

**CITY OF FARGO SPECIFICATIONS
SANITARY SEWERS**

**PART 1
DESCRIPTION OF WORK**

The work to be done under this section of the Specifications and the accompanying plans consists of the furnishing of all labor, material, accessories and equipment necessary to construct sewers in the City of Fargo. The work includes excavation, removal and replacement of paving where encountered; furnishing, laying and jointing pipe; making connections to existing sewers and manholes as necessary; constructing new manholes; protecting existing utilities and public and private property; backfilling trenches; bypass pumping and other work as may be necessary in order that the work may be completed in accordance with these Specifications and the plans accompanying them.

PART 2
MATERIAL

2.1. SOLID WALL POLYVINYLCHLORIDE (PVC) SEWER PIPE

2.1.1. MATERIAL

The material shall conform to “Standard Specifications for Rigid Polyvinyl Chloride Compounds”, ASTM D-1784, Class 12454-B or 12454-C or 12364-C. The pipe shall be produced using a continuous extrusion process employing a prime grade of white unplasticized polyvinyl chloride.

2.1.2. PIPE MANUFACTURE

The PVC sewer pipe and fittings 8” in diameter shall meet ASTM D3034, SDR 26 requirements; 10” to 15” in diameter shall meet the requirements of ASTM D3034 SDR 35 minimum; PVC pipe and fittings larger than 15 inches in diameter shall meet the requirements of ASTM F 679, wall thickness T-1, pipe stiffness of 46 psi. When pipe is installed at depths of 18 feet or more, SDR 26 with a pipe stiffness of 115 psi shall be used.

2.1.3. JOINTING

The joint system shall be an integral bell gasketed joint that forms a watertight seal in accordance with ASTM Specification D3212 and F477.

2.1.4. SERVICES

Services shall be made by the use of in-line wyes or, with the Engineer’s approval, saddle wyes may be used. Saddle wyes shall be PVC with a rubber gasket and shall be installed as per the manufacturer’s recommendation and attached with two stainless steel straps.

2.2. CLOSED PROFILE POLYVINYL CHLORIDE SEWER PIPE

2.2.1. MATERIAL

The pipe and fittings be made of PVC plastic meeting the requirements of ASTM D-1784 having a minimum cell classification of 12364 -A.

2.2.2. MANUFACTURE

The PVC profile wall pipe and fittings shall meet the requirements of ASTM F 794 latest edition and have a minimum pipe stiffness of 46 psi. Closed cell PVC pipe will only be allowed in 21-inch diameter or larger.

2.2.3. JOINTING

The joint system shall be of the bell and spigot type with a gasket that meets the requirement of ASTM D3212 & F477 to form a watertight seal. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe. Field cuts and field installed gaskets shall be done in accordance with the manufacturer's instructions and his recommended equipment and materials.

2.2.4. SERVICE CONNECTIONS

Connections to the pipe shall be made with GPK in-line fittings, GPK saddle wyes, or "Inserta-Tee" as manufactured by Fowler Manufacturing or approved equal. Installation shall be as per the manufacturer's recommendation. Exposed channels in the PVC profile pipe shall be sealed with 3M industrial sealant 612, 3M 605 urethane adhesive, or Hilti C-100 sealant.

2.2.5. APPROVED MANUFACTURERS

Vylon High Capacity and Diamond Plastics Pro-21 closed profile PVC pipes are approved products.

2.3. DUCTILE IRON PIPE

2.3.1. MATERIAL

Ductile iron pipe shall meet the requirements of ASTM A-746 Standards.

2.3.2. MANUFACTURE

The ductile iron pipe will be push-on joint type and shall be coated on the exterior with bituminous and on the interior with a factory applied minimum nominal thickness of 40 mil polyethylene lining. All ductile iron pipe shall be encased in 8-mil polyethylene plastic film or 4-mil cross-woven polyethylene plastic film. Pipe shall be Class 53 and ductile pipe will only be used with the Engineer's prior approval.

2.3.3. JOINTING

Joints shall meet the requirements of ANSI/AWWA C 111/A21.11.

2.3.4. SERVICES

Services shall be made by the use of in-line wyes or, with the Engineer's approval, saddle wyes may be used. Saddle wyes shall be PVC with a rubber gasket and shall be installed as per the manufacturer's recommendation and attached with two stainless steel straps.

2.4. REINFORCED CONCRETE PIPE

2.4.1. MATERIAL

Material, manufacture and testing of reinforced concrete pipe shall comply with ASTM C76 and to Section 1500-2.1 of these Specifications.

2.4.2. MANUFACTURE

The class and wall type will be as indicated on the plan sheets and shall meet the testing requirements as set forth in the latest edition of ASTM C76. All interior surfaces shall be spray coated with a 14-20 mil thick coating of Coal Tar Epoxy. Special coatings, if required, shall be as specified in the special instructions on the particular project. Concrete pipe will only be allowed when directly specified on the plans.

2.4.3. *PVC SHEET LINER*

1. General

All work for and in connection with the installation of the lining in concrete pipe, and the field sealing and welding of joints, shall be done in strict conformity with all applicable specifications, instructions, and recommendations of the lining manufacturer.

The manufacturer of the lining shall furnish an affidavit attesting to the successful use of its material as a lining for sewer pipes for a minimum period of ten years in sewage conditions recognized as corrosive or otherwise detrimental to concrete.

2. Material

2.1. Liner shall be Ameron T-Lock as manufactured by Ameron Protective Linings Division or approved equal.

2.2. Composition

The liner must be continuous and free of pinholes, both across the joints and in the liner itself. The material used in the liner and in all joint, corner, and welding strips shall be a combination of poly (vinyl chloride) resin, pigments, and plasticizers, specially compounded to remain flexible. Poly (vinyl chloride) resin shall constitute not less than 99 percent, by weight, of the resin used in the formulation. Copolymer resins will not be permitted.

2.3. Physical Properties

2.3.1. All plastic liner plate sheets, joint, corner, and welding strips shall have the following physical properties when tested at 77°F+/-5°.

Property	Initial	(Par.2.4)
Tensile strength	2200 psi min.	2100 psi min.
Elongation at break	200% min.	200% min.
Shore durometer, Type D	1 sec. 50 - 60 10 sec. 35 - 50	+/- 5 with respect to +/- 5 initial test result
Weight change		+/- 1.5

2.3.2. Tensile specimens shall be prepared and tested in accordance with ASTM D412 using die B.

2.3.3. Liner plate locking extensions embedded in concrete shall withstand a test pull of at least 100 pounds per linear inch, applied perpendicularly to the concrete surface for a period of one minute, without rupture of the locking extensions or withdrawal from embedment. This test shall be made at a temperature of 70 - 80° F inclusive.

2.3.4. The lining shall have good impact resistance, shall be flexible, and shall have an elongation sufficient to bridge up to 3-inch settling cracks, which may occur in the pipe or in the joint after installation, without damage to the lining.

2.3.5. The lining shall be repairable at any time during the life of the pipe or structure.

2.4. Chemical resistance

After conditioning to constant weight at 110° F, tensile specimens and weight change specimens shall be exposed to the following solutions for a period of 112 days at 77° F +/- 5°.

At 28-day intervals, tensile specimens and weight change specimens shall be removed from each of the chemical solutions and tested in accordance with

Paragraph 2.3.2. If any specimen fails to meet the 112-day requirements before completion of the 112-day exposure, the material will be subject to rejection.

Chemical Solution	Concentration
Sulfuric acid	20% *
Sodium hydroxide	5%
Ammonium hydroxide	5% *
Nitric acid	1% *
Ferric chloride	1%
Sodium hypochlorite	1%
Soap	0.1%
Detergent (linear alkyl benzyl sulfonate or (LAS)	0.1%
Bacteriological	BOD not less than 700 ppm.

* Volumetric percentages of concentrated C.P. grade reagents.

2.5. Pipe-size sheets and accessories

2.5.1. Pipe linings shall be a minimum of 0.065 inches in thickness and supplied as pipe-size sheets, fabricated by shop-welding the basic-size sheets together. Shop welds shall be made by lapping sheets a minimum of 2 inch and applying heat and pressure to the lap to produce a continuous welded joint.

Tensile strength measured across shop-welded joints measured in accordance with ASTM D412 shall be at least 2000 psi.

2.5.2. Sheets shall be supplied in prefabricated, pipe-sized tubular-shaped sheets, ready to lower onto the inner pipe forms. Transverse flaps shall be provided at the ends of sheets for pipe.

2.5.3. Welding strips Joint strips shall be sized per manufacturer's recommendations.

2.5.4. Prior to preparing the sheets for shipment, they shall be tested for pinholes using an electrical spark tester set between 18,000 – 22,000 volts. Any holes shall be repaired and retested.

3. Installation of lining

3.1. General

3.1.1. Lining shall be cast integral with the pipe at the pipe manufacturer's facility. Installation of the lining, including preheating of sheets in cold weather and the welding of all joints, shall be done in accordance with the recommendations of the lining manufacturer.

3.1.2. Coverage of the lining shall not be less than the minimum shown on the plans.

3.1.3. All nail and tie holes and all cut, torn, and seriously abraded areas in the lining shall be patched. Patches made entirely with the welding strip shall be fused to the liner over the entire patch area. Larger patches may consist of smooth liner sheet applied over the damaged area with adhesive. All edges must be covered with welding strip fused to the patch and the sound lining adjoining the damaged area.

3.1.4. Care shall be exercised in handling, transporting, and placing lined pipe to prevent damage to the lining. No interior hooks or slings shall be used in lifting pipe. All handling operations shall be done with an exterior sling or with a suitable fork lift.

3.1.5. On pipe having 360° liner coverage, the longitudinal edges of the sheet shall be butt welded. When pipe tubes are furnished, these are shop-welded joints made in accordance with 2.6.1.

3.1.6. No pipe with damaged lining will be accepted until the damage has been repaired to the satisfaction of the Engineer.

3.2. Field joints in lining for concrete pipe

3.2.1. No lining joint shall be made until after the trench has been back-filled and consolidated. Pipe joints must be dry before lining joints are made.

3.2.2. Field joints in the lining at pipe joints shall be made according for liner manufacturer recommendations.

3.2.3. All welding of joints is to be in strict conformance with the specifications and instructions of the lining manufacturer.

3.3. Testing and repairing damaged surfaces

3.3.1. After the pipe is installed in the trench, all surfaces covered with lining, including welds, shall be tested with an electrical holiday detector as approved by the lining manufacturer with the instrument set between 18,000 – 22,000 volts.

All welds shall be physically tested by a nondestructive probing method. All patches over holes, or repairs to the liner wherever damage has occurred, shall be accomplished in accordance with Paragraph 3.1.8.

