SECTION 300
Water Main Construction

Index:

1) General

A. Description: This work shall consist of the construction of water main and building service pipelines utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of potable water. The work includes the relocation or adjustment of existing facilities as may be specified in the Plans, Specifications and Special Provisions. All work will be done in accordance with CEAM specifications, Latest Edition, except as modified herein. In cases where there are conflicting requirements between the City's specifications and CEAM specifications, the more restrictive specification shall apply.

B. Work to Be Done: The contractor is to make the required excavation for laying water pipes and appurtenant structures; to do all ditching, diking, pumping, bailing, draining, sheeting, shoring, bracing, and supporting of the trenches to complete the pipe laying. He shall also do all related work such as fencing, lighting, temporary culverts or drains, conduit and provide bridges or means of maintaining travel on streets and roads in which the trenches are excavated. He shall repair damage done to structures and roads, refill trenches, clear away all rubbish and surplus or salvaged materials. He shall supply all material, tools, labor, and implements required to build and put in complete working order the pipes and appurtenances per plans and specifications. The contract should be aware that the City's utility system has been evolving since the early 1900's as such there is a varied inventory of pipe materials and appurtenances used within the system. The Contractor shall use Best Management Practices and Generally Accepted Means and Methods when working on or around the utilities. All connections to, and replacement of existing facilities shall be accomplished utilizing American or Canadian made products which are in accordance with these specifications or represent applications of said BMP's or Generally Accepted Practices.

C. Location of Underground Obstructions The location of pipes and other underground objects are approximate as shown on the plans, but should they be found to be otherwise, or should the contractor encounter quicksand, springs, rock or other difficulties he shall have no claim on that account, it being understood that the City does not warrant the plot of underground objects to be correct. The contractor shall be responsible for providing such independent investigations as may be necessary to verify the presence and or location of any underground facilities, which could potentially affect his/her work.

Included in these investigations it shall be the responsibility of the contractor to make a "Gopher One Call" or others, as appropriate, to obtain measurements necessary to locate pipes on public and private lands affected by the construction.

D. Maintenance of Traffic Whenever work interferes with the flow of traffic along a roadway, the Contractor shall provide for traffic control and signing and public safety in accordance with the provisions of temporary traffic control zone layouts-field manual Latest Edition. Any detours, road closures, lane closures, driving lane diversions, sidewalk closures or other roadway construction requiring safety devices will require a plan to be submitted to the City Engineer in writing at least 2 working days prior to the planned start of such action. Approval of the plan by the City Engineer will be required prior to proceeding. The plan shall be prepared in accord with MN MUTCD latest edition.

E. Private Lands The contractor shall not, unless consent has been given by the proper parties, enter or occupy with men, tools, or material any private land or city owned property adjoining the work. Storing materials and equipment of the boulevards or sidewalk shall be at the discretion of the Engineer with the contractor liable for any and all damage resulting therefrom.

2. Materials

A. General:

All materials required for this work shall be new material conforming to requirements of the reference specifications for the class, kind, type, size, grade, and other details indicated in the Contract. Unless otherwise indicated, all required materials shall be furnished by the Contractor.

All references to Gray Iron material in the specifications shall be construed to include both Gray Iron and Ductile Iron products, except where one or the other is specified.

All manufactured products shall conform in detail to such standard design drawings as may be referenced or furnished in the Specifications or Plans.

Otherwise, the Owner may require advance approval of material suppliers, product design, or other unspecified details as it deems desirable for maintaining adopted standards.

At the request of the Engineer, the Contractor shall submit, in writing, a list of materials and suppliers for approval.

The Engineer may request a Certificate of Compliance stating that materials furnished have been tested and are in compliance with the specification requirements.

(1) SAMPLES: Samples of the materials proposed or furnished for the work may be taken by the Engineer at any time, at the point of manufacture, point of delivery or site of work. They will be selected as far as practical, in accordance with standard methods for sampling materials as specified in the standards of the American Society for Testing and Materials. Cost of samples selected for testing shall be borne by the Contractor.

(2) STANDARDS: The use of an A.S.T.M., A.S.N.I., A.A.S.H.O., A.W.W.A or MNDOT designation in these specifications refers to the latest revision of that particular standard or tentative standard of that organization.

(3) COSTS OF TESTS: All tests including, but not limited to, pressure tests,

bacteriological tests, conductivity tests, etc. will be made at the expense of the contractor.

(4) Quality assurance tests such as trench compaction, and concrete compression tests will be taken and paid for by the City on City projects unless otherwise directed in the special provisions. In the event that the tests do not pass or meet specifications all re-testing will be at the Contractor's expense.

(5) ACCEPTANCE OR REJECTION: When the specimens tested conform to A.S.T.M. requirements, then all pipe represented by such specimens shall be considered acceptable. Copies of test reports shall be submitted to the Engineer before the pipe is installed in the project. In the event that any of the test specimens fail to meet these requirements, all pipe represented by such tests shall be subject to rejection. The Contractor, however, has the right to furnish additional specimens from the same shipment or delivery, at no cost to the City. The pipe will be considered acceptable if all of these specimens meet the requirements.

(6) REJECTED PIPE: Pipe which has been rejected by the Engineer shall be removed from the site of work by the Contractor and replaced with pipe which meets the requirements, without cost to the City.

(7) STRAIGHTNESS: Pipe intended to be straight shall have a maximum ordinate as measured from the concave side of the pipe not to exceed 1/8 inch per foot of length.

(8) MARKING: Each length of pipe shall bear the name or trademark of the manufacturer, the location of the plant and the date of manufacturer. Each length shall likewise be marked to designate the class or strength of the pipe. The markings shall be made on the exterior or interior of the pipe barrel near the bell or groove end and shall be plainly visible.

B. Pipe, Gaskets and Fittings:

All pipe furnished for water main and branch line installations shall be of the type, kind, size, and class indicated for each particular line segment as shown in the Plan and designated in the Contract Items. Wherever connection of dissimilar materials or designs is required, the method of joining and any special fittings employed shall be subject to approval of the Engineer.

All watermain pipe must be manufactured in the United States or Canada and must conform to the AWWA, ASA, and ASTM standards listed below. Gaskets, fittings, and other special parts shall also be manufactured in the United states or Canada and conform to the listed AWWA, ASA, or ASTM specifications-latest edition. Parts, fittings, reducers, etc. that have not been manufactured in the United States or Canada will be accepted only after written approval by the Engineer. All testing data, information, specifications, etc. for these components will be available upon request by the Engineer, regardless of their place of manufacture. All bolts will be "cor blue" or approved equal.

Pipe Description Class or Type Specification Joint

Cement Lined Class 52 ANSI A21.51 Mechanical Ductile Iron Pipe ANSI A21.4 or Push-On

Polyvinyl Chloride (PVC) pipe ANSI/AWWA C900 or C905, meeting the requirements of ASTM D-2241 and ASTM 1784, DR18, pressure class of 235 psi for 4" through 24" diameters. Pipe shall be slip joint type.

Cement Lined Cast Class 350 ANSI A21.10 Mechanical Iron Fittings ANSI A21.53 ANSI A21.4

Copper Service Type K Soft ASTM B88 Pipe Compression

HDPE (CTS) Water Service Pipe ANSI/AWWA C901 – SDR9 Rated 250 PSI

- Stainless Steel insert stiffeners required on all compression fittings

******As of 2014 – All components of pipe fittings, valves, hydrants, etc. shall be certified as lead-free as per Section 1417 of the Federal Safe Drinking Water Act.******

C. Electrical Conductivity

CAST OR DUCTILE IRON PIPE

Each joint on "push on" cast iron or ductile iron pipe, valves hydrants or fittings shall be electrically bonded with an external copper jumper capable of carrying 350 amps of current for an extended period of time to provide integral electrical conductivity capabilities. Copper (not lead) studded gaskets and mega-lugs will also be allowed. Copper jumpers are required across all valved connections. These copper jumpers can be either shop or field applied in accordance with these specifications. For field applied copper jumpers, either the "Burndy-Thermoweld" as supplied by Burndy Corporation, Norwalk, Connecticut, or "Cadweld" by Erico Products Company, Cleveland, Ohio will be permitted or equal.

Contractors or suppliers shall submit the method they propose to use for approval prior to construction

The copper jumper shall be a minimum 1/16" x 1/2" wide flat strip or equal cross section round copper wire in the annealed condition conforming to ASTM Specifications B152-58 Type DHP.

All copper jumpers shall be welded to the pipe and fittings by the metallic-arc welding process, if shop applied or by the exothermic welding process if field applied.

The copper jumper can be applied as a single strip welded at each end across the joint or by multiple strips with bolted connections in the middle. Silicon bronze bolts and nuts shall be used on all bolted connections.

All welded connections shall be made on a clean, metal surface which has been ground to remove coating and oxide. The area at the connection, including the weld, shall be

refinished with its original coating or other suitable protective coatings specified.

The assembled copper jumper across the joints shall be so installed that expansion, contraction, or relative pipe movement incidental to normal service use will not damage the connection to such an extent that electrical resistance will vary across the joint.

The completed watermain shall be tested for electrical conductivity as outlined under "Testing" in these specifications.

PVC PIPE (Tracer Wire)

All installations of PVC water main shall be installed with an electrically conductive tracer wire consisting of approved materials.

Tracer wire shall be #12 AWG copper clad steel, high strength, with a minimum 450 lb. break load (1,150 lb. break load for directional drilling/boring). The wire shall be insulated with a minimum of 30 mil thick HDPE, colored blue for mainline wire and red for grounding wire.

Tracer wire connectors shall be 3 or 4-way lockable type, specifically manufactured for use in underground tracer wire installation. Connectors shall be dielectric silicon filled to seal out moisture and prevent corrosion. Non-locking friction fit, twist-on, or taped connectors are prohibited.

Grounding of tracer wire shall be achieved by use of a drive-in magnesium grounding anode rod (minimum 0.5 lb.) specifically manufactured for this purpose.

D. Marking Tape: Marking tape shall consist of 3" wide polyethylene, minimum of 4.5 mil thickness, blue in color, with the words "BURIED WATER LINE BELOW" indicated on the tape.

E. Gate Valves and Boxes: Gate Valves shall be resilient seat valves meeting the requirements of A.W.W.A. Standard C509 and shall be designed for 200 p.s.i. working pressure. The City will accept valves 12 inches and under with the body of the gate valve constructed of ductile iron if the wall thickness meets or exceeds AWWA C509. The epoxy coatings shall meet or exceed all requirements of AWWA C550. The gate valves shall have mechanical joint ends, a non-rising operating stem with "O" ring seals, a two inch (2") square operating nut and shall open left. An open indicating arrow, the manufacturer's name, pressure rating and year of manufacture shall be cast on the body of all valves.

All gate valves are to be provided with vertical valve boxes. Valve boxes shall be Tyler No. 6860 Series "G" or approved equal. Valve boxes shall be provided for 7 ½ feet of cover, except where greater depths are indicated on the profiles of the plans. For depths over 8 feet, an operating nut extension will be installed up to a level of 8 feet deep. Valve boxes shall be at least 3 pieces with sufficient adjustment to provide at least 6" of adjustment above and below grade.

All gate valves shall have centering devices such as Gate Valve Adaptor manufactured by Adaptor, Inc. or the Tenor Centering Device manufactured by American Flow Control or a City approved equal.

All components of gate valves shall be American or Canadian made and made of lead-free materials.

F. Corporation Stops: Corporation stops shall be compression fitted, and shall be Ford FB 1004 Q (Compression) or an approved equal. Corporation stops shall have copper service pipe outlet. **All corporation stops and fittings shall be made of lead-free materials.**

Service Line Saddles: Saddles for PVC pipe shall conform to the requirements of AWWA C800 and shall be stainless steel sleeve type, with stainless steel bolts, nuts, and spring washers. Spring washers shall be manufactured from type 304 stainless steel, special "spring grade". Saddles shall include threaded outlet tapping sleeves and Nitrile Butadiene Rubber (NBR) gaskets.

Curb Stops and Boxes: Curb stops shall be compression fitted, and shall be Ford B 44-444 MQ (Compression) or an approved equal. Curb stops shall have copper service pipe inlet and outlet. Mueller curb stop valves will not be considered an approved equal. **All curb stops and fittings shall be made of lead-free materials.**

Copper service line piping shall be sized with an internal sizing tool prior to fitting.

Curb boxes shall be Minneapolis Pattern for 3/4" thru 2" sized curb valves, shall include a 66" stationary rod with standard hardware unless otherwise indicated by the plans or special provisions. Curb boxes shall be adjustable 6" up and 6" down from a standard depth of 7 ½ feet of cover.

G. Hydrants: Fire hydrants shall meet the requirements of A.W.W.A. Standard C502. Hydrants shall be Waterous model WB67 with a **22 inch traffic section** or approved equal. The Waterous Classic Pacer model hydrant shall be installed in locations directed by the City on the plan sheets. The date stamp of manufacture on each hydrant shall be within one calendar year of the date of installation (i.e. for a 2014 installation, the hydrant shall have been made in 2014 or 2014).

The hydrants shall have two 2½" hose connections and one 4" pumper connection with threads as outlined on the details herein. Hydrants shall open left and shall be provided with drain to operate only when hydrant is closed. Hydrants shall have 6" mechanical joint hub, 5" valve opening, 5" barrel, "O" ring stem seal, and shall have a bury depth equal to that of the main line to which they are connected, with a minimum of 7½ feet bury unless otherwise specified. U.S. or Canadian manufactured parts only. **All components of hydrants shall be made of lead-free materials.**

The Contractor shall deliver one (1) E-Z Guide Spring Base Hydrant Safety Marker (fiberglass) device with each new hydrant. The hydrant marker shall not include the dust cover for the spring. This hydrant marker shall not be installed.

The hydrant operating nut and nozzle thread shall conform to the standard used by the City of Hastings (see details at the end of this Section)

All hydrants shall be given one additional coat of paint after installation. All abraded surfaces shall be cleaned and primed prior to application of final field coat. Hydrants shall be painted one coat of primer paint and two finish coats of approved paint red in color (OSHA safety red #314 Koppers Glamortey 501 enamel).

<u>Before placing an order for hydrants the contractor shall submit shop drawings to the City Engineer for approval.</u>

H. Mortar: Mortar for use in masonry construction shall be an air-entrained mixture of one part Portland cement and three parts mortar sand, with sufficient water added to produce proper consistency, and with sufficient air-entraining agent added to maintain an air content within the range of 7 to 10 percent.

I. Concrete: Concrete for cast-in-place masonry construction shall be produced and furnished in accordance with the provisions of MnDOT Specification 2461 for the mix design indicated in the Plans, Specifications, or Special Provisions. The requirements for Grade B concrete shall be met where a higher grade is not specified. Type 3 (air-entrained) concrete shall be furnished and used in all structures having weather exposure.

J. Saddles shall be Mueller DB2A series, Ford 101B, 202B or equal.

K. All threaded rod will be stainless steel or hot dipped galvanized or approved equal.

3. Construction Requirements

A. Inspection: During the process of unloading, all pipe and accessories shall be inspected by the Contractor for damage. The Contractor shall notify the Engineer of all material found that has cracks, flaws or other defects. The Engineer shall inspect the damaged material and have the right to reject any materials he finds unsatisfactory. The Contractor shall promptly remove all rejected material from the site.

B. Removals, Trench Excavation and Backfill and Restoration: Removal of existing facilities, trench excavation and backfill and restoration shall be in accordance with the provisions of Section 4 of these specifications.

C. Utilities and Monuments: Care shall be taken not to move, without consent of the Engineer, any sewers, drains, water or gas pipes, utility conduit, or other structures; and in crossing these, and in running parallel or near them, they shall be sustained securely in place until the work is completed. Whenever it is necessary to interfere with said structures, the contractor shall maintain their respective services, and, if necessary for that purpose, shall lay temporary water, gas, or other pipes. He shall repair all damage done to any of said structures, and he shall leave them in good condition as they were previous to the commencement of the work.

No stone monuments, bench marks, etc., of any description, located in line of the work shall be removed or taken up unless it be in the presence of the Engineer or his assistants. All lot corners, pipe monuments, etc. that are located outside the ditch area shall be preserved, and if any are disturbed or removed, the contractor shall hire a registered land surveyor or replace them at the Contractor's expense.

D. Alignment, Grade and Utilities: All pipe shall be laid and maintained to the required lines and grades; with hydrants, valves and fittings at the required locations; with joints centered and spigots home; and with all valve and hydrant stems plumb.

The watermain shall be placed with a minimum of 7½' of cover for ductile iron pipe and 8½' of cover for PVC pipe. However, a slightly greater depth may be required to clear existing storm and sanitary sewers and sewer services. Accordingly, the pipe will be laid to the depth substantially as shown on the plans. Minor adjustments to this may be required in the field, and unless specified in the construction documents no unit of measurement or payment shall apply for such variation.

In certain locations where the watermain is in direct conflict with storm or sanitary sewer, the watermain shall be constructed under the sewer. Where it is necessary to use vertical bends to avoid sewer mains, no extra compensation will be made for this construction. However, the additional lineal footage will be measured and paid at the unit bid prices.

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

Watermains crossing sanitary sewers shall be laid to provide a vertical separation of at least 18 inches between the bottom of the watermain and the top of the sewer main. See standard plates for insulation requirements. Where local conditions prevent the minimum separation the following construction shall be used:

(1) Sewers passing over or under watermains shall be constructed of materials equal to watermain standards of construction (SDR18 or DIP) for a distance of at least 9 feet on either side of the watermain. Pressure testing to watermain standards shall be provided by the contractor.

(2) Sewers passing over watermains shall have adequate structural support for the sewers to prevent settlement, or deflection of the joints, or settling on and breaking of watermains. Watermains shall be laid at least 10 feet horizontally from any sanitary sewer, storm sewer or sewer manhole, whenever possible. When local conditions prevent a horizontal separation of 10 feet a watermain may be laid closer to a storm or sanitary sewer provided that:

(1) The bottom of the watermain is at least 18 inches above the top of the sewer;

(2) Where this vertical separation cannot be obtained, the sewer shall be constructed of materials and with joints that are equivalent to watermain standards of construction and shall be pressure tested to assure watertightness prior to backfilling. Approval of any such variation from Minnesota Codes or 10 States Standards shall be approved in writing by the Minnesota Department of Health prior to installation.

E. Cutting and Blocking of Pipe:

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe and so as to leave a smooth square-cut end. Pipe shall be cut with approved mechanical cutters. Flame cutting will not be allowed under any conditions. All rough edges shall be removed from the cut ends of pipe and, where rubber gasket joints are used, the outer edge shall be rounded or beveled by grinding or filing to produce a smooth fit.

Wherever it is necessary to deflect ductile iron pipe from a straight line either in the vertical or horizontal plane, to avoid obstructions, plumb stems, or produce a long radius curve when permitted, the amount of deflection allowed at each joint shall not exceed the allowable limits for maintaining a satisfactory joint seal as given in AWWA C-600 for mechanical joints and push-on joints. The maximum angular deflection at any joint for other pipe materials and joints shall not exceed the manufacturer's recommendations. If the specified alignment requires angular deflections greater than recommended or allowed, the Contractor shall provide appropriate bends or shorter pipes such that the maximum angular deflection is not exceeded.

All plugs, caps, tees, bends, and other thrust points shall be provided with reaction backing, or movement shall be prevented by attachment of suitable restraining devices, in accordance with the requirements of the Plans, Specifications, and Special Provisions. Mega-Lugs shall be provided on all mechanical joints.

In the absence of other specified requirements for reaction backing or restraining devices, the thrust blocking shall be done in accordance with the details at the rear of this Section.

All necessary tie rods, bands, fittings, nuts and bolts, and all labor and excavation required to install reaction restraints or thrust block shall be furnished by the contractor at their expense. No direct compensation will be made for these items and they shall be included into the lineal foot cost of installing watermain.

Where valves are located on dead ends, the valves shall be tied or lugged across the valves with tie rods from the plug to the valve and from the valve to the last pipe joint, unless approved in writing by the City Engineer.

On ductile iron pipe dead ends 6" through 12", joints shall be tied a minimum of 3 joints up to the plug and install reaction backing.

F. Laying Pipe: Before lowering and while suspended, the pipe shall be inspected for defects and cracks. Any defective, damaged or unsound pipe shall be rejected.

Remove all foreign matter or dirt from the inside of the pipe before it is lowered into the trench, and keep the pipe clean by approved means during and after laying. When connecting to existing watermain, only representatives of the Public Works Department are permitted to operate valves on the existing water system. The Contractor shall give the Public Works Department two working days notice when it is necessary to take a watermain out of service. Disruption of service shall be during the time of day when the least inconvenience will be caused to the customer. Fittings and other materials used for connecting to existing mains shall satisfy dimensional requirements found in the field.

On City Projects, the primary line and grade will be established by the Engineer. For trench installation, line and grade stakes will be set parallel to the proposed pipeline at an appropriate offset therefrom as will best serve the Contractor's operations wherever practical. For tunnel installation, line and grade stakes will be set directly above the proposed pipeline setting. Grade and line stakes will be set at 50 foot intervals along the pipeline; at each change in line or grade; and as needed for pipeline appurtenances and service lines.

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

The Contractor shall be responsible for the correct transfer of line and grade to all his working points and construction of the watermain and appurtenances to the prescribed line and grade established by the Engineer.

Trench excavation and bedding preparations shall precede ahead of pipe placement as will

permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. Pipe shall be kept clean by approved means during and after laying. The water main materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped or dumped into the trench.

At the time of pipe placement, the bedding conditions shall be such as to provide uniform and continuous support for the pipe between bell holes. Bell holes shall be excavated as necessary to make the joint connections, but they shall be no larger than would be adequate to support the pipe throughout its length. No pipe material shall be laid in water nor when the trench or bedding conditions are otherwise unsuitable or improper. Pipe shall be inspected and cleaned of any foreign matter and debris prior to being installed in the trench.

When placement or handling precautions prove inadequate, in the Engineer's opinion, the Contractor shall provide and install suitable plugs or caps effectively closing the open ends of each pipe section before it is lowered into laying position, and they shall remain so covered until removal is necessary for connection of an adjoining unit. At no time will the pipe be used for dewatering.

As each length of bell and spigot pipe is placed in laying position, the spigot end shall be centered in the bell and the pipe forced home and brought to correct line and grade. The pipe shall be secured in place with approved backfill material, which shall be thoroughly compacted by tamping around the pipe to a height of at least 12 inches above its top. Acceptable tamping techniques include hand tamping and use of hand operated mechanical tamping devices.

Connection and Assembly of Joints

Where rubber gasketed joints are specified, care shall be taken during the laying and setting of pipe materials to ensure that the units being joined have the same nominal dimension of the spigot outside diameter and the socket inside diameter. A special adaptor shall be provided to make the connection when variations in nominal dimension might cause unsatisfactory joint sealing.

Immediately before making the connection, the inside of the bell or socket and the outer surface of the spigot ends shall be thoroughly cleaned to remove oil, grit, excess coating, and other foreign matter. Insertion of spigot ends into the socket or bell ends shall be accomplished in a manner that will assure proper centering and insertion to full depth. The joint seal and securing requirements shall be as prescribed below for the applicable pipe and joint type.

Push-On Joints

The circular rubber gasket shall be kept in a warm, flexible condition at all times, and for purposes of placement shall be flexed inward and inserted in the gasket recess of the bell socket. A thin film of approved gasket lubricant shall be applied to either the inside surface of the gasket or the outside surface of the spigot end, or to both. Care shall be taken while inserting the spigot end to prevent introduction of contaminants. The joint shall be completed by forcing the spigot end to the bottom of the socket by the use of suitable pry-bar or jack type equipment. Spigot ends which do not have depth marks shall

be marked before assembly to insure full insertion. Field cut pipe shall be filed or ground at the spigot edge to resemble the manufacturer's fabricated detailing. The use of the bucket on the excavation equipment to force the pipe into the socket shall not be permitted.

Mechanical Joints

The last eight inches of the outside spigot surface and the inside bell surface of each pipe and appurtenance joint shall be painted with a soap solution, after being thoroughly cleaned. The gland shall then be slipped on the spigot with the lip extension toward the socket or bell end. The rubber gasket shall be kept in a warm, flexible condition at all times, and for purposes of placement shall be painted with soap solution and be placed on the spigot end with the thick edge toward the gland. An approved lubricant provided by the pipe manufacturer may be used in lieu of the soap solution.

After the spigot end is inserted into the socket to full depth and centered, the gasket shall be pressed into place within the bell evenly around the entire joint. After the gland is positioned behind the gasket, all bolts shall be installed and the nuts tightened alternately to the specified torque, such as to produce equal pressure on all parts of the gland.

G. Tracer Wire: Tracer Wire shall be installed in accordance with the latest specifications and details provided by the Minnesota Rural Water Association and as supplemented below.

Tracer wire shall be installed with all PVC main. Tracer wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, allowing for proper location of wire without loss or deterioration of low frequency (512 Hz) signal for a minimum distance of 1,000 linear feet. Tracer wire is not required on copper service lines.

Tracer wire systems must be installed as a single, continuous wire, except where using approved connectors. No looping or coiling of wire is allowed. Interconnection of tracer wires shall be completed using 3-way (tees) or 4-way (crosses) lockable connectors, and shall be installed in a manner so as to prevent any uninsulated wire exposure.

Install tracer wire continuously, by-passing around the outside of gate valves and fittings on the North or East side of the pipe and on the bottom half of the pipe. Wire shall be secured to the pipe (taped or tied) at 10 foot (minimum) intervals.

All tracer wire termination points shall include installation of an approved grounding anode rod with a minimum of 20 lineal feet of grounding wire connected to anode, buried at the same elevation of the water main, and installed in a direction 180 degrees opposite of the tracer wire at the maximum possible distance. All termination points must also utilize an approved tracer wire access box, specifically manufactured for this purpose. All access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the tracer wire connection and the terminal for the grounding anode wire connection. The grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

Above ground tracer wire access boxes shall be installed on all fire hydrants, properly affixed to the grade flange. Affixing with tape or plastic ties is prohibited.

Any damage occurring during installation of the tracer 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 is prohibited.

In those cases where an existing tracer wire is encountered on an existing water main that is being extended or tied into, the new tracer wire and the existing tracer wire shall be connected using approved connectors, and shall be properly grounded at the splice location.

In cases where PVC watermain is being installed and connected to ductile or cast-iron pipe, tracer wire shall be terminated utilizing a grounding rod installed at the location of the transition between pipe materials.

H. Marking Tape: Marking tape shall be installed with all watermain to indicate its location during future excavations. The tape shall be installed along the full length of all watermain a minimum of 12", maximum of 18", directly above the pipe. The tape shall be installed in a manner to avoid damage from backfilling and compaction operations.

