

CITY OF NORTHFIELD, MINNESOTA  
WATERMAIN SPECIFICATIONS

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## 1.00 SCOPE

### 1.01 GENERAL

It is the intent of these specification requirements to provide the requirements for watermain construction in the City of Northfield, Minnesota.

### 1.02 WORK INCLUDED

The Contractor shall, unless specified otherwise, furnish all materials, equipment, tools and labor necessary to do the work required under the contract and unload, haul and distribute all pipe, castings, fittings, valves, hydrants, and accessories. The Contractor shall also remove any street surfacing as required; excavate the trenches and pits to the required dimensions; construct and maintain all bridges for traffic control; sheet, brace and support the adjoining ground or structures where necessary; handle all drainage or ground water; provide barricades, guards and warning lights, lay and test the pipe, castings, fittings, valves, hydrants, and accessories, backfill and consolidate the trenches and pits; maintain the street or other surface over the trench until surface restoration; restore the roadway surface unless otherwise stipulated; remove surplus excavated material; and clean the site of the work.

The Contractor shall also furnish all equipment, tools, labor and materials required to re-arrange sewers, conduits, ducts, pipes or other structures encountered in the installation of the work. All the above work to completely construct the watermain facilities shall be done in strict accordance with the project's contract documents to which these Specifications are a part thereof.

### 1.03 LOCATION OF THE WORK

The location of this work is as shown on the plans.

### 1.04 COORDINATION OF WORK

The Contractor shall be responsible for the satisfactory coordination of the construction of the watermain facilities with other construction and activities in the area affected. Delays in work resulting from lack of such harmony shall not in any way be a cause for extra compensation by any of the parties.

### 1.05 REFERENCE REQUIREMENTS

A part of the contract documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship. Reference made to Man/DOT Specifications shall mean the most current edition of the Standard Specifications for Construction of the Minnesota Department of Transportation and all subsequent revisions.

## 2.00 MATERIALS

### 2.01 GENERAL

The materials used in this work shall be all new, and conform to the requirements for class, kind, size and materials as specified below. The Contractor shall submit in writing a list of materials showing the manufacture and designation of all materials. This list must be approved by the Engineer. Any material not listed below must have written approval by the City Engineer before it is incorporated into the work.

2.02 DUCTILE IRON PIPE AND FITTINGS

Ductile iron pipe shall be designed for a minimum working pressure of 150 pounds per square inch and shall conform to the applicable dimensions, and tolerances of A.W.W.A. Specification C151, latest revision, for ductile iron pipe.

Ductile Iron fittings shall conform to the latest revisions of A.W.W.A. Specification C110. Mechanical or push on joints shall be allowed, however the Contractor shall be consistent in the use of the selected joint style except where required for special fittings.

All ductile iron pipe shall be cement lined and the maximum deflection of the pipe shall not exceed two percent (2%) of the pipe diameter to prevent cracking of the lining.

Weighing scales may be required to verify weight of pipe.

Nominal thickness of wall for ductile iron pipe shall be as follows:

<u>Size</u>	<u>Trench Condition B</u>	<u>Thickness Inches</u>
6"	Class 52	0.31
8"	Class 52	0.33
10"	Class 52	0.35
12"	Class 52	0.37
14"	Class 51	0.36
16"	Class 51	0.37
18"	Class 51	0.38
20"	Class 51	0.39
24"	Class 51	0.41
30"	Class 51	0.43
36"	Class 51	0.48
42"	Class 51	0.53

All fittings, valves, hydrants and retaining rods shall be protected by using sacrificial zinc anode caps such as 175P190 Protecto caps as manufactured by Ebaa Iron or an approved equal. Contractors shall supply 2 Protecto Caps per mechanical joint gland installed.

All fittings, valves, hydrants, etc. Shall be secured utilizing Blue coated T-Bolts and nuts as manufactured by Star Pipe Products or approved equal. All fittings shall be epoxy coated.

All 6-inch diameter ductile iron pipe or larger shall be encased in polyethylene.

Pipe walls shall be of a thickness to support 2 1/2 full threads for the size of service necessary of Standard Corporation stop threads as specified by A.W.W.A. C800. A service saddle shall be used when the corporation stop exceeds the size listed in the following for each diameter of watermain. A straight 1" corporation shall be used on all 6" watermains.

<u>Watermain Size</u>	<u>Maximum Corp. Size Without Saddle</u>
6"	1"
8"	1 1/4"
10"	1 1/2"
12"	2"
14" and larger	2"

All ductile iron pipe shall be marked "DUCTILE IRON" in large letters. The nominal wall thickness shall be plainly marked on each piece of pipe.

All bonnet, packing and operating nut bolting to be 304 or 316 Stainless Steel.

2.03 GATE VALVES (4" TO 16" IN DIAMETER)

Gate valves on sixteen inch (16") diameter water lines and smaller shall be resilient wedge type and be installed on the line in a vertical position and provided with boxes. Gate valves shall be American Series 2500 RWGV1, Mueller Series A-2361 or approved equal.

The gate valves shall be iron body, bronze mounted non-rising stem with "O" ring seals designed for a minimum of 250 p.s.i. cold water working pressure with mechanical joints and shall conform to A.W.W.A. Specification C515. The wedge shall be symmetrical and seal well with flow in either direction. All gaskets shall be pressure energized O-rings.

Valves shall be provided with a two inch (2") square operating nut and shall open in a counter-clockwise direction. All fittings, valves, hydrants, etc. Shall be secured utilizing Blue coated T-Bolts and nuts as manufactured by Star Pipe Products or approved equal. All fittings shall be epoxy coated.

Gate valves should be installed for straightness utilizing the gate valve alignment tool shown in the City Details. Prior to installation of the wear course the City will ensure their mechanical gate valve wrench is able to access the gate valve nut. Any valves deemed inaccessible will require the valve box to be replaced.

2.04 VALVE BOXES

Valve boxes shall be ductile iron of the three (3) piece type suitable for a depth of 7 1/2 feet of cover over the top of the pipe or to a depth as shown on the plans. Shafts shall be 5 1/4 inch diameter, bases may be round or oval and length of adjustment shall be screw type. Valve boxes shall be manufactured by PowerSeal and include the valve box aligner, or by

an approved equal manufacturer. Drop covers on valve boxes shall bear the word "water" on the top.

In case of either over depth or less depth than 7.5 feet the valve boxes shall be supplied in such a manner in order to allow a minimum of six (6) inches of adjustment both ways.

## 2.05 HYDRANTS

All hydrants shall be Kennedy Model K81, American Darling Model B-84-B, or Clow Medallion and shall be in accordance with the standard A.W.W.A. Specification C502, latest revision, for hydrants except as otherwise provided herein to suit local requirements. The hydrant shall be supplied with a 16" breakoff section.

Hydrants are to have a five (5) inch minimum valve opening. They shall be equipped with two - 2 1/2 inch hose connections and one - 4 inch pumper connection (T.P. 40500). The 2 1/2" connections shall have National Standard threads (T.P. 7532). The threads are 3 1/16", O.D. by 7 1/2 threads per inch. The four (4) inch pumper connection shall have threads as follows: four (4) inch threads, five (5) inch O.D. by four (4) threads per inch.

"O" ring seals shall be provided to prevent water from reaching the 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.

Hydrant length shall be suitable for 7.5 feet depth of cover over the centerline of the cast iron lead pipes and a distance of 23"-25" from the grade or sidewalk line to the center of the outlet nozzles.

Each hydrant shall have a safety stem coupling and safety flange so constructed that, if hit, the stem will not bend and the hydrant barrel will not break, unless otherwise specified. It shall also permit rotation for the upper barrel or addition of extension sections.

The hydrant main valve shall be of the compression type and shall open against the pressure. The valve shall be faced with a resilient material which resists damage by rocks and other foreign matter, and shall be so designed that together with the seat, it is removable for repairs and replaceable without digging up the hydrant.

The gasket shall be inset so that it will remain attached to the seat rings and will not be injured when raised or lowered. A non-corrodible drain valve shall be provided and arranged so that it will automatically drain the hydrant barrel when the main valve is closed, and prevent any leakage when the main valve is open. The drain valve shall be faced with high-grade leather, or approved equal material, or have a tapered plug and seat for positive closure. The entire drain mechanism shall be lubricated with waterproof graphite grease. The hydrant drains shall not be plugged even in areas with the water table above the drain. The City shall be responsible for plugging drains as required.

Hydrants shall have satisfactory self-lubricating features for the stem threads. Where the stem (valve rod) or operating nut comes in contact with the packing, it shall be bushed with bronze or non-corrodible metal, and no leakage shall be permitted under the bushed surface. All movable parts within the hydrant shall be bronze or non-corrodible metal.

Outlet nipples shall be of bronze or suitable non-corrodible metal securely pinned or locked-in and caulked in place.

Hose caps shall be provided for all outlets and must be securely attached to the barrel with a chain constructed of material not less than one-eighth (1/8) inch in diameter. A rubber washer shall be provided in each cap and set in a groove to prevent its falling out when the cap is removed. The hose cap nut shall be of the same size and shape as the top operating nut. All caps shall be lubricated with waterproof graphite grease.

The size and shape of the operating nut shall be the National Standard pentagon nut, measuring 1 1/2 inch from point to flat.

Hydrants shall open to the left (counter clockwise) and shall be marked with an arrow to show the direction of opening. The hydrant shall be marked with the name of the manufacturer.

The bidder shall state weight of hydrant complete, and shall furnish detail working drawings, specifications, and description of hydrants which they propose to furnish.

All hydrants shall have a six (6) inch mechanical joint or slip on joint inlet for connecting to a six (6) inch ductile iron lead from the main. There shall be a gate valve between the hydrant and the watermain or lateral. The hydrant, gate valve and tee shall be installed with Mega-Lugs.

All new hydrants installed shall be equipped with a hydrafinder fiberglass shaft, or approved equal.

## 2.06 SERVICE PIPE AND FITTINGS

### 1. General

- a. Water service pipe and fittings shall conform to the provisions of 2611.2D, AWWA C800 and the following:
- b. Valves and fitting models to vary according to water main pipe size. See mfg. catalogue data.
- c. Saddles shall be provided for all corporation stops larger than 1½ inches.
- d. Curb boxes shall be adjustable and 8 feet in length with Minneapolis Pattern. Stationary rods are required.
- e. All fittings shall be compression style fittings.
- f. Any curb boxes that are located within concrete (sidewalks, driveways, etc.) shall have a PowerSeal Single Cover Water top or approved equal installed.

### 2. Copper Service Pipe Notes & Specifications:

- a. Copper pipe shall conform to ASTM B88, Seamless Copper Water Tubing, Type K, Soft Annealed Copper.
- b. Copper water service pipe connections shall be flared type.