3.3.2. Each transverse welding strip which extends to a lower edge of the liner will be tested by the purchasing agency. The welding strips shall extend 2 inches below the liner to provide a tab. A 10-pound pull will be applied to each tab. The force will be applied normal to the face of the structure by means of a spring balance. Liner adjoining the

welding strip will be held against the concrete during application of the force. The 10-pound pull will be maintained if a weld failure develops, until no further separation occurs. Defective welds will be retested after repairs have been made. Tabs shall be trimmed away neatly by the installer of the liner after the welding strip has passed inspection. Inspection shall be made within 2 days after joint has been completed in order to prevent tearing the projecting weld strip and consequent damage to the liner from equipment and materials used in or taken through the work.

A. Welders/Fusers

All welders/fusers for the PVC liner shall be precertified by Ameron or approved manufacturer prior to the start of work. All joints shall be numbered and initialed by the welder. The inspector will record on a daily basis the number of the joint and the welder at the end of each working day.

B. Factory Representative

The Contractor will make provisions to have a factory representative knowledgeable in joint fusing present at least one day during the first week of welding, and again at the time of the final inspection, to aid both the Contractor and the City in the detection of faulty welds, and to ensure the quality of the welds.

C. Final Inspection

The Contractor shall provide adequate ventilation, lighting and equipment (to include a cart/skateboard and tools) to allow for final inspection of all welds prior to putting the line in service.

2.4.4. JOINTING

Joints shall be of the bell and spigot type with a rubber “O”-ring type gasket that forms a watertight seal. Joints shall meet the requirements of ASTM C 443 OR C 361.

2.4.5. SERVICES

Services shall be made with “Inserta-Tee” as manufactured by Fowler Manufacturing Company or approved equal. The service hole in the pipe shall be cored to the recommended diameter and the tee installed as per the manufacturer’s recommendation.

2.5. CENTRIFUGALLY CAST FIBERGLASS-REINFORCED POLYMER MORTAR (CCFRPM) PIPE*2.5.1. MATERIAL*

This pipe shall have a stiffness of 72 psi and a pressure rating of 150 psi. It must meet AWWA C905 specifications. Each pipe shall be hydrostatically tested at the factory to two times the working pressure. The resin must meet the requirements of ASTM D3754 with the joints meeting ASTM D4161.

Installed pipe shall be pressure and leakage tested at 125 psi for a minimum of 30 minutes. Pressure and leakage shall be in accordance Section 1300 of these Specifications.

2.5.2. MANUFACTURE

Approved is HOBAS Pipe USA or approved equal.

2.5.3. INFILTRATION TESTING

Infiltration testing shall be performed on the new sanitary sewer line. The allowable limits of infiltration shall not exceed a rate of 100 gallons per inch of internal pipe diameter per mile per 24 hours with no allowance for manholes. Duration of all tests shall be a minimum of 2 hours. No more than 1500 feet of sewer shall be tested at any one time. Prior to testing for infiltration the system shall be pumped out so that normal infiltration conditions exist at the time of testing. The amounts of infiltration shall be determined by pumping the infiltrated water into calibrated drums, or by other approved methods.

2.5.4. SERVICES

Services shall be made with "Inserta-Tee" as manufactured by Fowler Manufacturing Company or approved equal. The service hole in the pipe shall be cored to the recommended diameter and the tee installed as per the manufacturer's recommendation.

2.6. MANHOLES

2.6.1. MATERIAL

Manholes shall meet the requirements of ASTM C478 and shall be furnished with an approved casting (Neenah R-1733 or EJ1205Z or approved equal) with a self-sealing lid, concealed pick bar, and the word "SANITARY" (or words "SANITARY SEWER") cast into the center of the lid in letters at least one inch high.

2.6.2. MANUFACTURE

The manholes shall be constructed in accordance with the detail drawings included as part of these Specifications. The manhole shall be furnished with an eccentric-type cone section. All manhole bases shall be monolithic or, if approved by the Engineer, a precast base or mini-tee manhole may be used. The main sewer shall be carried through manholes by split pipe whenever practicable. The concrete manhole shelves shall slope from the top edges of the invert at a rate of 2" per foot. When split pipe is not possible due to breaks in grade or elevation, the sewer invert shall be made of concrete. The shape of the invert shall conform exactly to the lower 1/3 of the pipe it connects and be left smooth and clean. Side branch inverts shall be constructed with as large radius of curvature as possible.

2.6.3. JOINTS

Connections to sewer pipe larger than 36" diameter shall be made with a resilient watertight seal integrally cast as part of the manhole. Smaller pipes may be connected to the manhole similarly, or with a resilient watertight pipe-to-manhole connector having all stainless steel components with no welds nor rivets. All resilient seals shall meet or exceed ASTM C-923 and be fastened to the sewer pipe by means of stainless steel bands. Joints between manhole sections shall be sealed with a butyl rubber gasket. The joint shall meet the requirements of ASTM 443 for pipe joints. PVC pipe connections to existing manholes shall be core-drilled and booted.

2.6.4. MANHOLE ADJUSTING RINGS

Manhole adjusting rings shall be as specified in Section 1500 of these Specifications.

2.6.5. *LIFT HOLES*

Lift holes shall be manufactured to provide a watertight seal.

2.6.6. *MANHOLE SEALS*

The Contractor shall install watertight manhole seals on the sanitary manholes as designated in the plans. The Contractor shall have the option of using either internal or external manhole seals except where a type of seal is specifically designated by the Engineer. These seals shall be installed as per the manufacturer's recommendations. Extensions will be paid for under the bid item for "Install Watertight Manhole Seal Extension", and shall be able to cover a minimum adjusting ring/chimney height of 7 to 10 inches.

The Contractor shall verify the dimensions and determine which type of seal should be utilized and the number of extensions that will be required. If an internal seal is used, the sealing surface shall be clean and free of loose material and excessive voids. If the surface has minor irregularities, a bead of butyl-rubber caulking shall be applied to fill these voids. If the sealing surface is rough or has excessive voids, a low-shrink mortar sealing surface shall be installed. Any flanges or protrusions on the interior to the casting shall be removed and ground smooth.

If an external seal is used, the Contractor shall install the seal as per the manufacturer's recommendation. The exterior of the manhole and casting shall be wire-brushed clean and leveled and smoothed with a low-shrink mortar surface if necessary.

A. INTERNAL SEAL

Internal seal shall be as manufactured by Cretex Specialty Products, NPC Inc., Strike Products Polyethylene I/I Barrier or approved equal. The sealing bands and all mounting hardware (screws, bolts, nuts, etc.) shall be type 304 stainless steel. Any casting modifications, mortar leveling, casting adjustment, concrete removal and replacement (due to offsets, etc.) shall be incidental to this bid item. If the I/I Polyethylene I/I Barrier is used, it shall be installed as per the manufacturers recommendation and the bottom surface of the I/I Barrier shall be sealed to the manhole cone top surface using a butyl sealant.

B. EXTERNAL SEAL

External seal shall be as manufactured by Cretex Specialty Products, NPC, Inc., WrapidSeal heat shrinkable sleeve system as manufactured by Conusa – CPS or approved equal. All concrete removal and replacement, excavation, backfill and casting adjustments shall be incidental to the bid item.

2.7. SANITARY SEWER FORCE MAIN TRACER WIRE

The tracer wire shall be in accordance with the requirements of Section 1300 of these Specifications, except it shall be green in color. The pedestal shall be a Rhino Triview Flex Pedestal complete with 6' long "U" channel, post or approved equal.

2.8. INSULATION

Insulation, where required by the Engineer, shall be extruded polystyrene (rigid), 2" thick unless noted otherwise, and shall be provided in 4' x 8' sheets, cut smaller where necessary.

PART 3
CONSTRUCTION

3.1. GENERAL

Excavation, trenching and backfilling shall be done in accordance with Section #1000 of these Specifications. Pipe and fittings shall be handled and laid in accordance with the manufacturer's or industry standards. Pipe, fittings and manholes shall be laid in the location shown on the plans, the exact location being designated by the Engineer. The bell and spigot shall be wiped clean and sufficient lubrication placed on the gasket and spigot end before the pipe is fully pushed into the bell. Field cut spigot ends shall be beveled prior to being pushed into the bell. Every part of the pipe shall be bedded uniformly throughout its length. Pipe shall be laid upgrade with the spigot end pointing in the direction of flow. All sewers must be kept thoroughly clean. When the trench is left at night or the pipe laying stopped, the upper end of the pipe must be closed with an end board or cap to prevent dirt and sand from entering the pipe.

3.2. ALIGNMENT

The Engineering Department will provide line and grade for all sanitary sewer pipes. Grade and alignment shall be maintained by the use of a line parallel to the grade and line of the sewer. This line is to be supported above the ground on batter boards spaced 50 feet or less apart and rigidly anchored to and supported by steel post driven into the ground.

Not less than 3 batter boards shall be maintained at all times. The Engineer shall be immediately notified of any misalignment of the batter boards set in accordance with the grade and alignment of the tacked offset stakes provided.

Electronic grade control is allowed, however the Contractor will be required to install and maintain batter boards and periodically check the line & grade from the offset stakes provided. In no instance will the Contractor be allowed to change the alignment or grade without the permission of the Engineer.

3.3. INSTALLATION OF WYE BRANCHES

Wye branches shall be located at the points designated by the Engineer. The Contractor shall ensure that the wye branches have been marked in advance of the construction of the sewer. If the locations have not been marked, the Contractor shall stop sewer construction until such time as the location (s) has been obtained. Wye branches shall not be installed causing the location of the service to be on the lower 1/2 of the sewer main. The location of the wye branch with reference to the nearest down-stream manhole shall be accurately determined and recorded together with the direction it faces.

3.4. INSTALLATION OF RISERS

If the sewer depth exceeds 12 feet in depth, risers shall be installed. This shall be done by installing a wye in the main sewer and placing a length of pipe sufficiently long to reach within 10' of the sidewalk grade. On risers of 5 feet or greater, 1 1/4" crushed rock shall be used to encase the wye and support the vertical bend outside of the wye. Work shall conform to the detailed drawings for sewer service connections and placed at the location shown on the plans or as ordered by the Engineer.

3.5. INSTALLATION OF SERVICE CONNECTIONS

Service connections on new construction shall have the risers laid on a slope not to exceed 2 feet vertically to 1 foot horizontally. The pipe shall be laid so that it has solid bearing on undisturbed earth. The service pipe shall make a horizontal angle with the wye branch or slant that ensures a proper connection is made. The first length of pipe shall not make a total angle with the branch or slant greater than 4 inches in two feet, and the wye branch or slant shall be installed in such a manner as to fit the alignment of the branch service line as closely as possible. On all new construction sewer services shall be installed as the sewer main is installed so that the backfill of the sewer main trench and the sewer service trench will be done in one continuous operation.

3.6. TRANSFER SEWER SERVICE

When it is indicated on the plans to transfer existing service connections to the new sewer and this item is included as a bid item, it shall be done in accordance with Section 1400 of these Specifications.

3.7. SEWER SERVICE REPAIRS

Repairs shall be in accordance with Section 1400 of these Specifications.