I. Setting Hydrants: Hydrants shall be located as directed by the Engineer and shall be placed as shown on the construction details attached herein. After each hydrant has been set, there shall be placed evenly around the base of the hydrant, at least one cubic yard of washed river rock. Two layers of 6 Mil polyethylene shall be carefully placed over the rock to prevent backfill material from entering voids in the rock drain. All hydrants must be maintained in a plumb position. Centering and plumbing devices will be provided.

J. Setting Valves, Valve Boxes and Fittings: Valves shall be set with the stems vertical and plumb, and in accordance with the detail sheet attached herein.

Unless otherwise directed by the Engineer, all gate valves located in areas outside of streets are required to be accompanied by a metal sign post and indicator placard with the initials "GV". The placard shall be mounted on the sign post at a height of no less than 3 feet above finished grade. The placard shall have green retro-reflective backing such as that found on traffic control signs with white retro-reflective lettering. The furnishing and installation of this sign post and sign shall be incidental to the cost of furnishing and installing the gate valve.

K. Curb Stops and Boxes: Curb stops and boxes shall be installed generally near the street right of way line or as established in the field by the inspector. Installation shall be as shown on the construction details attached herein. Backfilling shall be accomplished to avoid displacement or bending of the curb box. In the case of new subdivisions the curb box shall be placed on the easement line generally; 10 ft. into the property. The top of the curb stop box shall be located beneath finished grade to a depth no greater than 2". All adjustments needed to meet this requirement including, but not limited to couplings, splices, and cutting of the curb stop box shall be incidental to the furnishing and installation of the curb stop box.

Prior to connecting an existing water service to a new curb box, the new water service from new water main to the curb box shall be flushed out briefly to clear any debris in the line.

L. Corporation Stops: Corporation stops shall be installed in the upper quadrant of the main at an angle of not more than 22 degrees from the horizontal as shown in the water service detail attached herein. Corporation stops on 6" ductile iron water mains and all PVC water mains will require an approved saddle connection.

M. Copper Service: Copper service lines shall be installed continuous without joints between the corporation and curb stops with about 1 foot of slack at the corporation stop to allow for settlement and service line movement.

In general, water services shall have a 7½' bury in the street right of way with the exception of those locations in which conflict may occur with storm sewer. In these cases the water service shall be constructed below the storm sewer to permit 3 feet of clearance between storm sewer invert and water service. Special location requirements also apply to the construction/reconstruction of water and sewer services – see following pages. It shall be the duty of the Contractor to keep an accurate record of service connections, as to location, service address, installed pipe length & size, type of connection provided, existing pipe material at service connection, etc. This record shall be turned over to the Engineer at the end of each week.

N. Mega Lugs (domestic or Canadian only, except otherwise approved by the Engineer) shall be used on all mechanical joints and may be substituted for threaded rods and clamps if approved by the engineer for specific conditions.

O. Temporary Watermain & Services: Temporary main lines shall be a minimum of 2 ¼" in diameter, and shall meet all AWWA and Minnesota Department of Health requirements for use as a drinking water supply facility. The line shall be disinfected and tested in accordance with City of Hastings Specifications prior to being put into service. Temporary watermain will be compensated for by the lineal foot (LF), based on the length of the temporary main line installed and shall include all temporary service taps, fittings, hoses, and connections to homes.

Contractor is required to have a backflow prevention device furnished at every temporary water supply point (hydrant). Furthermore, contractor is required to have this backflow prevention device inspected and certified for proper function by a 3rd party plumber or other certified entity prior to turning on any supply to temporary water system.

In cases where homes or buildings are equipped with a backflow prevention device at the only point of connection on the exterior, the contractor has the option of installing a plumbing retrofit on the existing exterior faucet (with property owners signed consent), or shall connect the temporary water service line to the existing curb stop. No reimbursement will be made for any of the appurtenances related to either of these types of connections, (i.e. plumbing time & materials, excavation & backfilling, disconnection of existing line, safety fencing, etc.).

Contractor shall coordinate procedure for switching homes or buildings both on to, and off of, temporary water supply with the City of Hastings Public Works Department. The City will provide staff to oversee these switchovers being made inside the home and assist with this work as staff is available.

Contractor is responsible for removing all tools, materials, and plumbing modifications at homes that are connected to temporary system.

Ongoing maintenance of temporary water system, such as leaks at spigots or damage to temporary lines, shall be the responsibility of the contractor and this maintenance shall be considered incidental to the bid item supplied for temporary water system.

P. Connections with Existing Lines: Where proposed extensions connect into existing mains at old fittings and provide for such extensions, watermain stubs, or where new fittings must be cut into an existing main, the Contractor shall include in his bid for connection to existing mains the cost of all work necessary to make the connection to, or cut into the existing watermains. The Contractor shall assume all expenses incurred due to faulty valves which may require the connection to be made wet or under pressure. Should it be reasonable in the opinion of the Engineer or the Engineer's authorized representatives to accomplish the replacement of multiple valves or other fittings via excavation of a common trench, the contractor will receive only one unit of the line item for connection to existing watermain.

Work in connection with old mains shall be done at such times and in such a manner as not to interrupt the continuous supply of water in except between valves in the vicinity of the work. Such work shall be done in cooperation with the City authorities and only at such time as it is authorized by them.

Water shall be shut off during alterations to existing facilities and no valve or other control on existing system shall be operated for any purpose by the Contractor.

4. Removals, Trench Excavation, & Backfill

A. General: The work in this Section shall include miscellaneous removals, trench excavation, special pipe foundations, trench backfill, and restoration of street surfaces.

B. Granular Materials: Granular materials furnished for foundation, bedding, encasement, backfill, or other purposes as may be specified shall consist of any natural or synthetic mineral aggregate such as sand, gravel, crushed rock, crushed stone, or slag, that shall be so graded as to meet the gradation requirements specified herein for each particular use.

Granular materials furnished for use in Foundation, Bedding or Encasement construction shall conform to the following requirements:

Granular bedding material shall be pit run material and a graded aggregate product of which 100% will pass the 1" sieve and not more than 10% will pass the #200 sieve.

Granular materials provided for Foundation, Bedding, Encasement, or Backfill use as required by the Plans, Specifications, and Special Provisions, either as part of the pipe item work unit or as a separate contract item, shall be classified as to use in accordance with the following:

Material Use Designation Zone Designation

Granular Foundation----------	Placed below the bottom of pipe grade as replacement for unsuitable or unstable soils, to achieve better foundation support.
Granular Bedding----------	Placed below the pipe midpoint, prior to pipe installation, to facilitate proper shaping and to achieve uniform pipe support.
Granular Encasement----------	Placed below an elevation one foot above the top of pipe, after pipe installation, for protection of the pipe and to assure proper filling of voids or thorough consolidation of backfill.
Granular Backfill----------	Placed below the surface base course, if any, as the second stage of backfill, to minimize trench settlement and provide support for surface improvements.

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

C. Aggregates: Aggregate required for street restoration or special trench backfill where specified shall be in accordance with the following:

Aggregate for road surface shall meet MnDOT specification 3138 for Class 5 surfacing aggregate. Aggregate for shoulder surface shall meet MnDOT Specification 3138 for Class 5A crushed limestone.

D. Bituminous Surface Restoration: Refer to Section 700 of these specifications.

E. Concrete Pavement Restoration: The restoration of concrete pavements due to watermain installation will be further identified in the special provisions as each surface is unique in section and design. In general the pavement will be replaced with concrete of equal depth and reinforced in the manner of that removed. The replacement concrete shall be doweled to surrounding pavement and consist of concrete meeting MnDOT Specifications 2301 for concrete pavement.

F. Insulation: Watermain insulation shall be extruded rigid board material meeting or exceeding ASTM C 578-85 specifications for rigid cellular polystyrene thermal insulation. Insulation shall have a minimum R Value of 11 per 2 inch thick sheet, and have a compressive strength of 50 lbs per sq. inch or more. Acceptable manufacture Certifoam 40, Dow, or equal. Unless otherwise specified in the Plans, Specifications, and Special Provisions, board dimensions shall measure 8 feet long, 2 or 4 feet wide, and minimum 2"

inches thick. When required, insulation shall be installed for the width of the trench or 4 feet in width, whichever is less, at all locations where water or sewer mains are shallower than specified depth and at all crossings with storm sewers. Insulation shall be installed a minimum of 2 feet beyond the outside edge of storm sewer pipe at storm sewer crossings.

G. Construction Requirements:

(1) Where watermain is constructed on private right-of-way the topsoil shall be stripped prior to construction and stockpiled until the utilities have been installed and then the topsoil shall be spread over the disturbed area. Prior to installation of watermains on platted streets, the topsoil shall be salvaged.

(2) Removals: Plans indicate the location of pipe and miscellaneous structures necessary to be removed for construction of utilities. The debris resulting from removals shall become the property of the Contractor and shall be disposed of unless noted otherwise on the Plans.

(3) Trench Excavation: All work shall be done by open trench excavation unless otherwise noted.

Trench excavation shall be dug to the alignment and depth shown on the plans and only 100 feet in advance of the pipe laying. The trench shall be braced and drained so that workmen may work safely and efficiently therein.

Trench water shall be drained from the trench into natural drainage channels or storm sewers. Draining trench water into sanitary sewers or combined sewers will not be permitted.

Dewatering trenches will be incidental to the construction.

While any open excavations are maintained, the Contractor shall have available a supply of steel plates suitable for temporary bridging of open trench sections where either vehicular or pedestrian traffic must be maintained. Use of the plates shall be as directed or approved by the Engineer and where installed they shall be secured against possible displacement and be replaced with the permanent structure as soon as possible.

Braced and sheeted trenches shall be put in place and maintained as may be require to support the side of the excavation and to prevent any movement which may in any way endanger personnel or injure or delay the work or endanger adjacent buildings or other structures. All costs for any shoring shall be included in the unit bid for pipe installation.

Excavated material shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

Width of trench may vary with and depend upon the depth of trench and the nature of the excavated material encountered; but in any case shall be ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly. The minimum width of unsheeted trench shall be 18 inches and for pipe 10"

or larger, at least one foot greater than the nominal diameter of the pipe, except by consent of the Engineer. The maximum clear width of the trench at the top of the pipe shall not be more than 2 feet greater than the outside diameter of the pipe.

If the trench is excavated to a greater width than that authorized, the Engineer may direct the Contractor to provide a higher class of bedding, a higher strength pipe or both, than that required by the Contract, without additional compensation therefore, as the Engineer deems necessary to satisfy the design requirements.

Faulty trench excavation below grade lines shall be corrected with approved material, thoroughly compacted without additional compensation to the Contractor.

Blasting for excavation will not proceed until the Contractor has notified the Engineer and secured the engineers approval to do so. This notification shall in no matter relieve the Contractor of the hazards and liability contingent on blasting operations. The hours of blasting shall be fixed by the Engineer. Any damage caused by blasting shall be repaired by the Contractor as his expense. The Contractor's method of procedure relative to blasting shall conform to local and state ordinances. A City Blasting Permit shall be required.

Unsuitable Excavation -When excavated material is encountered that is unsuitable for backfill in the opinion of the engineer, it shall be disposed of by the contractor. Unless a disposal site is indicated on the plans and specifications, the contractor shall be responsible for finding a location for all waste materials and unsuitable soils. Excavation of this material is incidental to the removal/installation of the utility facility, and the cost of hauling and disposal of the wasted material shall be included in the cost of furnishing and placing replacement granular materials.

(4) Pipe Subgrade and Backfill Within Pipe Zone:

(a) Pipe Foundation in Good Soil -When the bottom of the trench consists of a material suitable to properly support the pipe the watermain shall be constructed in conformance with the Class "C" pipe bedding detail attached herein. Bell holes of ample dimensions shall be dug in the trench at each joint to permit proper joining of the pipe.

(b) Pipe Foundation in Poor Soil -If trench bottom conditions are encountered which appear to require stabilization, the Engineer shall be informed. The trench conditions shall be examined by the Engineer to determine the nature of such instability, employing the services of a testing laboratory if necessary. If it is determined that the trench bottom cannot support the pipe, a further depth and/or width shall be excavated and refilled to the pipe foundation grade with material herein described as granular Foundation and thoroughly compacted. This material shall be measured for payment. If the examination by the Engineer reveals that the afore-described conditions are caused by the Contractor's manipulation of the soils in the presence of excessive moisture or lack of proper dewatering, the Contractor shall take such steps as are necessary to stabilize the trench bottom including the use of pipe support material and improved dewatering methods. In such case, the cost of measures necessary shall be borne by the Contractor.

(c) Pipe Clearance in Rock -Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below outside barrel of the pipe of fittings, and

to a clear width of 12 inches on each side of all pipe and appurtenances for pipe 18 inches or less in diameter; for pipes larger than 18 inches, a clearance of 9 inches below and clear width of 12 inches on each side of inside diameter of pipe shall be provided. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes. Excavations below sub-grade in rock or in boulders shall be refilled to sub-grade with approved material, thoroughly compacted.
(d) Backfill at Pipe Zone -Backfill material at pipe zone shall be free from rock, boulders or other unsuitable substances and shall be deposited into the trench simultaneously on both sides of the pipe for the full width of the trench in 6 inch lifts thoroughly compacted to a minimum elevation of 6 inches above the top of the pipe. Compaction shall be accomplished by mechanical tamping.

(5) Backfill Procedure Above Pipe Zone

(a) General -Succeeding layers of backfill above pipe zone may contain coarser material but shall be free from pieces of rock, concrete, clay lumps more than one-third cubic foot in volume, roots, stumps, tin cans, rubbish, frozen materials and other similar articles that will cause excessive settlement. This type of backfill shall be placed in uniform one foot (1') lifts and each lift shall be compacted by mechanical means to a Standard Proctor Density of 95% to a depth of 3' below the surface. The top 3' must be compacted to a standard proctor density of 100%. Self propelled compactors will not be allowed in the first 2' above the pipe.

Bucket tamping will not be allowed as the sole means of compaction on any layer.

(b) The requirements outlined above shall also apply when backfilling above the pipe zone around existing utilities. The Contractor shall. When the space between utilities is not sufficient for adequate for a self propelled vibratory roller, other mechanical means shall be applied to ensure compliant compaction, including but not limited to jumping jack style compactors, vibratory plate compactors. Bucket tamping will not be allowed as the sole means of compaction on any layer. **The presence of existing utilities in tight configurations does not relieve the Contractor of fulfilling the compaction requirements.**

(c) Backfilling shall not take place at any time unless approved compaction equipment is available at the site. Backfill in trenches on streets shall be placed to an elevation that will permit the placement of base material and surfacing material. Backfilling shall not be done in freezing weather or with frozen material unless authorized by the Engineer. Where watermain construction is shown on the plans to take place across or along side of bituminous streets, the Contractor shall employ construction methods which will prevent damage to the street surface. If a spoil bank is placed on the roadway surface, equipment for backfilling shall be rubber-tired or crawler type without lugs.

(d) Replacement Backfill -Where trench excavation is encountered which is unsuitable for backfill, such material shall be replaced with granular borrow to be supplied by the Contractor at the direction of the Engineer. Replacement backfill shall include removal and disposal of the unsuitable material which it replaces.

(e) Excess or Deficiency of Backfill Material

1. Excess of Backfill Material -Any excess material due to construction shall be disposed of by loading and hauling the material to a suitable disposal site. Unless otherwise specified a disposal area shall be found by the Contractor. Backfill material delivered to the site by the Contractor in excess of what is needed shall not be compensated for by the City. It shall be the Contractor's responsibility to find a suitable location to dispose of or use this material. There will also not be any compensation for the Contractor hauling backfill material delivered to the site in excess of what was needed at the location to which it was originally hauled.

2. Deficiency of Backfill Material -Any deficiency in the quantity of material for backfilling the trenches or for filling depressions caused by settlement shall be supplied by the Contractor with no extra compensation allowed. Any settlement which occurs within one year after final acceptance shall be restored by the Contractor including affected street surfaces. All costs of such restoration shall be paid by the Contractor.

(6) Rock Excavation and Disposal. Where rock excavation is required, the Contractor shall expose the surface of the rock and the City will take elevations of the rock surface. This profile will be used to determine the pay quantity for rock excavation. The pay quantity for utility construction will be computed by the average end area method based on the maximum payment limits as shown on the details attached herein.

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

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

All excavated materials reserved for backfill or other use on the project shall be stored at locations approved by the Engineer that will cause a minimum of inconvenience to public travel, adjacent properties, and other special interests. The material shall not be deposited so close to the edges of the excavation as to create hazardous conditions, not shall any materials be placed so as to block the access to emergency services. All materials considered unsuitable by the Engineer, for any use on the project, or in excess of the amounts needed for the project construction shall be removed from the project and be disposed of by the Contractor. The Contractor shall include the cost of disposing of excess and/or unsuitable material in the price bid for rock excavation.

Water service lines shall normally be installed by trenching and be subject to the same requirements as prescribed for the main pipeline installation, except for those which may not be pertinent or applicable. Where water service lines are installed alongside

of sanitary or storm sewer service lines, installation shall be such as to maintain the minimum specified clearances between pipelines and provide proper and adequate bearing for all pipes and appurtenances.

Blasting or the use of explosives is not permitted within the City of Hastings for Rock Excavation.

(7) Trench Compaction Testing

a. The City or Developer, as appropriate, shall hire an independent laboratory and pay for trench compaction density tests. Signed copies of all reports on test results will be kept on file at Public Works, and copies of test reports will be furnished to the Contractor upon request. Test samples and locations shall be selected or approved by the Engineer and taken by a MnDOT certified technician in each area samples are taken for. Should any of the specified tests that are taken fail to meet the required of the specifications, the Contractor shall make the necessary corrections, additional tests will be required to satisfy that the specified test requirements have been obtained. The Contractor shall be responsible for payment for all additional testing required due to failed additional testing. The Contractor shall be responsible for all testing for manufactured pipe products.

b. Density tests for compaction of trench backfill shall be made in all areas where utility trenches fall within traveled roadways. One test for each 500 feet of street with a minimum of 2 tests per street and additionally around every second structure (max. 2 feet from the structure), shall be required to be taken in both the upper 3' of the trench(es), and in the area below 3' below subgrade in depth. Additional tests may be ordered by the Engineer for the trenches in roadways or in other areas if it is apparent that backfilling and compacting methods used do not obtain the specified densities. The tests for compaction will be as outlined under MnDOT "Specified Density Methods".

(8) Restoration of Surface Improvements -Wherever any surface improvements such as pavement, curbing, pedestrian walks, fencing, or turfing have been removed, damaged or otherwise disturbed by the Contractor's operations, they shall be repaired or replaced to the Engineer's satisfaction, as will restore the improvement in kind and structure to the preexisting condition. Each item of restoration work shall be done as soon as practicable after completion of installation and backfilling operations on each section of pipeline.

In general the restoration will be covered in the Special Provisions portion of the specifications. In the absence of any special instructions in the Special Provisions, or specific bid items for separate payment of restoration items, the contractor include restoration work as a part of the watermain construction.

5. Testing

The Contractor shall perform all testing in the presence of the Engineer or the Engineer's Authorized representative(s).

A. Pressure Test: After the pipe has been laid and partially backfilled as specified, all newly installed water pipe, including new water services from water main to curb box, hydrant leads, stubs, or any other valved section of it shall, unless otherwise specified, be subjected to hydrostatic pressure of 150 PSI. The duration of each pressure test shall be a minimum of 2 hours. **Zero drop in pressure will be allowed.**

Each valved section of pipe shall be slowly filled with water from a safe source 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 ***(minimum 4"diameter face, liquid filled, with 1-pound increments)*** and the necessary pipe taps made as directed. The Contractor shall notify the Public Works Department 24 hours in advance of filling the pipe with water, and the Public Works Department will operate main line valves for this filling.

Before applying the test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, if necessary, at points of highest elevation, and afterward tightly plugged.

All exposed pipes, fittings, valves, hydrants and joints will be carefully examined during the open trench test. Any cracks 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.

It is the Contractors responsibility to bear all costs associated with satisfying testing requirements, including providing, installation and removal of any temporary valving or appurtenances as may be required to test individual sections of pipeline. There shall be no direct compensation or reimbursement of these costs by the Owner.

B. Line Locating Test: The Contractor shall perform a locating test within one week after completion of pressure testing of the main on all ductile iron pipe and PVC pipe to establish that the water mains and services can be located in the future.

All water system facilities, including service lines, shall be traced and located in the field on the surface using typical low frequency (512 Hz) line tracing equipment, allowing for proper location of pipe without loss or deterioration of signal for a minimum distance of 1,000 linear feet. All locations to be verified by the Contractor and the City prior to acceptance.

Continuity/conductivity testing will not be accepted in lieu of actual line tracing

C. Disinfecting New Watermains: All water distribution systems or extensions to existing systems or any valved section of such extension, or replacement, shall be disinfected and tested in accordance with Minnesota Department of Health (MDH) requirements

prior to being placed into service. Such chlorination shall consist of a dosage of chlorine equivalent to at least 100 parts per million of chlorine. This may be accomplished by using a commercial type chlorinator for feeding a chlorine solution or by placing dry Calcium Hypochlorine such as "HTH" "PERCHLORON" or "MAXOCHLOR" in the line.

A predetermined dose shall be shaken into the pipe at the first joint attached to the existing water pipe, and the dosage shall be repeated at frequent predetermined intervals, preferably at each pipe joint as the pipe laying progresses, or as may be directed by the Engineer.

When treated with dry calcium hypochlorite or sodium hydrochlorite the newly laid pipe shall be filled very slowly to avoid washing the powder to the extremity of the pipeline. Additional requirements when using hypochlorite tablets are as follows:

1. Tablets must be attached to the top of the pipe with a food grade adhesive, such as denture grip. Silicone, glue, or other adhesives are strictly prohibited.
2. Estimated number of tablets per 20 foot pipe (based on 3-1/4 grain) is as follows:
    a. 6 inch pipe – 1 tablet
    b. 8 inch pipe – 2 tablets
    c. 10 inch pipe – 3 tablets
    d. 12 inch pipe – 5 tablets
    e. 16 inch pipe – 9 tablets

Treated water shall be retained in the pipe long enough to destroy all nonspore-forming bacteria. This period shall be at least 24 hours and preferably longer as may be directed. After chlorine treated water has been retained for the required time, the chlorine residual at pipe extremities and at other representative points shall be at least 50 parts per million.

Following chlorination, all treated water shall be thoroughly flushed by the Public Works Department from the newly laid pipe at its extremities until the replacement water throughout its length, shall, upon test, both chemically and bacteriologically, be proven equal to the water quality served the public from the existing water supply system. In the event the test in the opinion of the Engineer proves unsatisfactory, chlorination shall be repeated until a satisfactory condition of the water within the pipe is established.

A minimum of 24 hours after the chlorinated water has been flushed and the pipe has been refilled, it shall be the responsibility of the contractor to hire an MDH approved independent testing laboratory to collect and analyze water samples to determine if the watermain is bacteriologically safe. The Contractor shall arrange with the Public Works Department to turn on valves for the person who is collecting the water samples, and witness their procedure for sampling. Testing of the sample will meet the requirements of AWWA C-651 (requiring samples every 1200', at the end of the line and at each branch as well as a second complete set at least 24 hours after the first passing test) and the Minnesota Department of Health. If any samples show the presence of more than one coliform organism per 100 mL, the disinfection and sampling procedure shall be repeated until this standard is met. **No bacteriological test samples will be allowed to be taken from fire hydrants. Any sampling/testing service lines and/or other pipe components are considered incidental to these procedures**.

In the process of chlorinating newly laid water pipe, all valves or other appurtenances shall be operated while the pipe line is filled with the chlorinating agent.

Unless the Engineer shall direct otherwise, cuts made in existing pipe lines for the insertion of valves, fittings, repairs, or for any other purpose shall be chlorinated by preparing a chlorine solution of greater than 150 ppm and submerging or swabbing all pieces and parts. A clean tank similar to a "stock tank" or a 55 gal barrel with the chlorine solution can be used for submerging short pieces of pipe, valves, fittings, etc.

Larger pieces of pipe, cut ends, etc. shall be swabbed. After slowly filling the section and reversing the flow, the chlorinated water shall be retained for several hours then flushed until no odor of chlorine can be detected in the waste water, or preferably until a check shall have been made for residual chlorine.

The Contractor is cautioned to take EXTREME CARE when disinfecting watermain which will replace in-place watermain. The new main shall be thoroughly flushed before any in-place services are connected to the new watermain.

The Contractor shall secure all possible taps and water supplies connected to the section of main being tested to prevent accidental ingestion of the chlorinating solution.

D. Order of Water Main Testing and Procedure to Turn on Supply for New Mains:

1. Contact Hastings Public Works to coordinate operation of gate valves and fill water main to be tested
2. Pressure test new water main per section A above (including all new water service lines)
3. Flush new water main following passing pressure test
4. Leave new water main for minimum of 24 hours after flushing
5. Take bacteria sample 1
6. Verify that bacteria sample 1 passes test
7. After a minimum of 24 hours from the time of bacteria test number 1, take sample for bacteria test number 2
8. Following passing result from 2nd bacteria test, coordinate with Hastings Public works to operate and open gate valves to put new main into working order

6. Restoration & Clean-Up

A. Surface Restoration

Wherever any surface improvements such as pavement, curbing, pedestrian walks, fencing, or turf have been removed, damaged or otherwise disturbed by the Contractor's operations, they shall be repaired or replaced to the Engineer's satisfaction, as will restore the improvement in kind and structure to the preexisting condition. Each item of restoration work shall be done as soon as practicable after completion of installation and backfilling operations on each section of pipeline.

In general the restoration will be covered in the Special Provisions portion of the specifications. In the absence of any special instructions in the Special Provisions, or specific bid items for separate payment of restoration items, the contractor include restoration work as a part of the pipe construction.

B. Topsoil and Seeding:

Unless the bid items or Special Provisions call for sod, all easements, street right-of-ways, residential lawns, and any other public or private property that was not paved prior to construction, but was disturbed during construction shall be covered with four inches of top soil, seeded, and fertilized.

No extra compensation shall be made for this lawn restoration as it will depend upon the contractor's ability to minimize damage through his operation of equipment, and his clean up procedures.

SECTION 400
Sanitary and Storm Sewer Construction

INDEX

1) General

A. Description

This work shall consist of the construction of pipe sewers utilizing plant fabricated pipe and other appurtenant materials, installed for conveyance of sewage, industrial wastes, or storm water. The work includes construction of manhole and catch basin structures and other related items as specified. All work to be completed according to CEAM standards, Latest Edition, except where modified herein.

The contractor is to make the required excavation for laying the pipe and appurtenant structures; to do all ditching, diking, pumping, bailing, draining and laying under drain if required, all sheeting, shoring, bracing, and supporting, all fencing, lighting, and watching; to make all provisions necessary to maintain and to protect buildings, and other structures, fences, water pipe, gas pipe, sewers, culverts, conduit, railways and other structures; to repair damage done to such structures; to provide all bridges, fences, or other means of maintaining travel on intercepted streets and roads in which the trenches are excavated; to construct all foundation, all brick, concrete, stone and timber work; to set in place all iron work; to build all roadways, refill all trenches; to clear away all rubbish and surplus material, and to furnish all materials, all tools, implements and labor required to build and put in complete working order the specified section of sewer pipe as per plans and specifications.