<b>WATER SERVICE PIPE &amp; APPURTENANCES</b>						
<b>ITEM:</b>	<b>SERVICE</b>	<b>COMPRESSION TYPE Valves &amp; Fittings</b>				
		<b>For TYPE K COPPER &amp; POLYETHYLENE PIPE</b>				
	<b>PIPE SIZE</b>	<b>FORD MODEL #</b>	<b>A.Y. McDONALD / SMITH BLAIR MODEL #</b>		<b>MUELLER MODEL #</b>	
		<b>FORD</b>	<b>A.Y. McDONALD</b>		<b>MUELLER</b>	
Corporation Stop						
	3/4"	FB1000-3-Q	4701BQ		B-25008	
	1"	FB100-4-Q	4701BQ		B-25008	
	1.25"	FB1000-5-Q	4701BQ		B-25008	
	1.5"	FB1000-6-Q	4701BQ		B-25008	
	2"	FB1000-7-Q	4701BQ		B-25008	
Tapping Saddle		FORD	FORD	SMITH-BLAIR	SMITH-BLAIR	MUELLER
		for DIP WMN	for PVC WMN	for DIP WMN	for PVC WMN	
	3/4"	F202	FS303	313	372	N/A
	1"	F202	FS303	313	372	N/A
	1.25"	F202	FS303	313	372	N/A
	1.5"	F202	FS303	313	372	N/A
	2"	F202	FS303	313	372	N/A
Curb Stop		FORD	A.Y. McDONALD		MUELLER	
	3/4"	B44333MQ	6104Q		P-25155	
	1"	B44444MQ	6104Q		P-25155	
	1.25"	B44555MQ	6104Q		P-25155	
	1.5"	B44666MQ	6104Q		P-25155	
	2"	B44777MQ	6104Q		P-25155	
Curb Box	1.25" Diam. for 3/4" to 1.25" Curb Stops	FORD 8'- EM2-80-56	A.Y. MCDONALD 5614		N/A	
Curb Box	2" Diam. for 1.5" to 2" Curb Stops	FORD 8'- EM2-80-57	A.Y. MCDONALD 5615		N/A	

### 2.07 RETAINER GLANDS

All retainer glands shall be ductile iron with set screws similar to American Double-X mechanical joint retainer glands or approved equal and shall be suitable for 150 p.s.i. working pressure. Set screws shall be capable of withstanding torque of not less than 80 foot pounds.

### 2.08 ELECTRICAL CONDUCTIVITY MATERIALS

All joints on pipe and fittings shall be connected with an electrical conducting copper strap, clips or cable designed and tested to withstand 400 amps. No external clips on gaskets shall be allowed.

### 2.09 AIR RELIEF MANHOLES

Air relief manholes shall be constructed using precast sections conforming to ASTM Specifications C478.

The standard manhole casting shall be Neenah Factory No. R-1642B and shall have two concealed pick holes. The minimum allowable weight shall be 350 pounds.

Lettering on the manhole castings shall be as shown on the Standard Plate.

All castings shall conform to the requirements and dimensions shown on the drawings. All covers must fit closely in the rings in any and all positions and, when placed in the rings, must fit the ring solidly in all positions so that there will be no rocking from pressure applied on any point of the cover.

### 2.10 MORTAR

Mortar shall consist of a mixture of one part Portland Hydraulic Cement and two parts of a clean washed sand by volume. The quantity of mortar in the mixtures shall be sufficient to produce a stiff workable mortar, but in no case shall exceed 5 1/2 gallons of water per sack of cement.

Sand shall conform to ASTM C-144.

Portland Cement shall conform to ASTM C-150.

### 2.11 CONCRETE

Concrete to be used shall be composed of a mixture of fine and coarse aggregate and a Portland Hydraulic Cement conforming to the ASTM Specification Designation C-150, Type 1, with the proper water-cement ratio to obtain a concrete testing not less than 3,000 pounds per square inch in 28 days. The fine aggregate for concrete shall be composed of a clean washed sand of hard, sharp, durable particles. Coarse aggregate for concrete shall be composed of a gravel uniformly graded 3/4 inch maximum size to #4 sieve. Coarse aggregate shall be composed of hard durable particles free of shale, chert, flat or elongated pieces. Fine and coarse aggregate shall conform to the A.S.T.M. Specification for Concrete Aggregates, Design C-33. Mixing water shall be suitable for drinking purposes, containing no acids, alkalis, oils or other deleterious materials. Concrete shall be mixed in a



mechanically operated mixer so controlled that the drum shall operate a minute and one half after all materials including water are in the drum. Concrete mixtures shall conform to Mn/DOT Specification 2461. The slump shall not exceed four (4) inches plus or minus one (1) inch.

#### 2.12 STEEL REINFORCING BARS

Steel reinforcing bars shall be deformed steel bars with epoxy coating for concrete reinforcement in conformance with ASTM Designation A-615 and ASTM Designation A-15 Intermediate Grade Billet Steel.

#### 2.13 SOIL MATERIALS

##### A. NORMAL "FILL MATERIAL"

Is defined under the backfilling specification 9.05 of the Watermain Specifications.

##### B. GRANULAR SELECTED MATERIAL

Mn/DOT Specification 3149 aggregate shall be used for granular selected material as shown and specified under the pipe bedding classification or an equivalent natural granular soil.

##### C. FINE GRANULAR FILL MATERIAL

This material shall consist of sound durable particles without cohesion of clean sand and/or well rounded gravel. The largest size of gravel which may be used shall be dependent upon the size of the pipe use. A maximum of 3/8 inch gravel may be used when the pipe diameter exceeds 24 inches.

##### D. CLASS 4 AND CLASS 5 SAND AND GRAVEL

Class 4 and Class 5 sand and gravel shall be in conformance with Mn/DOT Specification 3138.

##### E. CRUSHED ROCK

The material shall consist of durable crushed quarry rock of which 100% passes a 2" sieve and of which 95% is retained on a #4 sieve size. It shall not contain soil overburden, sod, roots, plants, and other organic matter, or any other materials considered objectionable by the Engineer.

##### F. PIT RUN GRAVEL

The material shall consist of sound, durable particles of gravel and sand with which may be included limited amounts of fine soil particles as binding material, and of which 100% passes a 2" sieve and of which 90% is retained on the #200 sieve size. It shall not contain sod, roots, plants, and other organic matter, or any other objectionable materials.

##### G. CRUSHED ROCK OR PEA GRAVEL

Coarse granular pipe bedding material shall be a well graded crushed rock or pea gravel of which 100% passes a 3/8 inch sieve and a maximum of 5% passes a No. 10 sieve. It shall not contain sod, roots, plants and other organic matter, or any other objectionable materials.

- H. COARSE FILTER AGGREGATE Coarse filter aggregate material, to be used as granular foundation per CEAM Spec. 2621.2F or to be used beneath sanitary sewer and storm sewer structures or to be used as the gravel pit material below hydrants, shall be per Mn/DOT Spec. 3149.2H as determined by the Engineer. Course filter aggregate material shall also be used for surfacing due to wet conditions or other such uses.
- I. AGGREGATE BEDDING The aggregate bedding material to be used for granular bedding and granular encasement purposes as defined by CEAM Spec. 2621.2F, shall be per Mn/DOT Spec. 3149.

#### 2.14 TREATED TIMBER PILING

All treated timber piling shall conform to Mn/DOT Specification 3471.

#### 2.15 TEMPORARY WATER

The Contractor shall be responsible (until completion of the project) for providing water to any homes that have their individual water systems become inoperative due to construction operations. The temporary system shall consist of an aboveground distribution system utilizing a fire hydrant for the water source. Distribution piping shall be sized such that no pressure loss is experienced at the building being served. Each service line from the distribution system shall be valved such that work at the property or on the service can be performed without putting other properties out of service. Distribution pipe shall Aquamine type or an approved equal. Service lines to individual units shall be a black poly hose with a 150 psi rating and all rib beds shall be a galvanized material that is double clamped. No garden hose will be acceptable for use in the distribution system. This temporary water system shall be bacteria tested each time it is broken down and re-used. The Contractor shall be responsible for bacteria testing. A passing bacteria test from an approved laboratory must be supplied to the City of Northfield Water Department before the distribution system can be turned on.

The Contractor shall be solely responsible for protection of water heaters, softeners or other systems (it may be necessary to bypass these items). A licensed plumber shall be used for this work in buildings being served by temporary water. **It will also be required that the Contractor have a contact person to repair any breaks or other problems that may occur with temporary water services during non-working hours and weekends.** Whoever the contact person is must be willing to do repairs immediately when they are contacted.

The Contractor shall coordinate necessary watermain shutdowns with the City a minimum of 24 hours in advance

#### 2.16 INSULATION

Where required, insulation shall be placed directly on top of the sewer or water lines. Any water line that is to be installed with less than 6' of cover shall be insulated at the discretion of the Engineer. The area adjacent to the line being insulated shall be leveled and compacted even with the top of the sewer or water pipe. Special care shall be taken so that there are no irregularities in the surface the insulation will be placed on. Insulation shall be installed either 3" or 6" thick depending on the depth of line being insulated. Exact thickness of insulation will be determined by the Engineer. Insulation shall be placed in whole sheets (4' X 8') wherever possible. Broken pieces and scrap pieces will not be acceptable. Joints shall be overlapped.

#### 2.17 TRACER WIRE

All trace wire and trace wire products shall be domestically manufactured in the U.S.A. All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

Open Trench - Trace wire shall be #12 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.

Directional Drilling/Boring - Trace wire shall be #12 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.

Trace wire – Pipe Bursting/Slip Lining - Trace wire shall be 7 x 7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.

#### A. CONNECTORS

All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At Crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.

Direct bury wire connectors – shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.

Non locking friction fit, twist on or taped connectors are prohibited.

## B. TERMINATION/ACCESS

All trace wire termination points must utilize an approved trace wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.

All grade level/in-ground access boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded.

A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.

All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.

Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

Service Laterals on public property - Trace wire must terminate at an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.

Service Laterals on private property - Trace wire must terminate at an approved above-ground trace wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than 5 vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within 2 linear feet of the building being served by the utility.

Hydrants – Trace wire must terminate at an approved above-ground trace wire access box, properly affixed to the hydrant grade flange. (affixing with tape or plastic ties shall not be acceptable)

Long-runs, in excess of 500 linear feet without service laterals or hydrants - Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48” polyethylene marker post, color coded per APWA standard for the specific utility being marked.

## C. GROUNDING

Trace wire must be properly grounded at all dead ends/stubs

Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.

When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.

When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.

Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

#### D. TRACER WIRE INSTALLATION

Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.

Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire, and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.

Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5' intervals.

