keep the pilot hole open.

a. Alignment Requirements: Keep the grade to no shallower than the profile shown and with no intermediate high points that might trap air in pipe after installation.

Keep curvature of completed pilot hole less than that which will produce wall stresses at 0.50 of yield stress in the pipe after it is installed and subject to maximum working pressure.

Return pilot hole that is deviating from designed horizontal and vertical alignment to proper alignment with no abrupt changes and at a rate not exceeding [1 foot per 50 feet of pilot hole advance].

b. Horizontal Alignment of Pilot Hole: Within 3 feet of approved plan.

c. Acceptance: If pilot hole alignment fails to conform to specified requirements, drill new pilot hole with alignment meeting specified requirements.

4) Reaming Pilot Hole and Pulling Pipe: Obtain Engineer approval to proceed before enlarging pilot hole and pulling pipe into position.

While pulling pipe, enlarge pilot hole ahead of pipe to diameter sufficient for pulling pipe into position. While pulling pipe, handle pipe in manner that does not exceed manufacturer's specification for pipe stress. Limit radius of curvature along length of pipe during installation to no less than 275 feet. If pipe buckles or is otherwise damaged, remove damaged section and replace it with new pipe.

Pull pipe so that a minimum of 10 feet of pipe is exposed at both ends of bore.

5) Cleaning Pipe Ends: After pulling pipe, clean exposed ends for installation of fittings.

6) Pipe Joining Method: Use thermo-butt fusion process in accordance with ASTM D2657.

7) Handling and Disposal of Drilling Fluid and Cuttings: Ensure adequate provisions are made for handling and

containing muddy water drilling fluid and cuttings during drilling operations. Do not discharge these contaminants into waterways. Handle water and materials to conform with requirements of the agency(s) with regulatory jurisdiction.

Construct drilling fluid pits at entry and exit points in manner that completely contains mud and prevents its escape.

When on Site provisions for storing muddy water, drilling fluid, or cuttings on Site are exceeded, haul contaminants away to suitable legal disposal site.

Conduct directional drilling operation in such manner that drilling mud is not forced into waterways, wetlands, or the ground surface.

8) End Fittings: Fabricate and install mitered fittings at ends of pipe as required for attachment of adjacent sections of pipe. Fabricate fitting angles to correspond to field conditions. Do not connect adjacent sections of pipe by beveling pipe ends. Coat and line fittings as specified for pipe.

9) Pipe Abandonment: In event of failure to install pipe conforming to all tolerance and test requirements of this Section, retain possession of pipe and remove it from Site. Completely fill borehole with grout, sand, or flowable fill so as to prevent future settlement.

10) If pipe cannot be withdrawn, cut pipe off at least 3 feet below ground surface, record location on Drawings, and abandon pipe after filling pipe and the annular space with flowable fill.

11) Tracer Wire: The wire shall be installed alongside all HDPE pipe and connected to locations on each end where it can be easily accessed for future locating of the main.

12) Voids: Any voids that develop outside of drilled pipe shall be injected with a mixture of pea gravel, fine gravel, sands, and fines plus water and Portland cement, chemical compound, and a non-setting or other admixture to achieve continuous contact between the drilled pipe and ground.

3. FIELD SURVEY

Contractor shall identify and provide a survey of the horizontal and vertical location of the drilled pipe as it is being installed. The survey shall be to an elevation accuracy of 0.1 feet at 10-foot intervals along the pipe centerline.

WM-6.5 DISINFECTION OF WATERMAINS

Any construction work done on existing water mains, which may include cuts, plugs, valves and other fittings, or any newly installed water mains shall be **disinfected and flushed by Minneapolis Water Works personnel,** and the **water sampled and tested by the Minneapolis Water Works Water Quality Laboratory. The samples shall be confirmed to be free of coliform organisms prior to the water main being put back in service**. It may be necessary to add pitot-taps to the existing water main to flush and bleed the air from the main. Also, with an existing water main out of service it may be necessary to provide temporary service to the Minneapolis Water Works water users.

WM-6.6 ELECTRICAL CONDUCTIVITY TEST

Not required for this project.

WM-6.7 TRACER WIRE TEST

The electrical continuity of the tracer wire shall be demonstrated after the directional drilling and installation of the water main is complete.

WM-6.8 HYDROSTATIC TESTING OF WATERMAINS

The Contractor shall not conduct any pressure tests or leakage tests against any valve currently installed in the Minneapolis Water system. Installations made where the new section of pipe connects to an existing valve, the Contractor must install a plug with a pitot tap attached, as close to the valve as possible on the new section of pipe, and any pressure or leakage test must be taken against this plug. All temporary plugs, pitot taps and other materials installed or used for hydrostatic testing purposes only, shall be considered an incidental cost for water main work.