3.8. MANHOLES

The manhole base shall be set at the proper grade and alignment to provide a smooth transition from the incoming pipe (s) to the outgoing pipe. Manhole bases shall be bedded in 6" of 1 1/4" crushed rock. The area that is over-excavated adjacent to the manhole base and under the pipe shall be backfilled with 1 1/4" crushed rock to prevent settlement and provide for support for the pipe from the manhole edge to the regular trench excavation. Care shall be taken that the connection between the manhole and the pipe is watertight and the invert is smooth and continuous as it enters and exits the manhole.

3.9. CASTING TO GRADE (BOULEVARD)

This bid item shall be in accordance with Section 1500 of these Specifications, except that all joints between the rings and the manhole, the rings and the frame, and in-between rings shall be constructed water-tight by a method recommended by the ring manufacturer. In lieu of the use of a sealant, an external mechanical frame-chimney seal may be used for a watertight installation.

3.10. DEFLECTION TEST

Deflection tests shall be performed by the Contractor on all flexible conduit sewers. Deflection tests shall be conducted after the final backfill has been in place at least 30 days. Deflection tests shall be made using a Go/No-Go device or other approved method. The Contractor shall provide the appropriate equipment to test the sewer main. The diameter of the Go/ No-Go device or rigid mandrel shall be 95% of the undeflected inside diameter of the flexible pipe. The mandrel design shall have nine or more "legs". The Contractor is required to install and bed the pipe in such a manner as to limit the diametric deflection to less than 5%. All pipes exceeding 5% deflection shall be re-laid or replaced by the Contractor at his expense and at no additional cost to the owner.

3.11. LOW PRESSURE AIR TESTING

Upon completion of the sewer, before house services are connected to the pipe line, and after the line has been backfilled and cleaned, the Contractor shall furnish all necessary equipment and personnel to conduct a low pressure air test on all gravity plastic pipe sewer lines sized 30 inches in diameter or less. The test shall be conducted in the presence of the City's project representative

between two manholes in succession and in accordance with ASTM F-1417, as modified herein. The Contractor shall notify the representative a minimum of 48 hours prior to testing. All costs for performing the test shall be included in the price of the installed pipe.

The sewer pipe section under test shall be clean at the time of testing, but the pipe may be wetted. Pneumatic plugs each having a length greater than the diameter of the pipe being tested shall be used to plug the pipe ends at manholes. One plug shall have the air supply hose and the return air pressure hose. The air supply hose, connected from the compressor to the plug, shall have a throttling valve, bleeding valve, and shut off valve for control. The air pressure tap shall have a sensitive pressure gauge, 1 to 10 psi range, protected by a gauge cock and a pressure relief valve set a 10 psi. The gauge must be in 0.1 pound increments. The testing gauge shall be located at ground level, out of and away from the manhole. Air shall be slowly introduced into the plugged line until the internal air pressure reaches 4.0 psig 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 which time the air supply shall be regulated to maintain the pressure between 3.5 and 4.0 psig. After the stabilization period the air supply shall be shut off and timing begun.

The sewer section under test will be accepted as having passed the low pressure air test if it does not lose air at a rate to cause the pressure to drop more than 0.5 psig in less time than ½ minute per inch diameter of the pipe tested. If the pipe fails to meet the requirements of the test, the Contractor shall, at his sole expense, determine the source of leakage and repair/replace defective material and/or workmanship, after which, the low pressure air test and deflection test, if applicable, shall be performed again.

To determine the air pressure to be added for the average ground water above the pipeline, the ground water height in feet above the pipeline shall be divided by 2.31, and that incremental pressure added to the gauge pressure. A table for converting water height to gauge pressure is as follows:

Ground Water Level Over Top of Pipeline	Incremental Air Pressure to be Added to Gauge Pressure Readings
1 foot	0.43 psig (<i>4.43 psig total</i>)
2 feet	0.86 psig (<i>4.86 psig total</i>)
4 feet	1.72 psig (<i>5.72 psig total</i>)
8 feet	3.44 psig (<i>7.44 psig total</i>)
10 feet	4.30 psig (<i>8.30 psig total</i>)
Over 10 feet	<i>*DO NOT PERFORM TEST</i>

** If the air pressure required to run the test exceeds 8.3 psig, the Contractor shall lower the groundwater to acceptable levels by means of dewatering (incidental) and perform the test.*

3.12. TELEVISIONING

All gravity sewers shall be televised by the City of Fargo Street Department. Any abnormalities such as, but not limited to, deviations of grade, misaligned joints, cracked/defected pipe, rolled gaskets, shall be repaired by the Contractor at his expense. Sections requiring repair shall be re-televised to verify condition of repair. It is the Contractor's responsibility to provide drivable access to each manhole for the City of Fargo camera truck. Televising requires a 7 day advance notice and shall be scheduled through the inspector on site, and will be completed during normal City of Fargo Street Department hours. If the camera operator deems the pipe unsuitable for televising, the Contractor, at his expense, shall clean the sewer by means of jetting. Any/all costs associated with televising shall be incidental to other items.

3.13. SANITARY FORCE MAIN TRACER WIRE

All sanitary force main shall have a solid copper tracer wire secured to the sewer force main as it is being installed. Splices made to the tracer wire shall be sealed with a two-part mixture and enclosed in a plastic sleeve.

The tracer wire shall be looped up at pedestal locations or as directed by the Engineer. Enough wire shall be left above finished grade to allow connection into the pedestal fixture. A label shall be secured to the outside of the pedestal denoting "sewer locating line". All connections shall be made as per the manufacturer's recommendations.

Upon completion of the project the Contractor shall furnish a locator and using a low voltage circuit, test the entire tracer wire system in the presence of the Engineer. The test shall consist of a continuous above ground trace of the piping and appurtenances installed. All areas failing the location test shall be corrected at the Contractor's expense. The wire shall be tested in accordance with the requirements of ASTM B-1, B-3, B-8 and D-1248. All wire will be spark tested at 7500 VAC.

3.14. BYPASS PUMPING

The Contractor shall install a temporary bypass to maintain uninterrupted sewer service on sewer reconstruction or sewer repair projects where work will interfere with sewage flow in the existing sewer. The bypass shall be made by diverting the effluent flow at an upstream access manhole and pumping it through a separate conduit to a downstream reentry point or to an adjacent sewer

system. The pump and bypass conduit shall be of adequate size and capacity to handle the flow. The effluent level in the bypass pumping manhole shall not be allowed to rise more than 1 foot above the crown of the incoming sewer pipe. Bypass pumping shall be incidental to the sewer work.

Bypassing of sewage flow by means of plugging the existing sewer and providing for backflow of sewage through adjoining sewers may be allowed when existing piping is available and when approved by the Engineer.

On all temporary sanitary sewer bypass locations, the Contractor shall supply and maintain an overflow prevention monitor. The monitor shall be a field-ready corrosion resistant housing meeting IP67/NEMA 4, 4X standards with cellular communication capability. It shall be preprogrammed for the text service provider as designated by the Engineer. Unit must be designed for maintenance-free operation and non-confined space entry. Unit shall be provided with a field replaceable 6-volt Alkaline Lantern Battery and have the capability of transmitting text alerts to a minimum of three user-designated cell phones. Unit shall be Model 1st Response 8200 by Eastech Flow Controls, Upper River, NJ or approved equal.

PART 4
GUARANTEE, MEASUREMENT & PAYMENT

4.1. GUARANTEE

The guarantee shall be per the contract.

4.2. MEASUREMENT AND PAYMENT

4.2.1. GENERAL

The cost of excavating and trenching shall be included as part of this specification.

4.2.2. SANITARY SEWER PIPE

Pipe will be measured by customary and conventional methods and paid for on a unit price basis for the actual length installed. Measurement will be from center of manhole to center of manhole or from end of existing pipe to center of manhole or end of pipe stubout. No additional or direct payment will be made for the wyes or for the jointing of the pipes or manhole connections.

4.2.3. WYE BRANCHES

The cost of furnishing and installing the wye branches shall be included in the unit bid price per linear foot of sewer pipe in place.

4.2.4. STANDARD AND DROP CONNECTION MANHOLES

The cost of furnishing and installing the manholes will be paid for on a lump sum bid per each manhole installed. Costs shall include all excavation, bedding, backfilling, constructing, furnishing and installing the manhole and casting in place, connections to the sewer and sealing the manhole joints and lift holes. On Drop-Manholes all additional fittings, collars, pipe and appurtenances below the main sewer shall be included in the bid price.

4.2.5. RISER PIPES

Sewer service riser pipes will be paid for on a linear foot basis. The bid price shall include all bends, rock or concrete encasement if required, planking or any other incidental items required.

4.2.6. DEFLECTION AND AIR TESTING

No additional payment will be made for deflection and/or air testing. All costs for material, labor, and equipment necessary to complete the testing shall be included in the contract unit price per linear foot of sewer main installed.

4.2.7. FORCE MAIN

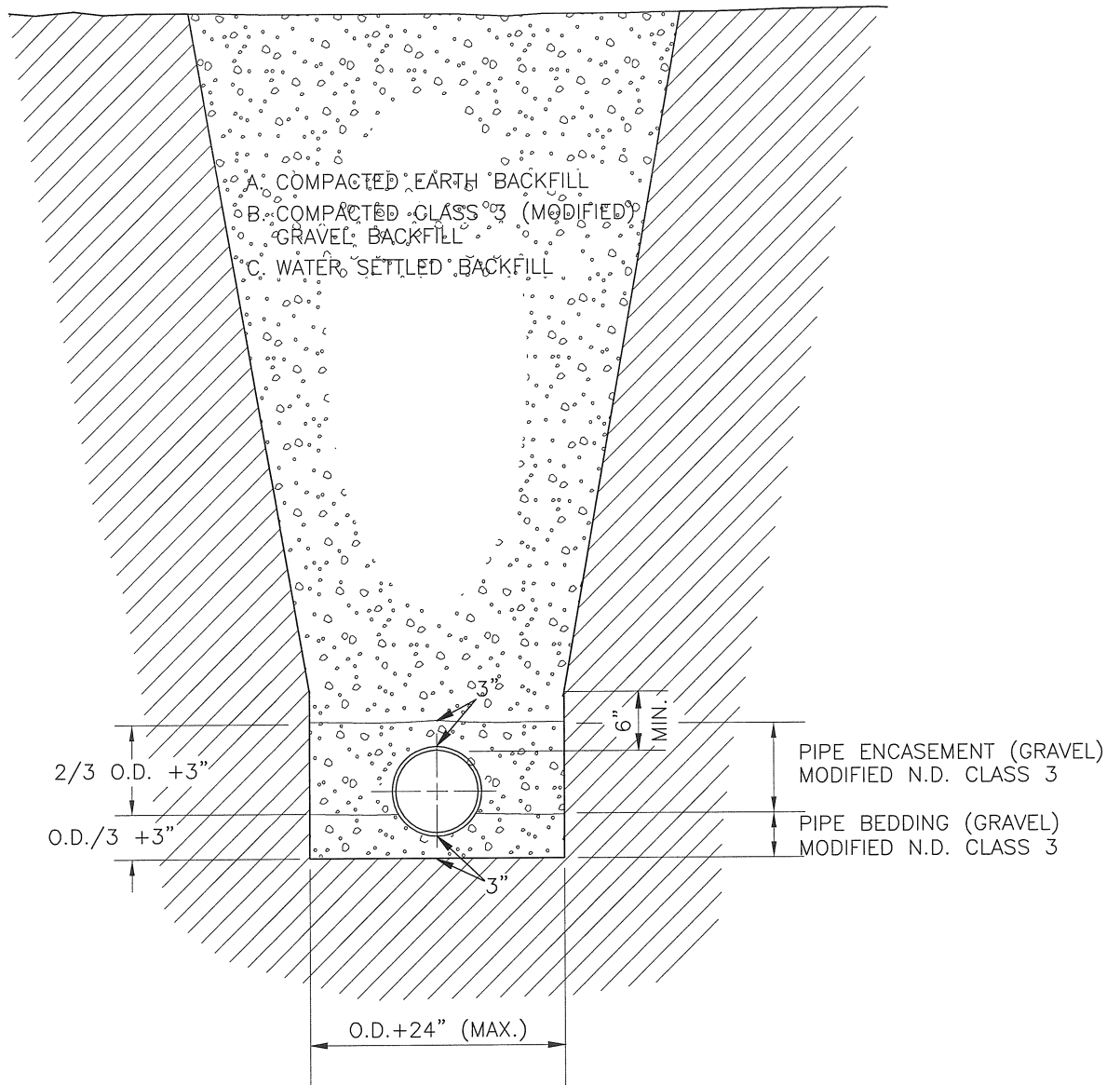
Pipe will be measured by customary and conventional methods and paid for on a unit price basis for the actual length installed. No additional or direct payment will be made for jointing, bends or connections.