Trace wire must be properly grounded as specified.

Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway.

At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire.

Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead- end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.

All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire.

In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

E. WATER SYSTEM

1. A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
2. Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the North or East side
3. Trace wire on all water service laterals must terminate at an approved trace wire access box color coded blue and located directly above the service lateral at the edge of road right of way.
4. Above-ground tracer wire access boxes will be installed on all fire hydrants.
5. All conductive and non-conductive service lines shall include tracer wire

F. PROHIBITED PRODUCTS AND METHODS

1. Uninsulated trace wire
2. Trace wire insulations other than HDPE
3. Trace wires not domestically manufactured
4. Non locking, friction fit, twist on or taped connectors
5. Brass or copper ground rods
6. Wire connections utilizing taping or spray-on waterproofing
7. Looped wire or continuous wire installations, that has multiple wires laid side-by-side or in close proximity to one another
8. Trace wire wrapped around the corresponding utility
9. Brass fittings with trace wire connection lugs
10. Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.
11. Connecting trace wire to existing conductive utilities

G. TESTING

All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.

This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

Continuity testing in lieu of actual line tracing shall not be accepted.

H. PRODUCTS

1. Tracer Wire
  - a. Open Trench – Copperhead #12 High Strength part #1230\*EHS or approved equal.

- b. Directional Drilling/Boring - Copperhead #12 High Strength part #1230\*EHS or approved equal.
- c. Pipe Bursting/Slip Lining – Copperhead SoloShot Extreme Strength 7 x 7 Stranded part # PBX-50

I. CONNECTORS

- a. Copperhead 3-way locking connector part # LCS1230\* or approved equal.
- b. DryConn 3-way Direct Bury Lug: Copperhead Part #3WB-01

J. TERMINATION/ACCESS

- a. Non-Roadway access boxes applications: Trace wire access boxes Grade level Copperhead adjustable lite duty Part # LD14\*TP or approved equal.
- b. Concrete / Driveway access box applications: Trace wire access boxes Grade level Copperhead Part # CD14\*TP 14” or approved equal.
- c. Fire hydrant trace wire access box applications: Above ground two terminal with 1” conduit. Copperhead part # T3-75-F (Cobra T3 Test Station, denoting “F” includes mounting flange) or approved equal.

K. GROUNDING

- a. Drive in Magnesium Anode: Copperhead Part # ANO-1005 (1.5 lb) or approved equal.

3.00 INSPECTION AND TESTING OF MATERIALS

3.01 SHOP INSPECTIONS AND TESTING

All materials furnished by the Contractor are subject, at the discretion of the Engineer, to inspection and/or testing by accepted methods at the plant of the manufacturer. This inspection and/or testing is to be made at the cost of the City. The material supplier shall provide the City with copies of test results on materials that are furnished to the Contractor.

3.02 FIELD INSPECTION AND TESTING

All materials furnished by or for the Contractor for incorporation into the work under contract shall, at the discretion of the Engineer, be subject to inspection and/or testing by methods acceptable to the Engineer and at the expense of the City.

3.03 DISPOSITION OF DEFECTIVE MATERIAL

All material found during the process of inspection and testing to be defective, or defective material encountered at any time during the progress of the work, will be rejected by the Engineer and the Contractor shall promptly remove from the site all such material.

3.04 CONCRETE TEST CYLINDERS

On all type of concrete construction, up to four (4) test cylinders may be taken from each section of the structure cast in one operation. The Contractor shall, within seven (7) days of their origin,

deliver all cylinders to an approved testing laboratory. The actual cost of testing shall be paid by the City.

#### 4.00 CONTRACTOR'S RESPONSIBILITY FOR MATERIALS

##### 4.01 MATERIAL FURNISHED BY CONTRACTOR

The Contractor shall be responsible for all material furnished by them, and the Contractor shall replace at their own expense all such material that is found to be defective in manufacturing or that has become damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered defective prior to the final acceptance of the work, or during the warranty period.

##### 4.02 MATERIAL FURNISHED BY THE OWNER

The Contractor's responsibility for material furnished by the owner shall begin at the point of delivery by the manufacturer, or owner, and upon acceptance of the material by the Contractor. The Contractor shall examine all material furnished by the owner at the time and place of delivery and shall reject all defective material. The point of delivery shall be stated in the "Special Provisions".

##### 4.03 REPLACEMENT OF DAMAGED MATERIAL

Any material furnished by the owner that becomes damaged after acceptance by the Contractor shall be replaced by the Contractor at the Contractor's expense.

##### 4.04 RESPONSIBILITY FOR SAFE STORAGE

The Contractor shall be responsible for the safe storage of material furnished by or to the Contractor and accepted by the Contractor, and intended for the work, until it has been incorporated in the completed project. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage and freezing.

#### 5.00 MATERIAL HANDLING, ALIGNMENT AND GRADE

##### 5.01 MATERIAL HANDLING

Pipe and other accessories shall, unless otherwise directed in the Special Provisions, be unloaded at the point of delivery, hauled to and distributed at the site of the project by the Contractor. They shall at all times be handled with care to avoid damage. In distributing the material at the site, each piece shall be unloaded opposite or near the place where it is to be laid in the trench. Pipe shall be so handled that the coating and lining will not be damaged. If, however, any part of the lining or coating is damaged, the repair shall be made by the Contractor, at the Contractor's expense, in a manner satisfactory to the Engineer.

##### 5.02 PIPE ALIGNMENT AND GRADES

All pipe shall be laid and maintained to the required lines and grades; with hydrants, valves and fittings at the required locations; and with joints centered and drawn "home"; and with all valve and hydrant stems plumb. The owner shall furnish line and grade stakes necessary for the work. It



shall be the Contractor's responsibility to preserve these stakes from loss or displacement. The Engineer may order the replacement of any stakes deemed necessary for the proper prosecution of the work. Any replacements shall be at the Contractor's expense. All pipes shall be laid to the depth shown on the contract drawings. The Contractor shall satisfactorily maintain the specified cover by the use of grade boards. If additional bends are required, where not shown on the drawings to maintain alignment around curves, the Contractor shall provide the required number and be compensated at the unit price as proposed on the bid form. The following is the maximum allowable joint deflection for the ductile iron pipe.

A.W.W.A. C-600 TABLE 1 & 2 - SUMMARY

(20' Pipe Length - except as noted)  
Max. Allowable Deflections (inches)

<u>Pipe Size</u>	<u>Mech. Joint</u>	<u>Push-on Joint</u>
4	31''*	21''
6	27''*	21''
8	20''*	21''
12	22''	21''
16	15''	12''
18	12''	12''
20	12''	12''
24	10''	12''
30	10''	8''
36	9''	8''
42	8''	8''
48	8''	8''

\*18' length

5.03 DEVIATION WITH ENGINEER'S CONSENT

No deviation shall be made from the required line or grade except with the written consent of the Engineer.

5.04 DEVIATIONS OCCASIONED BY OTHER UTILITY STRUCTURES

Wherever existing utility structures or branch connections leading to main sewers or to main drains or other conduits, ducts, pipe or structures present obstructions to the grade and alignment of the pipe, they shall be permanently supported, removed, relocated or reconstructed by the Contractor through cooperation with the Owner of the utility, structure or obstruction involved. In those instances where their relocation or reconstruction is impractical, a deviation from the grade will be ordered and the change shall be made in the manner directed with extra compensation allowed therefore at unit prices, if applicable.

6.00 UNDERGROUND, SURFACE AND OVERHEAD UTILITIES

6.01 EXISTING UTILITIES

Existing water and sewer mains, and other underground utilities, are shown on the plans only by general location. The Owner does not guarantee the locations as shown on the plans, and the Contractor shall be solely responsible for verifying the exact location of each of these utilities, without additional compensation. Prior to the start of any construction, the Contractor shall notify all utility companies having utilities in the project area.

The Contractor shall have sole responsibility for providing temporary support and for protecting and maintaining all existing utilities in the project area during the entire period of construction, including but not limited to the period of excavation, backfill and compaction. In carrying out this responsibility, the Contractor shall exercise particular care, whenever gas mains or other utility lines are crossed, to provide compacted backfill or other stable support for such lines to prevent any detrimental displacement, rupture or other failure.

#### 6.02 SUBSURFACE EXPLORATION

It shall be the Contractor's responsibility to determine and verify the location of existing pipes, valves or other underground structures as necessary to progress with the work with no additional compensation allowed. The Engineer shall make all known records available. All known utilities are designated on the plans in a general way only as stated above.

#### 6.03 OVERHEAD UTILITIES AND OBSTRUCTIONS

Overhead utilities, poles, etc. shall be protected against damages by the Contractor and if damaged by the Contractor, shall be replaced by the Contractor. Should it become necessary during the progress of the work to remove or relocate existing poles, overhead utilities and obstructions, the Contractor shall cause the same to be done at no expense to the owner unless otherwise provided for in the "Special Provisions". This requirement is not intended to allow utility companies to charge for expenses incurred for work performed where their utilities lie within the street right-of-way or dedicated easements.

It will be the duty of the Contractor to visit the site and make exact determination of the existence of any such facilities prior to the submission of the Contractor's bid.

### 7.00 EXCAVATION AND TRENCH PREPARATION

#### 7.01 GENERAL

The trench shall be so dug that the pipe can be laid to the alignment and depth required and shall be excavated only so far in advance of pipe laying as the Engineer shall specify. The trench shall be so braced and drained that the workers may work therein safely and efficiently. All trenches shall be sheeted and braced as per Chapter Sixty-Six: Trench bracing of the Minnesota Regulations Relating to Industrial Safety to a safe angle of repose. Such angle of repose shall be no less than that repose required by the Accident Prevention Division of the Minnesota State Industrial Commission or the requirements of the Occupational Safety and Health Act (OSHA) whichever is more restrictive.

It is essential that the discharge of any required trench dewatering pumps be conducted to natural public drainage channels, drains or storm sewers.

All trenches shall be excavated so that the pipe may be laid accurately to grade with a minimum of 7 1/2 feet of earth cover over the top of the watermains, unless otherwise noted on the drawings.

All trench bedding material shall be incidental unless otherwise indicated in the plans and specifications or if so directed by the Engineer. If bedding material is to be paid for on a weight basis, weight slips shall be delivered to the Engineer daily.

#### 7.02 TRENCH WIDTH AND DESCRIPTION

The trench width at the top of the excavation may vary depending upon the depth of the trench and the nature of material encountered. However, the maximum allowable width of trench shall be in strict accordance with MnDOT Specification 2503.3B. The width of the trench shall also be kept at a minimum to prevent excess destruction of the existing street or highway pavement.