After the installation and partial backfill of the water main, leaving the joints exposed for examination, each valve section shall be subjected to the pressure and leakage test prescribed herein. The Contractor shall furnish the pump, pipe connections, gauges, and measuring equipment, and shall perform the testing under the direct supervision of the Minneapolis Water Works Engineer. Where permanent air vents are not provided, the Contractor shall provide and install pitot taps as directed by the Minneapolis Water Works Engineer for release of air as the line is filled with water.

Where concrete reaction blocking is placed, the water main shall not be subjected to hydrostatic pressure until at least 5 days have elapsed after the concrete casting, with the exception that this period may be reduced to two days where high early strength concrete is used.

At the option of the Contractor, the pressure and leakage tests may be conducted simultaneously. Any defective joints, and any defective pipe, fittings, valves or hydrants revealed during the testing or before final

acceptance of the work, shall be satisfactorily corrected and the tests shall be repeated until the specific requirements have been met.

1. PRESSURE TEST

The section being tested shall be slowly filled with water and the specified test pressure shall be applied after all air has been expelled from the pipe. A hydrostatic pressure of not less than 150 pounds per square inch, measured at the lowest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner.

The specified pressure shall be held for a minimum duration of two hours, during which time all exposed pipe, fittings, valves, hydrants, and joints shall be carefully examined for visible leaks. Any defects discovered shall be corrected satisfactorily and the tests repeated until there is less than a 5 psi pressure loss for the two-hour duration.

2. LEAKAGE TEST

After satisfactory completion of the pressure test, a leakage test shall be performed on the new section of water main to determine the quantity of water that must be supplied into the section to maintain a test pressure of 150 pounds per square inch, after the air in the pipeline has been expelled and the pipe has been filled with water.

After filling the pipe with water and expelling all air in the line, the specified pressure shall be applied in the same manner as prescribed for the pressure test, and sufficient water shall be measured and supplied into the pipe section to maintain the pressure for a test duration of two hours.

No pipe installation will be accepted if the amount of makeup water is greater than that determined by the following formula:

In inch-pound units:

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where:

L = Testing allowance (makeup water) in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of pipe, in inches.
P = Average test pressure during the hydrostatic test, in pounds per square inch (gauge).

In metric units:

$$Lm = \frac{SD\sqrt{P}}{715,317}$$

Where:

Lm = Testing allowance (makeup water) is liters per hour.
S = Length of pipe tested, in meters.
D = Nominal diameter of the pipe, in millimeters.
P = Average test pressure during the hydrostatic test in KPA.

WM-6.9 PIPELINE TRENCH BACKFILLING OPERATIONS

All pipeline excavations shall be backfilled as will restore pre-existing conditions as the minimum requirements, and fulfill all supplementary requirements indicated in the Plans and these Special Provisions. The backfilling operations shall be started as soon as conditions will permit on each section of pipeline, so as to provide continuity and subsequent operations and restore normal public service as soon as practicable on a section–by-section basis. All operations shall be pursued diligently, with proper and adequate equipment, as will assure acceptable results.

Installation of flexible pipe in a trench shall include the placement of bedding and cover aggregate materials from a point six inches below the bottom of pipe to a point twelve inches above the top of the pipe. Placement and compaction of bedding and cover aggregate around the pipe shall be considered incidental to the installation of the pipe. Where existing soils do not meet the requirements of bedding and cover aggregates, the Contractor shall furnish the required granular materials.

Sheathing, shoring, and bracing materials shall be removed only when and in such manner as will assure adequate protection of inplace structures and prevent displacement of supported grounds. Sheathing and shoring shall be removed as the backfill reaches the level or respective support.

In the absence of special requirements, the backfilling from a point twelve inches above the top of flexible pipe shall be accomplished with the use of suitable materials selected from the excavated materials within the project.

Suitable material shall be defined as classified granular fill, free of foreign materials (rubbish, debris, etc.). Frozen clumps, oversize stone, rock, concrete or bituminous chunks, and other unsuitable materials that may enhance corrosion of pipe, or that may damage the pipe installation, prevent thorough compaction, or increase the risks of settlement unnecessarily shall not be used. Material selection shall be such as to make the best and fullest utilization of what is available, taking into consideration particular needs of different backfill zones. Material containing stone, rock, or chunks of any

sort shall only be utilized where and to the extent there will be no detrimental effect.

Backfill materials shall be carefully placed in accordance with the applicable requirements of MN/DOT Standards 2451.

Compaction of materials placed within the pipe bedding and cover zones shall be accomplished with portable mechanical compaction equipment, so as to achieve thorough consolidation under and around the pipe and avoid damage to the pipe. Above the cover zone material, the use of heavy roller type compaction equipment shall be limited to the safe pipe loading.