Any storm or sanitary sewer bypasses including, but not limited to pumping, setups, and permanently fixed pipe connections shall be considered incidental to the project and no additional payment will be made.

B. Location of Underground Obstructions: The location of pipes and other underground objects are approximately correct as shown on the plans, but should they be found to be otherwise, or should the contractor encounter quicksand, springs, rock, or other difficulties, he shall have no claim on that account, it being understood that the Owners or Engineer do not warrant the plot of underground objects to be correct.

It shall be the responsibility of the contractor to contact the necessary utility owners to obtain measurements necessary to locate private service pipes affected by the construction.

C. Private Lands: the contractor shall not, unless consent has been given by the proper parties, enter or occupy with men, tools, or material any private land or city-owned property adjoining the work. Storing of materials and equipment on the boulevards or sidewalk shall be at the discretion of the Engineer with the contractor liable for any and all damages resulting therefrom.

D. Maintenance of Traffic
Whenever work interferes with the flow of traffic along a roadway, the Contractor shall provide for traffic control and signing and public safety in accordance with the latest edition on the provisions of temporary traffic zone layouts field manual. Any detours, road closures, lane closures, driving lane diversions, sidewalk closures or other roadway construction requiring safety devices will require a plan to be submitted to the City Engineer in writing at least 2 working days prior to the planned start of such action. Approval of the plan by the City Engineer will be required prior to proceeding. The plan shall be prepared in accord with MMUTCD latest edition.

2) Materials

A. General Requirements

All the materials used in this work shall be new materials and conform to the requirements for class, kind, grade, type, size of material specified herein, or shown on the plans, or more specifically described in the Special Provisions. All materials shall be furnished by the contractor unless plans and specifications indicate otherwise.

At the request of the Engineer, the Contractor shall submit in writing a list of materials and suppliers for approval. Suppliers shall submit a Certificate of Compliance that the materials furnished have been tested and are in compliance with the specifications.

1) SAMPLES: Samples of the materials proposed or furnished for the work may be taken by the Engineer at any time, at the point of manufacture, point of delivery or site of work. They will be selected as far as practicable, in accordance with standard methods of sampling materials as specified in the standards of the American Society for Testing and Materials. Cost of samples selected for testing shall be borne by the Contractor.

2) STANDARDS: The use of an A.S.T.M., A.S.N.I., A.A.S.H.O., or A.W.W.A. designation in these specifications refers to the latest revisions or that particular standard or tentative standard of that organization.

3) COSTS OF TESTS: All tests, including but not limited to pressure tests, infiltration tests, mandrel tests, etc. will be made at the expense of the Contractor. Additional tests requested by the Contractor will be made at the expense of the contractor. Post construction sewer televising is required and will be paid by the City as a bid item.

4) FAILING TESTS: On City projects, quality assurance tests such as trench compaction, and concrete compression tests will be taken and paid for by the City. In the event that any of these tests do not pass or meet specifications, all retesting will be at the Contractor's expense.

5) ACCEPTANCE OR REJECTION: When the specimens tested conform to A.W.W.A. or A.S.T.M. requirements, then all pipe represented by such specimens shall be considered acceptable. Copies of test reports shall be submitted to the Engineer before the pipe is installed in the project.

In the event that any of the test specimens fail to meet these requirements, all pipe represented by such tests shall be subject to rejection. The Contractor, however, has the right to furnish additional specimens from the same shipment or delivery, at no cost to the Owner. The pipe will be considered acceptable if all of these specimens meet the requirements.

6) REJECTED PIPE: Pipe which has been rejected by the Engineer shall be removed from the site of work by the Contractor and replaced with pipe which meet the requirements, without cost to the Owner.

7) MARKING: Each length of pipe shall bear the name or trademark of the manufacturer, the location of the plant and the date of manufacture. Each length shall likewise be marked to designate the class or strength of the pipe. The markings shall be made on the exterior or interior of the pipe barrel near the bell or groove end and shall be plainly visible. Pipe with either elliptical reinforcing, or of special design with a double lap of steel at inside faces of the top and bottom of the pipe shall have the word "Top" or "Bottom" clearly stenciled on the inside of the pipe at the correct place to indicate the proper position when laid.

B. Pipe Requirements: These requirements cover specific types of pipe intended for use as sanitary sewers, industrial wastes, or storm sewers, and for use as culverts.

1) Reinforced Concrete Pipe and Fittings.

Reinforced concrete pipe, fittings and specials shall be stamp certified and conform with the requirements of MnDOT Specification 3236 (Reinforced Concrete Pipe) for the type, size, and strength class specified, subject to the following supplementary provisions:
The pipe shall be composed of concrete which shall consist of Portland cement, mineral aggregate, and water in which steel has been embedded in

such a manner that the steel and the concrete act together. Pipe that is provided under this classification shall meet the requirements set forth in A.S.T.M. Designation C-76 for circular pipe, and A.S.T.M. Designation C-507 for elliptical pipe, A.S.T.M. Designation C-506 for pipes arch, and all subsequent revisions thereof which shall govern, where they alter the A.S.T.M. Standards. Pipe classification shall be as called for in the Special Provisions, the bid documents, or on the plans, but in no case shall the pipe furnished be less than class 3 pipe.

All concrete pipe used for sanitary sewer, storm sewer, culverts, or industrial waste shall be watertight joints unless the plans indicate otherwise. All watertight joints shall be flexible joint that meet the requirements of A.S.T.M. C-361.

Reinforced Concrete Manhole Tees shall be precast concrete conforming to the requirements of MnDOT Standard Specification 2506.2 and MnDOT Standard Plate 4009H and shall be installed as shown in the drawings.

Lift holes on sanitary sewer pipe shall not be permitted unless authorized by the engineer.

2) Polyvinyl Chloride (PVC) Pipe and Fittings:

The pipe and fittings furnished under this classification shall meet the requirements for Polyvinyl chloride pipe and fittings as set forth in A.S.T.M. Designation D-3034 and all subsequent revisions thereof, for the size, Standard Dimension Ratio (SDR) and strength requirements as indicated on the plans. The pipe shall be smooth walled PVC and resistant to aggressive soils or corrosive substances in accordance with ASTM D-543.

Unless otherwise specified on the drawings, special provisions, or amended herein all main line sewer pipe shall be SDR 35 for depths from 8'-15', SDR 26 for depths from 15'-30', and DIP for depths in excess of 30' and services shall be SDR 26. All pipe and fittings shall be a watertight flexible gasket with fittings such as tees, wyes, saddles, elbows and others constructed with the same joint design and using the same gaskets as the adjacent pipe. Any adapters used to make connections between PVC and other types of pipe shall be the correct model Indiana Seal Shear Guard coupling or a City approved equal. PVC pipe and fittings shall all be marked as to manufacturers name or trademark, nominal pipe size, ASTM Designation, and SDR number.

3) Corrugated Polyethylene Pipe – DUAL WALL

DESCRIPTION

ASTM F2306 Standard Specification for 12 to 60 in. (300 to 1500 mm) Annular Corrugated Profile-wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications

ASTM D3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

Dual Wall Corrugated Polyethylene Pipe (PE/HDPE) for gravity sewers shall conform to the requirements of AASHTO M294 and/or ASTM F2306, and the requirements of AASHTO LRFD Bridge Design Specifications, Section 12. Joints shall conform to ASTM D3212 10.8psi watertight joint. Installation shall conform to ASTM D2321. Pipe shall be sizes and types indicated on the Drawings.

Aprons serving as end sections for (PE/HDPE) shall be polyethylene or approved equal.

Corrugated Steel Pipe flared ends shall conform to AASHTO M 36M and conform to the requirements of MnDOT Standard Specification 3626 and MnDOT Standard Plate 3123J.

No CPEP segment shall be shorter than its manufactured length in any pipe run except where expressly called for in the plan drawings, or otherwise approved by the Engineer or Engineer's Authorized Representative(s).

4) Ductile Iron Pipe:

Unless otherwise specified, all pipe furnished under these specifications shall conform to A.W.W.A. C-151 or A.N.S.I. A 21.51 for Ductile Iron Pipe and be of a thickness class as specified in the Contract Documents.

Fittings shall conform to the requirements of A.N.S.I. A-21.53 for the type of joint furnished.

Pipe and fittings shall be made with bell and spigot ends adaptable for use of a rubber gasket slip joint. They shall be straight and of true circular section with their inner and outer surface concentric.

Unless otherwise specified, all pipe and fittings shall be furnished with cement mortar lining meeting the requirements of ANSI A-21.4 for standard thickness lining. All exterior surfaces of the pipe and fittings shall have an asphaltic coating at least one mil thick. Spotty or thin seal coating, or poor coating adhesion, shall be cause for rejection.

5) Laterals and Riser Pipes

In general all laterals or riser pipes shall be DIP class 52, Schedule 40 PVC sewer pipe, or SDR 26 PVC pipe in the size called for on the plans or bid documents. All laterals and risers not connected to a service line shall have caps or plugs of the same material as the riser or as recommended by the manufacturer. In general all laterals, risers, fittings and caps shall be of the same material as the main sewer line.

6) Metal Sewer Castings

Metal castings for sewer structures such as manhole frames and covers, catch basin frames, grates and curb boxes, shall conform to the requirements of ASTM A-48 (Gray Iron Castings), subject to the following supplementary provisions:

Castings assemblies or dimensions, details, weights, and class shall be as indicated in the detailed drawings for the design designation specified. Unless otherwise specified, the casting shall be Class 30 or better. Lid-to-frame surfaces on round casting assemblies shall be machine milled to provide true bearing around the entire circumference.

Casting weight shall be not less than 95 percent of theoretical weight for a unit cast to exact dimensions, based on 442 pounds per cubic foot.

Sanitary and storm sewer castings shall have 2 concealed pick holes and shall be lettered “storm sewer” or “sanitary sewer”, and have a coal tar pitch varnish finish. Neenah Foundry castings R 1642 with type B cover shall be used for manholes and beehive style castings shall be R-2561A.

7) Pipe Joints

Concrete pipe joints shall be flexible watertight rubber gaskets conforming to ASTM Designation C-433-65, or the latest revision thereof.

PVC joints and joining systems shall be either solvent cement joints, or elastomeric gasket joints as called for on the plans or the Special Provisions. All joining materials shall comply with the latest ASTM Specification for such materials.

Cast iron and Ductile iron joints shall have continuous, molded, rubber gaskets conforming to AWWA Designation C 111 standards, and all subsequent revision thereof.

C. Manholes and Catch Basins.

1) Precast Concrete Manhole and Catch Basin Sections

Unless noted elsewhere in the specifications, plans, or special provisions, all new structures shall be constructed of precast reinforced concrete.

Precast concrete riser sections and appurtenant units (grade rings, top and base slabs, special sections, etc.) used in the construction of manhole and catch basin structures shall conform with the requirements of ASTM C-478, subject to the following supplementary provisions:

The precast sections and appurtenant units shall conform to all requirements as shown on the detailed drawings.

Joints of manhole riser sections shall be tongue and groove with rubber "O" ring joints provided on sanitary sewer manholes.

Air-entrained concrete shall be used in the production of all units. Air content shall be maintained within the range of 5 to 7 percent.

2) Block Manholes

Block manholes shall be constructed only where indicated by the special provisions or plans, using precast segmented block. Concrete used in the manufacture of these blocks shall conform with the requirements of ASTM's "Specifications for Concrete and Masonry Units for Construction of Catch Basins and Manholes", Serial Designation C-139-39. The blocks shall be radial blocks. Wall thickness and manhole diameters shall be as stated in the Special Provisions or as shown on the plans.

Manholes less than 5.5 feet deep shall have a precast flat top. All block manholes must be back plastered 1/4" thick on the exterior, upon completion, with ½" thick treatment for sections under water.

3) Concrete

Concrete for cast-in-place masonry construction shall be produced and furnished in accordance with the requirements of MnDOT Specification 2461. If no specific mix designation is shown on the plans, details, or called for in the special provisions the concrete shall meet mix designation Type 3A for 3900 psi compressive strength. Air-entrained concrete shall be furnished and used in all structures exposed to weather.

D. Miscellaneous Materials.

1) Granular Materials:

Granular materials furnished for foundation, bedding, encasement, backfill, or other purposes as may be specified shall consist of any natural or synthetic mineral aggregate such as sand, gravel, crushed rock, crushed stone, or slag, that shall be so graded as to meet the gradation requirements specified herein for each particular use.

Granular materials furnished for use in Foundation, Bedding or Encasement construction shall conform to the following requirements:

Granular bedding material shall be a graded aggregate of which 100% will pass the 1" sieve and not more than 10% pass the #200 sieve.

2) Aggregates:

Aggregate required for street restoration or special trench backfill where specified shall be in accordance with the following:

Aggregate for road surface shall meet MnDOT specification 3138 for Class V surfacing aggregate.

Aggregate for shoulder surface shall meet MnDOT specification 3138 for Class 5A crushed limestone.

3) Bituminous Surface Restoration:
Refer to Section 700 of these specifications.

4) Concrete Pavement Restoration:

The restoration of concrete pavements due to sewer main installation will be further identified in the special provisions as each surface is unique in section and design. In general the pavement will be replaced with concrete of equal depth and reinforced in the manner of that removed. The replacement concrete shall be doweled to surrounding pavement and consist of concrete meeting MnDOT Specifications 2301 for concrete pavement.

5) Insulation:

Sewer main insulation shall be extruded rigid board material meeting or exceeding ASTM C 578-85 specifications for rigid cellular polystyrene thermal insulation. Insulation shall have a minimum R Value of 11 per 2 inch thick sheet, and have a compressive strength of 50 lbs per sq. inch or more. Acceptable manufacture Certifoam 40 Dow, or equal. Unless otherwise specified in the Plans, Specifications, and Special Provisions,

board dimensions shall measure 8 feet long, 2 or 4 feet wide, and 2" inches thick. When required, insulation shall be installed for the width of the trench or 4 feet in width, whichever is less, at all locations where water or sewer mains are shallower than specified depth and at all crossings with storm sewers. Insulation shall be installed a minimum of 2 feet beyond the outside edge of storm sewer pipe at storm sewer crossings.

3) Construction Requirements

A. Inspection:

During the process of unloading, all pipe and accessories shall be inspected by the Contractor for damage. The Contractor shall notify the Engineer of all material found that has cracks, flaws or other defects. The Engineer shall inspect the damaged material and have the right to reject any materials he finds unsatisfactory. The Contractor shall promptly remove all rejected material from the site.

B. Trench Safety:

The trench shall be constructed to allow for installation of the sewer lines to the line and grade shown on the plans. The trench shall be braced and drained so that workman may work safely therein. All trenches shall be excavated and sheeted or braced in compliance with applicable State and Federal regulations relating to industrial safety (Accident Prevention Division of the State Industrial Commission, OSHA, etc.)

C. Salvaged Material Removal

Where salvaged materials such as crushed rock or stone, or topsoil, are encountered in excavation for utility installation, such materials shall be carefully removed and stockpiled for future use by the Contractor. After installation of the utilities the material shall be spread over the roads or lawns from which it was removed. In the case of undeveloped streets all topsoil shall be removed prior to installation of the sewer mains, but stockpiled beyond the street right-of-way and salvaged. This is considered incidental to the construction, and no separate pay item will be made.

D. Utilities and Monuments

Care shall be taken not to move, without consent of the Engineer, any sewers, drains, water or gas pipes, utility conduit, or other structures; and in crossing these, and in running parallel or near them, they shall be sustained securely in place until the work is completed. Whenever it is necessary to interfere with said structures, the contractor shall maintain their respective services, and, if necessary for that purpose, shall lay temporary water, gas, or other pipes. He shall repair all damage done to any of said structures, and he shall leave them in good condition as they were previous to the commencement of the work.

No stone monuments, bench marks, etc. of any description, located in line of the work shall be removed or taken up unless it be in the presence of the Engineer or his assistants. All lot corners, pipe monuments, etc. that are located outside the ditch area shall be preserved, and if any are disturbed or removed, the contractor shall hire a registered land surveyor or replace them.

E. Alignment, Grade and Utilities

On City projects, the primary line and grade will be established by the Engineer. For trench installation, line and grade stakes will be set parallel to the proposed pipeline at an appropriate offset from there as will best serve the Contractor's operations wherever practical.

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

The Contractor shall arrange operations to avoid unnecessary interferences with the establishment of the primary line and grade stakes, and shall render whatever assistance may be required by the Engineer in accomplishing the staking. The Contractor shall be responsible for preservation of the primary stakes, and if negligent in providing necessary protection, shall bear full cost of any re-staking.

No deviation shall be made from the required line or grade except with the consent of the Engineer or Engineer's Authorized representative(s).

Watermains crossing sanitary sewers shall be provided a vertical separation of at least 18 inches between the bottom of the watermain and the top of the sewer main. Where local conditions prevent the minimum separation the following construction shall be used:

(1) Sewers passing over or under watermains shall be constructed of materials equal to watermain standards of construction for a distance of at least 9 feet on either side of the watermain.

(2) Sewers passing over watermains shall be adequate structural support for the sewers to prevent settlement, or deflection of the joints, or settling on and breaking of watermains.

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

(1) The bottom of the watermain is at least 18 inches above the top of the sewer;
(2) Where this vertical separation cannot be obtained, the sewer shall be

constructed of materials and with joints that are equivalent to watermain standards of construction and shall be pressure tested to assure watertightness prior to backfilling.

F. Removals

Plans indicate the location of pipe and miscellaneous structures necessary to be removed for construction of utilities. The debris resulting from removals shall become the property of the Contractor and shall be disposed of by him. All salvaged materials that are removed shall be loaded, transported and unloaded by this contractor at a location called for on the plans or as directed by the Engineer.

G. Trench Excavation

General: The work in this Section shall include miscellaneous removals, trench excavation, special pipe foundations, trench backfill, and restoration of street surfaces. All work shall be done by open trench excavation.

Trench excavation shall be dug to the alignment and depth shown on the plans and a maximum of 100 feet in advance of the pipe laying unless approved by Engineer. The trench shall be braced and drained so that workmen may work safely and efficiently therein.

Trench water shall be drained from the trench into natural drainage channels or storm sewers. Draining trench water into sanitary sewers will not be permitted and drainage into storm sewers will only be allowed after MPCA regulations are met regarding such drainage.

Dewatering trenches will be incidental to the construction.

While any open excavations are maintained, the Contractor shall have available a supply of steel plates suitable for temporary bridging of open trench sections where either vehicular or pedestrian traffic must be maintained. Use of the plates shall be as directed or approved by the Engineer and where installed they shall be secured against possible displacement and be replaced with the permanent structure as soon as possible.

Braced and sheeted trenches shall be put in place and maintained as may be required to support the side of the excavation and to prevent any movement which may in any way endanger personnel or injure or delay the work or endanger adjacent buildings or other structures. All costs for any shoring shall be included in the Contractor's bid for the work items.

Excavated material shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters shall be kept clear or other satisfactory provisions made for street drainage.

Width of trench may vary with and depend upon the depth of the trench and the

nature of the excavated material encountered; but in any case shall be ample width to permit the pipe to be laid and jointed properly and the backfill to be placed and compacted properly. The minimum width of unsheeted trench shall be 18 inches, and for pipe 10" or larger, at least one foot greater than the nominal diameter of the pipe, except by consent of the Engineer. The maximum clear width of the trench at the top of the pipe shall not be more than 2 feet greater than the outside diameter of the pipe.

If the trench is excavated to a greater width than that authorized, the Engineer may direct the Contractor to provide a higher class of bedding, a higher strength of pipe or both, than that required by the Contract, without additional compensation, as the Engineer deems necessary to satisfy the design requirements.

Faulty trench excavation below grade lines shall be corrected with approved material, thoroughly compacted without additional compensation to the Contractor.

When permitted, blasting for excavation will not proceed until the Contractor has notified the Engineer of the necessity to do so and received approval, such notification not being necessary where only occasional boulders are involved. This notification shall in no matter relieve the Contractor of the hazards and liability contingent on blasting operations. The hours of blasting shall be fixed by the Engineer. Any damage caused by blasting shall be repaired by the Contractor as his expense. The Contractor's method of procedure relative to blasting shall conform to local and state ordinances.

Unsuitable Excavation - When excavated material is encountered that is unsuitable for backfill in the opinion of the engineer, it shall be disposed of by the contractor. Unless a disposal site is indicated on the plans and specifications, the contractor shall be responsible for finding a location for all waste materials and unsuitable soils. Excavation of this material is incidental to the removal/installation of the utility facility, and the cost of hauling and disposal of the wasted material shall be included in the cost of furnishing and placing replacement granular materials.

H. Granular Materials - Use and Designation

The granular materials described below refer to the designation and gradations listed under the materials section previously outlined within these specifications.

Granular materials provided for Foundation, Bedding, Encasement, or Backfill use as required by the Plans, Specifications, and Special Provisions, either as part of the pipe item work unit or as a separate contract item, shall be classified as to use in accordance with the following:

Material Use Designation	Zone Designation
Granular Foundation----------	Placed below the bottom of pipe grade as replacement for unsuitable or unstable soils, to achieve better foundation support.
Granular Bedding----------	Placed below the pipe midpoint, prior to pipe installation, to facilitate proper shaping and to achieve uniform pipe support.
Granular Encasement----------	Placed below an elevation one foot above the top of pipe, after pipe installation, for protection of the pipe and to assure proper filling of voids or thorough consolidation of backfill.
Granular Backfill----------	Placed below the surface base course, if any, as the second stage of backfill, to minimize trench settlement and provide support for surface improvements.

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

I. Pipe Subgrade & Backfill

Trench backfilling: The following backfilling procedures includes, but is not limited to, sanitary sewer, storm sewers, laterals and service connections, catch basin leads, manholes and catch basins.

1. Pipe Subgrade and Backfill Within Pipe Zone:

(a) Pipe Foundation in Good Soil - When the bottom of the trench consists of a material suitable to properly support the pipe it shall be constructed in conformance with the Class “C” pipe bedding detail attached herein. Bell holes of ample dimensions shall be dug in the trench at each joint to permit proper joining of the pipe.

(b) Pipe Foundation in Poor Soil - If trench bottom conditions are encountered which appear to require stabilization, the Engineer shall be informed. The trench conditions shall be examined by the Engineer to determine the nature of such instability, employing a testing laboratory if necessary. If it is determined that the trench bottom cannot support the pipe, a further depth and/or width shall be excavated and refilled to the pipe foundation grade with granular foundation and thoroughly compacted. This material shall be measured for payment.

If the examination by the Engineer reveals that the aforedescribed conditions are caused by the Contractor's manipulation of the soils in the presence of excessive moisture or lack of proper dewatering, the Contractor shall take such steps as are necessary to stabilize the trench bottom including the use of pipe support material and improved dewatering methods. In such case, the cost of measures necessary shall be borne by the Contractor.

(c) Pipe Clearance in Rock-Ledge rock, boulders and large stones shall be removed to provide a clearance of at least 6 inches below outside barrel of the pipe of fittings, and to a clear width of 12 inches on each side of all pipe and appurtenances for pipe 18 inches or less in diameter; for pipes larger than 18 inches, a clearance of 9 inches below and clear width of 12 inches on each side of inside diameter of pipe shall be provided. Adequate clearance for properly jointing pipe laid in rock trenches shall be provided at bell holes. Excavation below subgrade in rock or in boulders shall be refilled to sub-grade with approved material, thoroughly compacted.

(d) Backfill at Pipe Zone - Backfill material at pipe zone shall be free from rock, boulders or other unsuitable substances and shall be deposited into the trench simultaneously on both sides of the pipe for the full width of the trench in 6 inch lifts thoroughly compacted to a minimum elevation of 6 inches above the top of the pipe. Compaction shall be accomplished by mechanical tamping.

2. Backfill Procedure Above Pipe Zone -

(a) General - Succeeding layers of backfill above pipe zone may contain coarser material but shall be free from pieces of rock, concrete, clay lumps more than one-third cubic foot in volume, roots, stumps, tin cans, rubbish, frozen materials and other similar articles that will cause excessive settlement. This type of backfill shall be placed in uniform one foot (1') lifts and each lift shall be compacted by mechanical means to a Standard Proctor Density of 95% to a depth of 3' below the surface. The top 3' must be compacted to a standard proctor density of 100%. Self propelled compactors will not be allowed in the first 2' above the pipe. **Bucket tamping will not be allowed as the sole means of compaction on any layer.**

(b) The requirements outlined above shall also apply when backfilling above the pipe zone around existing utilities. When the space between utilities is not sufficient for adequate for a self propelled vibratory roller, other mechanical means shall be applied to ensure compliant compaction, including but not limited to jump jack style compactors, vibratory plate compactors. Bucket tamping will not be allowed as the sole means of compaction on any layer. **The presence of existing utilities in tight configurations does not relieve the Contractor of fulfilling the compaction requirements.**

(c) Backfilling shall not take place at any time unless approved compaction equipment is available at the site. Backfill in trenches on streets shall be placed to an elevation that will permit the placement of base material and surfacing material. Backfilling shall not be done in freezing weather or with frozen material unless authorized by the Engineer. Where sewer main construction is shown on the plans to take place across or along side of bituminous streets, the Contractor shall employ construction methods which will prevent damage to the street surface. If a spoil bank is placed on the roadway surface, equipment for backfilling shall be rubber-tired or crawler type without lugs.

(d) Replacement Backfill - Where trench excavation is encountered which is unsuitable for backfill, such material shall be replaced with granular borrow to be supplied by the Contractor at the direction of the Engineer. Replacement backfill shall include removal and disposal of the unsuitable material which it replaces.

(e) Excess or Deficiency of Backfill Material -

1. Excess of Backfill Material - Any excess material due to construction shall be disposed of by loading and hauling the material to a suitable disposal site. Unless otherwise specified a disposal area shall be found by the Contractor. Backfill material delivered to the site by the Contractor in excess of what is needed shall not be compensated for by the City. It shall be the Contractor's responsibility to find a suitable location to dispose of or use this material. There will also not be any compensation for the Contractor hauling backfill material delivered to the site in excess of what was needed at the location to which it was originally hauled.

2. Deficiency of Backfill Material - Any deficiency in the quantity of material for backfilling the trenches or for filling depressions caused by settlement shall be supplied by the Contractor with no extra compensation allowed. Any settlement which occurs within one year after final acceptance shall be restored by the Contractor including affected street surfaces. All costs of such restoration shall be paid by the Contractor.