For trench width at the top of pipe greater than specified in the paragraph above, the Contractor may propose alternate strength of pipe to depth of cover relationships other than those listed on the Form of Proposal, or shown on the plans. Such proposals must be submitted to the Engineer for approval in writing and with pertinent pipe strength and soil weight data at least fourteen (14) days prior to the desired construction date. No extra compensation shall be allowed for any increase in material or construction costs created by alternate plans.

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 the excavation is inadvertently made below the bottom conforming to grade, it shall be backfilled with well-tamped pit run sand or fine gravel or other material as approved by the Engineer at no additional expense to the Owner.

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 one (1) foot minimum clearance on all sides.

The trench shall be kept free from water until the joints have been completed.

#### 7.03 PIPE FOUNDATION IN POOR SOIL

When the bottom of subgrade is soft and in the opinion of the Engineer cannot adequately support the pipe, a further depth and/or width shall be excavated and refilled to pipe foundation grade with approved material and thoroughly compacted; or other approved means, such as piling, shall be adopted to assure a firm foundation for the pipe with extra compensation allowed the Contractor as provided elsewhere in these specifications. This does not apply to soil which is unsuitable due to high water level. If this is the case, the Contractor shall dewater the area to provide adequate laying conditions.

The Contractor shall furnish, drive, and place piling if ordered by the Engineer. Piles shall be driven in exact position at locations determined by the Engineer. The Contractor at the Contractor's own expense must replace piles not correctly positioned at the completion of driving.

#### 7.04 PIPE CLEARANCE IN ROCK

Ledge rock boulders, and large stones shall be removed to provide a clearance of at least twelve (12) inches below outside barrel of the pipe, valves, or fittings, and to a clear width of twelve (12) inches on each side of all pipe and appurtenances for pipe sixteen (16) inches or less in diameter; for pipes larger than sixteen (16) inches, a clearance of eighteen (18) inches below and clear width of nine (9) inches on each side of pipe shall be provided. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes.

#### 7.05 PIPE FOUNDATION IN ROCK

The space between the bottom of the trench and the bottom of the pipe shall be backfilled with granular base material thoroughly tamped and compacted, a minimum of 12 inches. Generally speaking the material from the trench excavation, other than rocks or boulders, shall be considered as suitable material. No additional compensation for placing or tamping this material shall be allowed.

#### 7.06 SOLID ROCK EXCAVATION DEFINED

Solid rock excavation shall include such rocks as are not decomposed, weathered or shattered and which will require blasting, barring, wedging or use of air tools for removal. Under this classification shall be included the removal of any concrete or masonry structure (except concrete pavement, curb, gutter and sidewalk) exceeding one (1) cubic yard in volume that may be encountered in the work.

#### 7.07 BLASTING PROCEDURE

The hours of blasting will be fixed by the Engineer. The Contractor's method of procedure relative to blasting shall conform to local and State laws and Municipal Ordinances.

#### 7.08 BRACED AND SHEETED TRENCHES

The Contractor shall adequately brace and sheet excavations wherever necessary to prevent caving or damage to nearby property. The cost of this temporary sheeting and bracing, unless provided for otherwise, shall be considered as part of the excavation costs without additional compensation to the Contractor. Trench sheeting shall remain in place until pipe has been laid, tested for defects and repaired if necessary, and the earth around it compacted to a depth of one (1) foot over the top of the pipe. Sheeting, bracing, etc., placed in the "pipe zone" (that part of the trench below a distance of one (1) foot above the top of the pipe) shall not be removed without the written permission or written order of the Engineer; that sheeting thereby left in place shall be paid for at the unit price bid. Sheeting ordered left in place by the Engineer in writing shall be paid for at the unit price bid.

The Contractor may also leave in place, at the Contractor's expense, to be embedded in the backfill of the trench any sheeting or bracing in addition to that ordered left in place by the Engineer for the purpose of preventing injury or damage to persons, corporations, or property, whether public or private, for which the Contractor under the terms of this contract is liable.

#### 7.09 PILING OF EXCAVATED MATERIAL

All excavated material shall be piled in a manner that will not endanger the work and that will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory

provisions made for street drainage. Material shall not be placed where runoff or sluffing of piles will encroach onto private property. Silt fence shall be placed in all places where runoff will exit the right-of-way or outside the construction easement.

#### 7.10 BARRICADES, GUARDS AND SAFETY PROVISIONS

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, torches, flashers, and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the roadway. All material piles, equipment and pipe which may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor. The rules and regulations of the local authorities respecting safety provisions shall be observed. All traffic control shall be in conformance with Appendix B of the Minnesota Manual on Uniform Traffic Control Devices.

#### 7.11 TRAFFIC AND UTILITY CONTROLS

Excavations for pipe laying operations shall be conducted in a manner to cause the least interruption to traffic. Where traffic must cross open trenches, the Contractor shall provide suitable bridges at street intersections and driveways. The Contractor shall post, where directed by the Engineer, suitable signs indicating that a street is closed and necessary detour signs for the proper maintenance of traffic. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire or police call boxes, or other utility controls shall be left unobstructed and accessible during the construction period.

#### 7.12 PRIVATE PROPERTY PROTECTION

Trees, fences, poles and all other private property shall be protected unless their removal is authorized; and any property damage shall be satisfactorily restored by the Contractor, or adequate compensation therefore shall be the responsibility of the Contractor.

#### 7.13 TUNNELING, JACKING, BORING OR EXCAVATION OTHER THAN OPEN TRENCH

Where pipe cannot be placed by open trench excavation, the method for placing and payment therefore shall be stated in the Special Provisions.

#### 7.14 RAILROAD AND HIGHWAY CROSSINGS

When any railroad is crossed, all precautionary construction measures required by the railroad shall be followed. See Special Provisions or Detail Drawings. The Contractor shall be responsible for securing of necessary crossing permits.

Before any construction is started, the successful bidder shall meet with the Minnesota Department of Transportation, County Highway Department, Railroad Maintenance Engineer, and the Engineers to determine the construction procedure to be followed, methods of rerouting traffic, placing of barricades, flares, signs, flaggers, etc., and methods of preventing damage to the highway or railroad. If required by the railroad or highway department, the Contractor shall deposit with them a certified check in the amount specified by them to cover the required repair work.

#### 7.15 INTERRUPTION OF WATER SERVICE

No interruption of water service will be allowed unless approved by the City Engineer. A 48-hour notice is required from the Contractor for all water shut down operations. The Contractor will be required to provide temporary water service whenever possible. If an interruption in water service is approved, all consumers affected by the operation shall be notified by the Northfield Water Division and be advised of the probable time when service will be restored. All valves that are required to be opened or closed shall be operated only by the Northfield Public Works Department.

#### 7.16 WATER TO HOMES

The Contractor shall be responsible (until completion of the project) for providing water to any homes that have their individual water systems become inoperative due to construction operations. The temporary system shall consist of an aboveground distribution system utilizing a fire hydrant for the water source. Distribution piping shall be sized such that no pressure loss is experienced at the building being served. Each service line from the distribution system shall be valved such that work at the property or on the service can be performed without putting other properties out of service. Distribution pipe shall be a black poly hose with a 150 psi rating and all rib beds shall be a galvanized material that is double clamped. No garden hose will be acceptable for use in the distribution system.

The Contractor shall be solely responsible for protection of water heaters, softeners or other systems (it may be necessary to bypass these items) in buildings being served by temporary water. A licensed plumber shall be used for this work. **It will also be required that the Contractor have a contact person to repair any breaks or other problems that may occur with temporary water services during non-working hours and weekends.** Whoever the contact person is must be willing to do repairs immediately when they are contacted.

The Contractor shall coordinate necessary watermain shutdowns with the City a minimum of 24 hours in advance.

Payment for temporary water service shall be compensation in full on a lump sum basis for all coordination, materials, labor, plumbing expenses and other work necessary to provide temporary water to project residences

#### 7.17 INCIDENTAL ITEMS

The furnishing and installing of specific items and/or the performance of work under certain circumstances shall not be individually paid. The costs shall be included in the unit price bid for the individual pipeline items associated with the stated specific item or work effort. Such items of work include but are not limited to:

1. Interference with other above and underground structures and utilities.
  - a. The removal and restoration, or protection of existing structures and utilities that are shown on the plans and for which there is no bid item for removing and restoring, or working around the utility.
2. Unless separately itemized in the *Schedule of Unit Prices*, any dewatering necessary for construction.
3. Foundation materials placed in lieu of performing necessary dewatering.

4. Bulkheading of existing pipes to be abandoned in place.
5. Granular foundation, granular bedding and granular encasement materials.
6. Granular foundation materials used in lieu of bedding materials in the specified bedding zone, where specified.
7. Granular foundation materials used in unstable trench conditions.
8. The removal and disposal of native materials that are unsuitable for bedding and/or backfill.
9. Providing and maintaining utility service.
10. The replacement of all material displaced due to shrinkage or loss during the excavation and backfilling operations.
11. The removal of excess materials above the original topography the resulting from the additional volume created from pipe bedding, utility pipe, and/or underground structures.
12. Delays due to other utility conflicts that result during the course of construction.
13. Protecting existing improvements and previously accepted elements of this construction from damage.
14. Protecting the inverts of other utility pipes from the accumulation of debris and soil, the removal of blockages that threaten to damage property, and/or the cleaning of both the newly constructed lines and the existing lines of all debris and soil that accumulated during the construction.
15. If a separate bid item for bypass pumping is NOT included in the *Schedule of Unit Prices*, providing temporary bypass pumping / control of storm water flows around the construction zone, include in the price bid for the associated items being installed.
16. The use of special construction techniques such as trench boxes, sheeting, shoring, etc. , include in the price bid for the associated items being installed.
17. Compaction testing and compaction, if required, include in the price bid for the associated items being installed.

**7.18 SPECIFICATION REFERENCES**

- A. City of Northfield Standard Contract Document and Technical Specifications.
- B. Reference CEAM Specification No. 2600 shall apply to excavating, installing bedding and backfilling all trench excavation construction necessary for the completion of work, except as modified herein.
  1. All references to Mn/DOT specifications shall mean the specific edition, including Supplemental Specifications and Technical Memoranda as identified in Section 01420 of these Specifications.
  2. CEAM Specification 2600.3.A1 Maintenance of Traffic is hereby deleted, See Section 01555 of these Specifications.
  3. CEAM Specification 2600.3.A2 Establishing Line and Grade is modified by Section 01720 of these Specifications.
  4. CEAM Specification 2600.3.A3 Protection of Surface Structures:
    - (a) Street signs shall be considered as items of essential service.
    - (b) The last sentence in the third paragraph is deleted.
  5. CEAM Specification 2600.3.A5 Removal of Surface Improvements - All rubble and debris to be disposed of off-site, shall be disposed of at a location secured by



the Contractor and in a manner in compliance with applicable Local, State and Federal regulations.