1. SPECIAL BACKFILL MATERIAL REQUIREMENT

MATERIAL DESIGNATIONS	ZONE
Bedding Aggregate	Placed below the pipe midpoint, prior to pipe installation, to provide a cushion course and facilitate uniform pipe support.
Fill Aggregate	Placed below the surface base course, if any, as the second stage of backfill, to achieve thorough initial consolidation of foundation for surface improvements
Base Aggregate	Placed below the surface paving course or other improvement to a specified depth to provide uniform structure support.

In each case above, unless otherwise shown in the Plans, the lower limits shall be the top surface of the next lower course as constructed. The upper limits of each course are established to define variable needs for aggregate gradation and compaction or void content, taking into consideration the sequence of construction and other variables. The material and zone designations described above shall only serve to fulfill the objective and shall not be construed to restrict the use of any particular materials in other zones where gradation requirements are met.

2. AGGREGATE GRADATION CLASSIFICATIONS

Granular materials furnished for foundation, bedding, encasement, backfill, or other purposes as may be specified shall consist of any natural or synthetic mineral aggregate such as sand, gravel, crushed

rock, or crushed stone that shall be so graded as to meet the gradation requirements specified herein for each particular use.

PERCENT PASSING **SIEVE SIZE**	**AGGREGATE USE CLASS**			
	BEDDING	COVER	FILL	**BASE**
3 inch	-	-	100	-
2 inch	-	-	90-100	-
1 inch	-	100	-	100
¾ inch	-	85-100	-	90-100
½ inch	-	-	-	-
3/8 inch	100	-	-	50-90
#4	35-100	35-80	35-100	35-80
#10	45-90	20-65	20-100	20-65
#40	14-45	10-35	5-50	10-35
#200	0-5	2-10	3-10	3-10

In the absence of specific Contract Items covering restoration items, all necessary restoration work shall be done at the Contractor's expense, as being part of the work required under the pipeline installation items. Where separate payment is specifically provided, only that work which is necessitated by the Contract will be compensated for. Any improvement removed or damaged unnecessarily shall be replaced or repaired at the Contractor's expense.

WM-6.10 BLOCKING

All blocking used under the mains during construction shall be removed prior to backfilling.

WM-6.11 WATER QUALITY SAMPLES

Water quality samples shall be taken by the City of Minneapolis, as directed by the Engineer, at hydrants and pitot-taps after cutting and plugging an existing main or before putting a new section of pipeline into service. If any sample turns out positive, the City shall resample or rechlorinate that section of water main as necessary until the main is free of all coliform bacteria. Required rechlorination, flushing, sampling, etc. needed on mains that the Contractor installed shall be at the Contractors' expense. Required rechlorination, flushing, sampling, etc. on mains rehabilitated by the City shall be done at its own expense

WM-6.12 PITOT-TAPS

Pitot-taps shall be installed on both sides of line gates for pressure testing, flushing, chlorination, and for taking bacteriological samples. The taps shall be housed inside of the precast manholes that are required for all gates.

WM-7 METHOD OF MEASUREMENT AND BASIS OF PAYMENT

All items required to furnish and install the water main for this project shall be paid for at the bid Contract Lump Sum price under item 2504.601 "14" Watermain HDPE (Directionally Drilled). This shall include all costs of furnishing and installing the pipe complete in place as specified including all costs for providing an approved plan for the pipe installation, the pipe installation, and surface restoration as may not be specifically covered under other Contract Items. All costs of pipeline disinfection, leakage testing, pipe jointing materials, dead end plugs and caps, making connections to existing mains, blocking and restraint materials, and other work necessary for proper installation of pipe as specified shall be included for payment under the lump sum bid price, without any additional compensation being made therefor.

Other Miscellaneous

Unless its existence is shown in the Plans, and other provisions provided for payment, the removal of ledge rock or rocks larger than ½ cubic yard in volume from the excavation shall be paid for as Extra Work.

All costs of excavating to foundation grade, preparing the foundation, placing and compacting backfill materials, restoring surface improvements, and other work necessary for prosecution and completion of the work as specified, shall be included for payment as part of the appropriate pipe and pipe appurtenance items without any direct compensation being made therefor.

All costs of disinfecting and performing the required tracer wire, pressure, and leakage tests on all piping and appurtenances installed in the completion of the work shall be incidental to the Contract water main lump sum pay item provided, and no direct payment shall be made therefore.

No payment will be made for the use of steel plates for covering trenches as may be necessary to complete the work.

In the absence of special payment provisions, all costs of repairing, replacing, or otherwise restoring surface improvements as required by the Contract shall be included for payment as part of other Contract items without any direct compensation being made therefor.