4.2.8. TRACER WIRE

Payment for the tracer wire shall be incidental to the force main. The locating pedestal will be paid on a unit price per each basis and shall include all labor, material and equipment necessary to install one locating wire pedestal.

4.2.9. OTHER COSTS

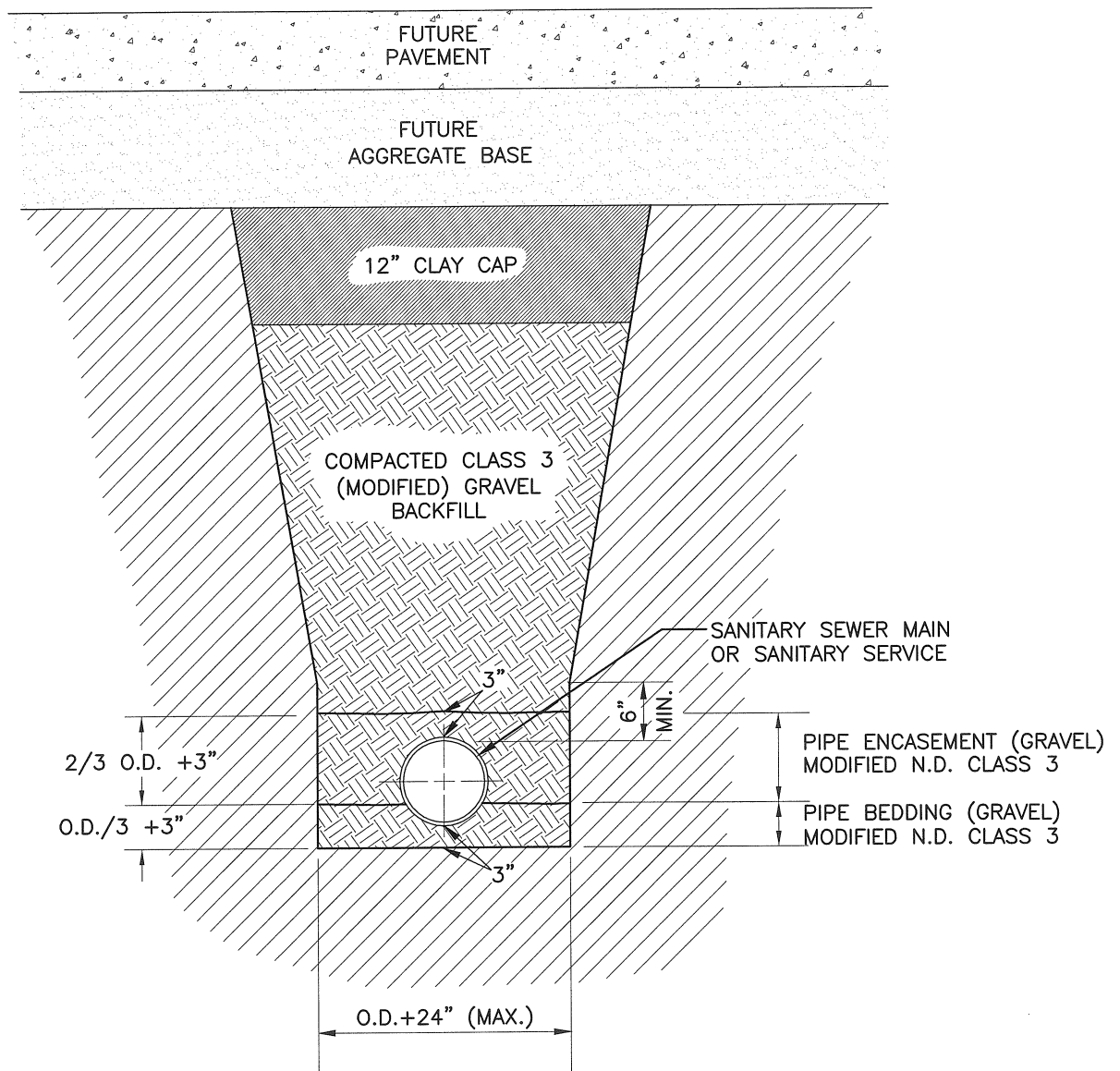
All costs for work necessary to properly complete the work specified herein shall not be bid items; the costs shall be charged to other items unless a bid item is included on the bid sheet.



NOTE:

CRUSHED CONCRETE MEETING THE
 ND CLASS 5 AGGREGATE GRADATION
 REQUIREMENTS MAY BE SUBSTITUTED
 FOR THE PIPE BEDDING & ENCASEMENT
 MATERIAL.

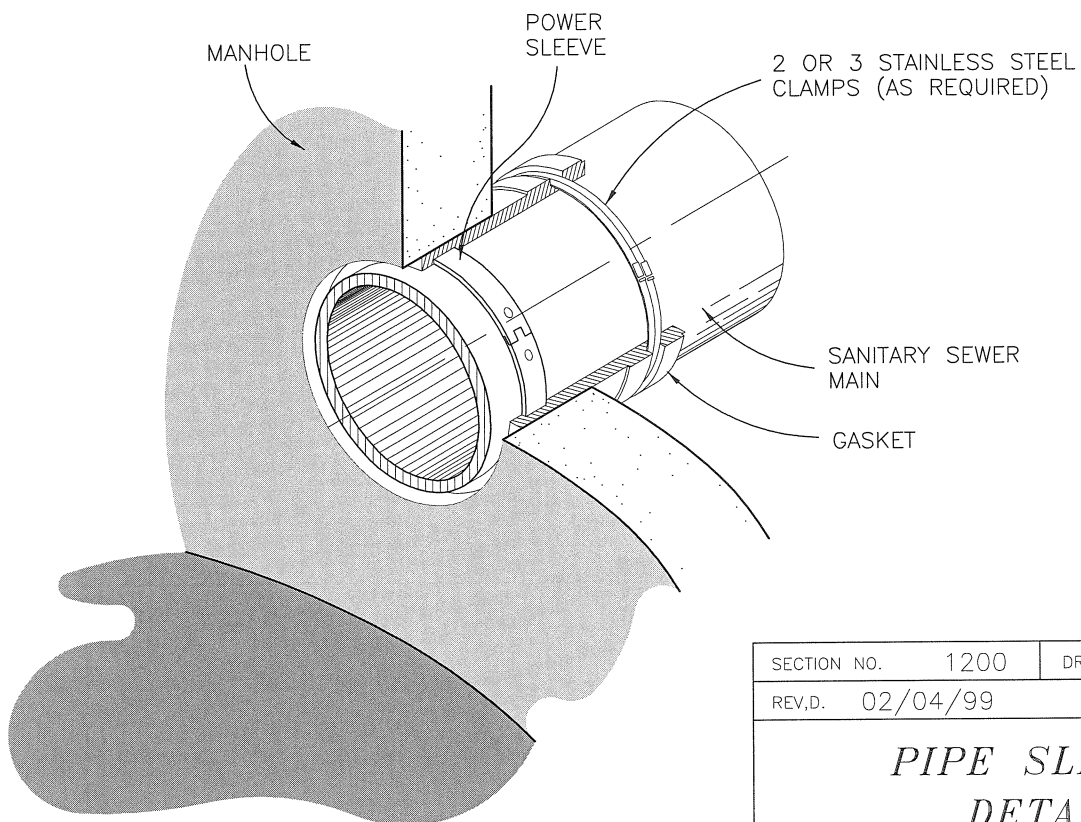
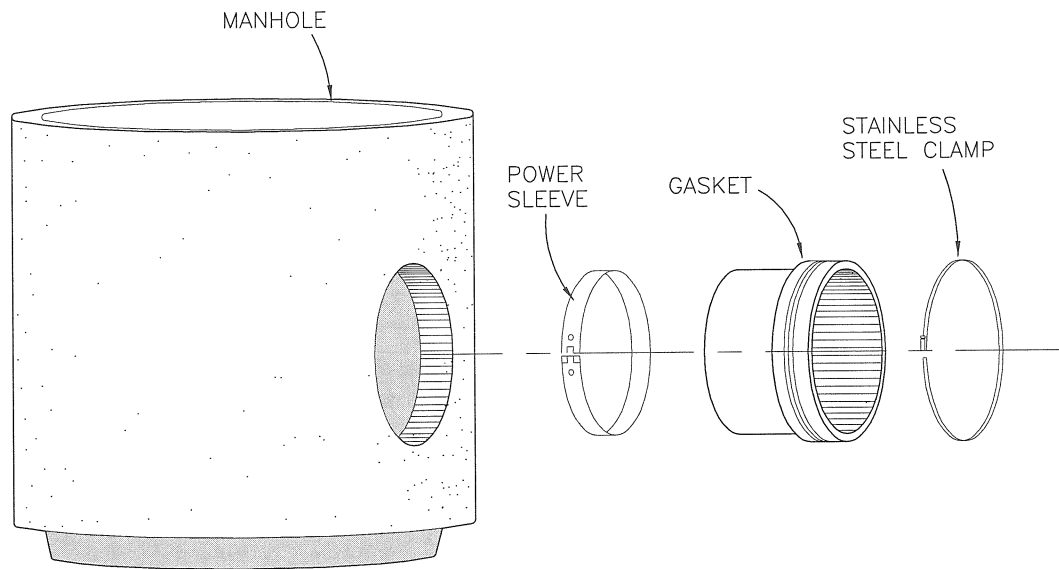
SECTION NO.	1200	DRAWING NO.	5.1
REV.D.	2012		
<i>SANITARY SEWER TRENCH BACKFILL</i>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BED	DATE	2-21-2012



NOTE:

THIS DETAIL APPLIES WHERE SANITARY SEWER IS INSTALLED UNDER FUTURE PAVING WITH EDGE DRAIN.