6. CEAM Specification 2600.3.B3 Excavation Limits and Requirements - OSHA limitations shall also apply to the top of trench width determination. The seven day written notice is waived if changing soil conditions and OSHA compliance apply.
  7. CEAM 2600.3.C1 Jacking/Boring - The Contractor is responsible for protecting all existing utilities above the elevation of the pipe invert minus 2 times the wall thickness of the casing pipe being installed. In addition, bentonite materials shall not be permitted to flow back into the excavation during the non-open cut construction.
  8. CEAM 2600.3.F1 Turf Restoration is hereby deleted, See Section 02920 of these Specifications.
  9. CEAM 2600.3.F1 Pavement Restoration is hereby deleted, See applicable sections of these Specifications.
  10. CEAM 2600.4 Method of Measurement Paragraphs B and C are hereby deleted. See applicable sections of these Specifications.
- C. Reference Mn/DOT Specification No. 2451 shall apply to granular materials for foundation, bedding and encasement of utility line construction, except as modified herein.
- D. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

## 8.00 LAYING OF PIPE

### 8.01 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.

Watermain materials shall be carefully lowered into trench piece by piece by means of a derrick, ropes or other suitable tools or equipment, in such a manner as to prevent damage to materials and protective coatings and lining. Under no circumstances shall watermain materials be dumped into the trench.

Watermain shall be installed at a minimum depth of 7 ½ feet. If the Contractor cannot achieve this depth due to obstructions or other such reasons, the main shall be insulated as directed by the Engineer.

### 8.02 LAYING OF PIPE AND FITTINGS

Before lowering and while suspended, the pipe and fittings shall be inspected for defects. Any defective, damaged or unsound material shall be rejected.



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, and in the suspension of work at any time, suitable stoppers shall be placed to prevent earth or other substances from entering the main.

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

If an existing utility is shown on the plans and there is no bid item for removing and restoring, or working around the utility, the Contractor shall be required to remove and restore, or protect the utility.

The inverts of existing sewers (storm & sanitary), culverts, subdrains, etc. shall be protected during construction. The Contractor is responsible to inspect and clean, if necessary, all lines which have become compromised by the construction operations.

The trench for all flexible pipe shall be undercut six-inches below the pipe barrel to permit the installation of granular bedding or foundation material.

The trench for all rigid pipe shall be undercut three-inches below the pipe barrel to permit the installation of granular bedding or foundation material.

The Contractor shall install and operate a dewatering system to maintain all trenches free of water wherever necessary. The Contractor shall make his own subsurface investigations and determine what dewatering methods to utilize to prevent such damage.

The Contractor shall be responsible for any damage to adjacent structures or buildings caused by the dewatering operations.

Use of granular foundation material in lieu of performing dewatering is permitted.

All suitable excess excavated material shall remain the property of the Owner and shall be loaded, hauled, placed and compacted at a site chosen by the Owner within 2 miles of the site. All unsuitable excess excavated material, with the exception of topsoil shall become the property of the Contractor and shall be removed from the site and disposed of at a site secured by the Contractor.

All excess excavated material shall become the property of the Contractor and shall be removed from the site and disposed of at a location secured by the Contractor.

### 8.03 JOINTING OF PIPE AND FITTINGS

Ductile Iron: Jointing of mechanical joint pipe, push-on joint pipe, and fittings shall be done in accordance with A.W.W.A. Section 9b and 9c of A.W.W.A. Specification C600 latest revision.

When pipes are cut in the field, the cut or straight end shall have all sharp or rough edges removed before assembly.

#### 8.04 SETTING HYDRANTS

Hydrants shall be placed as located by the Engineer.

All hydrants shall be supported on an 8 inch concrete block or equal concrete base. Each hydrant shall be braced and tied as shown on the detail drawings. After each hydrant has been set, there shall be placed around the base of the hydrant, not less than one cubic yard of crushed rock from which all fine material has been removed. A layer of polyethylene, minimum 4 mil thickness, shall be carefully placed over the rock to prevent the backfill from entering the voids in the drain rock. All hydrants must be maintained in a plumb position during the backfilling operation. Care shall be taken to ensure no excessive horizontal pressure is exerted on the hydrant barrel when plumbing the hydrant.

#### 8.05 CONDUCTIVITY

Conductivity shall be provided throughout the water system by use of copper straps or approved conductive gaskets with copper inserts. All mechanical joint fittings shall be equipped with copper straps. Lead tipped gaskets will not be approved for conductivity.

Copper jumper straps between sections of pipe shall be not less than 1/16" x 3/4" strap bolted to shop welded pipe straps of the same size. Bolts shall be 5/16" diameter bronze. For all locations where shop welded straps are not available, field welds shall be made using the Cadweld method with size 32 cartridge. Each field weld shall be properly made after filing the surface of the pipe to a clean bare metal over the entire area of the weld. Straps bolted to mechanical joint fittings shall be not less than 1/16" x 1 1/2". All straps shall be securely fastened and backfill placed so as to not damage the conductivity.

#### 8.06 SEWER CROSSINGS

Watermains crossing 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.

- A. Sewers passing over or under watermains shall be constructed of materials equal to watermain standards of construction.
- B. A length of water pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

#### 8.07 VALVES, BOXES, MANHOLES, VAULTS AND FITTINGS

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.

Unless otherwise specified or shown on the drawings, cast iron valve boxes shall be installed with all gate valves 16 inches or smaller. Valve boxes shall be firmly supported to maintain centered

and plumb alignment over the wrench nut of the valve, with box cover  $\frac{1}{4}$ " to  $\frac{1}{2}$ " below the surface of the finished pavement or at such other level as may be directed by the Engineer.

All bends, tees, hydrants and plugs shall be securely braced against undisturbed soil using timbers, precast concrete block with wooden wedges or poured in place concrete thrust blocks. The method of anchorage must be reviewed and approved by the Engineer prior to backfilling. In addition, retaining glands shall be installed at all bends.

On hydrants leads and on stubs for future lines, all fittings, valves and hydrants shall be tied with rods or bolts to the main line tee in accordance with the manufacturers recommendations. The valve shall be tied to tee and the hydrant shall be tied to the valve as shown on the Standard Detail Plates. Mega-lugs shall be considered as an acceptable method.

#### 8.08 BUILDING SERVICES

Curb stops and boxes shall be installed as shown on the standard plates. The curb stop and box shall be located on the property line, unless specified otherwise. All curb stops shall be on the building side of the sidewalk.

Corporation stops shall be tapped into the main only when full of water under pressure. No taps shall be made into a dry pipe. Corporation stops shall be turned into the pipe until tight and shall not be turned back to facilities having the operation nut on the top.

The copper service lines as placed between the watermains and the curb boxes shall have a minimum of 7.5 feet of cover except at the goose neck which shall have 6  $\frac{1}{2}$ ' minimum cover. Therefore, service lines must be placed (incidental to the project) beneath any obstruction, which would prohibit the required cover if the service line were placed on top of said obstruction. The method of tunneling under an obstruction shall be approved by the Engineer.

One continuous copper line without any joint shall be installed from the corporation to the curb stop unless otherwise approved by the City Engineer. All copper pipe fittings shall be compression type.

Each curb box shall be marked by a 2" x 2" wooden post; extending from the bottom of the curb box to a point two feet above the ground service. All watermain taps shall be inspected by the City of Northfield or the project inspector prior to backfilling.

The Contractor shall furnish the inspector with ties to the services (curb stop) relating to building corners, manholes, hydrants and etc.

All new service lines shall be 1" Type K copper. The connection from the 1" copper line to the meter shall be as follows for each meter type:

5/8" X  $\frac{1}{2}$ " Meter: The line from the 1" copper and main shut-off valve to the meter shall be  $\frac{3}{4}$ " copper pipe. The fitting connecting the  $\frac{3}{4}$ " copper to the 5/8" X  $\frac{1}{2}$ " tailpiece on the meter must be a brass bushing  $\frac{3}{4}$ " male to  $\frac{1}{2}$ " female. This type of fitting will allow for the full 5/8" inside

diameter from the 3/4" copper through the water meter tailpiece. This also pertains to the house side of the meter and tailpiece. Full-flow ball valves shall be installed on both sides of the meter.

3/4" Meter: 3/4" tailpiece may be hooked to the 3/4" copper pipe with a 3/4" female copper fitting. Full-flow ball valves shall be installed on both sides of the meter.

1" Meter: 1" tailpiece may be hooked to the 1" copper pipe with a 1" female copper fitting. Full-flow ball valves shall be installed on both sides of the meter.

#### 8.09 SERVICE ABANDONMENT

Any Water Service that is to be abandoned shall be abandoned at the main. A machine inserted threaded tapered plug H-10034 made by Mueller Companies shall be used for any services 2" or smaller. All other services shall be plugged at the main with mechanical joint plugs. Any large diameter pipe (4" or bigger) that is left in place shall be sand-filled.

All curb stop and boxes must also be completely removed.

### 9.00 BACKFILLING

#### 9.01 GENERAL

All excavation in trenches shall be backfilled to the original ground surface or to such grades as specified or shown on the plans. The backfilling shall begin as soon as practicable after the pipe has been placed. Prior to any backfilling, the excavation shall be cleaned of all trash, debris, organic material, and other undesirable material. All trenches must be completely backfilled at the end of each day. No open trenches shall be allowed after daylight hours without written approval from the City Engineer.

#### 9.02 BACKFILL PROCEDURE AT PIPE ZONE

Backfilling and compacting shall be done as thoroughly as possible so as to prevent settlement. Depositing of the backfill shall be done so the shock of falling material will not injure the pipe or structures. Grading over and around all parts of the work shall be done as directed by the Engineer.

Bedding material as specified in Watermain Specifications 2.16 or other suitable material as determined by the Engineer, free from rocks and boulders, shall be deposited in the trench simultaneously on both sides of the pipe for the full width of the trench to a height above the top of the pipe as specified, shovel placed and plate tamped to fill completely all spaces under and adjacent to the pipe. In the event that natural, suitable, granular material is not encountered during the normal excavation of the trench, or when the material encountered is determined unsuitable by the Engineer for backfilling around the pipe as required above, the Contractor shall provide and place such approved material obtainable from other excavation on the project at no additional compensation. If suitable material is not available as stated above, the Contractor shall purchase suitable material as specified for backfilling around the pipe.

The Contractor shall be paid for only that select material required for filling or backfilling as may be stated in the Special Provisions or as they may be directed to purchase and place by the Engineer. All quantities of such material used shall be verified by the Engineer.