3. Rock Excavation and Disposal

Where rock excavation is required, the Contractor shall expose the surface of the rock and the City will take elevations of the rock surface. This profile will be used to determine the pay quantity for rock excavation. The pay quantity for utility construction will be computed by the average end area method based on the maximum payment limits as shown on the details attached herein.

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

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

All excavated materials reserved for backfill or other use on the project shall be stored at locations approved by the Engineer that will cause a minimum of inconvenience to public travel, adjacent properties, and other special interests. The material shall not be deposited so close to the edges of the excavation as to create hazardous conditions, not shall any materials be placed so as to block the access to emergency services. All materials considered unsuitable by the Engineer, for any use on the project, or in excess of the amounts needed for the project construction shall be removed from the project and be disposed of by the Contractor. The Contractor shall include the cost of disposing of excess and/or unsuitable material in the price bid for rock excavation.

Blasting or the use of explosives is not permitted within the City of Hastings for Rock Excavation.

4. Service Lines

Service lines shall normally be installed by trenching and be subject to the same requirements as prescribed for the main pipeline installation, except for those which may not be pertinent or applicable. Where water service lines are installed alongside of sanitary or storm sewer service lines,

installation shall be such as to maintain adequate bearing for all pipes and appurtenances.

5. Tests on Backfill

All testing of materials and densities in this section shall be taken by an independent testing laboratory (see Section 300 for testing frequency). Cost of these tests shall be paid by the City on City projects and by the developer on private projects.

J. Trench Preparation for Pipe

When the bottom of the trench consists of a material suitable to properly support the pipe the following methods of bedding shall apply:

1) Pipe Foundation in Good soil: Class "C" ordinary bedding shall be used. 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. Bell holes shall be excavated to insure the pipe resting for its entire length upon the bottom of the trench and to permit jointing to be made properly.

2) Correcting Faulty Grade: Any part of the trench excavated below grade shall be corrected with approved material, thoroughly compacted without additional compensation to the Contractor.

3) Pipe Foundation in Poor Soil: When the bottom at sub-grade is soft and in the opinion of the Engineer, cannot support the pipe, a further depth and/or width shall be excavated and refilled to pipe foundation grade with approved material, thoroughly compacted, or other approved means shall be adopted to assure a firm foundation for the pipe without extra compensation allowed.

4) Crushed Rock for Pipe Stabilization: When directed by the Engineer, "Crushed Rock for Pipe Stabilization" shall be placed. "Crushed Rock for Pipe Stabilization" shall include removal and disposal of the unsuitable subgrade material which it replaces. If the examination by the Engineer reveals that the aforedescribed conditions are caused by the Contractor's manipulation of the soils in the presence of excessive moisture or lack of proper dewatering the Contractor shall take such steps as are necessary to stabilize the trench bottom including the use of pipe support material and improved dewatering method. In such case, the cost of measures necessary shall be borne by the Contractor.

If in the Engineer's opinion the conditions are not caused by the Contractor the costs of the crushed rock shall be paid for by the Owner at the price quoted to the Contractor for delivery of the crushed rock at the job site.

Pipe Clearance in Rock: See Rock Excavation within these specifications.

K. Pipe Laying

1) General: Before lowering and while suspended, the pipe shall be inspected for defects and cracks. Any defective, damaged or unsound pipe shall be rejected. Remove all foreign matter or from the inside of the pipe before it is lowered into the trench, and keep the pipe clean by approved means during and after laying.

2) Point of Commencement and Direction of Laying: The laying of pipes in finished trenches shall commence at the lowest point in the proposed sewer line, and proceed towards the upper end. All pipe shall be laid with the bell and spigot pipe, or with the receiving groove end of tongue and groove pipe pointed up-grade.

3) Pipe Laying: All pipes shall be laid with ends abutting and reasonable care exercised when shoving the pipes together so that the joints will be properly adjusted. The pipes shall be fitted and matched so that when set firmly to line and grade they will form a sewer with a smooth and uniform invert.

The pipes shall be pushed "home" by pushing the bell or up-grade end of the pipe with a crowbar or pry-bar, using a protective wood block between the bar and pipe.

All pipes over 15 inches in diameter shall be assembled with the aid of an approved come-along unless the engineer approves other methods of assembly.

Bedding, installation and pipe laying requirements for PVC and truss pipe shall be in accordance with ASTM D-2321 Standard Recommended Practice for Installation of Thermoplastic Sewer Pipe.

L. Pipe Jointing

Joints shall be made of the material called for under the materials section of these specifications, and as prescribed below for the type of pipe called for on the plans.

a) Cleaning and Assembly of Joint: The last 8" of the spigot and the inside of the bell of the pipe shall be thoroughly cleaned to remove oil, grease, grit, and other foreign matter from the joint.

b) Mortar Joints for Storm Sewers: If cement mortar joints are specified in the Special Provisions, mortar shall be relatively stiff and shall be composed of one part Portland Cement and one and one-half (1-1/2) parts of clean sand with only enough water added to get proper consistency. Joint material shall completely fill the joints so that when the pipes are shoved together, the material will be forced out the edges of the joint entirely around the pipe.

After joints are made, any superfluous material inside the pipe shall be removed by means of an approved follower or scraper. All joints must be watertight, and any leaks or defects discovered must be immediately repaired. Any pipe which

has been disturbed after being laid must be taken up, the joint cleaned and properly re-laid as directed by the Engineer.

c) Rubber Gasket Joints: Compression jointed pipe shall be assembled in strict accordance with the manufacturers specifications with particular care taken to keep the ends of the pipe clean. The jointing surface shall be coated with a soap solution, or lubricant material recommended by the manufacturer, to overcome the frictional resistance encountered when pushing the spigot end of the pipe "home".

d) Mechanical Joint Cast Iron Pipe: Joints shall be clean as stated above, and the gasket then pressed in place within the bell. The cast iron gland shall be moved along the pipe into position for bolting. All bolts shall be inserted and the nuts screwed up tightly with the fingers. All nuts shall be tightened with a suitable wrench with nuts spaced 180 degrees apart tightened alternately to provide equal pressure on the gland.

e) Resilient Type Factory-Fabricated Joints: Where resilient type factory fabricated joints are installed as a composite part of the pipe, their method of jointing shall adhere to the manufacturers recommendations, using a welding type lubricant as recommended by the manufacturer.

f) Solvent Cemented Joints (PVC or ABS Pipe): For pipe designed for solvent cement joints, clean both ends of the joint with a cleanser recommended by the manufacturer, and then liberally apply solvent cement to the spigot for a distance equal to the joint depth. After inserting the spigot into the bell and pushing it "home" as far as possible rotate the pipe 30 to 90 degrees to distribute the cement.

M. Service Connections

1) Wye Branches: If the top of the main sewer is fourteen feet or less below the street grade, horizontal wye branches shall be placed at the locations directed by the Engineer. The wye branch shall be placed so the connection has a slight vertical angle with the main sewer. Plugs shall be provided for the openings.

2) Connections following Lining of Main: If project specifies sanitary sewer service replacement in conjunction with sanitary sewer main lining, in order to minimize risk of sanitary sewage backup sewer services shall be fully reinstated as soon as possible following mainline lining. Partial reinstatement shall take place immediately following mainline lining. Contractor will be responsible for any emergency reinstatements necessary as a result of lining creating sewer backups.

3) Risers: When the sewer mains are greater than fourteen feet below the street grade risers shall be installed per the details at the end of this section.

4) Records and Location of Service Connections: It shall be the duty of the Contractor to keep an accurate record of service connections, as to location, service address, installed pipe length & size, bends, depth of top riser, type of connection provided, existing pipe material at service connection, etc. Location shall be made in respect to nearest manhole center, down-grade from the service. This record shall be turned over to the Engineer at the end of each week.

5) Size of services: The wye branch, riser, and service lines normally will be four (4) or six (6) inch diameter for residential and commercial connects, unless otherwise stated. Refer to plans, special provisions and bid schedules for specific size for this project.

N. Manhole Installation

1) General: All drainage structures both sanitary and storm drainage, shall be constructed of materials and dimensions shown on the standard detail sheet of the plans. An Infi-shield, I/I Barrier, or other City approved ring seal shall be provided on all sanitary sewer and storm sewer structures. All new structures shall have a minimum of two adjustment rings, and no more than a maximum of 6 adjustment rings. **All adjustment rings shall be HDPE plastic rings manufactured by LadTech, or a City approved equal.**

2) Manhole Excavation: The excavation shall be limited to the size required for the manhole to be constructed, and shall be sheathed and braced as necessary to protect the workmen and prevent loss of ground. The manhole base shall conform substantially to the required shape and dimensions; excavation shall be backformed if necessary to achieve this end. In case excavation for the base in stable soil has been carried below the required depth, such excess depth shall be filled in concrete, or crushed rock.

3) Manhole Base and Inverts: The invert of a manhole for pipe sewers shall be the same diameter as the larger of the adjoining sewers. The pipe or approved lagging shall be laid through the manhole, and the upper half of the pipe shall be removed after the manhole is built. The pipe shall be supported on brick for solid concrete blocks for the pouring of the concrete base. The concrete of the manhole shall be extended under the pipe to where the pipe rests on undisturbed soil. This extended portion of the manhole base shall rest on undisturbed soil, and shall in no case extend beyond the first joint. Where the pipe enters the manhole above the manhole base, it shall be supported from the wall of the manhole back to undisturbed soil with a wall of backfill concrete or brick or solid concrete block columns.

4) Cones, Corbel, or Chimney: The manhole wall constructed of concrete block, precast or monolithic concrete, shall be constructed at the specified diameter to an elevation approximately 4 feet below the established or proposed street grade. From this point the manhole shall be corbeled in at ½ inch horizontal to one inch vertical to the diameter of the manhole frame. The face of the manhole in which the steps are installed shall be kept vertical. Flat top slabs may be used only where

specified or by permission of the Engineer.

5) Castings: Manhole frames, covers and steps shall be furnished and placed by the Contractor unless otherwise specified in the Contract Documents.

The manhole frame shall be centered, brought to grade and embedded in a mortar course. The inner face of the mortar joint shall be trowel finished. All adjustment rings are incidental to the construction of new structures. Payment for adjustment rings placed used on existing structures that remain in place shall be included in the bid item for the installation of a new casting and frame for up to one (1) foot of vertical adjustment (not including casting depth). Adjustments exceeding one (1) foot (not including casting depth) shall be paid as CONSTRUCT MH or CB RISER and paid on a linear foot basis.

Unless otherwise directed by the Engineer, all manholes located in areas outside of streets are required to be accompanied by a metal sign post and indicator placard with the initials "MH". The placard shall be mounted on the sign post at a height of no less than 3 feet above finished grade. The placard shall have green retro-reflective backing such as that found on traffic control signs with white retro-reflective lettering. The furnishing and installation of this sign post and sign shall be incidental to the cost of furnishing and installing the manhole.

6) Connection for Future Sewers: Where indicated on the sewer plans, Contractor shall furnish and install connection pipe for future sewers, building sewers, or drains. The connection pipe shall be one of the same type as specified for the sewer through the manhole and shall terminate in a bell or groove end having the same type of joint as provided on the sewer being constructed. The connection pipe shall be carefully set to the line and grade indicated on the plan, and neatly bricked or concreted into the manhole wall. If no elevation is shown for the connection pipe, it shall be set on top of the manhole bench. Unused connection pipes shall be bulkheaded and capped.

7) Connections to existing sewers: Where indicated on the plans, the Contractor shall make connections from new lines which extend out from new manholes to existing sewers. The connection to existing pipe shall include the use of a Fernco 5000 Series Strongback RC Coupling, or a City approved equal when pipe types are not identical.

8) Outside Drop Connection: When a sanitary sewer, or building sewer enters a manhole 24 inches or more above the crown of the outgoing sewer, the incoming sewer shall be connected to the manhole by means of an outside drop connection. The outside drop connection shall be shown on the detail drawings. The cost of the outside drop connection shall be included in the unit price bid for the outside drop member length (height), and include all core drilling for new pipe inlets, neoprene boots, invert/spillway construction, concrete horseshoes, concrete fill, and DIP and fittings (up to and including the tee). No separate payment will be made for a connection to an existing manhole in this case.

Inside Drop: When a sanitary sewer enters a manhole at an elevation between 24" and 6" above the outlet elevation of the manhole, an insert shall be provided such that sewage is redirected into the manhole invert so as to avoid excessive cleaning of the manhole. A standard plate detail of this assembly is shown at the end of this section.

9) Grades for settling manhole frames: The manhole frame shall be set at the elevation given on the sewer plan, or when no such elevation is given, they shall be set as follows:

The manhole castings and frame shall be adjusted to 1/4" to 3/8" below a 4' straight edge laid across the bituminous wearing course. Castings outside these tolerances shall be readjusted at no additional cost to the city.

O. Catch Basin Installation

1) General: All catch basins shall be constructed of materials and to dimensions shown on the standard detail sheet of the plan, or as amended by the Special Provisions. Adjusting rings are incidental except in cases described in part 5 of the above section.

2) Excavation: Excavation for catch basins, shall be limited to the size required for the catch basin with sufficient room for workmen, and walls, and shaped to prevent loss of ground. The base shall conform substantially to the required shape and dimensions, and in the event that excavation for the base has been carried below the required depth the excess depth shall be filled with concrete or crushed rock.

3) Grades for setting catch basin frames: The top of the catch basin casting or frames shall be set at the elevation staked in the field by the engineer. The casting shall be furnished as a part of the catch basin, with a minimum of 4 inches of adjustment between casting and precast tops of the catch basin.

P. Trench Consolidation

In sandy soil, puddling, jetting, or water flooding for consolidating the backfilling may be done. The first flooding should be applied after the backfilling has been compacted by tamping up to one foot above the top of the pipes, and the second flooding during or after the subsequent filling of the trench. An excess of water should be avoided in order to prevent disturbance of the earth under and around the pipes and also to prevent an undue excess of pressure upon them.
1) Contractor shall have sufficient 2-1/2" diameter hose on hand to accomplish the required watering of the ditch and shall exercise caution in the operation of the City hydrants.
2) In soils not conducive to water flooding, backfilling shall be tamped mechanically as determined by the Engineer.

3) When for any reason the work is left unfinished, all trenches, and excavation

shall be filled if so required and the roadways and sidewalks left unobstructed, and with the surfaces in a safe and satisfactory condition.
4) Trench Compaction Tests: Density tests for compaction of trench backfill shall be made in all areas where utility trenches fall within traveled roadways. One test for each 500 feet of street with a minimum of 2 tests per street and around every second structure, shall be required to be taken in both the upper 3' of the trench(es), and in the area of the trench between the pipe and 3' below the surface. Additional tests may be ordered by the City Engineer for the trenches in roadways or in other areas if it is apparent that backfilling and compacting methods used do not obtain the specified densities. The tests for compaction will be as outlined under MnDot "Specified Density Methods".
Standard Proctor tests indicating 100% minimum density in the upper 3 feet and 95% minimum density below 3 feet will be required.

4. Special Construction Requirements

A) These special construction requirements are special conditions that occur repeatedly in reconstruction projects involving utility and street reconstruction. For more specific details for this project see the special provisions.

The disposition of abandoned facilities and reconnection of existing facilities shall be as shown on the plans or as provided for herein.

B) Abandon Existing Manhole or Catch Basin. The Contractor shall remove and salvage the castings, knock a hole in the concrete base of the Catch Basin or Manhole, bulkhead all pipe leads, and fill with granular material.

C) Lower or Raise Existing Utilities - Where required by storm sewer conflicts, the Contractor shall lower or raise the existing sanitary and/or watermains to provide for the crossing of the planned storm sewer grade. The Contractor shall replace the existing affected sanitary pipe with DIP. Payment for raising or lowering sanitary or watermain shall be at the unit price per lineal foot including all necessary fittings complete in place.

D) Expose Existing Service Where required for connection to an existing service, the Contractor shall excavate down and expose the existing service prior to service construction, as directed by the Engineer, to determine if lowering of the service is required and to establish grades for connection.

E) Connection and Assembly of Joints Jointing pieces of unlike material shall, whenever possible, be completed with the applicable prefabricated adapter for the specific pipes being installed. Installation of the adapter shall be in accordance with the manufacturer's instructions. If no manufactured adapter can be obtained for a particular joint, the joint shall be made in accordance with applicable plan drawings or with drawings and directions as furnished by the Engineer.

5. Testing

A) Air Test Method:

The sewer pipe section under test shall be clean at the time of testing but the pipe may be wetted. Pneumatic balls shall be used to plug the pipe ends at manholes. Low pressure air shall be introduced into the plugged line until the internal air pressure reaches 4.0 psi greater than the average back pressure of any ground water pressure that may submerge the pipe. At least two minutes shall be allowed for the air temperature to stabilize before readings are taken and the timing started. During this time the contractor shall check all plugs with soap solution to detect plug leakage. If plugs are found to leak, air shall be bled off, the plugs shall be retightened, and the air shall be reintroduced into the line.

The sewer section under test will be accepted as having passed the air leakage test if it does not lose air at a rate to cause the pressure to drop from 3.6 to 3.0 psi in less time than one-half minute per inch in diameter of the pipe tested.

B) Deflection Testing:

Deflection testing shall be performed on all plastic gravity sewer pipes. The test shall be conducted by qualified testing personnel after the sewer trench has been backfilled to the desired finished grade and has been in place for 30 days.

The deflection test shall be performed by pulling a rigid ball or pointed mandrel through the pipe without the aid of mechanical pulling devices. The ball or mandrel shall have a minimum diameter equal to 95% of the actual inside diameter of the pipe. The maximum allowable deflection shall not exceed five percent of the pipe's internal diameter. The time of the test, method of testing, and the equipment to be used for the test shall be subject to the approval of the Engineer.

All testing shall be performed by the Contractor at his expense without any direct compensation being made therefore, and the shall furnish all necessary equipment and materials required.

Although truss pipe is considered a rigid pipe the engineer may require a deflection test on completed sections of sewer mains constructed with truss pipe.

C) Televising of Sewers:

Televising of sanitary sewers and plastic storm sewers shall only be completed after these systems have passed a deflection test and have been cleaned and made free of debris. Immediately prior to televising, the

televisor shall discharge sufficient clear water into the pipe to assist in identifying sags and misalignment. Televising shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by close circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any condition which may indicate improper installation. A **flash drive or electronic file transfer site** with suitable log shall be kept and later submitted to the Engineer. All televising shall be done from the downstream manhole in the direction opposite of flow. The following conditions shall apply to the sewer acceptance TV inspection:

1. The recording shall have an on-screen display showing the following:
    i. Upstream and downstream manhole numbers or location
    ii. Footage from the downstream manhole
    iii. Inspection date
2. Video must be of sufficient quality and clarity to be discernable for the analysis of potential defects as determined by the Engineer. Video determined to be of insufficient quality will not be accepted and no additional payment will be made to the contractor for recollection and resubmission of video in rejected segments.

D) Cost of Testing:

All testing for sewer mainlines and service lines, other than televising, shall be performed by the Contractor without any direct compensation being made, and included in the cost of constructing the sewer lines.

Trench Compaction Testing

The City or Developer, as appropriate, shall hire an independent laboratory and pay for trench compaction density tests. Signed copies of all reports on test results will be kept on file at City Hall, and copies of test reports will be furnished to the Contractor upon request. Test samples and locations shall be selected or approved by the Engineer and taken by a MnDOT certified technician in each area from which samples are taken. Should any of the specified tests that are taken fail to meet the requirements of the specifications, the Contractor shall make the necessary corrections, the Engineer shall take such additional tests as may be required to satisfy that the specified test requirements have been obtained. The Contractor shall be responsible for payment for all additional testing required due to failed initial testing. The Contractor shall be responsible for all testing required for manufactured pipe products.

6. Restoration & Clean-Up

A) Surface Restoration

Wherever any surface improvements such as pavement, curbing, pedestrian walks, fencing, or turf have been removed, damaged or otherwise disturbed by the Contractor's operations, they shall be repaired or replaced to the Engineer's satisfaction, as will restore the improvement in kind and structure to the preexisting condition. Each item of restoration work shall be done as soon as practicable after completion of installation and backfilling operations on each section of pipeline.

In general the restoration will be covered in the Special Provisions portion of the specifications. In the absence of any special instructions in the Special Provisions, or specific bid items for separate payment of restoration items, the contractor include restoration work as a part of the pipe construction.

B) Topsoil and Seeding:

Unless the bid items or Special Provisions call for sod, all easements, street right-of-ways, residential lawns, and any other public or private property that was not paved prior to construction, but was disturbed during construction shall be covered with four inches of top soil, seeded, and fertilized.

No extra compensation shall be made for this lawn restoration as it will depend upon the contractor's ability to minimize damage through his operation of equipment, and his clean up procedures.

7. Cured In Place Pipe (CIPP)

DESCRIPTION

This work shall be done in accordance with the Standard Specifications for "2631-CIPPS Sewer Pipe Rehabilitation – Cured In Place Pipe Systems" (referenced "CEAM") as published by the City Engineers Association of Minnesota, St. Paul, Minnesota, 2018 Edition, or as modified herein.

It is the intent of this specification to provide for the rehabilitation of pipelines and conduits by the installation of a resin-impregnated flexible tube Cured-In-Place Pipe System (CIPPS). The rehabilitation of pipelines shall be done by the installation of a resin-impregnated flexible tube which, when cured, shall be continuous and tight-fitting throughout the entire length of the original pipe. The CIPP shall extend the full length of the original pipe and provide a structurally sound, joint less and water-tight new pipe within a pipe. The Contractor is responsible for proper, accurate and complete installation of the CIPP using the system selected by the Contractor.

Neither the CIPP system, nor its installation, shall cause adverse effects to any of the Owner's processes or facilities. The use of the product shall not result in the formation or production of any detrimental compounds or by-products at the wastewater treatment plant. The Contractor shall notify the Owner and identify any by-products produced as a result of the installation operations, test and monitor the levels, and comply with any and all local waste discharge requirements. The Contractor shall cleanup, restore existing surface conditions and structures, and repair any of the CIPP system determined to be defective. The Contractor shall conduct installation operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians, businesses, and property owners or tenants.

The Contractor shall contact the owner/residents and businesses within the project limits to inform them of the project and provide them with any information deemed necessary for the successful performance of the contract, and to inform them of temporary sewer service disconnections.

The prices submitted by the Contractor, shall include all costs of permits, labor, equipment and materials for the various bid items necessary for furnishing and installing, complete in place, CIPP in accordance with these specifications. If the Contractor damages the sewer during construction and is unable to complete the lining in a satisfactory manner, the cost of the dig and/or repairs shall be included in the unit price bid for the cured-in-place liner. Closed-circuit televising tapes are available from the Owner for the sanitary sewers listed on the proposal. The Contractor shall satisfy himself as to the condition of the sanitary sewer and the number of point repairs to be made. A separate bid will not be accepted for any point repairs and the cost for individual repairs shall be included in the bid prices included in the proposal. All items of work not specifically mentioned herein which are required to make the product perform as intended and deliver the final product as specified herein shall be included in the respective unit prices bid.

REFERENCED DOCUMENTS

This specification references ASTM F1216 (Rehabilitation of pipelines by the inversion and curing of a resin-impregnated tube), ASTM F1743 (Rehabilitation of pipelines by pulled-in-place installation of a cured-in-place thermosetting resin pipe), and ASTM D790 (Test methods for flexural properties of non-reinforced plastics) which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

QUALIFICATIONS

Since sewer products are intended to have a 50-year design life, and in order to minimize the Owner's risk, only proven products with substantial successful long term track records will be approved.

Products and Contractors seeking approval must meet all of the following criteria to be deemed Commercially Acceptable:

a. For a Product to be considered Commercially Proven, a minimum of 100,000 linear feet or 250 manhole-to-manhole line sections of successful wastewater collection system installations in the U.S. must be documented to the satisfaction of the Owner to assure commercial viability. In addition, at least 50,000 linear feet of the product shall have been in successful service within the State for a minimum of five years.

b. For a Contractor to be considered as Commercially Proven, the Contractor must satisfy all insurance, financial, and bonding requirements of the Owner, and:

- Must have had at least 5 (five) years active experience in the commercial installation of the product bid. In addition, the Contractor must have successfully installed at least 100,000 feet of the same product bid in wastewater collection systems.
- Field Supervisor/Foreman: Minimum five (5) years as a foreman/superintendent for a cured-in-place lining crew (installing actual product included with this bid/project), and a minimum of 100,000 lineal feet of cured-in-place lining, installed under his/her supervision.
- Such experience shall include the actual product, by trade name, CONTRACTOR proposes to install.
- Acceptable documentation of these minimum installations must be submitted to the Owner.

c. Sewer rehabilitation products submitted for approval must provide Third Party Test Results supporting the long term performance and structural strength of the product and such data shall be satisfactory to the Owner. Test samples shall be prepared so as to simulate installation methods and trauma of the product. No product will be approved without independent third party testing verification.

MATERIALS

a. Tube: The sewn Tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216 or ASTM F1743, Section 5. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections.

b. The wet out Tube shall have a uniform thickness that when compressed at installation pressures will meet or exceed the Design thickness.

c. The Tube shall be sewn to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during inversion. Overlapped layers of felt in longitudinal seams that cause lumps in the final product shall not be utilized.

d. The outside layer of the Tube (before wet out) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate monitoring of resin saturation during the resin impregnation (wet out) procedure.

e. The Tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the

Tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.

f. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

g. Seams in the Tube shall be stronger than the non-seamed felt.

h. The outside of the Tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 ft. Such markings shall include the Manufacturers name or identifying symbol. The tubes must be manufactured in the USA.

i. Resin - The resin system shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst system that when properly cured within the tube composite meets the requirements of ASTM F1216 and ASTM F1743, the physical properties herein, and those which are to be utilized in the Design of the CIPP for this project. The resin shall produce CIPP which will comply with the structural and chemical resistance requirements of this specification.

Structural Requirements:

a. The CIPP shall be designed as per ASTM F1216, Appendix X.1. The CIPP design shall assume no bonding to the original pipe wall.

b. The Contractor must have performed long-term testing for flexural creep of the CIPP pipe material installed by his Company. Such testing results are to be used to determine the Long-term, time dependent flexural modulus to be utilized in the product design. This is a performance test of the materials (Tube and Resin) and general workmanship of the installation and curing. A percentage of the instantaneous flexural modulus value (as measured by ASTM D-790 testing) will be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. Values in excess of 50% will not be applied unless substantiated by qualified third party test data. The materials utilized for the contracted project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in Design.

c. The Enhancement Factor 'K' to be used in 'Partially Deteriorated' Design conditions shall be assigned a value of 7. Application of Enhancement (K) Factors in excess of 7 shall be substantiated through independent test data.

d. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If separation of the layers occurs during testing of field samples, new samples will be cut from the work. Any reoccurrence may cause rejection of the work.

e. The cured pipe material (CIPP) shall conform to the structural properties, as listed below.