SECTION NO.	1200	DRAWING NO.	5.2
REV.D.			
<i>SANITARY SEWER TRENCH UNDER NEW PAVEMENT</i>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	<i>BED</i>	DATE	<i>2-21-2012</i>



SECTION NO.	1200	DRAWING NO.	5.3
REV.D.	02/04/99		
<i>PIPE SLEEVE DETAIL</i>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	<i>BEO</i>	DATE	<i>2-21-2012</i>

MANHOLE COVER SHALL HAVE
 -CONCEALED PICK BAR
 -"O" RING GASKET

CASTING FRAME & COVER
 NEENAH FOUNDRY CO. R-1733
 MUNICIPAL CASTINGS INC. 301-7/301A
 EAST JORDEN 1205-AGSSA
 OR APPROVED EQUAL

3-2" ADJUSTING RINGS

MANHOLE STEP
 12" O.C.
 (SEE DETAIL)

48" DIA. PRECAST
 CONCRETE MANHOLE

PRECAST MONOLITHIC
 MANHOLE W/GASKET
 ASSEMBLY FOR 8"
 TO 15" DIA. MAINS

1 1/4" CRUSHED ROCK
 TO BE USED TO
 SUPPORT PIPE IN
 OVEREXCAVATED AREA
 & 1/2 WAY UP PIPE

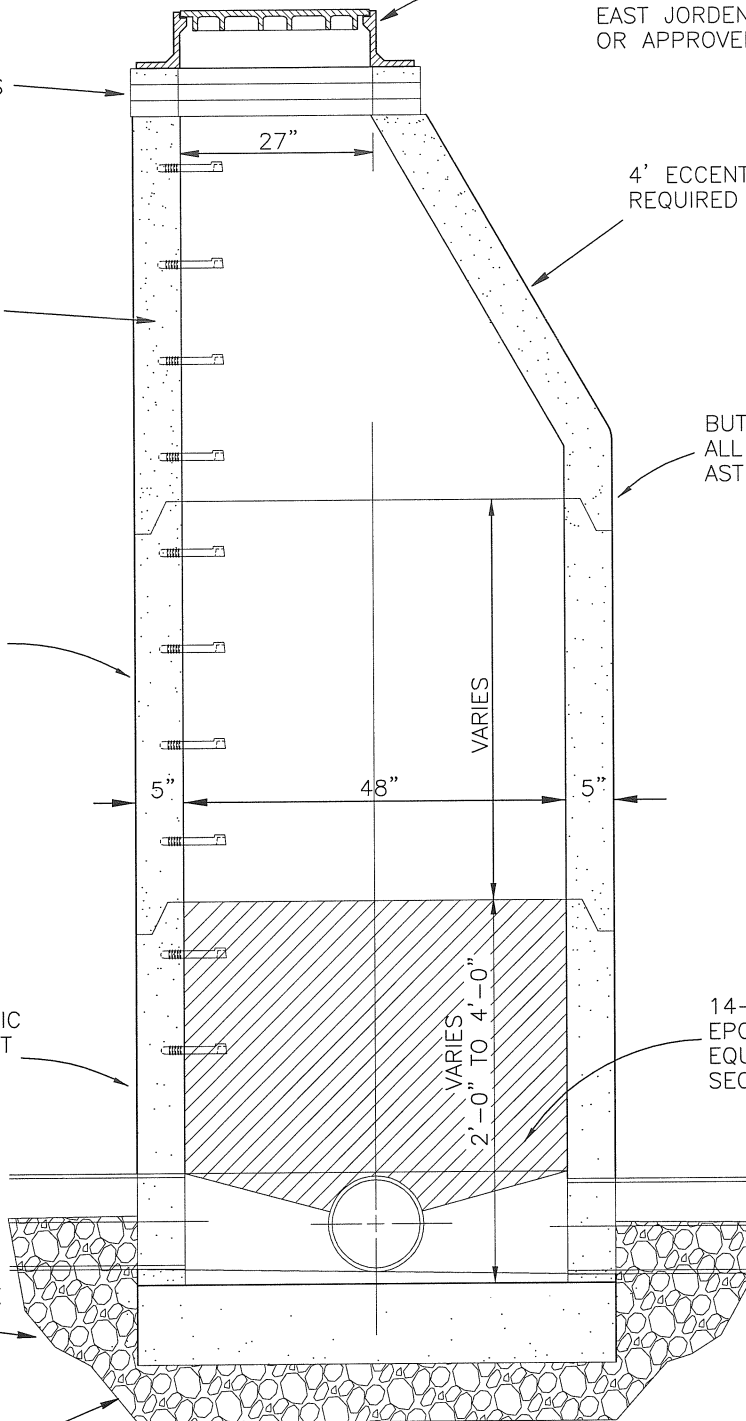
6" OF 1 1/4" ROCK
 UNDER MANHOLE BASE

NOTE:
 LIFT HOLES TO BE
 MANUFACTURED
 WATER PROOF

4' ECCENTRIC CONE
 REQUIRED

BUTYL RUBBER GASKET ON
 ALL JOINTS (JOINT TO MEET
 ASTM 433 REQUIREMENT)

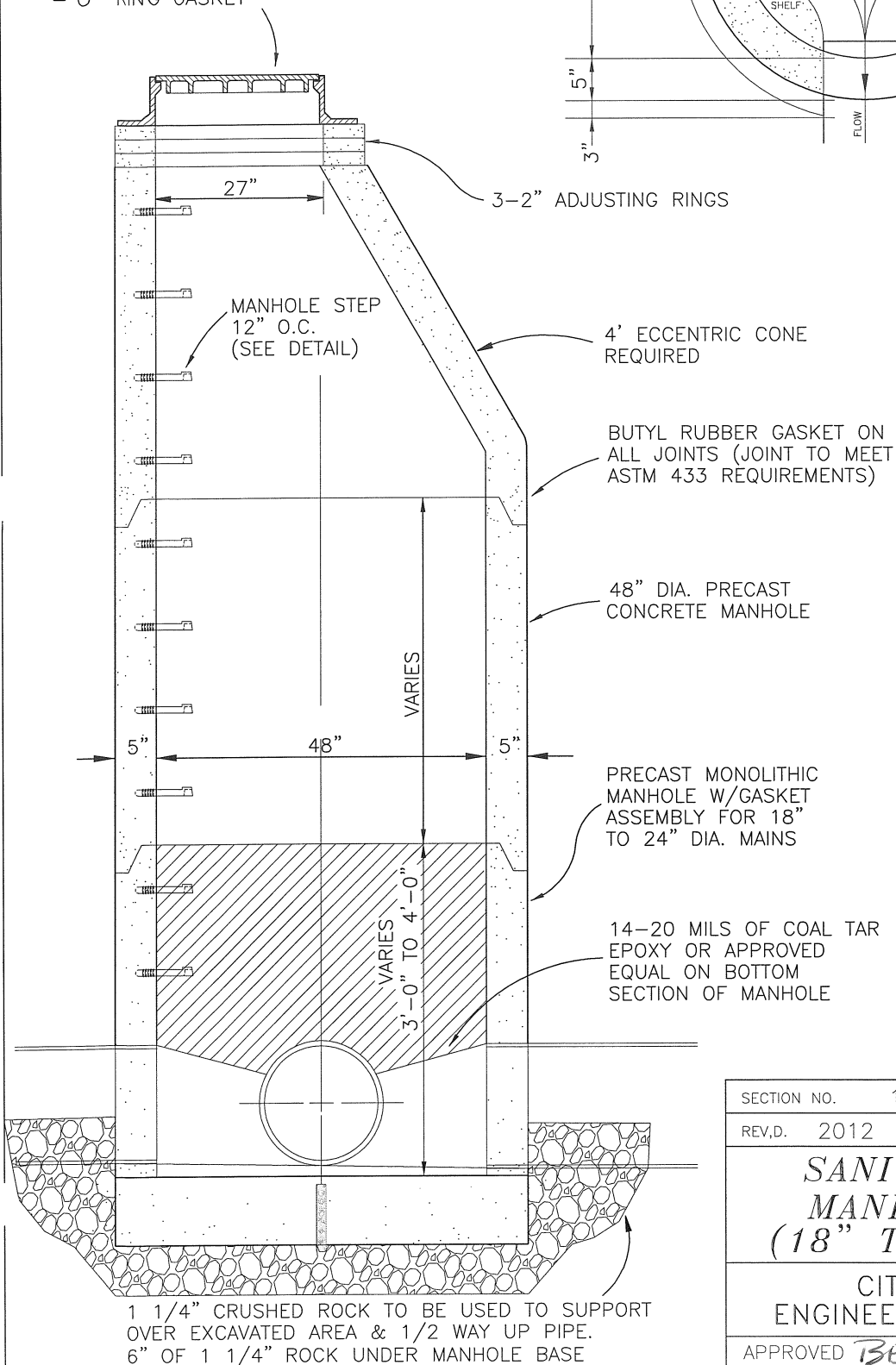
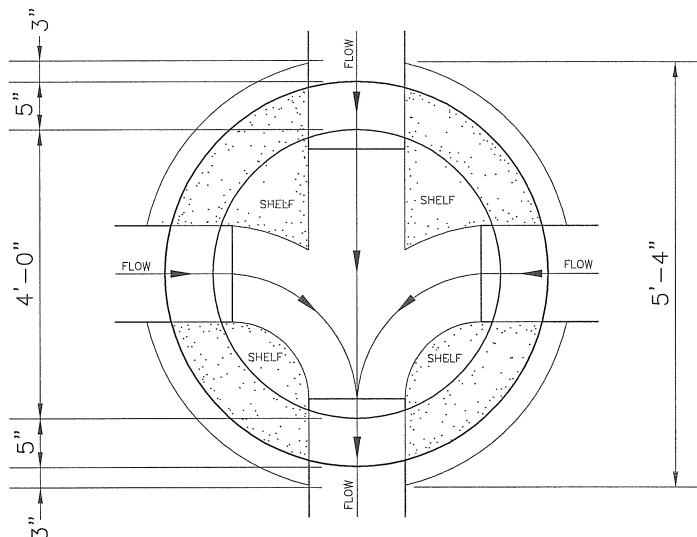
14-20 MILS OF COAL TAR
 EPOXY OR APPROVED
 EQUAL ON BOTTOM
 SECTION OF MANHOLE



SECTION NO.	1200	DRAWING NO.	5.4
REV.D.	2012		
SANITARY SEWER MANHOLE DETAIL(8",10" 12",15" MAINS)			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BED	DATE	2-21-2012