### 9.03 BACKFILL PROCEDURE ABOVE THE PIPE ZONE

Unless otherwise specified, suitable backfill material shall be furnished and the following backfill procedures as applicable shall be used above the "pipe zone" to either the existing surface elevation or design grade, as specified, with the cost of such considered incidental to the installation of the pipe unless specified for a particular section of the project by the Special Provisions and/or plans, or allowed in writing by the Engineer, and a unit price has been established.

#### A. Type I

Under improved or proposed roads and streets and under existing utilities, "Fill Material" (Article 9.05) in compacted thickness at near optimum moisture content shall be placed by mechanical or other means approved by the Engineer so that excessive settlement will not result.

The trench shall be backfilled in no greater than one foot (1') lifts to the top of existing ground. Backfill material shall be compacted to 95% of the standard moisture density relationship of soils (ASTM D698-70) except the top three feet (3') of the trench, which shall be compacted to 100% density. All material shall be plate tamped on either side of the pipe to completely fill all voids regardless of the type of pipe being installed.

Any settlement greater than one inch (1") as measured with a ten foot (10') straight-edge within the warranty period of this contract shall be considered failure of the mechanical compaction and all street surfaces, driveways, boulevard and ditch areas shall be repaired by the Contractor at no cost to the City.

#### B. Type II

Under areas where settlement is allowable in the judgment of the Engineer, "Fill Material" (Article 9.05) may be placed in layers thicker than twelve inches, and a high degree of compaction shall not be necessary. When backfilling with loose soil types, the material may be backfilled above the existing ground surface or design grade so that the backfill in settling will more nearly conform to the design grade.

#### C. Type III

Under State or county highways and road, the Contractor shall obtain the necessary permits, at the Contractor's expense, before commencing any type of work upon a State or county highway or roadway. All such work, especially backfilling, shall conform to State and county standards and specifications.

### 9.04 DISPOSAL OF EXCESS MATERIALS AND DEBRIS

Unless otherwise specified, excavated material either not suitable or not required for fill material shall be disposed of by the Contractor outside of the right-of-way at the Contractor's expense in any manner the Contractor may elect subject to the provisions of the following paragraph.

Before dumping such materials or debris on a private or public land, the Contractor must obtain from the owner of such land written permission for such dumping and a waiver of all claims against the owner for any damage to such land, which may result therefrom together with all permits required by law for such dumping. A copy of such permission, waiver of claims and permits shall be filed with the Engineer before said despoils is made.

#### 9.05 FILL MATERIAL

Normal, allowable "fill material" used in backfilling shall be sand, gravel, or clay, free from pieces of rock, concrete or clay lumps more than one-third (1/3) cubic foot in volume, roots, stumps, organic soil, vegetation, tin cans, rubbish, frozen materials, and similar articles and sustenance's whose presence in the backfill would cause excessive settlement. In that portion of the backfill that is within six inches (6") of a road subgrade, there shall be no stones, which will be retained on a 3-inch sieve.

#### 9.06 DENSITY TESTS

Density tests will be performed by an approved soils testing firm at various locations and depths throughout the project as directed by the Engineer. The Contractor shall cooperate fully and provide assistance, including equipment and labor, as necessary to complete these tests with no additional compensation being made to the Contractor.

All testing costs pertaining to passing tests shall be paid for by the City. All testing costs pertaining to failing tests will be charged to and paid for by the Contractor.

#### 9.07 TEST ROLLING

Test tolling shall be in accordance with Section 2111 of the current Minnesota Department of Transportation Standard Specification, at no additional cost to the owner. Fully loaded trucks maybe used instead of rollers.

### 10.00 TESTING AND DISINFECTING MAINS

#### 10.01 PRESSURE TESTING

All watermain including fittings, valves, services and hydrants shall be tested in accordance with and shall meet the requirements set forth in American Water Works Association (AWWA) Specifications C-600 latest revision.

The Contractor shall have the option of using an alternative testing procedure as identified below:

After the pipe has been laid including fittings, valves, hydrants, and services and the line has been backfilled in accordance with these specifications, all newly laid pipe, or any valved section thereof, unless otherwise directed by the Engineer, shall be subjected to a hydrostatic pressure of 150 pounds per square inch. The duration of each such test shall be two (2) hours. The allowable pressure drop shall not exceed two (2) psi in the last hour of the two (2) hour pressure test.

Each valved 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 apparatus 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. The pressure gauge shall be a standard pressure gauge. The dial shall register from 0-200 psi and have a dial size of 4 ½ inches with 1 psi increments. 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 of highest elevations, and afterward tightly plugged.

The pressure testing procedure shall be set up in a manner that will allow pressure testing of each main line valve. Upon completion of the watermain test, the Contractor shall proceed to test each main line valve by subjecting it to a pressure of 150 psi for five (5) minutes. The allowable pressure drop shall not exceed five (5) psi in the five (5) minute period.

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.

The pressure gauge for the tests shall be an Ashcroft Model 1082 with a 4 1/2 inch dial face with one (1) psi increments or approved equal. The gauge maybe tested by the City of Northfield at any time to ensure accuracy of the gauge being used for the testing.

#### 10.02 DISINFECTING MAINS

After completion of the installation and testing, the Contractor shall disinfect the new pipe, valves and fittings as described in A.W.W.A. Specification No. C-651 by use of the Continuous Feed Method. The Contractor may elect to use the Tablet Method, which is generally described as follows:

The Contractor shall place hypochlorite tablets in each section of pipe and also in hydrants, hydrant branches and other appurtenances during construction. The tablets shall be attached to the top of the pipe with an adhesive of hot tar or "Permatex" No. 2 gasket cement, or other approved material.

When the installation has been completed, the main shall be filled with water at a velocity of less than one (1) foot per second. This water shall remain in the pipe for at least 24 hours. After the 24-hour retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is less than one (1) ppm.



Tests are required to determine chlorine residual at the end of the 24-hour retention period and after flushing to ascertain that the heavily chlorinated water has been removed from the pipeline. At the end of the 24-hour retention period, the main shall contain not less than 10-ppm chlorine.

The number of tablets required per 18-foot length of pipe based on 3 3/4 grain available chlorine per tablet is as follows:

<u>Diameter</u>	<u>No. of Tablets</u>
4"	1
6"	2
8"	3
10"	4
12"	5
16"	9
18"	12
20"	14
24"	20

Only fresh disinfectants shall be used and the main filled with water and flushed not later than one (1) 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.

**10.03 ELECTRICAL CONDUCTIVITY TEST**

Conductivity test shall be performed on all mains after they have been pressure tested and are full of water at normal operating pressure. A direct current of 350 amps at 30 volts shall be passed through the line for 4 minutes. Current flow shall be measured continuously on a suitable ammeter and shall remain steady without interruption or excessive fluctuation throughout the period. At the end of the four (4) minute period, the current shall be raised to 400 amps for one (1) minute without fluctuation. Insufficient current or wide fluctuations of ammeter needle shall be evidence of defective conductivity, which shall be isolated, corrected and retested. The connection for the conductivity shall be made either to a gate valve or to the hydrant barrel. Connections shall not be made to any operating mechanism of the hydrant.

Acceptable equipment for the test shall be an arc-welding machine with adequate sized cables to carry the test current without voltage drop or overheating. Conductivity test shall be carried out in the presence of the Engineer or the Engineer's duly authorized agent. Caution shall be exercised at all times when working with electrical equipment and wires during the conductivity test.

**10.04 BACTERIA TESTING**

After the the water line has been tested at 150 psi for two hours, the Northfield Water Division will flush the line and allow the contractor to obtain a sample.

The Water Division staff will load, flush, and operate all new watermain valves and hydrants. If the Water Division is short of staff, they may elect to have the Contractor assist with these tasks.



#### 10.05 DIP SPRINKLER SERVICES

Any DIP line that is run into a building for Fire Protection shall be tested in the same manner as a street watermain, with the following additions. The service shall be run into the building and tested before any other lines are hooked up to it. The following test performed on these lines shall be:

##### A. PRESSURE TESTING

All watermain including fittings, valves, services and hydrants shall be tested in accordance with and shall meet the requirements set forth in American Water Works Association (AWWA) Specifications C-600 latest revision.

The Contractor shall have the option of using an alternative testing procedure as identified below:

After the pipe has been laid including fittings, valves, hydrants, and services and the line has been backfilled in accordance with these specifications, all newly laid pipe, or any valved section thereof, unless otherwise directed by the Engineer, shall be subjected to a hydrostatic pressure of 150 pounds per square inch. The duration of each such test shall be two (2) hours. The allowable pressure drop shall not exceed two (2) psi in the last hour of the two (2) hour pressure test.

Each valved 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 apparatus 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 of highest elevations, and afterward tightly plugged.

The pressure testing procedure shall be set up in a manner that will allow pressure testing of each main line valve. Upon completion of the watermain test, the Contractor shall proceed to test each main line valve by subjecting it to a pressure of 150 psi for five (5) minutes. The allowable pressure drop shall not exceed five (5) psi in the five (5) minute period.

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.

The pressure gauge for the tests shall be an Ashcroft Model 1082 with a 4 1/2 inch dial face with one (1) psi increments or approved equal. The gauge maybe tested by the City of Northfield at any time to ensure accuracy of the gauge being used for the testing.

##### B. DISINFECTING MAINS

After completion of the installation and testing, the Contractor shall disinfect the new pipe, valves and fittings as described in A.W.W.A. Specification No. C-651 by use of the Continuous Feed Method. The Contractor may elect to use the Tablet Method, which is generally described as follows:

The Contractor shall place hypochlorite tablets in each section of pipe and also in hydrants, hydrant branches and other appurtenances during construction. The tablets shall be attached to the top of the pipe with an adhesive of hot tar or "Permatex" No. 2 gasket cement, or other approved material.

When the installation has been completed, the main shall be filled with water at a velocity of less than one (1) foot per second. This water shall remain in the pipe for at least 24 hours. After the 24-hour retention period, the heavily chlorinated water shall be flushed from the main until the chlorine concentration in the water leaving the main is less than one (1) ppm.

Tests are required to determine chlorine residual at the end of the 24-hour retention period and after flushing to ascertain that the heavily chlorinated water has been removed from the pipeline. At the end of the 24-hour retention period, the main shall contain not less than 10-ppm chlorine.

The number of tablets required per 18-foot length of pipe based on 3 3/4 grain available chlorine per tablet is as follows:

<u>Diameter</u>	<u>No. of Tablets</u>
4"	1
6"	2
8"	3
10"	4
12"	5
16"	9
18"	12
20"	14
24"	20

Only fresh disinfectants shall be used and the main filled with water and flushed not later than one (1) 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.