Minimum Physical Properties: The cured pipe material (CIPP) shall, at a minimum, meet or exceed the structural properties, as listed below and meet the requirements listed under the design considerations.

Property	Test Method	Cured Composite Per ASTM F1216	Cured Composite Per Design
Flexural Modulus Of Elasticity (Short Term)	ASTM D-790	250,000 Psi	Contractor Value
Flexural Strength (Short Term)	ASTM D-790	4,500 Psi	Contractor Value

f. The required structural CIPP wall thickness shall be based as a minimum, on the physical properties listed above and in accordance with the Design Equations in the appendix of ASTM F 1216, and the following design parameters:

Design Safety Factor	2.0 (1.5 For Pipes 36" Or Larger)
Retention Factor for L.T. Flexural Modulus*	1% - 60%
Ovality	2% Or As Measured By Field Inspection
Constrained Soil Modulus	Per AASHTO LRFD Sect. 12 & AWWA Manual M45
Groundwater Depth	As Specified Or Indicated in the Soil Borings
Soil Depth (Above The Crown)	As Specified Or Indicated On The Plans
Live Load	H20 Highway
Soil Load (Assumed)	120 Lb/Cu. Ft.
Minimum Service Life	50 Years
Design Condition (partially/fully deteriorated)	Fully

* (*as determined by Long-Term tests described in paragraph b*)

g. The Dimensional Ratio for specific pipe section requirements, based on the pipe condition, depth, ovality, etc. shall be computed using ASTM F 1216 Design Equations.

h. Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

Testing Requirements:

a. Chemical Resistance - The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.

b. Hydraulic Capacity - Overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

c. CIPP Field Samples - When requested by the Owner, the Contractor shall submit test results from field installations in the USA of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified in above have been achieved in previous field applications. Samples for this project shall be made and tested as described below.

CONSTRUCTION REQUIREMENTS

Preparation: The Contractor shall clean the interior of the existing host pipe prior to installation of the CIPP liner. All debris and obstructions that will effect the installation and the final CIPP product shall be removed and disposed of. The CIPP liner shall be constructed of materials and methods, that when installed, shall provide a joint less and continuous structurally sound liner able to withstand all imposed static and dynamic loads on a long-term basis.

a. Access: It will be the responsibility of the Owner to locate and designate all manhole access points open and accessible for the work, and provide rights of access to these points. Traffic Control shall be the responsibility of the Contractor and shall conform to the latest revision of the MMUTCD and other provisions of this specification herein. The Contractor shall keep the roadway open to traffic at all times unless given prior approval by the Engineer.

b. Water Usage: Water is available from the City at designated locations for cleaning, inversion, and other work items requiring water. Use of an approved double check backflow assembly shall be required. The Contractor shall provide his own approved assembly. A meter will be attached to the designated location for tracking purposes. No fees will be charged for water for use in CIPP installation processes and any pre-cleaning. All other water use shall follow requirements in the Special Provisions (Section 200) of these Specifications.

c. Cleaning of Sewer Lines: The Contractor shall remove all internal debris from the pipe line that will interfere with the installation and the final product delivery of the CIPP as required in these specifications. Solid debris and deposits shall be removed from the system and disposed of properly by the Contractor. Moving material from manhole section to manhole section shall not be allowed. As applicable the contractor shall either plug or install a flow bypass pumping system to properly clean the pipe lines. Precaution shall be taken, by the Contractor in the use of cleaning equipment to avoid damage to the existing pipe. The repair of any damage, caused by the cleaning equipment, shall be the responsibility of the Contractor. The Contractor shall dispose off all cleaning debris at no additional charge.

d. Bypassing Sewage: On high volume, high flow main lines, the Contractor may be required to provide for the flow of existing mainline and service connection effluent around the section or sections of pipe designated for CIPP installation. Installation of the liner shall not begin until the Contractor has installed a sewage by-pass system and all pumping facilities have been installed and tested under full operating conditions including the bypass of mainline and side sewer flows. Once the lining process has begun, existing sewage flows shall be maintained, until the resin/felt tube composite is fully cured, cooled down, fully televised and the CIPP ends finished. The Contractor shall coordinate sewer bypass and flow interruptions with the Owner at least 14 days in advance and with the property owners and businesses at least 3 business days in advance. The pump and bypass lines shall be of adequate capacity and size to handle peak flows. The Contractor shall submit a detail of the bypass plan and design to the Engineer prior to proceeding with any CIPP installation. As stated earlier in this section of the Specifications and also in the Special Provisions (Section 200), compensation for by-pass pumping and all associated plans and approvals shall be included in the prices bid.

e. Inspection of Pipelines: Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any conditions which may prevent proper installation of the CIPPS into the pipelines and it shall be noted so that these conditions can be corrected. A videotape and suitable log shall be kept for later reference by the Owner. The Owner has copies of a video inspection of the sewers to be relined, and these are available for prospective bidders. However, since the deterioration of sewer is an ongoing process, and roots, solids, and deposits can accumulate over time, the Contractor shall base the design of the liner on inspections made immediately prior to installation.

f. Line Obstructions: It shall be the responsibility of the Contractor to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the inversion process, that was not evident on the pre-bid video and it cannot be removed by conventional sewer cleaning equipment, then the Contractor shall make a point repair excavation to uncover and remove or repair the obstruction. Such excavation shall be approved in writing by the Owner's representative prior to the commencement of the work and shall be considered as a separate pay item.

g. Public Notification: The Contractor shall make every effort to maintain service usage throughout the duration of the project. In the event that a service will be out of service, the maximum amount of time of no service shall be 8 hours for any property served by the sewer. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:

1. Written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor they can call to discuss the project or any problem which could arise.

2. Personal contact with any home or business, which cannot be reconnected within the time stated in the written notice.

h. The Contractor shall be responsible for confirming the locations of all branch service connections prior to installing and curing the CIPP.

Installation:

a. Liner Installation: CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, with the following modifications:

   The wet out tube shall be positioned in the pipeline using either inversion or a pull-in method. If pulled into place, a power winch should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.
   Temperature gauges shall be placed inside the tube at the invert level of each end to monitor the temperatures during the cure cycle.

   Curing shall be accomplished by utilizing hot water under hydrostatic pressure or steam in accordance with the manufacturer's recommended cure schedule.

   The Contractor shall remove the protruding tap to the inside wall of the pipe. In no case shall the pipe be less than 95 percent open to flow.

b. Resin Impregnation: The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used. To insure thorough resin saturation throughout the length of the felt tube, the point of vacuum shall be no further than 25 feet from the point of initial resin introduction. After vacuum in the tube is established, a vacuum point shall be no further than 75 feet from the leading edge of the resin. The leading edge of the resin slug shall be as near to perpendicular as possible. A roller system shall be used to uniformly distribute the resin throughout the tube. If the Installer uses an alternate method of resin impregnation, the method must produce the same results. Any alternate resin impregnation method must be proven.

c. Cool Down: The Contractor shall cool the CIPP in accordance with the approved CIPP manufacturer's recommendations as described and outlined in the PWS. Temperatures and curing data shall be monitored and recorded, by the Contractor, throughout the installation process to ensure that each phase of the process is achieved as approved in accordance with the CIPP System manufacturer's recommendations.

d. Finishing Operations: The installed CIPP shall be continuous over the entire length of a sewer line section and be free from visual defects such as foreign inclusions, dry spots, pinholes, major wrinkles and delamination. The lining shall be impervious and free of any leakage from the pipe to the surrounding ground or from the ground to inside the lined pipe. Any defect, which will or could affect the structural integrity or strength of the linings, shall be repaired at the Contractor's expense. The beginning and end of the CIPP shall be sealed to the existing host pipe. The sealing material shall be compatible with the pipe end and shall provide a watertight seal. If any of the service connections leak water between the host pipe and the installed liner, the connection mainline interface shall be sealed to provide a water tight connection. If the wall of the CIPP leaks, it shall be repaired or removed and replaced with a watertight pipe as recommended by the manufacture of the CIPP system.

e. Manhole Connections: A seal, consisting of a resin mixture or hydrophilic seal compatible with the installed CIPP shall be applied at manhole walls in accordance with the CIPP System manufacturer's recommendations.

f. Reinstatement of Existing Branch Connections: It is the intent of these specifications that branch connections to buildings be reopened without excavation, utilizing a remote controlled cutting device, monitored by a video TV camera. The Contractor shall certify they have a minimum of 2 complete working cutters plus spare key components on the site before each inversion. Unless otherwise directed by the owner or his authorized representative, all laterals will be reinstated. No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such excavation and restoration work.

Only existing branch connections indicated on the Plans or otherwise as directed by the Engineer shall be reinstated as part of the project. Contractor shall notify Engineer of any service branch connection not identified on the Plans for reinstatement that shows any evidence of being in use.

If project specifies sanitary sewer service replacement in conjunction with sanitary sewer main lining, partial reinstatement per manufacturer recommendations of universal connector shall take place immediately following mainline lining. Contractor will be responsible for any emergency reinstatements necessary as a result of lining creating sewer backups.

Cleanup: Upon acceptance of the installation work and testing, the Contractor shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

TESTING AND INSPECTION

a. Testing: One CIPP sample for each diameter shall be prepared and physical properties tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either method proposed. The flexural properties must meet or exceed the values listed in Table 1 of the applicable ASTM.

Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than 87½% of the design thickness as calculated in this document.

b. Inspection: Visual inspection of the CIPP shall be in accordance with ASTM F1743, Section 8.6.
c. Televising: Televising shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by close circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any condition which may indicate improper installation. **A flash drive or electronic file transfer site with suitable log shall be kept and later submitted to the Engineer**. All televising shall be done from the downstream manhole in the direction opposite of flow. The following conditions shall apply to the sewer acceptance TV inspection:

    1. The recording shall have an on-screen display showing the following:
        a. Upstream and downstream manhole numbers
        b. Footage from the upstream manhole
        c. Inspection date

    2. Video must be of sufficient quality and clarity to be discernable for the analysis of potential defects as determined by the Engineer. Video determined to be of insufficient quality will not be accepted and no additional payment will be made to the contractor for recollection and resubmission of video in rejected segments.

8. SANITARY SEWER SERVICE LATERAL LINING

When called for by the plans and schedule of unit prices, the service lateral lining shall provide a one-piece, homogenous, cured in-place full circle main to lateral connection lining by air inversion with no overlapping materials. The lateral lining system shall be installed after all CIPP lining has been completed on the mainlines, as prescribed by the Special Provisions.

The inverted lateral CIPP lining must be able to invert to a minimum distance of seventy-five feet while being able to compromise 4" and 6" lateral connections including lateral diameter changes with main pipe diameters of diameters of 8" through 24". The one-piece CIPP main to lateral lining will incorporate gasket sealing technology and the use of compressible materials in the main CIPP portion. Collar type systems, two-piece systems, systems where the lateral is pulled in-place and CIPP connection systems that are based on adhesion will not be allowed. All main to lateral sewer service lining connections shall comply with ASTM F2561-06 or ASTM 1216.

This specification covers requirements and test methods for the reconstruction of a sewer service lateral pipe and a short section of the main pipe without excavation. The lateral pipe shall be remotely accessed from the main pipe and from a cleanout. This shall accomplished by the installation of a resin impregnated one-piece main and lateral lining by means of air inflation and inversion. The liner is pressed against the host pipe by

pressurizing a bladder that is held in place until the thermo-set resins have cured. When cured, the liner shall extend over a predetermined length of the service lateral and a particular section of the main pipe as a continuous, one-piece, tight fitting, corrosion resistant and verifiable non-leaking cured in-place pipe. The Main/Lateral Lining shall be in accordance with ASTM F2561-06 or ASTM 1216.

a) General

The reconstruction shall be accomplished using a non-woven textile tube of particular length and a thermo-set resin with physical and chemical properties appropriate for the application. The lateral tube located within a translucent inversion bladder is vacuum impregnated with the synthetic resin and is then placed inside of a protective carrying device. The mainline portion of the liner is physically attached to the lateral portion and is affixed around a rigid "T" launching device. The protective "T" launching device is winched into the existing sewer. When the "T" launching device is properly positioned at the lateral connection, the mainline bladder is inflated by pressurized air that presses the main liner against the host pipe. The lateral portion is then, inverted up through the lateral service line by the action of the inversion bladder. Once the resin-saturated liner is cured, the inversion bladder and launching/carrying devices are removed.

b) Material

The liner assembly shall be continuous in length and consist of one or more layers of absorbent textile material i.e. needle punched felt, circular knit or circular braid that meet the requirements of ASTM F1216 and ASTM D5813 Sections 6 and 8. The textile tube and sheet shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe segments, and flexibility to fit irregular pipe sections. The wet-out textile tube and sheet shall meet ASTM F 1216, 7.2 as applicable, and shall have a uniform thickness and 5% to 10% excess resin distribution that when compressed at installation pressures will meet or exceed the design thickness after cure.

The outside layer of the textile tube (before inversion) and interior of the textile sheet shall be coated with an impermeable, translucent flexible membrane. The textile sheet before insertion shall be permanently marked as a "Lateral Identification" correlating to the address of the building and the lateral pipe services. The sheet and tube shall be surrounded by a second impermeable, flexible translucent membrane (translucent bladder) that will contain the resin and facilitate vacuum impregnation while monitoring of the resin saturation during the resin impregnation (wet-out) procedure.

The mainsheet and lateral tube shall be a one-piece assembly formed in the shape of a "T" or WYE. No intermediate or encapsulated elastomeric layers shall be in the textile that may cause de-lamination in the cured in-place pipe. The main sheet will be flat with one end overlapping the second end and sized accordingly to create a circular lining equal to the inner diameter of the main pipe. The lateral tube will be continuous in length and the wall thickness shall be uniform. The lateral tube will be capable of conforming to offset joints, bells, and disfigured pipe sections.

c) Resin System

- The resin/liner system shall conform to ASTM D5813 Section 8.2.2 - 10,000-hour test.
- The resin shall be a corrosion resistant polyester, vinylester, epoxy or silicate resin and catalyst system that when properly cured within the composite liner assembly, meets the requirements of ASTM F1216, the physical properties herein, and those which are to be utilized in the design of the CIPP, for this project.
- The resin shall produce CIPP, which will comply with the structural and chemical resistance requirements of ASTM F1216.

Table 1 CIPP INITIAL STRUCTURAL PROPERTIES

Property	*ASTM Test*	*Minimum value*	
		psi	(MPa)
Flexural Strength	D 790	4,500	(31)
Flexural Modulus	D 790	250,000	(1,724)

d) Design Considerations

- The CIPP shall be designed per ASTM F1216, Appendix X1.
- The CIPP design for the lateral tube shall assume no bonding to the original pipe.

e) Installation Recommendations

- Access Safety – Prior to entering access areas such as manholes, an excavation pit, performing inspection or cleaning operations, an evaluation of the atmosphere to determine the presence of toxic or flammable vapors or lack of oxygen shall be undertaken in accordance with local, state, or federal safety regulations.
- Cleaning and Inspection – As per NASSCO Standards.
- Accessing the Lateral – A cleanout is required to be located on the exterior of the building for CIPP lateral lengths greater than three feet. The cleanout fitting must be either TEE shaped or back to back WYE shaped where the lateral meets the cleanout riser pipe. The cleanout shall be located no less than within two (2) feet of the finished liner.
- Plugging – The upstream side of the cleanout shall be plugged during insertion and curing of the liner assembly ensuring no flows enter the pipe and no air, steam or odors will enter the building. When required, the main pipe flows will be by-passed. The pumping system shall be sized for normal to peak flow conditions. The upstream manhole shall be monitored at all times and an emergency deflating system will be incorporated so that the plugs may be removed at any time without requiring confined space entry.
- Inspection of Pipelines – The interior of the pipeline shall be carefully inspected to determine the location of any condition that shall prevent proper installation, such as roots, and collapsed or crushed pipe sections. These conditions shall be noted. Experienced personnel trained in locating breaks, obstacles, and service connections by closed circuit television shall perform inspection of pipelines.
- Line Obstructions – The existing service lateral shall be clear of obstructions that prevent the proper insertion and expansion of the lining system. Changes in pipe size shall be accommodated, if the lateral tube is sized according to the pipe diameter and condition.

Obstructions may include dropped or offset joints of no more than 20% of inside pipe diameter.

- Resin Impregnation – The lateral tube and mainline sheet shall be encapsulated within the translucent bladder (liner/bladder assembly) shall be vacuum-impregnated with resin (wet-out) under controlled conditions. The volume of resin used shall be sufficient to fill all voids in the textile lining material at nominal thickness and diameter. The volume shall be adjusted by adding 5% to 10% excess resin for the change in resin volume due to polymerization and to allow for any migration of resin into the cracks and joints in the original pipe. No dry or unsaturated area in the mainline sheet or lateral tube shall be acceptable upon visual inspection.
- Liner Insertion – The lateral tube and inversion bladder will be inserted into the carrying device. The mainline liner and bladder shall be wrapped around the "T" launching device and held firmly by placing four (4) hydrophilic O-rings around the main liner. An adhesive sealant 300ml in volume is applied to the main/lateral interface and shall be applied as a two-inch (2") wide band on the main liner. Both the launching and carrying device are pulled into the pipe using a cable winch. The pull is complete when the open port of the "T" launching device is aligned with the interface of the service connection and mainline pipe. The lateral tube is completely protected during the pull. The mainline liner is supported on a rigid "T" launcher that is elevated above the pipe invert through the use of a rotating skid system. The liner assembly shall not be contaminated or diluted by exposure to dirt, debris, or water during the pull.
- Bladder – The main bladder shall be inflated causing the main sheet to unwrap and expand, embedding the hydrophilic O-rings between the main liner and the main pipe as the main liner is pressed tight against the main pipe. The lateral tube is inverted by the action of the lateral bladder through the center of the main liner as it extends up into the lateral pipe to a termination point that shall be no less than 2-feet from the exterior cleanout. The Main/Lateral bladder assembly shall extend past all ends of the liner, as no cutting shall be required.
- Curing – After liner placement is complete; pressure is maintained pressing the liner firmly against the inner pipe wall. The liner is chemically cured and with a suitable heat source (i.e. steam). The heating equipment shall be capable of delivering a mixture of steam and air throughout the liner bladder assembly to uniformly raise the temperature above the temperature required to cure the resin. The curing of the CIPP must take into account the existing pipe material, the resin system, and ground conditions (temperature, moisture level, and thermal conductivity of the soil). The heat source temperatures shall be monitored and logged during the cure and cool down cycles. The manufacturer's recommended cure schedule shall be submitted.
- CIPP Processing – Curing shall be done without pressure interruption with air or a mixture of air and steam for the proper duration of time per the resin manufacturer's recommendations. When the heat source is removed and the temperature on both ends of the CIPP reaches 100 degrees Fahrenheit or less, the processing shall be finished

f) Reinstatement of Existing Branch Connections

It is the intent of these specifications that lateral to buildings be reinstated without excavation. Unless otherwise directed by the owner or his authorized representative, all laterals will be reinstated. No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such excavation and restoration work.

g) Finish

The finished CIPP – Shall be continuous over the entire length of the rehabilitated sewer service lateral and 16" of the main pipe (5" on either side of a 6" lateral or 6" on either side of a 4" lateral connection). The CIPP shall smooth with minimal wrinkling and increase flow rate. The CIPP shall be free of dry spots, lifts, and delaminated portions. The CIPP shall taper at each end providing a smooth transition for accommodating video equipment and maintaining proper flow in the mainline. After the work is completed, the installer will provide the owner with video footage documenting the repair and the visual markings identifying the sewer lateral address as completed work. The finished product must provide an airtight/ watertight verifiable non-leaking connection between the main sewer and sewer service lateral.

The installer shall perform and record a televising inspection of the finished installation, and furnish the video recording on a flash drive or electronic file transfer site with suitable log to the Engineer. **Each post-installation lateral inspection shall be identified on the video by street address of the property it serves.**

h) Recommended Inspection & Testing Practices

Gravity Pipe Leakage Testing – If required by the owner in the contract documents or purchase order, gravity pipes should be tested using an air test method where a test plug is placed adjacent to the upstream and downstream ends of the main sheet CIPP and at the upper most end of the lateral tube. This test should take place after the CIPP has cooled down to ambient temperature. This test is limited to pipe lengths with no service connections. The test pressure shall be 4 PSI for a three-minute) minute test time and during this time the pressure shall not drop below 3.5 PSI.

9. TRANSITE (ASBESTOS CONCRETE) SANITARY SEWER SERVICE REPLACEMENT

Transite (asbestos concrete) pipe is considered a hazardous material by the Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Health (MDH). When called for by the plans a bid item for the removal and disposal of Transite pipe sanitary sewer services will be included in the schedule of line items. This item will be considered as compensation for the cutting, removal, and disposal of any existing Transite sewer services encountered during the reconstruction of the sanitary sewer services throughout the project area.

All procedures used for removal activities shall be performed by a Minnesota Licensed asbestos abatement contractor and shall be performed by certified personnel. Removal activities shall be in accordance with MPCA and MDH rules and regulations. The cost of obtaining an asbestos removal permit and any and all disposal charges will also be included in this line item. Should these procedures be required, the contractor will not receive any extension of time for the completion date of the project.
The contractor will be required to provide a copy of all permits, licenses, and personnel certifications to the City prior to the commencement of any removal activities.

The City will make a good faith effort to assist the contractor in determining where there are increased odds of encountering the material. However, the City will not, under any circumstances, consider compensation of downtime caused by any time gap between the discovery of Transite or other asbestos concrete pipe and the arrival of the abatement contractor on site to remove it, as there is limited knowledge as to the locations where the material exists.

SECTION 600
Standard Specifications for Concrete
Curb & Gutter, Sidewalk, and Driveways

Index

1. SCOPE OF WORK

The work to be done under these specifications consists in furnishing all the necessary materials, tools, and labor, and doing all the necessary excavating and filling required for the laying of Portland cement concrete curb and gutter, sidewalks, private and alley driveways as directed by the City or designated representative for the quantity specified in the bid proposal. Unless otherwise noted Minnesota Department of Transportation (Latest Edition) Standard Specification 2521 and 2531 for concrete work shall govern.

2. TYPE AND WIDTH

All concrete curb and gutter, private and alley driveways shall be constructed of Portland cement concrete and shall be as specified on the plans or in the bid schedule.

All sidewalks shall be constructed of Portland cement concrete and shall be five feet in width unless directed otherwise by the Engineer, specified otherwise on the plans, or otherwise described in the bid schedule.

a. Exposed Aggregate Sidewalk: The Contractor shall construct the sidewalk in a manner so as to have the same appearance in color, texture, and sawcut pattern as the existing/adjacent exposed aggregate sidewalk. The Contractor is advised to review the existing walk prior to construction. The Contractor will be required to construct a section of walk of at least 25 square feet. This section must be reviewed and approved by the Engineer prior to proceeding with construction. This will be considered incidental to the walk construction.

3. **CEMENT**

The cement shall be air-entrained Portland pozzolan cement conforming to AASHTO M240 specifications. Air-entraining admixtures shall conform to AASHTO C260 with requirements that the admixture as used shall have strength such that not more than two quarts of solution per cubic yard of concrete will produce the required air content in the concrete.

4. **WATER**

Water used shall be potable water and shall be clean, free from oil, acids, alkali, or vegetable matter. The water shall be paid for by the contractor under the rules and regulations of the Hastings Water Department. The inspector must approve and be present if water is added on-site. The contractor shall never add more water than the mix design allows. A test cylinder will be taken after thorough mixing.

5. **AGGREGATES, PROPORTIONING AND MIXING**

In general the concrete for this work will be furnished by an approved ready-mixed plant, and delivered to the site in truck-type mixers. All concrete shall be delivered to the job site within one hour after introducing of water to the mixer contents. With each load of concrete delivered to the site there shall be furnished a duplicate delivery ticket; one copy of which shall be given to the inspector.

The gradation of the fine and coarse aggregates, the type of concrete, the grade of concrete, maximum slump, and proportioning of the concrete shall meet the Minnesota/DOT mix designation 3F52 for manual placement, and 3F32 for slip-form placement.

In the event that concrete from a ready-mixed plant is not available the contractor shall submit a design mix, including gradation of aggregates, to the Engineer for his approval.

6. **DESIGN MIX**

The MnDOT design mix to be utilized for this work is intended to produce concrete in accordance MnDOT Table 2461.2-6. Mixes for the following items shall be used where indicated on the plans:

a. **Slipform Concrete Curb and Gutter**: MNDOT Concrete Mix No. 3F32.

b. **4 or 6 inch Concrete Walk & Concrete Driveways:** MNDOT Concrete Mix No. 3F52.

c. **Exposed Aggregate Sidewalk**: Where indicated on Plans, conform to requirements of MNDOT Concrete Mix No. 3F52EX.

d. **High Early Sidewalk & Driveways:** Concrete Mix 3HE52 shall be used in instances called for high early strength as indicated on the Plans, Schedule of Bid Prices, or as determined necessary by Engineer or Contractor.

7. PREPARATION OF SUBGRADE & COMPACTION

The foundation shall be prepared by excavating to the lines, grades, and cross sections shown on the plans or required herein. All soft material shall be removed and be replaced with suitable material. All roots from trees and rock or stones greater than 2 inches in diameter shall be removed to a depth 6 inches below the bottom of the curb and gutter.

The foundation or material underlying concrete shall be thoroughly compacted and a minimum of 4 inches of Class V bedding conforming to MNDOT specification section 2211 shall be placed on top of the foundation and compacted to within 1 inch of the proper elevation before the forms are set.

If indicated on the plans, the crushed aggregate base course for the roadway may be placed under the curb and gutter.

If called for on the plans or specifications a granular sub-base course material shall be placed and compacted under the curb and gutter.

In every case the subgrade must be thoroughly moistened prior to placement of concrete.

All tree root removal or stone removal shall be included in the unit price bid for curb and gutter. In the case of bedrock excavation the unit price bid for rock excavation shall be payment for rock removal and replacement with suitable granular material.

8. FORMS

Forms shall be of wood or metal, and shall be straight and of sufficient strength to resist springing or other displacement during the process of depositing and consolidating the concrete. Forms for driveways shall be a minimum of 6" in depth (nominal – i.e. 2X6 is 5.5 inches). The forms shall be set to proper line and grade and staked in position and shall be sufficiently tight to prevent leakage of mortar.

The forms shall be of the full depth of the required curb, gutter, or combination curb and gutter sections, and shall be of such a design as to permit secure fastening.

The forms shall be of a depth equal to the depth of the sidewalk. The forms shall be set to proper line and grade and staked in position and shall be sufficiently tight to prevent leakage of mortar. Proper slope toward outer edge of the sidewalk shall be ¼ inch fall to each foot in width and no more, unless approved by the Engineer. Before placing any concrete the forms shall be clean and oiled and the subgrade shall be thoroughly moistened.

They shall be set upon the prepared subgrade to proper line and grade and firmly staked in position. The fine grading shall then be completed and the subgrade shall be thoroughly moistened and the contact surfaces of the forms shall be oiled.