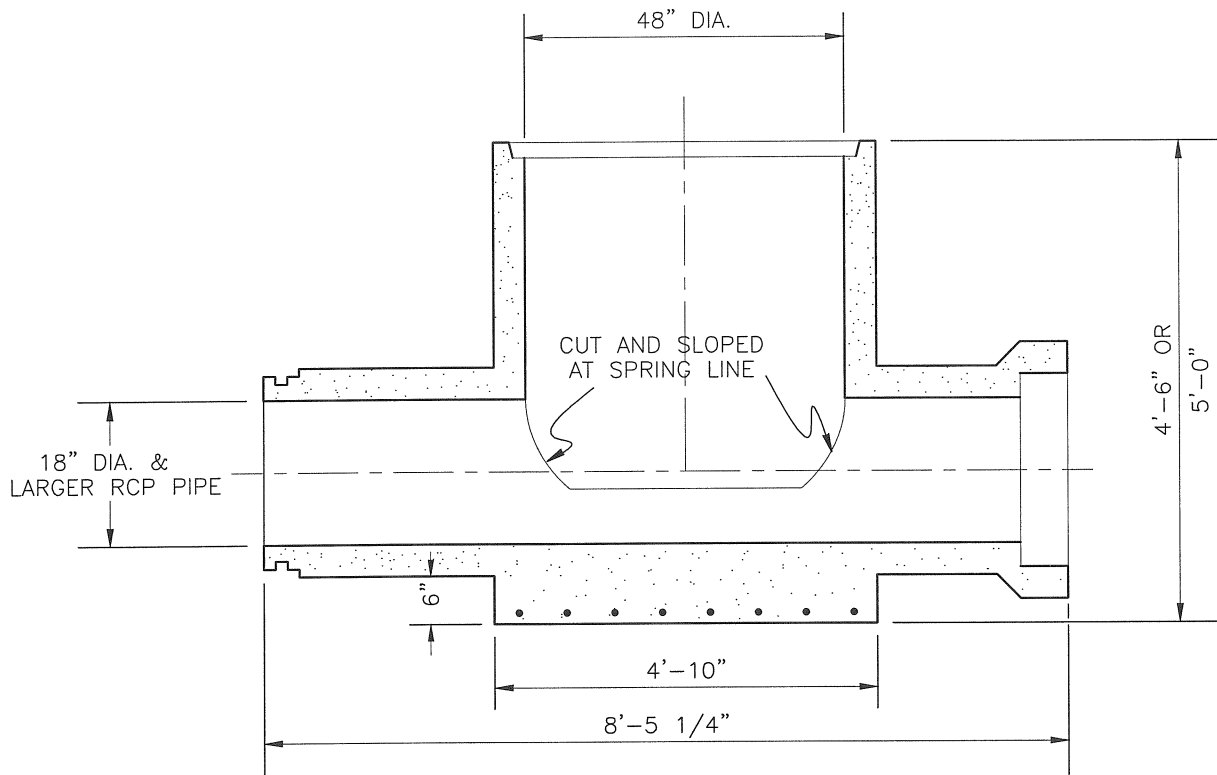
NOTE:
 CASTING FRAME & COVER TO BE
 NEENAH FOUNDRY CO. R-1733
 MUNICIPAL CASTINGS INC. 301-7/301A
 EAST JORDEN 1205-AGSSA
 OR APPROVED EQUAL

MANHOLE COVER SHALL HAVE
 -CONCEALED PICK BAR
 -"O" RING GASKET



NOTE:
 LIFT HOLES TO BE
 MANUFACTURED
 WATER PROOF

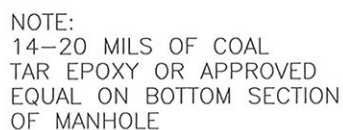
SECTION NO.	1200	DRAWING NO.	5.5
REV.D.	2012		
SANITARY SEWER MANHOLE DETAIL (18" TO 24" MAINS)			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BEO	DATE	2-21-2012




SECTION NO.	1200	DRAWING NO.	5.6
REV.D.	March, 1999		
<i>MINI-TEE</i> <i>MANHOLE DETAIL</i>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BED	DATE	2-21-2012

COVER SHALL HAVE
- CONCEALED PICK BAR
- "O" RING GASKET

5.6 MINI-TEES



SECTION NO.	1200	DRAWING NO.	5.7
REV.D.	2013		
<p align="center"><i>SANITARY SEWER MANHOLE (EXTERIOR DROP CONNECTION)</i></p>			
<p align="center">CITY OF FARGO ENGINEERING DEPARTMENT</p>			
APPROVED		DATE	1-2-13

CASTING FRAME & COVER
NEENAH FOUNDRY CO. R-1733
MUNICIPAL CASTINGS INC. 301-7/301A
EAST JORDEN 1205-AGSSA
OR APPROVED EQUAL

COVER SHALL HAVE
-CONCEALED PICK BAR
-"O" RING GASKET

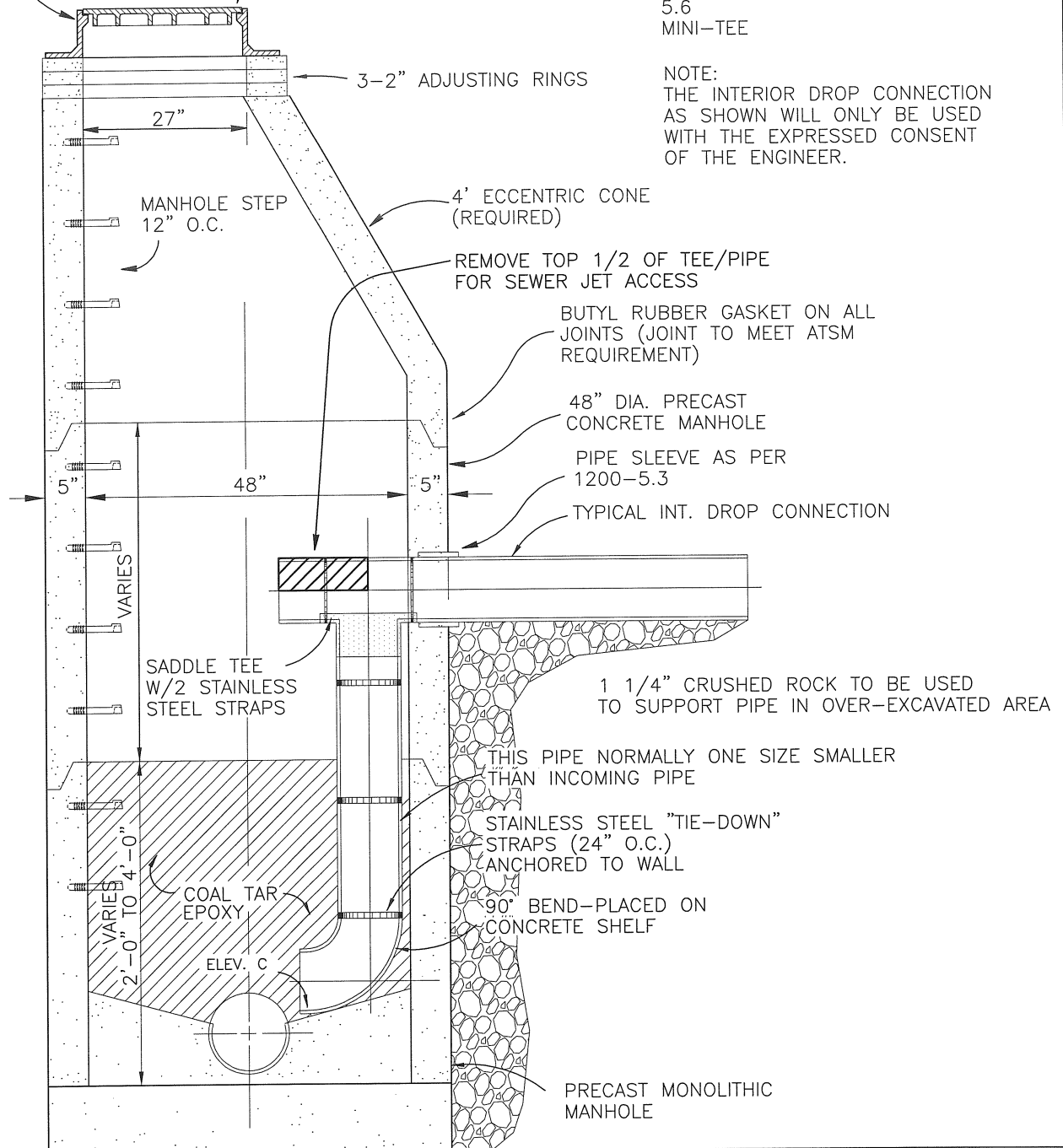
NOTE:
INVERT AND LOWER MANHOLE SECTION
AS PER DETAILS:

5.4
(8", 10", 12" & 15" MAINS)

5.5
(18", 21" & 24" MAINS & LARGER)