**C. ELECTRICAL CONDUCTIVITY TEST**

Conductivity test shall be performed on all mains after they have been pressure tested and are full of water at normal operating pressure. A direct current of 350 amps at 30 volts shall be passed through the line for 4 minutes. Current flow shall be measured continuously on a suitable ammeter and shall remain steady without interruption or excessive fluctuation throughout the period. At the end of the four (4) minute period, the current shall be raised to 400 amps for one (1) minute without fluctuation. Insufficient current or wide fluctuations of ammeter needle shall be evidence of defective conductivity,

which shall be isolated, corrected and retested. The connection for the conductivity shall be made either to a gate valve or to the hydrant barrel. Connections shall not be made to any operating mechanism of the hydrant.

Acceptable equipment for the test shall be an arc-welding machine with adequate sized cables to carry the test current without voltage drop or overheating. Conductivity test shall be carried out in the presence of the Engineer or the Engineer's duly authorized agent. Caution shall be exercised at all times when working with electrical equipment and wires during the conductivity test.

**D. FULL FLUSHING TEST**

The Contractor must flush all lines used as Fire Protection the full diameter of the pipe with a City of Northfield representative present. It will be the responsibility of the contractor to provide all materials necessary to display a full flush. The Engineer must approve the Contractors method of flushing. Flushing into the Sanitary Sewer System will not be allowed.

**E. BACTERIA TESTING**

After the water line has been tested at 150 psi for two hours, and the Full Flushing Test is complete, the Contractor must perform a Bacteria Test. It will be the responsibility of the Contractor to have this test completed. The Contractor must furnish a signed document showing the passing test results from an accepted Laboratory before the City of Northfield will supply water to the property.

**11.00 PRIVATE SERVICES** Sanitary sewer and water services shall be constructed to the right-of-way line at a minimum and to houses as directed by the Engineer. Sewer and water services shall be installed in the same trench to the greatest extent possible. The connection of the new service to the existing service shall be considered incidental and should be figured into the price for the wye or curb stop and box.

A water service will be installed to the right-of-way as a minimum or to the building as directed by the Engineer. Services installed to the building shall be brought beyond the foundation to an opening in the basement floor. A separate sewer service (4") and water service (1") shall be installed from the mainline pipes for each unit of multiple family housing structures such as double bungalows, triplexes, quads, etc. A variance from these requirements is acknowledged only in the event that a revised service layout detail is drawn on the plans and receives written approval by the City Engineer.

Boring, pneuma-gophering, tunneling, insertion inside existing services or other means of service installation will be required in some cases for water and sewer line installations. All surfaces will be restored to their original condition.

Sewer and water service work on the interior of the buildings from the point of floor openings to the water meter, sewer stack, or other required locations shall be performed by a licensed plumber.

The Contractor is responsible for the protection of all property not scheduled for replacement in the building. Work shall be performed in conformance to all applicable codes.

The Contractor shall be responsible for coordination with the homeowner for the protection of private property on the exterior and interior of the home, including trees.

#### Remove Concrete Floor / Concrete Pavement Special

- (a) Where necessary, the Contractor shall remove and replace portions of the existing concrete floor for the purpose of sanitary sewer and water service work in buildings as directed by the Engineer. All edges shall be neatly saw-cut. The concrete removal area shall be as small as possible to complete the work. Replacement of the floor shall be performed by a qualified craftsman and shall meet or exceed the thickness, quality, finish, and appearance of the existing floor, which is typically 4" crushed aggregate base with a minimum Portland cement concrete (PCC). The Contractor shall be responsible for the removal of rubble, excess dirt, protection of existing property from dust accumulation or other damage and cleanup for a complete patch, satisfactory to the Engineer and homeowner.

The Contractor shall be responsible for coordinating the schedule and other items relevant to this work with the homeowner such that adequate notice is available to allow removal of carpet, furniture, etc. by the homeowner. Payment shall be at the contract unit price per square foot measured in place upon completion. All materials, labor, rubble and excavated material disposal, cleanup, or other required items are incidental. Any hours spent by the plumber on removing or replacing concrete floor will not be included in the common laborers pay item.

#### Common Laborers (Connect Services in Building)

- (b) Payment for sanitary sewer and/or water service work from the location of the pipe in the floor opening to the meter, sewer stack, or other required location on the inside of the building shall be on a time and material basis. No hours shall be charged for preparation work such as remove and replace concrete floor, excavation, removal, etc. Materials shall be paid at the invoice cost plus 15% markup. A currently licensed plumber shall perform the work. Hours shall be based on one licensed plumber. Payment shall be at the contract unit price per man-hour.

Coordination, testing, flushing, property protection or other items required to satisfactorily complete the work outside the building are incidental to bid items for that work. Actual hours worked in the building will be counted and rounded to the nearest ¼ hour. The Contractor shall give the Engineer sufficient notice prior to any work such that inspection can be provided. The Contractor shall provide itemized receipts for each service indicating property address, crew, dates, times work performed, materials used and total hours.

When is it required to bring a new service into the structure and to the water meter, the line must consist of an approved State Plumbing Code material. Galvanized steel or lead pipe is prohibited on City of Northfield Reconstruction Projects.

If the new service line is connected to an existing service other than at the meter and the existing material consists of galvanized steel, a brass fitting or approved bimetal connector is required to make this connection.

## 12.00 SURFACE RESTORATION, CLEANUP AND GUARANTEE

### 12.01 RESTORATION OF SURFACE

All surfaces disturbed during the construction period, whether caused by actual excavation, deposition of excavated material, or by the construction equipment, shall be returned to its original conditions or better. Exceptions to the above, if any, or special instructions pertaining to any particular section of the project will be outlined in the "Special Provisions". Any excess dirt shall be removed by the Contractor in accordance with Section 9.04 of these Specifications.

### 12.02 DUST CONTROL DURING CONSTRUCTION

The Contractor, at the Contractor's own expense, shall maintain dust control as necessary and in a manner satisfactory to the Engineer until final acceptance of the project or until restoration has been completed.

### 12.03 MAILBOX RESTORATION

The Contractor, at the Contractor's expense, shall replace and restore mailboxes disturbed by the work.

### 12.04 MAINTENANCE OF STREETS UNTIL SURFACED

After backfilling, the Contractor shall maintain the streets as required and blade as necessary to provide a passable, rut free, pothole free surface for traffic until the surfacing is completed or to the date of final acceptance.

### 12.05 CLEANING UP

Surplus pipe material, tools, and temporary structures shall be removed by the Contractor, and all dirt and/or rubbish caused by the Contractor's operations and excess earth from excavations shall be hauled to a dump provided by the Contractor, and the construction site shall be left in a condition satisfactory to the Engineer.

### 12.06 GUARANTEE

The Contractor shall be held responsible for any and all defects in workmanship and materials which may be developed in any part of the entire installation furnished by the Contractor and upon written notice from the Engineer shall immediately replace and make good, without expense to the owner, any such faulty part or parts and damage done by reason of same, during the period as prescribed in Section 31 of the General Conditions.

### 12.07 FAILURE TO REPLACE DEFECTIVE PARTS

Should the Contractor fail to make good the defective parts within a period of thirty (30) days of such notification, after written notice has been given to the Contractor, the owner may replace these parts, charging the expense of same to the Contractor.

### 13.00 TURF ESTABLISHMENT

#### 13.01 GENERAL

All turf establishment shall be in accordance with Article 13.00, Turf Establishment, of the Street Specifications which is included as part of this Standard Specification.

### 14.00 TREATED WOOD PILING

#### 14.01 GENERAL

The Contractor shall furnish the labor and material to provide a piled foundation as shown on the drawings.

#### 14.02 MATERIALS

Material used shall comply with those specified under Article 2.17 and shown on the drawings.

#### 14.03 HANDLING

The handling of treated piling, wood caps and saddles shall be subject to the following requirements.

- A. The use of chains, cant hooks, pickaroons, peaveys, or other pointed hooks in handling piles, shall be prohibited, excepting end hooks, cable or rope slings shall be used in loading, and proper blocking shall be used to support the material during the wrapping and removal of slings.
- B. Avoid handling that will cause sudden dropping, breaking of outer fibers, bruising, or penetrating surfaces. Give cut or damaged surfaces, including tops of piles after "heading" a brush treatment of hot creosote oil in such quantities as will fill shakes, splits and penetrate thoroughly cut surfaces.

#### 14.04 PILE DESIGN AND CAPACITY

- A. Pile lengths are based on 20-foot lengths furnished and driven. Pile design is based on 20-ton capacity. From results of "Capacity" tests, the piling will be designed as to actual lengths required. All piling shall be designed for at least twelve (12) inch over length for cutting at required cut-off elevation.
- B. Longer piles shall be provided where required to provide specific bearing capacities. Where specified bearing capacities are attained with pile lengths less than designed effective lengths, shorter piles may be used as approved.
- C. Except for capacity test purposes, piles should not be ordered until design pile lengths have been verified.

- D. The capacity of driven piles shall be computed by the following formula for piles driven by single or double acting steam or air hammers, or a comparable formula as designated by the Project Engineer.

$$P = \frac{2 W H}{S + C}$$

- P - Allowable load in pounds  
W - Weight of hammer in pounds  
H - Height of all of stroke of hammer in feet  
S - Average penetration in inches, averaged for the last foot of driving  
C - Constant 1.0 for drop hammer - 0.1 for steam diesel or air hammers

- E. Except as otherwise indicated, all wood piles shall be driven by means of a gravity, steam, diesel or air hammer or by a combination of water jets and hammers as is approved by the Engineer.

1. When gravity hammers are used, they shall weigh not less than 2,000 pounds, preferably not less than 3,000 pounds, and in no case shall the weight of the hammer be less than the combined weight of the driving cap and the pile.
2. Steam, diesel, or air hammers shall be used whenever practicable. For piles under 50' in length, the hammer shall develop at least 7,000 foot pounds of energy per blow, and for piles 50' and longer shall develop at least 12,000 foot pounds of energy per blow.

- F. Pile driving caps will be used when directed by the Engineer.

#### 14.05 CAPACITY TEST DRIVING

Capacity test driving shall be as follows:

- A. Test piling for determining 20-ton capacity for vertical piles and 16-ton capacity for inclined piles shall be driven as specified herein and under Section 13.06.
- B. Piles shall be long enough to be driven to 20-ton capacity for vertical piles and 16-ton capacity for inclined piles. Pile shall be driven at location shown corresponding to designed piles, cut-off at elevation required, and left in place to be used as actual foundation piling. This test pile to be deducted from the total permanent piling required. Cost of pile and driving is included in proposal.
- C. Install test pile with same size and type hammer operating with same effective energy and efficiency used to install permanent piles.