Forms shall remain in place a minimum of 12 hours after placing the concrete.

9. PLACING CONCRETE

Immediately before placing the concrete, the inside faces of the forms shall be wetted and the foundation moistened with water.

The concrete shall be placed in a manner that will prevent segregation; consolidated by hand tamping or internal vibrating to fill all voids; struck off to the required grade; and floated smooth. Curb face forms and contraction joint inserts shall be removed as soon as the concrete has set sufficiently to retain its molded shape.

Steel separation plates conforming to the true contour of the curb, or curb and gutter shall be spaced not less than 6 feet nor more than 10 feet apart.

The top surface of curbs shall be hand-floated with a suitable trowel as soon after the face forms have been removed as the condition of the concrete will permit.

After the water sheen has disappeared, joints and edges shall be rounded to the radii shown in the Plans or as directed by the Engineer, and all concrete surfaces exposed to view shall be lightly brushed to a uniform texture.

10. SLIPFORM MACHINE PLACEMENT

Any continuous sections of curb & gutter 100 feet or greater shall be installed with a slip form curb machine.

Instead of using fixed side forms, concrete may be placed and formed to the required shape by using an approved type of extrusion machine that will produce a finished product meeting the standards for dimension quality, workmanship and appearance as would be achieved with fixed-form construction provided for herein. Hand finishing will be required only to the extent necessary to obtain the specified surface finish and texture.

11. JOINT CONSTRUCTION

Expansion Joints

Expansion joint material shall consist of one-half inch preformed cork or bituminous fiber expansion fiber expansion joint filler conforming to the requirements of the standard specifications for preformed expansion joint fillers for concrete, A.A.S.H.O. designation M213.

One-half inch (½") transverse expansion joint filler shall be placed through the curb at uniform intervals of not more than 150 feet, and at the ends of all curved sections; and at the ends of all radii, and at the face of all castings for storm water or other utilities.

One-half inch (½") transverse expansion joint filler shall be placed through the sidewalk at uniform intervals of not more than 100 feet. In locations where the sidewalk extends from the back of curb to a building, one-half inch expansion joint filler shall be placed between the sidewalk and back of abutting parallel curb and between sidewalk and

building or other rigid structure. One-half inch expansion joint filler shall be placed between all approach walks and the main walk and between approach walks and the curb. One-half inch expansion joint filler shall also be placed at all private and alley driveways, along lot lines extended of each street, along the outer edge of sidewalks extended and along the curb where such aprons meet. Edge surfaces shall be clean of debris and surfaces smooth to provide effective sealing. Debris that is found in the joint will be removed along with the filler material and refilled with a material approved by the City Engineer.

Expansion joints with filler material shall also be placed at locations where the concrete surrounds or adjoins any existing fixed objects such as fire hydrants, building foundations, and other rigid structures. Edge surfaces shall be clean of debris and surfaces smooth to provide effective sealing. Any debris will be removed, filler taken out and refilled with a material approved by the City Engineer.

When sidewalk is constructed adjacent to a building which is not on the lot line and the property owner wishes to pour a continuous walk from the curb to the building, the ½ inch expansion joint filler may be moved from the lot line to the building foundation; providing, however, that the distance between the building and the lot line does not exceed two (2) feet.

Contraction Joints

All contraction joints for concrete sidewalk shall be sawcut. Contraction joints for concrete curb and gutter shall be formed (tooled). Contraction joints for concrete driveways and driveway aprons shall match the existing driveway jointing if existing concrete is present, otherwise either formed or sawcut joints may be accepted.

No joint shall deviate more than 5 degrees from a position perpendicular to the surface of the finished sidewalk nor shall the axis of any joint deviate more than ½ inch either way from a straight line.

When the sidewalk is constructed in partial width slabs, transverse joints in adjacent slabs shall be placed in line with like joints in the previously constructed slabs.

Contraction joints shall be provided intervals no greater than 10’ and no less than 5’ in curb and gutter construction, unless otherwise instructed by the Engineer.

The contraction joints shall generally be formed or sawcut to a depth to prevent random/uncontrolled cracking.

Joints shall be constructed perpendicular to the subgrade and shall align with similar joints in adjoining work when practicable. Transverse joints shall be placed at right angles to the longitudinal axis of the work unless otherwise indicated in the Contract.

Exposed Aggregate Sidewalk: Within 48 hours of placement. The Contractor shall sawcut the sidewalk into panels 16 to 20 inches square, spaced evenly within each panel, and aligned in a straight manner either parallel or perpendicular to the centerline of the sidewalk. The sawcuts shall be a minimum of 2 inches in depth or one-half the thickness of the walk, whichever is greater.

12. **SPOT REPLACEMENT & ADJOINING TO EXISTING CONCRETE**

Connections between new concrete and existing concrete shall be completed in accordance with the City of Hastings Standard Details.

Concrete curb and gutter, sidewalk, or concrete driveway pavement that is cured beyond hardness, either poured earlier in the same day, or poured previously as part of the same project shall be considered existing concrete and therefore shall adhere to the dowel requirements in the standard details.

Rebar shall not be used to join to any portion of an existing driveway to new concrete.

Where concrete sidewalk is continuing from an existing sidewalk panel, Contractor shall dowel minimum of 2 12" #4 epoxy coated bars to connect existing panel to new panel. Dowel connections shall be considered incidental to the bid price of concrete walk, no additional payment will be made for this work.

This work shall be incidental to the bid items for removal & replacement of sidewalks and curbs.

13. **FINISHING**

The face surfaces of the curb, gutter, and combination curb and gutter, shall be thoroughly troweled and brushed. Unless otherwise provided, the back edge of the curbs, the edge of the gutter adjacent to the pavement, and edges adjacent to expansion joints shall be rounded with an edge of ¼" radius. Any honeycombed areas occurring along forms shall be pointed with mortar. Areas containing excessive honeycombed areas shall be removed and replaced by order of the Engineer.

After wearing surface has been worked to an approximately true plane, contraction joints shall be made by sawcut, tooled contraction joints will not be permitted. Sawcut joints shall be made transversely and at right angles to the centerline of the walk at intervals so that the resultant square or rectangles shall be of equal width (approx. 5' long). Each slab shall be rounded on all edges of a radius of approximately ¼ inch. The contraction joints shall extend to at least 1/3 the walk thickness and shall be approximately 1/8 inch wide. The surface of all sidewalks shall be roughened and in no case shall it be troweled to a smooth surface. Roughening shall be done by use of a brush or other suitable tool.

a. Exposed Aggregate Sidewalk: Provide an exposed aggregate finish using surface retardation to produce a medium to deep exposure, so that the aggregate becomes the dominant surface feature. Embedment or top seeding of aggregate is not permitted. Apply retardant coating as soon after the concrete surface has been screeded, edged, and jointed. Retardant shall be applied in accordance with the manufacturer's instructions to produce a 6 mm (± 2mm) etch of mortar removal after final set. Surface mortar shall be removed by washing with water under pressure. Avoid excessive pressure which loosens individual aggregate particles. Following approval of the exposed aggregate finish obtained, a 10 percent muratic acid wash shall be applied to the exposed aggregate surfaces. Surfaces shall be flushed thoroughly with water following a 5 to 10 minute interaction period between the acid solution and the surface. Following the

curing process as detailed below, any staining or streaking of the exposed aggregate surface resulting from the moist curing shall be removed before applying the sealer. The exposed aggregate finish shall be sealed with two coats of a clear acrylic based compound with 18 percent minimum solids conforming to ASTM C309.

14. SEWER & WATER STAMP

The contractor must stamp an S (sewer) on the face of the curb directly over the location of any new or newly replaced sewer service. The contractor must stamp a W (water) on the face of the curb directly perpendicular to the location of the curb stop. Records of the locations of the service lines will be kept by the City's on-site inspector and indicated to the contractor at the time of curb placement.

15. PROTECTION AND CURING

Immediately after finishing has been completed and the free water has disappeared, the entire surface of the concrete shall be sealed by spraying thereon an impervious membrane that shall conform to the requirements of the standard specifications for liquid membrane-forming compounds for curing concrete ASTM C 309 designation, White Pigmented, Type 2, Class B.

The Contractor shall protect the new work from traffic or physical damage at his expense until adequately cured and of required strength. This includes erection and maintenance of barricades and warning lights, signs, or watchman to direct traffic if needed.

Where the sidewalk is abutting a building face, landscape retaining wall, fencing, or other structural or decorative members, this contractor shall use an equivalent clear curing compound in lieu of the white pigmented type.

a. Exposed Aggregate Sidewalk: Curing of the concrete shall be completed by covering with white polyethylene sheeting.

Traffic shall be excluded from the new construction for not less than 7 days when the temperatures are generally 70 F. or higher and not less than 10 days when temperatures are generally lower than 60 F.

In special cases where conditions warrant and with authority of the Engineer, the period of time for exclusion of traffic from the new work may be reduced to 5 days.

16. THICKNESS AND BASE PREPARATION

Unless noted otherwise on the plans, all driveways shall have a 4 foot long concrete driveway apron. The 6 inch concrete driveway shall be constructed on a 4 inch Class V aggregate base. The cost of the Class V aggregate base shall be included in the price bid for concrete driveway pavement. Where concrete driveway aprons abut gravel drives, the Contractor shall grade the existing gravel drive to match the aprons as directed by the Engineer.

Where curb stop boxes fall within driveway segments that are being replaced, they shall be covered by an A style "Top hat" casting to be submitted to engineer for approval.

The thickness of sidewalks shall be not less than 4 inches and not less than 6 inches through residential driveways and 8 inches through commercial/industrial driveways. Private driveways shall not be less than 6 inches.

17. **STEPS**

The Contractor shall construct step risers where shown on the plans or directed by the Engineer. The risers will be an average 6 inches in height, but must not exceed Building Code Standards. Payment will be based on vertical surface area constructed. Horizontal surface area will be paid at the price bid for 4" concrete walk.

18. **TESTING**

All concrete material testing shall be performed at the frequency specified by the MnDOT SALT Schedule of Materials Control. Concrete plant testing is required on all projects designated for State Aid Funding. The City will pay for the testing on City projects, Developers must pay for tests on private projects.

19. **REMOVAL OF FORMS AND BACKFILL**

Forms shall not be removed until the concrete has had sufficient time to properly cure and harden. Replacement of fill back of the completed curb and gutter shall be done as soon as possible after forms are removed to avoid hazards and personal injury, liability for which the Contractor is responsible.

In areas where yards and boulevards are developed, backfills must be of topsoil described in Section 1200 of these specifications.

In areas of new curb and gutter where the boulevard has been left low in anticipation of sidewalk construction, the contractor shall backfill and grade the boulevard area at the same time he backfills and grades the areas around the sidewalk.

20. **COLD WEATHER**

Except by specific written authorization, concreting operations shall not be continued when a descending air temperature in the shade and away from artificial heat falls below 40˚ F, nor resumed until an ascending air temperature in the shade away from artificial heat reaches 35˚ F. After October 1, use of extreme service curing compound as per MnDOT Specifications Section 2301.3 M.3, and Section 3755 will be required.

21. CONCRETE WASHOUT

Under no circumstances will the concrete supplier or Contractor be allowed to wash out concrete trucks onto the project streets or behind the curb. Instead, all concrete washout activity for this project must incorporate the BMP of an impermeable catchment device to retain all water and concrete slurry material in accordance with the Storm Water Pollution Prevention Plan and MPCA Regulations. Where there is an absence of a Materials Staging and Storage area than within City ROW, the City will not permit the construction of a concrete washout basin. The concrete supplier also has the option of hauling their remaining slurry back to the concrete plant.

22. CLEAN UP AND DISPOSAL OF DEBRIS

Bid proposal items shall include the cost of all reasonable clean-up, backfill and the proper disposal of all debris, to the satisfaction of the Engineer or his authorized representative. The contractor shall dispose of surplus excavation and shall restore the site of the work to a neat and workmanlike condition. Excess material generated by base preparation activities shall not be disposed of behind curbing or within any portion of the boulevard. A washdown area will be designated by the Engineer and shall be used as the sole site for concrete washdown.

23. ACCEPTANCE

The City will deem concrete aggregate popouts exceeding 7 occurrences per square yard on concrete flatwork or curb as excessive and require the section be removed and replaced prior to the City acceptance of the work. Full panel removal and replacement is required.

Contractor is required to construct all pedestrian ramps and landings to meet the requirements put in place by the American with Disabilities act and MNDOT Standard Pedestrian Ramp Details. Failure to construct pedestrian ramps and landings to these requirements will result in removal and replacement at the expense of the Contractor.

SECTION 700
Grading, Gravel Base, and Bituminous Pavement

Index

1. SCOPE OF WORK

This work shall consist of the construction of a plant mixed bituminous surface or pavement of bituminous concrete on the approved prepared roadbed, base course, or existing surface in accordance with the specifications and contract, and in conformity with the lines, grades, and typical sections shown on the plans.

This work shall also include constructing the roadway excavation and embankments within the right-of-way, easements, and adjacent roadside areas as indicated on the plans.

2. APPLICABLE SPECIFICATIONS

All work under this contract shall conform to the requirements of the most recent Minnesota Department of Transportation (MnDOT) Standard Specifications for Highway Construction and any supplemental specifications to the most current Standard Specifications, or as amended herein.

3. MATERIALS

All materials used in the work shall conform to the requirements of MnDOT Standards as stated above.

A. AGGREGATE BASE. The material shall conform to the requirements of MnDOT Specification 3138 for Class 5. The Contractor may substitute recycled aggregates or reclamation material for virgin aggregates, meeting the requirements of 3138 Class 5 Aggregate, and modified below:

1. The Contractor shall submit the certified composition breakdown of the proposed recycled material by percent.
2. The maximum percentage of recycled concrete shall be 30%.
3. The Contractor shall submit gradation and bituminous extraction reports and receive approval from the Engineer prior to placement of any material. The gradations shall be in conformance with MnDOT Specification 1503.

When the aggregate base work has been completed, the Engineer shall review the condition of the base with the Contractor to ensure that it has been constructed to the proper alignment and grade. Any soft spots encountered shall be removed as directed by the Engineer. Payment for this excavation work shall be made at the unit price bid for subgrade excavation and shall include removal of this material from the project area. The soft spots shall than be filled with Class 5, or another material approved by the Engineer.

B. PLANT MIXED BITUMINOUS SURFACE. Mixture designs for all courses of pavement on streets shall be in accordance with MnDOT Spec. 2360, Plant Mixed Asphalt Pavement, except where modified herein.

C. BITUMINOUS TACK COAT: The bituminous material for tack coat shall be CSS-1 or CSS-1h.

D. BITUMINOUS JOINT ADHESIVE: During final pavement operations, Bituminous Joint Adhesive shall be applied at all concrete/bituminous interfaces, and at all butt joints.

4. CONSTRUCTION METHODS

The construction methods used for this work shall be as required in the MnDOT standards for the type of work involved.

A. **Bituminous Surfaces (Street, Driveways, and Trails)** – Shall meet the requirements of MnDOT 2360, and modified below:

No bituminous course (lift) thicker than 3 inches shall be placed. No succeeding bituminous lifts shall be placed within 12 hours of the previous lift. Trails shall be paved in accordance with the typical section provided on the Plans. Typical residential bituminous driveways will consist of a 1.5" lift of base course (Mix is SPNWB230B), with the wearing surface constructed from a 1.5" lift (Mix is SPWEA240B) bituminous mixture. Commercial/Industrial driveways shall be restored with bituminous at the depth of the existing driveway or as directed by the Engineer. Bituminous tack coat shall be applied between layers, and the bituminous section of the driveway shall be placed on 4" of compacted Class 5 aggregate base.

When the bituminous surfacing has been placed, the Engineer shall review the condition of this surfacing work with the Contractor to ensure that it has been constructed to the proper alignment, quality and grade. The bituminous course shall be constructed with maximum deviation of plus or minus ¼" from the planned compacted thickness. On streets, the Contractor is required to use a self-propelled pneumatic tire roller as an intermediate roller on all wearing courses. Any soft spots, cracked areas, etc. shall be removed, repaired, and approved by the Engineer prior to the placement of the wear course. The removal and disposal of this material shall be at the Contractors expense. Bituminous surfacing materials replaced shall also be at the Contractors expense.

Wearing course for trails will be permitted to be placed only after all other heavy equipment work is completed. Any damage to the wear course or trails done by the Contractor may result in overlaying the trail. Shouldering work shall be completed at the unit bid price for Class 5 base compacted in-place.

B. **Bituminous Tack Coat** - Shall meet the requirements of MnDOT 2357, and modified below:

Bituminous tack coat shall be applied at a rate of 0.07 gallons per square yard. The contact surfaces of all fixed structures, the edge of the in-place mixture in all courses at transverse joints, and the wearing course at longitudinal joints shall be given a uniform coating of Liquid Asphalt or Emulsified Asphalt before placing the adjoining mixture. The bituminous materials shall be applied by methods that will ensure uniform coating and in no case shall the application be excessive.

C. **Aggregate Base** – Shall meet the requirements of MnDOT Spec 2211.

A certificate of aggregate must be provided to the engineer from the aggregate source prior to delivery to the project. See Testing (section 11) for quality control and assurance requirements.

5. BITUMINOUS TRAIL MIXTURE:

The bituminous mixture shall must conform with what is designated on the Plans. All mix designs must be submitted to and approved by the Engineer prior to delivery to the site.

6. EXCAVATION

A. Excavation and Embankment. All street and utility construction is to be preceded by stripping of the existing surface and excavation and embankment for street construction, including stripping of boulevard topsoil and removal of miscellaneous items and unstable sub base soils in accordance with the lines and grades shown on the plans. The balance of the excavation required for grading and street construction, including the removal of topsoil and subgrade excavation required for removal of unsuitable materials and for base construction and placement of topsoil, shall be classified as Common Excavation. Rough grading of the project streets shall be performed prior to installation of any utilities therein. After utility and service construction has been completed within the roadway, the Contractor shall proceed with final sub base grading and compaction. Compaction shall be by the Specified Density Method. Standard Proctor tests indicating 95 percent minimum density below three (3) feet and 100 percent in the upper three (3) feet will be required.

B. Utility Excavation. In various locations within the project the installation of utilities may precede the street excavation in order to insure compliance with scheduled project completion. In this instance the requirement under Section a) above will be amended to allow utility construction to proceed street construction. See Special Provisions for specific details.

C. Rock Excavation and Disposal. Where rock excavation is required, in the street, the Contractor shall expose the surface of the rock and the City will take elevations of the rock surface. This profile will be used to determine the pay quantity for rock excavation. The pay quantity for utility construction will be computed by the average end area method. Rock excavation for utility work will be done as specified in the Section of the Specifications for the specific utility involved. **Blasting or the use of explosives is not permitted within the City of Hastings for Rock Excavation.**

D. Subgrade Excavation. Subgrade Excavation shall consist of removal of unsuitable material after the roadway has been excavated, graded and compacted to design subgrade elevations. Any excavation below design subgrade elevations required to remove unsuitable materials prior to final grading and compacting of the subgrade shall be classified as and paid for as common excavation.

7. DUST CONTROL

Water shall be applied at such times and in such amounts for stabilization and dust control. Contractor shall supply water at their own expense. Use of City water must be purchased at the water loading station at the Public Works Building, 1225 Progress Drive. The City will not allow a hydrant meter for use by the Contractor.

8. CLASSIFICATION OF MATERIALS

a) Common Excavation. Common excavation shall include soil, muck, rubble, wood, debris, boulder, stone, masonry or concrete fragments less than one-half cubic yards in volume, together with other miscellaneous matter that can be removed effectively with power operated excavators without resorting to drilling and blasting within the proposed road section as shown on the Plans.

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

All excavated materials that are reserved for backfill or for other use on the construction project shall be stored at locations approved by the Engineer that will cause a minimum of inconvenience to public travel, adjacent properties, and other special interests. The material shall not be deposited so close to the edges of the excavation as would create hazardous conditions, not shall any materials be placed so as to block the access to emergency services.

b) Rock Excavation. Rock excavation shall be defined to include all hard, solid rock in ledge formation, bedded deposits and unstratified masses; all natural conglomerate deposits so firmly cemented as to present all the characteristics of solid rock; and any boulder stone, masonry or concrete fragments exceeding one-

half cubic yard in volume. Materials such as shale, hard pan, soft or disintegrated rock which can be dislodged with a hand pick or removed with a power operated excavator will not be classified as rock excavation.

c) Selected Granular Borrow (CV) shall consist of material meeting MnDOT specification 3149 for select granular borrow and will consist of borrow materials hauled onto the site. The select granular borrow will be used for subgrade fill as required by the various project sites.

9. MILL BITUMINOUS SURFACE

The Contractor shall mill the existing bituminous surfaces of the streets within the project in accordance with MnDOT Specifications.

The contractor shall make a stockpile of milled material on or near the construction site at the approval of the engineer to be used as stabilization material for maintenance as required by Section 100-411 of the Specifications. There may also be instruction in the Special Provisions for delivery of some quantity of millings to another site within the City. In any case, all millings not retained at the site for temporary maintenance purposes or delivered to other City lands become the property of the contractor.

10. ADJUSTMENT OF FRAMES AND CASTINGS

a) Adjustment of Curb Valve Boxes. The Contractor shall obtain the location of all curb valve boxes in the street and boulevard from the Public Works Department of City of Hastings, and shall furnish all labor required to raise or lower each valve box to the elevation of the finished street or boulevard grade. In cases where it is necessary to increase the length of the valve box, the Contractor shall furnish and install all new extensions and couplings as necessary. Adjustments and bituminous needed for adjustment will be considered incidental.

b) Adjust Utility Castings. The Contractor shall be responsible for keeping all new and existing manholes, gate valve boxes and catch basins clean and free of dirt at all times. Prior to the start of bituminous surfacing, the Contractor shall inspect all water valve boxes to assure that they are clean, vertical, undamaged, and the valves operable. Misaligned or damaged boxes shall be replaced. All boxes shall be lowered and manhole castings removed and steel covers placed over the manholes, on projects calling for bituminous base.

Final adjustments to grade of utility castings in bituminous pavement shall be made after the base course is placed and before the wearing course is placed. On projects requiring bituminous base, the mix around the casting shall be removed and castings adjusted to finished elevation. Adjustments and bituminous needed for adjustment will be considered incidental.

The manhole and gate valve castings shall be adjusted to 3/8” to 1/2" below a 4' straight edge laid across the bituminous wearing course. Castings outside these tolerances shall be readjusted at no additional cost to the city.

If the manhole castings adjustment causes the distance from the top manhole step to the top of the castings to exceed 20", the Contractor shall install a 9" aluminum, plastic or cast iron step into the manhole at no additional cost to the City. Payment for adjustment of existing manhole and catch basin frames will be made only when the adjustment necessitates the addition or removal of concrete adjustment rings or masonry, or when the top precast concrete cover must be turned or adjustment rings of a catch basin must be shifted laterally to meet a proposed curb. No compensation will be allowed for removal of castings when such removal is for the convenience of the workman.

c) Pavement Level Setting for Manhole and Gate Valve Covers: During the placement of the final lift of asphalt pavement, the paving contractor shall use plywood templates to set the level of pavement around the circumference of all manhole and gate valve covers. The templates shall be used after placing asphalt, and prior to rolling, such that handwork may be performed to bring the pavement to a uniform level above the manhole and gate valve lids. The plywood templates shall be of a thickness no less than 3/8", and not to exceed 1/2", and the dimensions shall match those of the covers for which they will be used.

All covers shall be cleaned after paving operations are completed so that they are easily opened.

11. TESTING

a) Testing: The City will hire an independent testing laboratory for all City projects to complete the following construction testing:

-Subgrade and base density testing
-Aggregate moisture and gradation testing
-Bituminous material gradation, oil content and density testing
-Concrete slump, air content, and strength testing.

On Developer led projects, developer is responsible for hiring an independent laboratory to complete these same tests.

On MnDOT or State-Aid projects, contractor must provide all quality control testing as required by MnDOT specifications and Schedule of Materials Control.

Signed copies of all reports on test results will be kept on file at City Hall, and copies of test reports will be furnished to the Contractor upon request. Test samples and locations shall be selected or approved by the Engineer or the Engineer's representative. Should any of the specified tests fail to meet the requirements of the specifications, the Contractor shall make the necessary corrections to the failed work. After completing the necessary corrections, additional tests will be required to satisfy that the specified test requirements have been obtained.

b) Asphalt. All Bituminous testing shall be done in accordance with the latest edition of the MnDOT Schedule of Materials Control and MnDOT spec 2360 unless otherwise specified by the Engineer.

c) Aggregate Base Class 5 Testing. All testing of the aggregate base material source and material placed on site shall be done in accordance with the latest edition of the MnDOT Schedule of Materials Control unless directed otherwise by the Engineer. Compaction shall be tested using quality compaction as well as the Penetration Index Method (DCP's). Prior to the placement of asphalt pavement, the contractor must perform a roll test per MnDOT Specification 2111 under the supervision of the Engineer. No paving may take place until the acceptance of this test.

d) Street Deflection Testing. Prior to the placement of any base material, the Engineer shall review the condition of the sub base with the contractor to ensure that it has been constructed to the proper alignment and grade. Deflection testing will be conducted by means of test rolling per MnDOT Specification 2111. The truck will be driven in any locations the Engineer may direct to determine if any soft spots exist. Any soft spots encountered shall be removed as directed by the Engineer. The soft spots will be filled with select granular borrow, approved aggregate base, or other material as directed by the Engineer. Additional tests will be performed until passing results are achieved.

12. BITUMINOUS JOINT SAWING & SEALING

Bituminous joint sawing and sealing shall be performed in accordance with the material and construction specifications in the latest edition of the MnDOT Standard Specifications for Construction.

This work shall consist of saw cutting, cleaning, drying and sealing transverse joints in new bituminous surfaces according to the Plans, the applicable MnDOT Standard Specifications, the details in the Plan, as directed by the Engineer, and the following:

MATERIALS

(A) Joint Sealant Material

The Contractor shall provide certification that the sealant meets the requirements of ASTM D-6690 type II.

The crack sealant compounds shall be packaged in sealed containers. Each container shall be clearly marked with the name of the manufacturer, the trade name of the sealant, the manufacturer's batch and lot number, the pouring temperature, and the safe heating temperature.

A copy of the manufacturer's recommendations concerning the heating and application of the joint sealant material shall be submitted to the Engineer before the commencement of the work. These recommendations shall be followed by the Contractor. The temperature of the sealer in the field application equipment shall never exceed the safe heating temperature recommended by the manufacturer. Any given quantity of material shall not be heated at the pouring temperature for more than six hours and shall never be reheated. Material shall

not be placed if the material's temperature is below the manufacturer's recommended minimum application temperature.

Mixing of different manufacturers' brands or different types of sealants shall be prohibited.