5.6
MINI-TEE

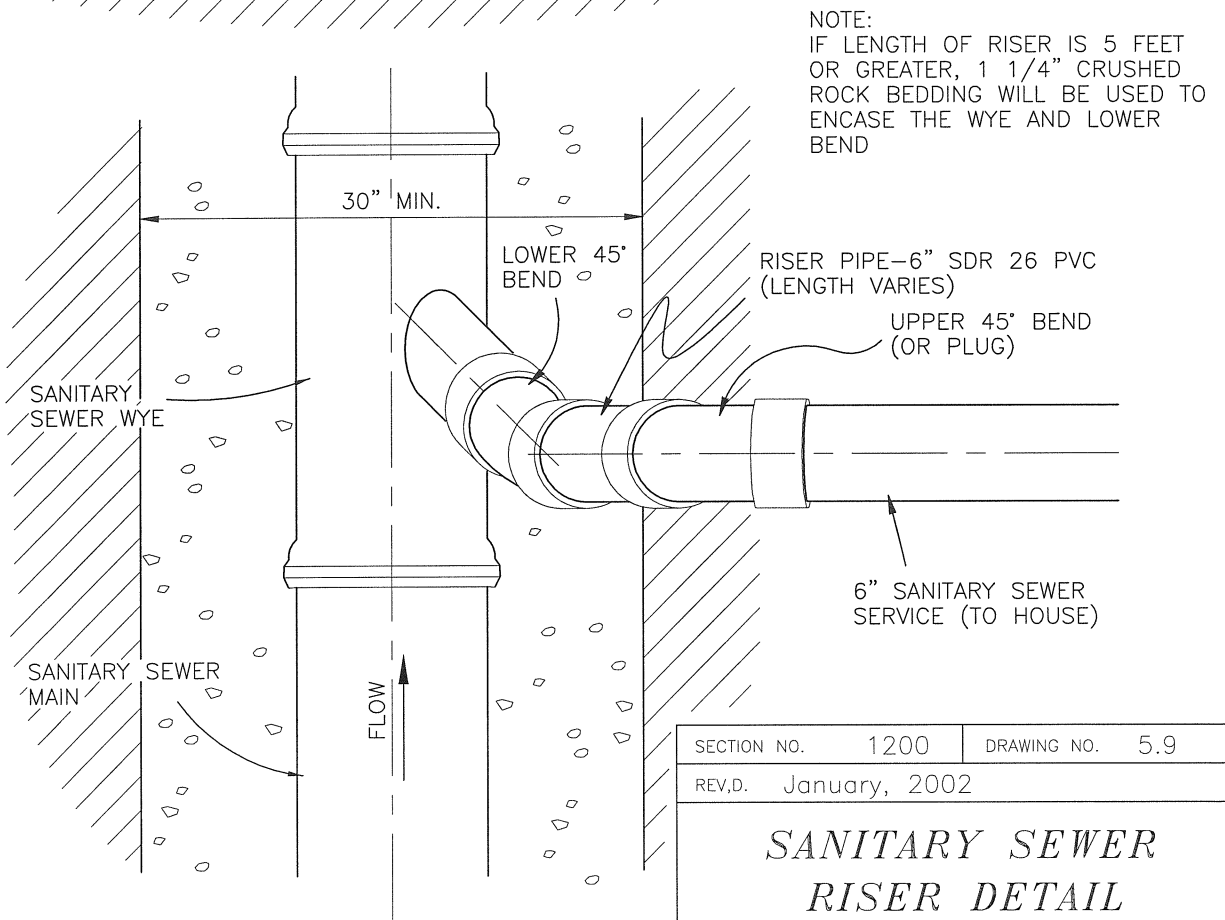
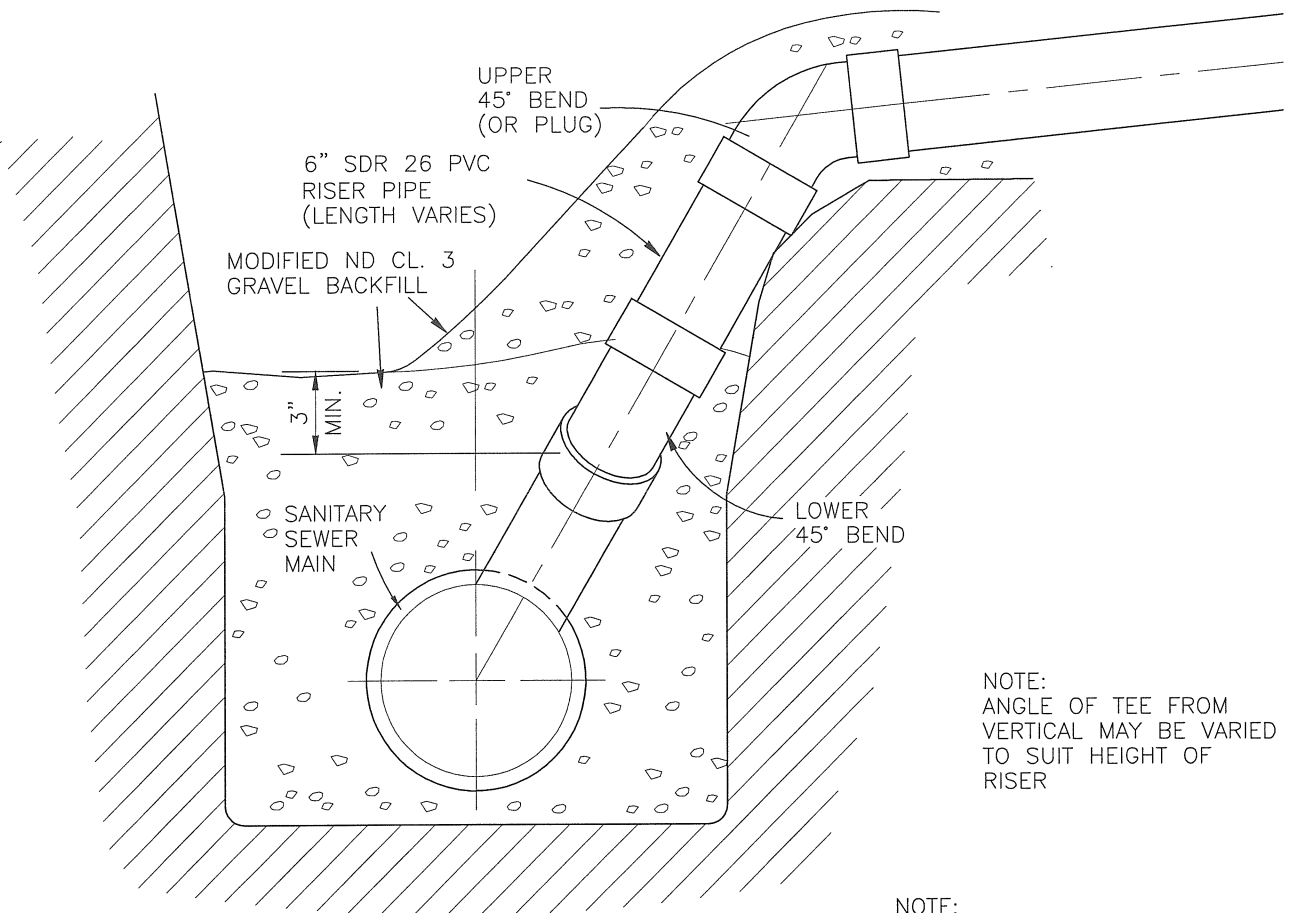
NOTE:
THE INTERIOR DROP CONNECTION
AS SHOWN WILL ONLY BE USED
WITH THE EXPRESSED CONSENT
OF THE ENGINEER.



NOTE:
LIFT HOLES TO BE
MANUFACTURED
WATER PROOF

NOTE:
14-20 MILS OF COAL
TAR EPOXY OR APPROVED
EQUAL ON BOTTOM SECTION
OF MANHOLE

SECTION NO.	1200	DRAWING NO.	5.8
REV.D.	2012		
SANITARY SEWER MANHOLE (INTERIOR DROP CONNECTION)			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BED	DATE	2-21-2012



SECTION NO. 1200 DRAWING NO. 5.9

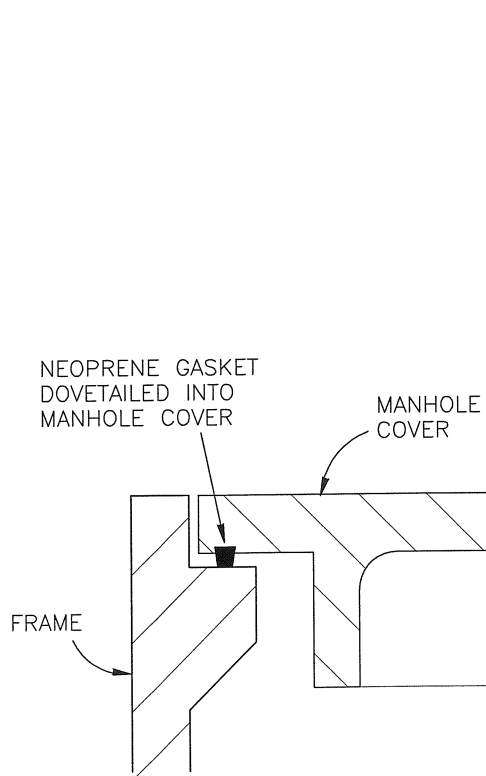
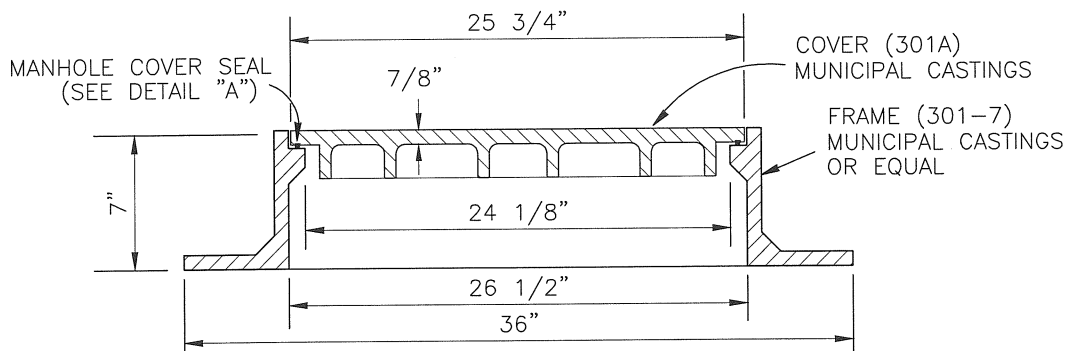
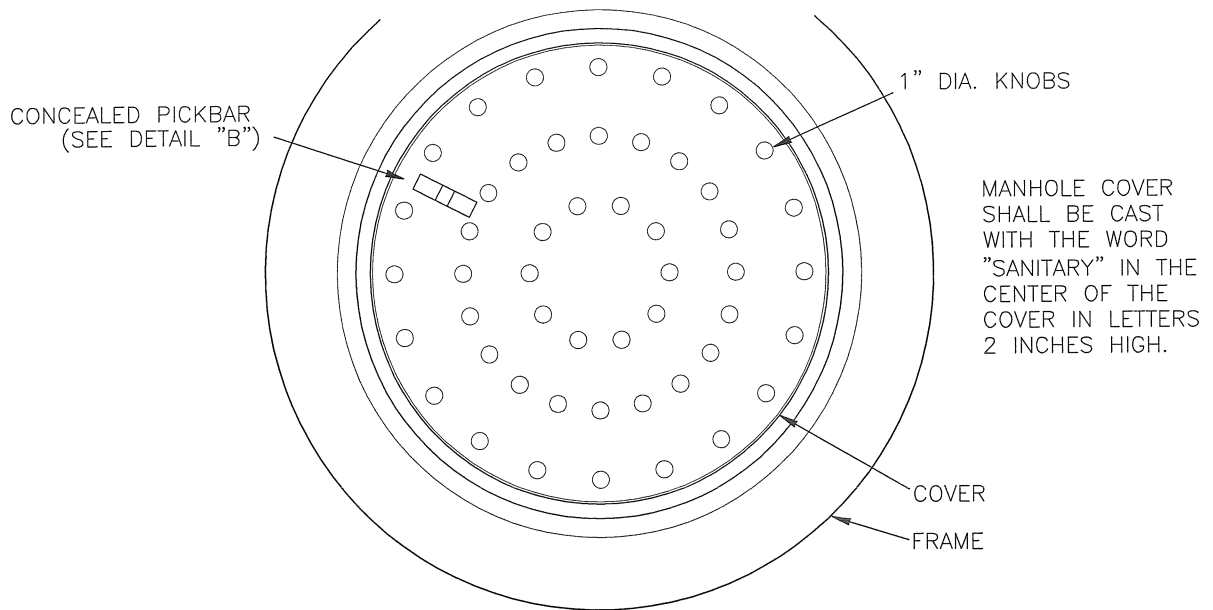
REV.D. January, 2002