#### 14.06 INSTALLING PILING

Piles shall be installed according to the following requirements:

- A. Do not install piles until excavation or fill in area they are to occupy has been completed to indicate grade elevation. Do not install piles within 20'-0" of concrete less than seven (7) days old, unless so directed by the Engineer.
  - B. Locate piles to indicated lines. Install either to plumb position or to exact indicated batter. Maximum permissible deviation after driving, from indicated locations is such that the center of the pile shall be offset not more than six (6) inches. Maintain gravity center for each group of footing piles, where piles number two (2) or more, by templates or otherwise, to conform with indicated locations. The piles shall not deviate more than 1/2" per foot of pile length. Piles shall be driven in a manner that will minimize disturbing piling previously driven.
  - C. Provide proper driving caps and pile driver heads for hammers. Use suitable collars or bands where required for protection of butts against splitting, brooming and other damage when piles are driven.
  - D. Pile driving leads rigid enough to hold the pile in correct alignment during driving will be required for all types of hammers.
  - E. Install each permanent pile without interruption from first hammer blow until required penetration per blow as directed has been obtained; any deviation from this requirement will be permitted only subject to unforeseen causes. In any event, install final 25% of pile length to completion without interruption. Install piles full required length, except that if the Engineer determines indicated length of certain piles to be impracticable or undesirable, cut off such piles at depth as directed. After installation, cut off piles square at cut-off grade line; remove surplus material from site.
  - F. When handling or driving piles, take special precautions to prevent overstress or leading away from plumb or true position. When high resistant strata lying near surface must be penetrated, spud piles may be used to relieve long piles of hard driving during early stages of driving operations.
  - G. Piles that are damaged, mislocated, or driven out of alignment will be replaced with new piles as directed without additional cost to owner.
  - H. When driving piles in clusters, or under any conditions of relatively close spacing, make observations to determine any uplift. If uplift occurs, reinstall piles so affected to either their original resistance or elevation or both.
- The Contractor shall keep an accurate and detailed log of each pile, indicating the depth to which the pile is driven, the rate of penetration under the last series of blows, and the general driving characteristics. A reproducible copy of the log shall be furnished to the owner.
- I. Measurement shall be based on effective length of piles in place measured to nearest foot.

#### 14.07 PILE CAPS



Pile caps shall be of construction grade, creosoted timber to the size and dimensions as shown on the detail plate contained in these specifications. Timber pile caps shall be fastened to the pile with 3/4" galvanized driftpins set in predrilled holes to prevent splitting. Timber members of the pile cap that crack or split during installation shall be removed and replaced at no cost to the owner.

**15.00 METHOD OF PAYMENT**

The work shall be measured and the compensation determined in the following manner or as identified on the bid form.

**15.01 DUCTILE IRON PIPE**

Ductile iron pipe will 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, disinfecting, and all material or work necessary to install the pipe complete in place at the depth above 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 will be measured from the centers of connecting pipes to centers of valves or hydrants. All lengths will be measured in a horizontal plane unless the grade of the pipe is more than fifteen percent.

**15.02 DUCTILE IRON FITTINGS**

Ductile iron fittings and specials will be paid for at the contract unit price per pound for the standard weight of the fittings and specials installed on the basis of body weight only. Shall be published in AWWA C-153, as follows:

Bends, Caps, Plugs & Sleeves							
Size	Fitting Weights, lbs. (AWWA C153)						
	Bends – MJ x MJ, (degrees)				Caps MJ x MJ	Plugs MJ x MJ	Sleeves <sup>1</sup> MJ x MJ
	90	45	22.5	11.25			
3	19	16	15	14	8	8	18
4	25	22	18	16	9	10	20
6	39	32	31	30	15	16	33
8	57	46	46	42	22	26	46
10	89	70	64	58	32	36	62
12	108	86	80	67	42	46	76
14	210	160	136	93	66	75	140
16	264	202	172	148	92	95	170
18	335	250	255	205	114	121	200
20	400	305	310	245	125	135	255
24	565	405	412	315	166	175	335

<sup>1</sup> Weights are based on the use of long sleeves.

Tees, Crosses & Reducers									
		Fitting Weights, lbs. (AWWA C153)					Fitting Weights, lbs. (AWWA C153)		
Run	Branch	Tee	Cross	Reducers	Run	Branch	Tee	Cross	Reducers
Large	Small	MJ x MJ	MJ x MJ	MJ x MJ	Large	Small	MJ x MJ	MJ x MJ	MJ x MJ
4	4	32	40	-	18	6	275	-	-
6	4	46	62	24	18	8	295	-	190
6	6	56	75	-	18	10	315	-	195
8	4	60	84	32	18	12	335	-	180
8	6	72	98	36	18	14	380	-	190
8	8	86	105	-	18	16	405	-	195
10	4	78	98	46	18	18	435	-	-
10	6	90	121	47	20	6	315	-	-
10	8	105	135	50	20	8	345	-	-
10	10	120	145	-	20	10	370	-	220
12	4	94	119	58	20	12	395	-	205
12	6	110	138	58	20	14	440	-	200
12	8	125	149	57	20	16	465	-	200
12	10	140	187	61	20	18	505	-	225
12	12	160	213	-	20	20	535	-	-
14	4	172		-	24	6	415	-	-
14	6	182	210	100	24	8	445	-	-
14	8	206	231	100	24	10	470	-	-
14	10	228	255	100	24	12	500	-	305
14	12	234	269	100	24	14	550	-	310
14	14	280	299		24	16	580	-	320
16	6	228	250	124	24	18	625	-	305
16	8	248	264	124	24	20	660	-	300
16	10	264	286	124	24	24	720	-	-
16	12	280	312	112					
16	14	316	-	140					
16	16	322	385	-					

- a. The weight for fittings not listed in the tables above shall be in accordance with AWWA C153. The weight for fittings not listed in the tables above **or** in AWWA C153 shall be the actual weight of the fitting(s) furnished and installed based on acceptable documentation provided by the Contractor.

**15.03 HYDRANT WITH VALVE**

Hydrants will be paid for at the contract unit price per hydrant installed complete with drainage pit, gravel, concrete base, and bracing. Hydrant extensions will be paid for at the contract unit price per lineal foot, where specified by the Engineer.

**15.04 VALVES AND BOXES**

Valves and boxes (including extensions) will be paid for at the contract unit price bid for each size valve and box furnished and installed complete.

15.05 COPPER WATER SERVICE PIPE

Copper water service pipe will 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. The unit price shall include all pipe, fittings, laying, excavation, backfilling and testing.

15.06 CORPORATION COCKS

Corporation cocks will be paid for at the contract unit price for each size furnished and installed and shall include the saddle where required and the tap or connection to the watermain.

15.07 CURB STOPS AND BOXES

Curb stops, boxes and extensions will be paid for at the contract unit price for each size furnished and installed and shall include necessary fill when required.

15.08 AIR RELIEF MANHOLES

Air relief manholes will be paid for at the contract unit price per manhole installed complete as detailed including corporation cock.

15.09 PILING

Piling up to twenty (20) feet long including caps shall be paid for at the contract unit price for each single pile bent in place. No additional payment will be made for cradles.

Any piling required over twenty (20) feet in length shall be paid for as excess length of piling. Cut off lengths will not be paid.

Double pile bents shall be paid for according to the length of each individual pile. There shall be no additional compensation for lumber or hardware used to tie the piles together.

15.10 FOUNDATION MATERIAL

Material used for refilling to pipe foundation grade to assure firm foundation for pipe shall be paid for at the contract unit price per ton if included in the bid form. No foundation material will be paid for that is installed without the knowledge or consent of the Engineer nor will payment be made for rock installed only for dewatering purposes. Payment shall include cost of excavation and placement.

15.11 SPECIAL SECTIONS

Special sections will be paid for at the contract price on a lump sum basis for all work and material necessary for the complete installation or construction.

15.12 SHEETING ORDERED LEFT IN PLACE

Sheeting ordered left in place shall be paid for at the contract unit price per 1000 board feet.

### 15.13 JACKING

Payment for jacking will be paid for at the contract unit price per lineal foot. Watermain used in jacking will be paid separately at bid unit prices for that diameter watermain.

### 15.14 MERGED ITEMS

The cost of all material and labor required to complete this project as specified and shown on the plans, but not specifically included as a pay item, shall be merged with the various unit prices bid.

### 15.15 ROCK EXCAVATION

Rock excavation shall be paid for at the contract unit price bid per cubic yard excavated. The volume used for payment shall be computed assuming a rectangle, the width of which is equal to the outside diameter of the pipe installed plus one foot (1'), and the depth of which is the distance from the top of the rock formation to a point twelve inches (12") below the barrel of the pipe.

### 15.16 TEMPORARY WATER

Payment for temporary water service shall be compensation in full on a lump sum basis for all coordination, materials, labor, plumbing expenses and other work necessary to provide temporary water to project residences

### 15.17 INSULATION

Payment for insulation will be paid for by the square foot of area covered, regardless of the thickness required by the Engineer.

### 15.18 INCIDENTAL ITEMS

The furnishing and installing of specific items and/or the performance of work under certain circumstances shall not be individually paid. The costs shall be included in the unit price bid for the water system items, as indicated. Such items of work include but are not limited to:

1. The furnishing and installing polyethylene encasement material, include in the price bid for watermain.
2. Concrete blocking or metal ties, include in the price bid for watermain.
3. Valve umbrella anchorage assembly, include in the unit price bid for valves.
4. Locating and connecting to an existing watermain or hydrant, include in the price bid for watermain.
5. Locating and connecting to an existing water service line, include in the price bid for watermain.
6. Hydrostatic, leakage and continuity testing, include in the price bid for watermain.
7. Furnishing and installing thrust block, tie rods and joint restraints as shown on the plans and as specified.
8. Turning hydrant heads to a location as directed by the Engineer, include in the price bid for hydrants.
9. If a separate bid item for temporary water service is NOT included in the *Schedule of Unit Prices*, providing continuous temporary water service to affected users, include in the price bid for watermain.

10. The wood and/or metal parts are necessary to identify the ends of the unattached service lines and curb stops are included in the price bid for water services.
11. If a separate bid item for bypass pumping is NOT included in the *Schedule of Unit Prices*, providing temporary bypass pumping / control of storm water flows around the construction zone, include in the price bid for watermain.
12. The painting or re-painting of hydrants with scratches and/or abrasions, include in the price bid for hydrants.
13. Providing temporary corporations, copper pipe, plugs, etc. for hydrostatic watermain testing, include in the unit price bid for watermain.
14. If the watermain is to be installed inside a casing pipe, furnishing and placing the carrier pipe, carrier pipe support materials, sand fill and grout seals, include in the unit price bid for watermain.
15. Furnishing and installing tracer wire and electrical connections and all appurtenances related to installing services, mainline pipe and/or tracer wires, include in the price bid for watermain.