(B) Bond Breaker Tape

Bond breaker tape shall consist of regular masking tape or other suitable bond breaker tape designed for use with hot pour sealants. The width of the tape may be equal to but not more than 3 mm [1/8 inch] narrower than the width of the saw cut.

WEATHER LIMITATIONS

Sealant materials may be placed during a period of rising temperature after the air temperature in the shade and away from artificial heat sources has reached 4.4° C [40.0° F] and indications are for a continued rise in temperature. During a period of falling temperature, placement of the sealant material shall be suspended until the above conditions are met.

Sealants shall not be placed when, in the opinion of the Engineer, the weather or roadbed conditions are unfavorable. Sawing and sealing shall be permitted only during daylight hours.

EQUIPMENT REQUIREMENTS

The melting kettle shall be double jacketed boiler type, equipped with both agitation and recirculation systems capable of melting and applying the sealant through a pressure-fed hose and wand. The melter shall be capable of starting at ambient temperature and bringing the sealing material to application temperature in one hour or less, while continuously agitating and recirculating the sealant. The melter shall be equipped with automatic thermostatic controls and temperature gages to monitor the sealant temperature in the applicator lines and temperature of heat transfer oil in the kettle jacket.

A self-propelled power saw capable of providing a straight cut of uniform depth and width shall be used. Diamond saw blades with either single or gang blade arrangement shall be used. The saw blade or blades shall be of such size and configuration such that the desired joint reservoir shape and deep saw cut are achieved in one pass of the saw. Two pass cutting will not be allowed. No spacers between blades shall be allowed unless the Contractor can show that the desired reservoir and saw cut can be obtained with them. Either wet or dry sawing will be permitted provided the above conditions are met.

The air compressor shall be capable of producing a continuous stream of clean, dry air through the nozzle at 690 kPa [100 psi] and 3.5 m3/minute [125 cubic feet per minute (CFM)] minimum. The compressed air unit shall be equipped with water and oil traps and must produce sufficient air volume and pressure to remove

all debris from the sawed joint and all adjacent road surfaces in a safe manner such that the debris will not re-enter the joint prior to the sealing operation.

The heat lance shall operate with propane and compressed air in combination and be capable of achieving a temperature of heated air at the exit orifice of 9,82˚ C [1,800˚ F] and a discharge velocity of 914 m/sec. [3,000 feet per second].

CONSTRUCTION DETAILS

(A) General

The Contractor shall conduct the operation so that saw cutting of transverse joints, cleaning, and sealing are a continuous operation. Traffic shall not be allowed to knead together or damage the sawed joints. Sawed joints not sealed before traffic is allowed on the pavement shall be re-sawed, if necessary, when sawing and sealing operations resume at no additional cost to the State. Saw cutting, cleaning and sealing shall not be done within 48 hours of placement of the wear course. The Contractor shall make saw cuts no more than 40 feet apart.

(B) Saw cutting of Transverse Joints

The transverse saw cut joints shall be cut into mainline pavement directly above existing transverse cracks in the mainline pavement, but shall terminate a distance of 300 mm [1 foot] shy of the shoulder pavement unless otherwise detailed on the Plans or directed by the Engineer. Existing straight cracks shall be marked by the Contractor where the crack meets the edge of the mainline so that the crack can be located after the final bituminous course is completed. The Contractor's procedure for locating these transverse cracks shall be subject to approval of the Engineer.

(C) Cleaning Operation

Dry sawed joints shall be thoroughly cleaned with an air compressor meeting the requirements previously outlined. Cleaning shall continue until the joint is dry and all dirt, dust or deleterious matter is removed from the joint and adjacent pavement to the satisfaction of the Engineer.

Wet sawed joints and adjacent pavement shall be thoroughly cleaned with a water blast (345 kPa [50 psi] minimum) immediately after sawing to remove any sawing slurry, dirt or deleterious matter adhering to the joint walls or remaining in the joint cavity. The joints shall then be dried with an air compressor. Cleaning shall continue until the joint is dry and all dirt, dust or deleterious matter is removed to the satisfaction of the Engineer. If the air compressor produces dirt or other residue from the joint cavity, the Contractor may be required to re-clean the joint with a water blast.

Following cleaning, the sawed joints shall be dried and warmed with a hot air lance. The Contractor shall be careful not to burn the pavement surface. After the hot air lance has been used to warm and dry the joint, the backer tape shall be placed into the bottom of the joint reservoir. Under no circumstances shall more than two (2) minutes elapse between the time the hot air lance is used and the sealant is placed.

The Contractor shall be required to provide protective screening, subject to approval of the Engineer, if his cleaning operations could cause damage to or interference with traffic in adjacent lanes.

(D) Sealing Operation

The joints shall be sealed when the sealant material is at the pouring temperature recommended by the manufacturer. The Contractor shall fill the joint such that after cooling, the sealant is flush with the adjacent pavement along the edges and the center does not sag more than 3 mm [1/8 inch] below the pavement or shoulder surface. Care shall be taken in the sealing of the joints so that the joints are not overfilled and the final appearance shall present a neat fine line. The applicator wand shall be returned to the machine and the joint sealant material recirculated immediately upon completion of each joint sealing. The Engineer may require the Contractor to use a squeegee to force the sealant material into narrow joint shapes if in the opinion of the Engineer the sealant material is not flowing into the joint properly. Sand shall not be spread on the sealed joints to allow for opening to traffic. The sealant shall be tack free before opening to traffic. A given quantity of sealant material shall never be heated at the pouring temperature for more than six (6) hours and shall never be reheated.

(E) Acceptance Sampling

The Contractor shall record the temperature of the kettle and the temperature of the sealant once every hour during the actual working operations. This information is to be recorded on the forms provided by the Engineer. At the end of each day's production, the completed forms shall be presented to the Engineer, and they shall be placed in a permanent file by the Engineer. The Engineer shall continuously review the sealant temperatures. Temperatures measured more than -12˚ C [10˚ F] above the manufacturer's specified safe heating temperature shall result in the rejection of the material in use and the Contractor shall dispose of the overheated material, at his expense, in an acceptable manner.

WORKMANSHIP

Sealed joints shall be rejected if there is evidence of poor workmanship or obvious defects, such as, but not limited to the following:

(a) Sawed joint not filled completely
(b) Lack of bond to the sides of the joint
(c) Excessive debris or moisture in the joint
(d) Contamination of the sealant
(e) Sawed joint not filled flush

Rejected sealed joints shall be repaired, the sealant removed and disposed of in an appropriate manner and the joints resealed as necessary, to the Engineer's satisfaction and at no further cost to the State

13. **PAVEMENT MARKINGS**

(A) Description

1. Water-Based Traffic Paint – Where called on the plans provide placement of acrylic latex traffic marking paints for use on long lines, symbols, and parking lots shall be performed in accordance with the material and construction specifications in the latest edition of the MnDOT Standard Specifications for Construction.

2. Epoxy-Based Traffic Paint – Where called for in the plans, placement of permanent epoxy pavement markings for use on long lines, symbols, and parking lots shall be performed in accordance with the material and construction specifications in the latest edition of the MnDOT Standard Specifications for Construction. This work shall consist of furnishing and applying epoxy resin pavement markings with "beads-on" for the control and guidance of traffic in accordance with the details shown in the Plans, the attached "Specification for Epoxy Resin Pavement Markings" and the following sections.

(B) Materials

1. Water-Based Traffic Paint – Provide High Solids Water-Based Traffic Paint in accordance with MNDOT 3591. Qualified materials can be found on MNDOT's Qualified Product List on the Office of Traffic, Safety and Operations website.
2. Epoxy-Based Traffic Paint – Provide Epoxy Based Traffic Paint in accordance with MNDOT 3590. Qualified materials can be found on MNDOT's Qualified Product List on the Office of Traffic, Safety and Operations website.
3. Drop-On Glass Beads – Provide qualified Drop-On Glass Beads in accordance with MNDOT 3592. Qualified materials can be found on MNDOT Qualified Products List on the Office of Traffic, Safety and Operations website.

(C) Weather

1. Perform pavement marking operations according to the following unless approved by the Engineer:
    a. Work only during daylight hours.
    b. Work may begin when pavement and air temperature is 50 degrees Fahrenheit and rising.
    c. The road surface must be dry during the application and drying period of the paint.
    d. Work may not be applied in windy conditions that carry overspray off the work area.

(D) Pavement Preparations

1. The Roadway surface must be clean from sand, silt, and debris.

(E) Traffic Control

1. Contractor shall adhere to Traffic Control for moving operations per the MN MUTCD manual and in accordance with the "Field Manual for Temporary Traffic Control Zone Layouts", except as may be approved by the Engineer.
2. The contractor shall install, maintain, and promptly remove traffic control once track-free markings are obtained. The Contractor may request to work nights but not without approval from the Engineer. All traffic control required for night work shall be used and is incidental to the request.
3. Any tire tracks of paint from unacceptable levels of traffic control shall be removed as unacceptable work. The Contractor is responsible for all claims of damage to motor vehicles.

(F) Applicator Truck

1. Long Line Applicator Truck - The applicator truck supplied shall be of adequate size and power to apply long line pavement markings in a continuous manner for whole roadways several miles in length. The applicator truck shall be able to place double lines on the left side and a single line on the right side all in either a continuous or intermittent manner. Line placement shall be in full view of the operator and the applicator truck shall have a video guidance system for the driver. The applicator truck shall have a glass bead dispenser system capable of applying the beads at the rate specified. The applicator truck shall be able to and will air blast in front of each line application. The applicator truck shall have paint agitators, heaters and re-circulator. The applicator truck and any follow vehicles shall have rotating beacons, warning signs, arrow boards and all other devices needed to conduct operations in a safe and efficient manner. The applicator truck shall be in good working order, shall have one operator capable of making needed repairs and technical adjustments to the equipment and each crew shall have a technical expert knowledgeable in application techniques, traffic control and safety operations and regulations (this can be the same person).

2. Symbol and Parking Lot Applicator Truck – The applicator truck used in application of symbols and parking lot markings shall have rotating beacons, warnings signs, arrow boards and all other devices needed to conduct operations in a safe and efficient manner. All equipment shall be in good working order, shall have one operator capable of making needed repairs and technical adjustments to the equipment and each crew shall have a technical expert knowledgeable in application techniques, traffic control and safety operations and regulations (this can be the same person).

(G) Paint Application

1. Control – Application is over existing lines, TRPM, or painted guide lines used as a control.
2. Layout - All pavement markings shall be laid out according to the MN MUTCD. The Contractor shall notify the LGU if existing markings do not

meet the MN MUTCD. Broken line pavement markings shall use the MN MUTCD standard 10’ line on, 40’ line off cycle.

3. Rate - The paint shall be applied with a wet-film thickness of at least 20 mil, or 320 linear feet of 4” line per gallon and 100 square foot of symbols per gallon. Apply at a greater thickness based on pavement condition per LGUs approval. Glass beads shall be applied at 8 pounds per gallon of paint immediately following the application of paint.
4. Tolerance
    a. Line Work – Minimum linear pavement markings shall not be less than the specified width and shall not vary by more than ¼”. The width will not vary by a rate more than ¼”/10 ft. The broken line segments shall not vary by more than 3” and the number of broken line segments shall be between 102 and 108 per mile of marked pavement. Alignment deviations from the control guide or existing lines shall not exceed 2”. The transverse position of linear markings shall not vary more than the rate of 1”/10 ft. Pavement marking material shall not be applied over a longitudinal joint.
    b. Symbols - All symbols shall be applied with stencils or some other suitable template of appropriate size. Dimensions of symbols are available from Mn/DOT’s Office of Traffic, Safety and Operations. Any deviation of 1” from acceptable stencil size is out of tolerance

(H) Schedule

1. Contractor shall apply paint within timeframe as called out by the plans and specifications. Paint shall not be placed until 7 days after the wear course has cured or as approved by the Engineer.
2. All epoxy pavement markings shall be placed within seven (7) Working Days after a three (3) day curing period has passed after the completion of the wearing course mixture.

14. BITUMINOUS JOINT ADHESIVE

Description

This work is the application of a hot-applied modified asphalt used as an adhesive on a cold construction joint for hot mix asphalt (HMA) pavements.

Material

Provide joint adhesive as specified in Table 1.

TABLE 1. JOINT ADHESIVE SPECIFICATIONS

TEST	SPECIFICATION
Brookfield Viscosity, 204 °C [**400 °F**] ASTM D 3236	4,000-10,000 cp
Cone Penetration, 25 °C [**77 °F**] ASTM D 5329	60-100 mm
Flow, 60 °C [**140 °F**] ASTM D 5329	5 mm maximum
Resilience, 25 °C [**77 °F**] ASTM D 5329	30% minimum
Ductility, 25 °C [**77 °F**] ASTM D 113	30 cm minimum
Ductility, 4 °C [**39.2 °F**] ASTM D 113	30 cm minimum
Tensile Adhesion, 25 °C [**77 °F**] ASTM D 5329	500% minimum
Softening Point ASTM D 36	77 °C [**170 °F**] min.
Asphalt Compatibility ASTM D 5329	Pass

Construction Requirements

Weather Limitations

Apply when the pavement surface temperature is 4 °C [**40 °F**] and rising.

Equipment Requirements

Use a jacketed double boiler type melting unit, with both agitation and recirculation systems. Provide a pressure feed wand application system.

If necessary, use a hot air lance with propane and compressed air in combination, capable of heating air at the exit orifice to 982 °C [**1800 °F**] and a discharge velocity of 914 m/sec [**3000 feet per second**].

Material Handling

Submit a copy of the manufacturer's recommendations for heating and re-heating material, and for applying the joint adhesive material.

Do not remove the joint adhesive from the package until immediately before it is placed

in the melter. Use clearly marked boxes with the name of the manufacturer, the trade name of the adhesive, the manufacturer's batch and lot number, the application/pour temperature, and the safe heating temperature. Feed additional material into the melter at a rate equal to the rate of material used.

Furnish a production data sheet for each melter on the project. Include the manufacture's melting/heating rate in pounds per hour to application/pour temperature. Also include the conditions under which the rate of melting/heating sealant to application/pouring temperature was determined. Provide automatic thermostatic controls and temperature gauges to monitor the temperature of heat transfer oil in the kettle jacket. No payment will be made for material placed in excess of 110 per cent of the melters capacity, based on the manufacturer's melting rating and the actual number of hours worked.

Furnish, for Mn/DOT's use, an infrared temperature-measuring gun accurate to 1°C at 204°C [**1°F at 400°F**]. Check the pouring temperature of the adhesive, at least once per hour, at the point of discharge. Stop production if the adhesive falls below the recommended application/pour temperature. If the adhesive temperature at the point of discharge exceeds the maximum safe heating temperature, empty the melter and dispose of the adhesive in an environmentally safe method. No payment will be made for this material or its disposal.

Do not mix different manufacturer's brands or different types of adhesives.

Joint Adhesive Application

The joint face must be clean and dry. If necessary, use a heat lance. Apply the joint adhesive material over the entire face of the top lift, cold longitudinal edge of a HMA pavement where an adjacent HMA pavement will be constructed. Apply a band approximately 3 mm [**1/8"**] thick. The use of an application shoe attached to the end of application wand is recommended. Do not overlap the joint by greater than 12.5 mm [**½"**] at the top of the joint and 50 mm [**2"**] at the bottom of the joint. Apply the joint adhesive, at the point of discharge, above the recommended pour temperature of 193 °C [**380** °F] and below the safe heating temperature of 210 °C [**410 °F**]. Apply the joint adhesive immediately in front of the paving operation. If the adhesive is tracked by construction vehicles, repair the damaged area and restrict traffic from driving on the adhesive.

Quality Control

The Contractor is responsible for all the quality control (QC) sampling and testing.

Provide material certification and quality control test results for each batch of adhesive used on the project. The adhesive must meet all requirements in Table 1.

Provide 2 sample boxes for each lot of adhesive used on the project, for field sampling. Each sample box shall hold 2.3 kg [**5 pounds**] of adhesive. Provide Teflon or Silicone-lined boxes.

Quality Assurance
The City is responsible for all quality assurance (QA) sampling and testing.

Acceptance of the adhesive material is based on certification and quality control results, provided by the contractor, that adhesive meets the requirements in Table 1.

Use field samples to verify that the delivered adhesive meets the requirements. Take a sample, on the first day of production, from the application wand, during the first 20 minutes of placing adhesive from each melter on the project. Each sample shall consist of two, Teflon/Silicone lined boxes each containing 2.3 kg [**5 pounds**] of adhesive. Label the two sample boxes with the: SP number, date, time, location, adhesive temperature, manufacture, and lot number. Number each box one of two, or two of two. Take one sample for each lot of adhesive used on the project. Mn/DOT may conduct additional sampling and testing.

If a field sample fails to meet any of the requirements in Table 1, the work completed with the material from the lot that the field sample represents, shall be subject to a reduction in the Contract unit price equal to ten (10%) percent for each failing property.

SECTION 1200
Trees and Turf Restoration

Index

1. SCOPE OF WORK

This work shall consist of establishing ground cover, and installing plant stock and plant materials within the construction area or as designated by the engineer. Also included are soil preparation, fertilization, mulching, and items related to preparing the area for seed, sod, trees, shrubs, etc.

2. APPLICABLE SPECIFICATIONS

The special conditions and general conditions of the contract apply to this section. Where indicated herein MnDOT specifications, refers to the requirements of the Minnesota Dept. of Transportation standard specifications for highway construction latest edition, and any supplemental or amended additions to the latest edition of the handbook including the MnDOT Seeding Manual (2023 Edition)

3. MATERIALS

All materials used in the work shall conform to the following standards or requirements:

A. Topsoil

Topsoil shall be obtained from natural, well drained areas, and shall be friable soil, fertile, without mixtures of subsoil, or rock. Topsoil shall be free of clay, stones, wood chips, roots or debris. Topsoil shall meet the requirements of the MnDOT Section 3877.2 for Loam Topsoil Borrow and a minimum of 4" deep.

B. Sod

Sod shall be a Bluegrass blend, highland stock, densely-rooted, and locally grown. The sod shall be mowed to a height of two (2) inches before cutting and a uniform thickness of 3/4 inch or more. Sod shall be sufficiently moist to withstand rolling and handling. Sod shall be laid immediately and not be cut more than 24 hours in advance of delivery to the project site and subsequent placement. Rolling shall occur as soon as possible with a self-propelled roller weighing at least 300 lbs.

C. Hydromulching/Hydroseeding

a. Seed: The seed shall be fresh, clean, new crop seed and shall have a minimum germination rate of 85%. It shall be free of all noxious weed seeds and at least 92% free of all other weed seeds. Seed mix shall be a mixture as specified herein and sown at the rate called for in the special conditions or specified herein.

b. All areas not to be protected by placement of an erosion control blanket shall receive a mulch cover within 4 hours after being seeded.

c. Fertilizer shall be commercial formula containing at least the minimum analysis of 10% total Nitrogen, 10% phosphoric Acid, 10% water soluble Potash (10-10-10), conforming to applicable MnDOT requirements. Fertilizer shall be applied at the rate of 250 pounds per acre.

d. Hydromulch for seeded areas shall be made up of Type 5 as described in MnDOT Standard Specification 3884. Hydromulch shall be applied uniformly, per the manufacturer's recommendations.

e. Water shall be suitable for irrigation and free from ingredients harmful to plant life. Water shall be provided by Contractor and used as required.

D. Seed Mixture & Fertilizer

The following seed mixtures and fertilizers for permanent vegetation establishment shall be used unless the Special Provisions or Water Quality Improvements sections indicate differently. All mixtures shall be as specified below from the MnDOT Seeding Manual (2023 edition) for permanent vegetation establishment:

Application	MnDOT Seed Mix	MnDOT Fertilizer
General Use Boulevards	25-151	Type 3
General Stormwater	33-261	Type 4

E. Mulch Material (non Hydromulching/Hydroseeding)

Mulch material for most projects will be Type 1 or Type 5 as outlined in MnDOT Specification No. 3882. Mulch material for tree and shrub plantings will be composted wood chips or shredded bark. The mulch shall be free of inorganic debris, large sticks, leaves of deciduous trees and other foreign materials.

F. Wood Fiber Blanket

Where specified, a natural material only wood fiber mat constructed of curled wood excelsior stitched together with biodegradable thread shall be used to protect a newly seeded area.

G. Water for Irrigation

Water shall be suitable for irrigation and free from all ingredients harmful to plant life. Please see the Section 200 – Special Provisions for water use on City projects.

H. Planting Mixture or Backfill Soil

1. Planting mixture for tree pits, shrub pits, and ground cover beds shall consist of 2 parts topsoil and 1 part peat moss.

2. Each cubic yard of planting mixture shall be thoroughly mixed with 20 cups of specified fertilizer prior to backfilling.

3. Use soil excavated from planting holes and provide amendments where water-holding capacity is deficient. Remove all debris including rocks larger than 2" DIA.

I. Plants

Plants shall be nursery grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least two years unless specified otherwise. Unless specifically noted otherwise, all plants shall be exceptionally heavy, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry.

Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free of disease, insect pests, eggs, or larvae, and shall have healthy, well developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving growth.

J. Ball and Burlap

Unless specified otherwise all trees and shrubs shall be balled and burlapped when dug, and shall arrive at the job site in that condition. Balled and burlapped plants shall be dug with firm natural balls of earth of sufficient diameter to encompass the fibrous and feeding root system necessary for full recovery of the plant.

Balled and burlapped trees, shall have a root ball size of ten (10x) the caliper.

The ball shall be firm wrapped with burlap or similar material and bound with twine, cord, or secured in a wire basket.

Nursery grown material shall be pruned and thinned at the place of growth immediately prior to digging as required for packaging and safe moving. Do not remove self-locking tags during this pruning prior to delivery to site.

K. Staking and Guying Material

Since most city construction will require planting stock to be installed in the fall of the year, the city will normally not require trees to be staked and guyed. However in very soft ground, the trees will require three guys at 120 degree intervals.

L. Wood Mulch

Each tree or shrub shall be planted in such a manner that there is a three inch depression in the area disturbed by the planting process. This area shall be filled with wood mulch. The mulch shall be finely shredded bark type. The mulch shall be free of inorganic debris, large sticks, leaves of deciduous trees and other foreign materials.

M. Rock Mulch

Rock Mulch or gravel shall be "#57 Washed Stone" with acceptable pieces up to one and one half (1 1/2") inch in size. The contractor shall supply a selection of color samples of the rock proposed, to the Engineer for approval.

4. CONSTRUCTION METHODS

A. Ground Preparation

All areas to receive seed, sod, or plantings shall be brought to proper line and contours as indicated on the plans. All holes, depressions and rivulets shall be filled in to ensure no disruption of established drainage patterns. Hand raking may be required to ensure that proper elevations and an even grade is established. All rubble, sticks, branches or stones and extraneous matter over 1/2" diameter on the surface, which will interfere with the sod, shall be picked up and removed.

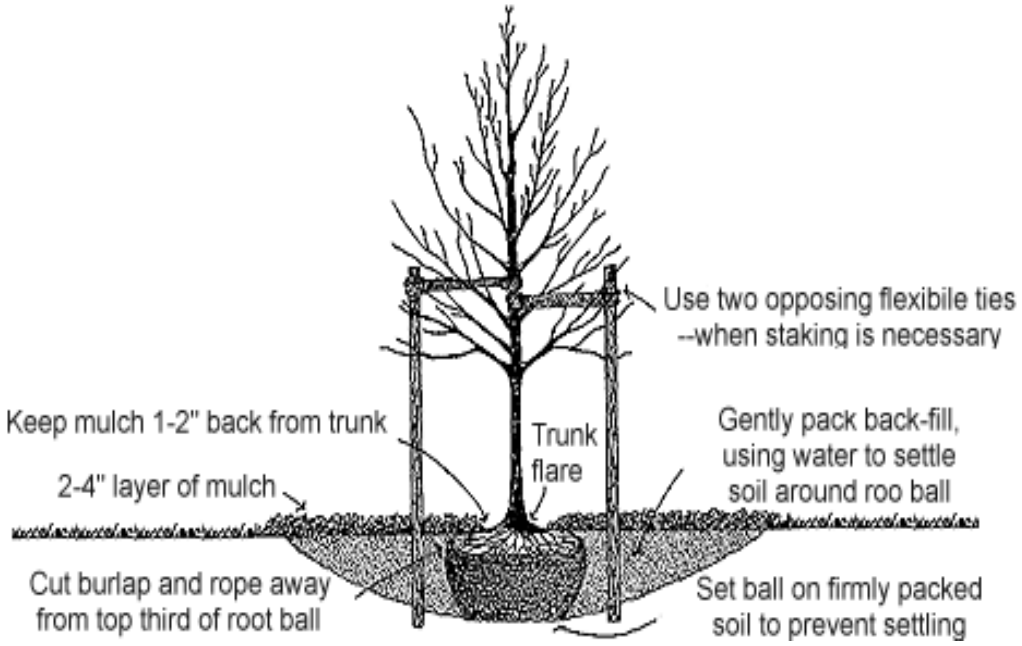
All areas to receive sod or seed shall be worked until the soil is smooth, fine, and to an even finished grade. A minimum of 4 inches of topsoil shall be applied and conditioned by dragging the area with a harrow, or similar equipment designed to level and breakup the soil.

B. Deciduous Tree Planting

All planting areas (pits or beds) shall be excavated as follows and all excavated material removed from the site:

Excavation For	Width	Depth
B & B Trees	Ball + 24"	Ball + 6"
B & B Shrubs	Ball + 12"	Ball + 6"
Canned Shrubs	Can + 12"	Can + 6"

Excavation shall not occur when the soil moisture is so great that excessive compaction will occur, or so dry that clods will not break up. The walls and bottom of all pits shall be scarified prior to placement of the plant material.



C. Installation of Plant Material

Trees shall be planted in the center of hole that is at least three times the diameter and exactly as deep as the root ball. To prevent the root ball from being planted too deeply, it should sit on solid, undisturbed ground rather than on loose soil. To plant the tree at the proper depth, make sure the upper surface of the root ball and the root collar is level with the existing grade of the area. Because of cultivation in the nursery, B&B stock may have soil piled on the top of the root collar (where the trunk flares out to the roots) causing trees to be planted too deeply. Pull this excess soil away to determine the proper depth of the planting hole. Plants shall be centered, plumb, and placed in such a manner that the root ball is not disturbed. Cut and remove all twine from the trunk and pull all burlap away from the trunk and top of the ball. Water as the backfill is added to eliminate voids. Water all

plants after mulching is completed.

Or from MNSTAC guidelines:

- Prepare the site by digging a hole 3 to 5 times larger than the root ball. Remove sod or grass. Till or break up the soil to a depth of 10 to 12 inches.
- Dig a hole in the center of this circle that is 1 foot larger in diameter than the root ball and is exactly as deep. Maintain undisturbed soil beneath the root ball to prevent the tree from settling.
- Place the tree carefully in the center of the hole and double-check that the trees root-collar (the bulge right above the root system) is just above the top of the soil.
- Backfill when the tree is standing straight up. Backfill the hole with the soil that was removed. As the back fill is added, lightly pack or water the soil to eliminate air pockets. Backfill to the height of the root ball, but do not pack soil on top of the root ball.
- Mulch with wood chips to a depth of 4 inches on top of the planting circle.
- Keep the mulch 4 inches away from the trunk to prevent fungus from growing on the tree trunk.
- Water is very important to a newly planted tree. A slow root saturating one-hour trickle once a week is a good rule of thumb for a new tree. This provides the new roots with sufficient moisture without drowning them. If it rains or is very dry the watering schedule should be adjusted accordingly.

D. Sodding

Before laying sod; excess soil, rocks, debris and other delirious material shall be removed so that the finished surface of the sodded areas will be slightly lower or flush with pavements, curbs and adjacent sodded surfaces and drainage structures. Any excavation necessary will be considered as part of the sodding operations and no separate payment will be made other than the payment for sodding.

Before laying the sod the contractor shall ensure that the area to be sodded conforms to the natural drainage pattern across the site, or when available complies with the City approved grading plan. The contractor shall further ensure that there is good soil drainage and low compaction in the top 4" (four inches) of soil.

Sod shall be laid in sections with closely abutting joints upon a pre-moistened bed. Any openings that may occur shall be neatly plugged with sod. Sod shall then be thoroughly tamped, rolled and watered.

A mixture of screened topsoil and seed shall be brushed into cracks, in the event that the sod shrinks or cracks.

In general the sod will not have to be staked or "pegged" except at the top and bottom of slopes. On slopes steeper than 4 to 1 the engineer may require the sod to be pegged or staked. If staking of the sod is not required it shall be understood

that the Contractor will be responsible for the successful establishment of the sod and will be required to replace or repair all sod that becomes displaced or damaged or eroded. There shall be no extra payment made for replacement or repair of replaced sod.

E. Installation of Wood Fiber Blanket

Wood fiber blankets shall be placed on the specified areas within 24 hours after sowing of the seed on that area. The blankets shall be rolled out or laid parallel to the direction of water flow, with the netting on top. The blankets shall be spread evenly without stretching, and so the fibers are in direct contact with the soil over the entire area. Adjacent strip edges shall be butted snugly against (or overlap) each other. Strip ends shall overlap each other at least 10 inches. All overlaps shall be made with the upgrade strip on top.

The upgrade end of each blanket strip shall be buried at least six inches in a vertical slot in the soil, with the soil being pressed firmly against the embedded blanket. All joints and outer edges of the blanket shall be stapled at 3 foot intervals or less, so as to secure the outside netting strand of each strip. Staples placed at junctures and strip ends shall have a maximum spacing of 16 inches. Staples shall be placed throughout the blanket at a maximum spacing of three feet. All staples shall be inserted flush with the ground surface.

F. Sowing Seed

All seed shall be delivered to the site in a dry condition and kept dry until used. No moldy or wet seed shall be used.

Broadcast seeding and hydroseeding shall not be done when the wind velocity exceeds 15 Miles per hour or during periods when wind gusts could affect the placement and coverage.

When seed is planted using a seed drill the equipment shall have an accurate metering device for managing seed mixture and seed used. All seed shall be planted at right angles to the surface drainage.

G. Wood Mulch

Each tree or shrub shall be planted in such a manner that there is a three-inch depression in the area disturbed by the planting process. This area shall be filled with wood mulch. The mulch shall be finely shredded bark type. The mulch shall be free of inorganic debris, large sticks, leaves of deciduous trees and other foreign materials.

Each tree or shrub shall be mulched to a depth of 4 inches on top of the planting circle. Keep the mulch 4 inches away from the trunk to prevent fungus from growing on the tree trunk.

H. Applying Mulch

Mulch shall be spread by mechanical means to provide a uniform distribution at the application rate specified. When poor mulch distribution occurs, the Contractor will be required to re-mulch areas where coverage is too light and remove the excess where coverage is too heavy as determined by the Engineer.

Seeding shall always be conducted prior to mulching. On all seeding areas within 10 feet of the roadway surfacing the Contractor shall seed and immediately firm the seedbed, mulch, and anchor the mulch as a continuous operation. Should mulch application or mulch anchoring be delayed so that the seed or mulch becomes dislodged by traffic or wind, the affected areas shall be reseeded and mulched at the Contractor's expense.

I. Disk Anchoring

Type I mulch shall be anchored with a disk, clodbuster, or other approved equipment. This equipment shall anchor the mulch by punching it into the soil to a depth of approximately 2 to 3 inches. Spacing between the blades or disks shall not exceed 8 inches. The mulch shall be anchored immediately after placement unless otherwise authorized by the Engineer.

5. APPLICATION RATES

Unless specified on the plans, or in the Special Conditions the following rates will be used for applying landscape materials:

A. Topsoil -	Shall be a minimum of 4 inches thick.
B. Sod -	Shall be cut a minimum of 3/4 inch thick and cover all areas indicated or disturbed areas.
C. Seed -	General use areas - 100 lbs per acre. Parks & Recreational areas - 150 lbs per acre Storm Water Ponds - 90 lbs per acre.
D. Hydroseeding-	Seed mixture as above. Fertilizer rate 250 lbs per acre Mulch rate - 2 ton per acre Asphalt Binder - 35 gal. Per acre Water - 850 gal. Per acre
E. Blown Compost-	135 CY/Acre, with Seed Application Rate as per above (Section 5.C)
F. Fertilizer -	Park areas - 500 lbs per acre All other areas - 250 lbs per acre
G. Mulch -	All areas 2 ton per acre
H. Wood Mulch -	Around trees and plantings 3" deep. All other uses 2" deep.
I. Rock Mulch -	All areas 3" deep

6. PLANTING SEASONS

Unless specified on the plans or in the Special Conditions the following seasons for planting and completing landscape installations shall be followed in accordance with the MnDOT Seeding Manual (2023 Edition):

- Sowing Seed - April 1st to June 1st or July 20th to September 20th
- Placing Sod – April 15th to June 10th or August 10th to November 1st
- Tree Planting - May 1st to May 30th and September 30th to October 31st.
- Shrubs & Bushes - Planting installation shall be done between April 1st and November 15th or during the season or seasons which are normal for such work as determined by weather conditions and accepted practice in the locality and subject to the Engineer's approval.

The Engineer, in extreme circumstances, and at the Contractor's written request may issue a field order amending the planting and seeding dates. Any work that is accomplished by the contractor beyond the seasons defined above shall be at his/her sole risk. The City shall not pay for re-planting or reseeding.

7. TREE PRESERVATION REQUIREMENTS

A Tree Preservation Plan shall be prepared, prior to notice to proceed, in accordance with these guidelines for each project. The preparation and implementation of such plan will be considered incidental and no additional payment will be allowed. The plan shall include the following information:

1. The name(s), telephone number(s), and address(s) of all contact persons on the project.
2. Delineation of the buildings, structures, impervious surfaces existing or to be built.
3. Delineation of all areas to be graded and limits of land disturbance.
4. Location of utility services and easements.
5. Size, species, and location of all existing trees or woodlands located within the area. They should be identified in both graphic and tabular form.
6. Identification of all significant trees and woodlands proposed for removal within the construction area. They should be identified in both graphic and tabular form.
7. Measures to protect significant trees or significant woodlands.
8. Size, species, and location of all replacement trees proposed to be planted on the property in accordance with the Tree Replacements Schedule.
9. Signature of all persons preparing the plan.

Measures to protect Significant Trees and Significant Woodlands shall include but are not limited to:

1. Installation of snow fencing or polyethylene laminate safety netting placed at the drip line or at the perimeter of the critical root zone (CRZ), whichever is greater, of significant trees and significant woodlands to be preserved. No grade change.
2. Identification of any oak trees requiring pruning between April 15 and July 1; any Oak tree so pruned shall be required to have any cut areas sealed with an appropriate tree wound sealant.
3. Installation of retaining walls or tree wells to preserve trees.
4. Placement of utilities in common trenches outside the critical root zone of Significant Trees, or use of tunneled installation.
5. Prevention of change in soil chemistry due to concrete washout and leakage or spillage of toxic materials, such as fuels or paints.
6. Use of tree root aeration, fertilization, and/or irrigation systems.
7. Transplanting of Significant Trees into a protected area for later moving into permanent sites.
8. Therapeutic pruning to be done according to International Society of Arboriculture (ISA) standards.

The areas where construction activities impact trees, that are being saved, are defined as the “tree protection zone”. Construction methods to be used in the tree protection zone and after care of trees are described on the following page.

Impacts to Tree to Minimize Damage	**Construction Activity**	**Methods / Treatments**
Root loss around trees	Stripping of soil surface before grading; clearing unwanted trees	Restrict stripping of topsoil
		Install fences to protect trees from injury
	Remove existing structure	Any woody vegetation to be removed, adjacent trees to remain, should be cut at ground level and not pulled out by equipment
	Lowering grade; scarifying preparing subgrade	Before grading, root prune tree at edge of excavation to depth required.
		Spoil beyond cut face can be removed by equipment sitting outside the dripline of the tree.
	Trenching for utilities; drains	Avoid open trenching in root area.
		Tunnel under roots, if possible. If not, within root area, dig trench by hand, bridging roots greater than 2 inches in diameter.
		Consolidate utilities into one trench
Wounding of Tree Crown	Injury from equipment	Fence trees to enclosed low branches and to protect trunk.
		Prune to minimum height required prior to construction.
		All pruning should be done by a Certified Arborist and conform to ANSI pruning standards
Injury to tree roots	Compact surface soils	Fence trees to keep traffic and storage out of protected root zone.
		Where traffic cannot be diverted, protect soil surface within protected root zone with layer of wood chips or a crossing bridge.
	Spills or waste disposal	Fence trees to exclude dumping.
		Clean up accidental spills immediately.

The tree and planting plan shall be approved by the City Forester.

8. **TREE TRIMMING**

Trimming of branches overhanging the work area shall be considered incidental to the contract as part of street and/or utility construction.

Contractor must contact City Forester prior to beginning trimming activities. **All trimming services performed shall be inspected and approved by the City Forester.** In the case of rejection, the contractor shall be required to complete the work to an acceptable level. In addition, all tree trimming must be completed in accordance with the following:

- Applicable Standards
  - Trimming shall be done in a workmanlike manner in accordance with ANSI Standards Z133.1 and A300
  - Trimming cuts shall follow the guidelines set by the International Society of Arboriculture (ISA).
  - Trimming will be under the direct supervision of an International Society of Arboriculture (ISA) Certified Arborist. Proof of the certification must be presented to The trimming shall be of an improvement nature, eliminating present conflicts while preventing future problems and maintaining an acceptable appearance. All aspects of the tree trimming shall be related to the shaping of the tree to its natural and characteristic form. No "topping" will be performed.
  - Tree trimming and root removal shall be accomplished in season by guidelines prepared by the MN/DNR for protection of individual tree species from diseases and wilt.
- The trimming shall primarily involve an operation including:
  - The removal of dead, diseased, damaged, or weakened branches;
  - The removal of watersprouts and suckers on the trunk and main scaffold branches;
  - The removal of low hanging branches and limbs including those interfering with pedestrian and street traffic;
  - The removal of old pruning stubs and recutting of shaping of old pruning wounds or injuries if necessary;
- Equipment that will damage the bark and cambium layer shall not be used on or in the tree. For example, the use of climbing spurs (hooks, irons) is not an acceptable practice for pruning operations on live trees. Sharp tools shall be used so that clean cuts will be made at all times.
- Trees susceptible to serious infectious diseases should not be pruned at the times when the pathogens causing the diseases or insect vectors are most active.
- The contractor shall arrange for the removal and disposal of all tree materials including logs, limbs, branches, leaves, chips and sawdust.
- No trees, logs, branches, etc. will be left on the public right-of-ways overnight. All trees, logs, wood, limbs, branches and brush shall be chipped or hauled within 24 hours from the time of removal.
- All tree roots affected by construction shall be sawn, prior to initiation of excavation activities

9. CLEARING & GRUBBING

All Work included in this Section shall be performed in accordance with the following paragraphs, and the provisions of all other Contract Documents.

Work covered under this Section includes providing all materials, equipment, and labor to clear and grub stumps, trees, dead falls, sticks, brush, and rocks within the clearing limits. All trees greater than 6" in diameter within the construction/clearing limits shall only be removed with prior approval of the Engineer and City Forester. Work includes but is not limited to:

1. Cutting, clearing and grubbing of selected trees, brush, and stumps.
2. Removal of stumps/large trees and excess brush to a disposal location determined by Contractor.
3. Removal of all woody debris, brush, roots, branches, dead wood, and misc. rocks that may interfere with the installation of erosion control mats.
4. Trimming of limbs or branches overhanging areas where construction activity (excavation, dump trucks, etc.) may harm existing trees.

References

1. Minnesota Department of Transportation Standard Specifications for Construction, 2020 Edition, hereafter referred to as MnDOT Standard Specifications.
2. American Society for Testing and Materials, Current Edition, hereafter referred to as ASTM.

Sequencing & Scheduling

1. Contractor shall obtain Notice to Proceed from Owner before beginning any clearing and grubbing operations.
2. Contractor and Sub-Contractor shall meet with Engineer and City Forester prior to the start of cutting and clearing to mark trees and determine limits of clearing and grubbing work.
3. Prior to disturbing existing vegetation or soils, temporary erosion control measures shall be in place.
4. Contractor shall perform the clearing and grubbing operation in accordance with the schedule of work to be submitted in accordance with Section 200 of the Specifications.

Clearing Trees for Removal

The Contractor shall remove trees and brush selected by the Engineer for proper performance of the Work as shown on the Drawings.

Trees larger than 6 inches in diameter will be marked in the field for removal by the Engineer and City Forester or their authorized representatives. All trees larger than 6

inches in diameter that are not marked in the field by the Engineer shall be left in place and protected during construction.

Trees and brush marked for removal in the clear and grub limit will be cut at ground surface grade and only those with a diameter greater that 2-inches will have roots removed, or as directed by the Engineer.

Where root severing has to occur, the root cutting will be clean cuts—not jagged or ripped. The Contractor shall use a trenching machine, vibratory knife, or rock saw to a depth of 18 in. along the outside limits of disturbance in the vicinity of existing trees prior to clearing and grubbing. When a trenching machine is used, the trench shall be immediately backfilled. All exposed roots should be covered as soon as possible.

Contractor shall dispose of the trees, in accordance with all Laws and Regulations, at an off-site location selected by Contractor.

Trimming of branches that are intruding into to work area must be overseen by a certified arborist supplied by the contractor, or their subcontractor. If an arborist is not available, the City Forester may be requested to oversee trimming activities. Contractor is responsible for clearing all limbs that may be inadvertently ripped, hit, or otherwise damaged by construction equipment at the time of clearing and grubbing for the project and in advance of other activities beginning. Refer to Section 9 above, Tree Trimming, for full list of requirements regarding trimming of trees.

Burning of trees on Site shall not be allowed.

Grubbing

Grubbing shall consist of the removal of stumps, sticks, and brush remaining after clearing operations has been completed. Contractor shall dispose of the grubbed materials, in accordance with Laws and Regulations, at an off-site location selected by Contractor.

Stumps shall be disposed of off-site at an appropriate location to be determined by the Contractor.

Grubbing shall be completed to the satisfaction of the Engineer, all woody debris such as roots, dead limbs, and branches shall be removed from the job site and completed before earthwork begins.

Grubbing and root removal shall be completed below the fill embankment area prior to embankment construction, or as directed by the Engineer.

10. **BLOWN COMPOST SEEDING**

This Work consists of all labor, materials, equipment and services required to perform blown compost seeding as specified or as directed by the Engineer. This Work shall be performed in accordance with the applicable MnDOT Standard Specifications 2575, 3876, 3890, and the following.

References

The Minnesota Department of Transportation "Standard Specifications for Construction," 2020 Edition (MnDOT Spec.), shall be used as reference.

Products

A) Seed

Seed Mix 25-151, MnDOT 3876 or approved equal

B) Compost

1. Compost used for erosion control shall consist of a weed free compost as per MnDOT 3890, Grade 2 derived from a well-decomposed source of leaf, grass and wood feedstock. The compost shall be produced using an aerobic composting process meeting CFR 503 regulations, including time and temperature data indicating effective weed seed, pathogen and insect larvae kill:

   i. Square cut wood chips (i.e. from a wood chipper), municipal solid waste compost, or Class B biosolids will not be allowed.
   ii. The compost shall be free of any refuse, contaminants or other materials toxic to plant growth. Compost shall possess no objectionable odors. Compost shall not resemble the raw material from which it was derived and non-composted products will not be accepted.
   iii. Physical requirements for new turf areas:

      1. Particle size: 100 percent passing through a 1/2 inch sieve in accordance with TMECC 02.02-B "Sample sieve for aggregate size classification."
      2. Soluble Salt: 3.0 max. mmhos.
      3. pH: 5.5 to 8.0.
      4. Maturity: Compost shall be tested and must be classified as "finished" according to the Solvita compost maturity test, or an approved equal.
      5. Moisture Content: 35 to 55 percent.
      6. Material shall be relatively free (<1 percent by dry weight) of inert or foreign man made material.

7. A sample shall be submitted to the Engineer for approval prior to being used and must comply with all local, state and federal regulations, along with a certificate of compliance. Test results using the US Composting Council Seal of Testing Assurance Program is acceptable.

C) Fertilizer

1. In accordance with soil test recommendations. If soil tests are not done the installer shall use MnDOT Fertilizer Type 2.
2. Post-emergent fertilizer MnDOT Fertilizer Type 2.
3. In-season fertilizer shall have analysis approximately 25-0-3, and the nitrogen component shall be at least 50 percent SCU or other slow release form unless stated differently by a soil fertility analysis.

Execution

A) Equipment

1. Pneumatic Blower – The pneumatic blower unit shall be capable of combining seed and compost and uniformly applying the compost soil to the depth required. The blower unit must have a dust suppressor and a seed injector system capable of evenly distributing the specified seed mix.

Construction Requirements

A) Contractor performing seeding and/or erosion control shall be certified by the University of Minnesota Erosion and Stormwater Management Certification Program. Other certification may be accepted upon approval by the Engineer.

B) The seeding contractor shall inspect the seed bed to be assured that it is in acceptable condition for seeding. Any final preparations required shall be performed by this contractor. General Contractor is responsible for getting final grade to 1 inch below finished elevations unless a deeper compost/seed application is indicated by the Landscape Architect.

C) Seed shall be sown by use of pneumatic blower combining seed and approved compost.

D) Seed shall be blended evenly throughout the compost layer and calibrated to the amount indicated.

E) In level seeding areas and slopes up to 3:1, scarify slopes to a depth of 1 inch and remove large clods, rocks, stumps, roots larger than 1/2 inch diameter, and any other debris on areas to be established. Pre-plant fertilizer shall be incorporated during the soil preparation.

F) Compost and shall be uniformly applied to a depth of 1 inch using an approved spreader unit. An application rate of approximately 135 CY per acre is required to yield 1 inch of compost depth. Apply compost layer approximately 3 feet beyond the top of all slopes or overlap into existing vegetation. The compost/seed mixture shall not be compacted or rolled.

G) Post-emergent fertilizer shall be applied 21 days after germination. Rate shall be calculated to apply 3/4# N per 1,000 sq. ft., unless stated differently by soil tests.

H) Seeding after November 1 will be classified as a dormant seeding and seeding rate will be increased by 10 percent. Areas failing to successfully seed in fall shall be seeded in early spring of the following year.

I) Contractor shall supply ample evidence showing this amount of material has been effectively placed (i.e., truck load tickets).

11. MAINTENANCE AND WATERING

Maintenance of restored turf areas and tree plantings shall begin immediately after installation.

The Contractor is responsible for watering newly placed seed for a minimum of 30 days or until turf has reached a uniform minimum height of 2", whichever is longer. 90% of the restored area must reach the specified height to be considered uniform growth.

The Contractor is responsible for watering newly planted trees for a minimum of 30 days following installation in the amount and frequency recommended by the tree supplier based on the tree's size, species, and planting environment.

This period of 30 days or until turf is uniformly established shall be considered the Contractors Maintenance Period. Watering shall be considered incidental to the Contract throughout this maintenance period.

Additions and Exceptions:

- **Contractor must obtain written approval from Engineer prior to installing any seed outside of the specified planting season.**
- Frequency of watering throughout the contractor maintenance period shall be determined by the Engineer based on weather, soil, and other contributing factors. At no time should watering during the contractor maintenance period be less frequent than every other day without a rainfall of 0.5" or greater between water applications.
- Areas that are dormant seeded shall be reseeded in the Spring of the following year if germination of at least 90 percent is not achieved.
- All seed that is installed between June 11th and August 14th shall be subject to an increased Contractor Maintenance Period of 60 days. Watering shall be completed daily unless otherwise directed by engineer for seed planted during this timeframe.
- The Contractor Maintenance Period shall carry over into the next growing season in the event that seeding is performed late in the fall or in the event that dormant seeding is used.

12. **WARRANTY**

All plants, trees, ground cover, and sod planted under this contract shall be unconditionally warranted for one year or one full growing season, whichever is longer, from the date of final acceptance. Any delay in completing of landscape operations that extends the planting into more than one season shall extend the warranty period correspondingly.

During the warranty period the contractor shall at the earliest possible time replace, plant material of the same species, size, quality and grade as that of the original material plants which have lost 25% or more of their branches. Seeded or sodded areas showing deterioration, bare spots of one (1) square foot or greater shall be corrected, and thin areas shall be repaired with like material during the warranty period.

SECTION 1500
Erosion & Sediment Control

Index

1. SCOPE OF WORK

It is recognized that construction activities disturb the existing ground, and present a possibility of soil erosion, soil sedimentation, and transfer of soil materials off the construction site. It is intended to identify various measures and materials herein to be used in erosion control. Some measures of erosion control have been identified and shown on the plans and unit prices requested in the bid proposal. However, the weather encountered during construction and actual working conditions during the time of construction may require additional erosion control measures to be taken as described herein.

2. NPDES PERMIT/ADHERENCE TO SWPPP

Upon award of this contract, the General Contractor will be required to complete the application for the National Pollution Discharge Elimination System (NPDES) General Storm-water Permit for Construction Activity administered by the Minnesota Pollution Control Agency (MPCA). A component of this permit includes the implementation of a Storm-Water Pollution Prevention Plan (SWPPP). The City has incorporated the SWPPP into the construction plans.

The contractor, as a co-signatory of the permit, will be responsible for complying with the conditions of the permit. Except where indicated with separate bid items, all work and associated costs incurred by the contractor for implementing the permit conditions and supplementing BMPs in the field to respond to changing conditions or additional needs that arise throughout the course of the project are included in the Contract line item "Erosion & Sediment Control".

The NPDES permit requires that regular inspections of erosion/sediment control devices are performed. The Contractor will be required to assign a member of their staff to perform and keep an ongoing log of all these inspections. Inspections are required on a weekly basis during dry conditions, and within 24 hours after a rainfall event of more than ½". To determine whether an inspection is required, the contractor shall install, monitor, and maintain a rain gauge on/near the construction site. Copies of all inspection reports must be submitted to the City Engineer on a monthly basis at minimum.
Any required repairs or maintenance of erosion/sediment control devices shall be done within 48 hours of the inspection unless otherwise outlined in the SWPPP. If repairs are not made within the specified time, the City reserves the right to hire an independent party to complete this work and charge the contractor for these expenses.

3. **SILT FENCE**

Silt fencing shall be installed in accordance with manufacturers recommended practices. A silt trench 4 inches to 6 inches deep shall be dug and the bottom of the silt fabric installed in the trench and backfilled with excavated soil.

4. **EROSION CONTROL BLANKET**

Where specified, a natural material only wood fiber mat constructed of curled wood excelsior stitched together with biodegradable thread shall be used to protect a newly seeded area.

The blanket shall be installed in accordance with the manufacturers recommended installation procedure and stapled to the ground with the recommended amount of staples for the slope or ditch condition.

5. **STORM SEWER INLET PROTECTION**

All existing and newly constructed storm sewer inlets shall be protected from the deposition of sediment. Shop drawings of all devices that the contractor proposes to use to protect inlets shall be submitted for review by the Engineer.

6. **ROCK CONSTRUCTION EXIT**

The contractor shall stop mud, and soil from traveling off the construction site and being deposited on adjacent streets where it can be washed into storm sewers, ditches and streams. To aid in this effort he shall construct a rock construction exit at each exit from the construction site, or as otherwise shown on the Plans. The exit shall be constructed as shown on the detail at the end of this section. These exits shall be maintained and if they allow mud to track off the site they shall be rebuilt, or cleaned.

If a rock construction exit is not feasible or becomes deficient, the Contractor will be required to regularly sweep and clean tracking from the connecting hard-surface streets. If the Contractor does not keep up with this maintenance, the City will clean the streets and charge the Contractor for all costs incurred.

7. **FILTER BLANKET MATERIAL**

Filter blanket material shall conform to the requirements of MnDOT Standard Plate No. 3133A and MnDOT Specification 3601 for filter layer material.

8. **RIP RAP**

Random riprap shall conform to the appropriate gradation of MnDOT Specification 3601 for the appropriate class of material as designated on the Drawings.

Concrete grout for grouted riprap shall conform to MnDOT Specifications 2461 and 2511.

The grouted riprap shall be placed in conformance with MnDOT Specifications 2461 and 2511 as designated by MnDOT Standard Plate No. 3133A. Size of material and thickness of layer is to be constructed as noted on the Drawings.

Salvaging of existing rip rap for reuse within the project shall include removing all deleterious materials and soils from the salvaged rip rap so as to return it to as close a state as possible as new rip rap. Cleaning rip rap of such deleterious materials shall be incidental to the unit item for Salvaging Random Rip Rap.

9. **REMOVAL**

Removal of all erosion controls shall occur promptly upon direction of the City Engineer.

10. **PROTECTION OF PROPERTY & UTILITIES**

The Contractor shall be responsible for the placement, implementation and maintenance of all erosion and sediment control devices, methods, and procedures. The contractor shall manage and marshal such resources as detailed by the Storm Water Pollution Prevention Plan and shall implement such additional measures and procedures as are necessary to protect the project site and any other utilities or properties as may be affected by erosion and sediment runoff form the project site. The contractor shall be responsible for any clean-up, and for restitution costs resulting from his/her failure to control said runoff and erosion.

11. **DUST CONTROL**

The Contractor shall be responsible for watering the site as needed to limit the nuisance of airborne dust resulting from construction activity at the direction of the Engineer during all phases of the project. Watering may be required multiple times daily during dry conditions. Watering for dust control shall be considered incidental to the bid item provided for erosion control.