SANITARY SEWER RISER DETAIL

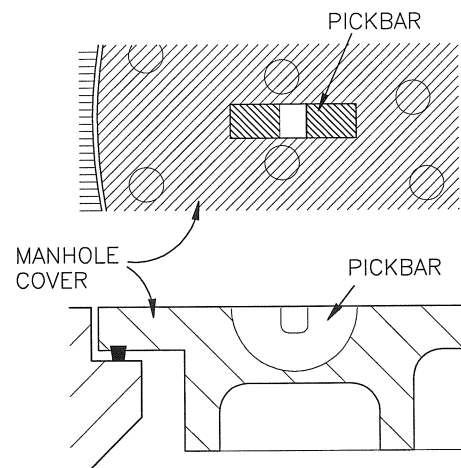
CITY OF FARGO
ENGINEERING DEPARTMENT

APPROVED *BED*

DATE *2-21-2012*

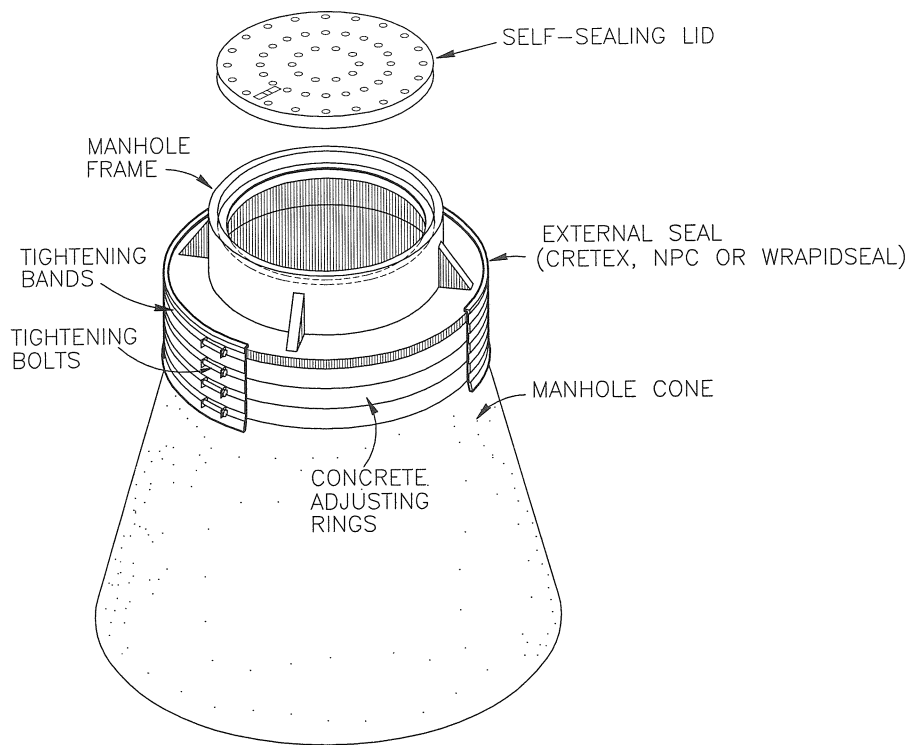


DETAIL "A"

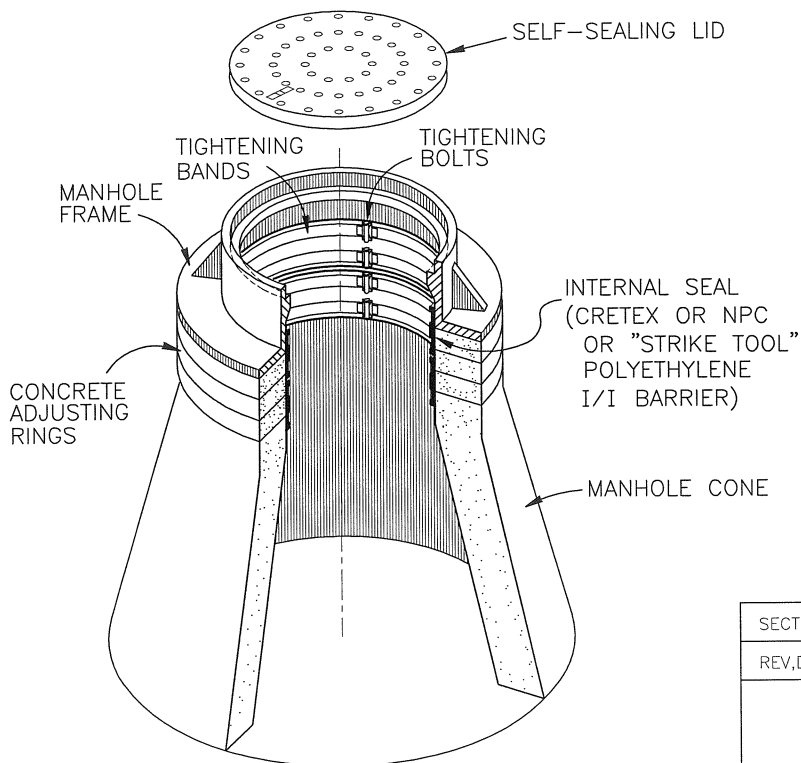


DETAIL "B"

SECTION NO.	1200	DRAWING NO.	5.10
REV.D.	2012		
<i>SANITARY MANHOLE COVER CASTING</i>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BED	DATE	2-21-2012

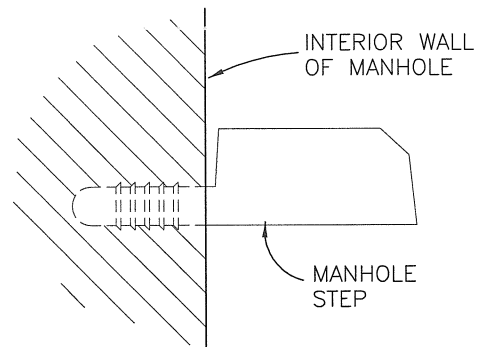
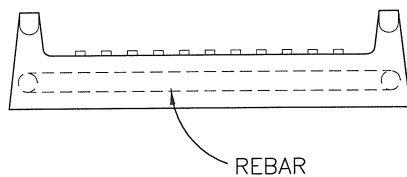
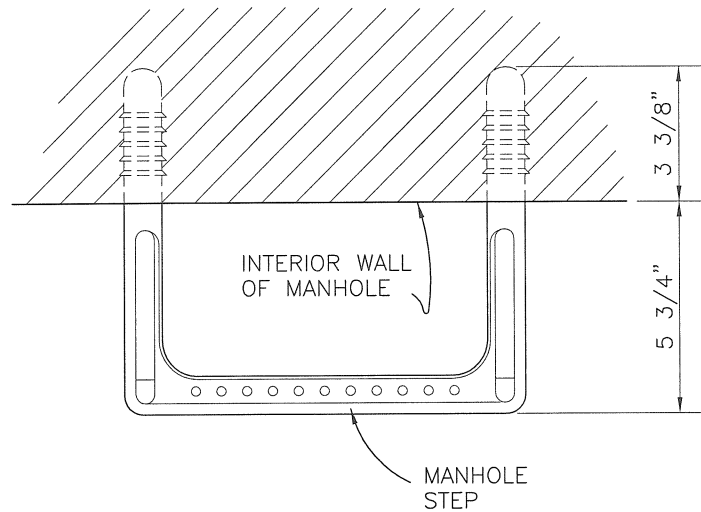


EXTERNAL MANHOLE SEAL



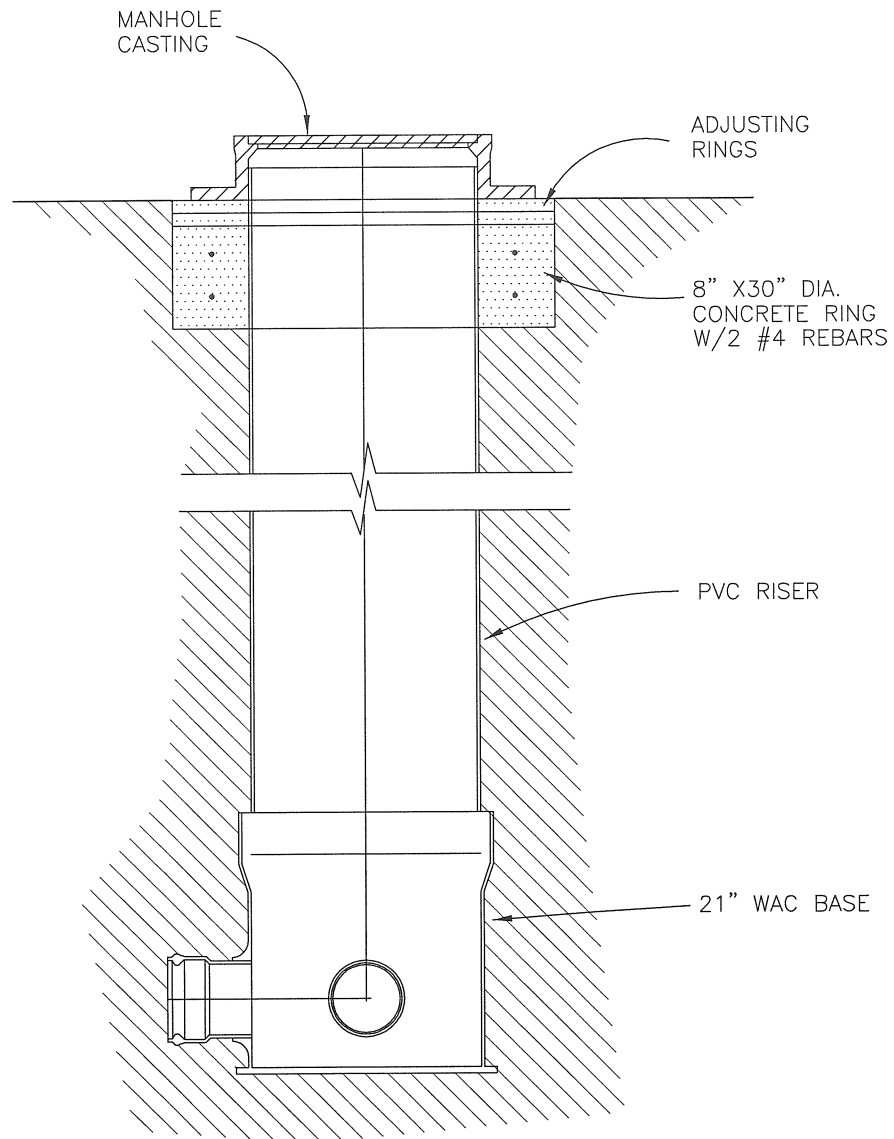
INTERNAL MANHOLE SEAL

SECTION NO.	1200	DRAWING NO.	5.11
REV.D.	March, 2007		
<i>MANHOLE SEALS DETAIL</i>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BED	DATE	2-21-2012



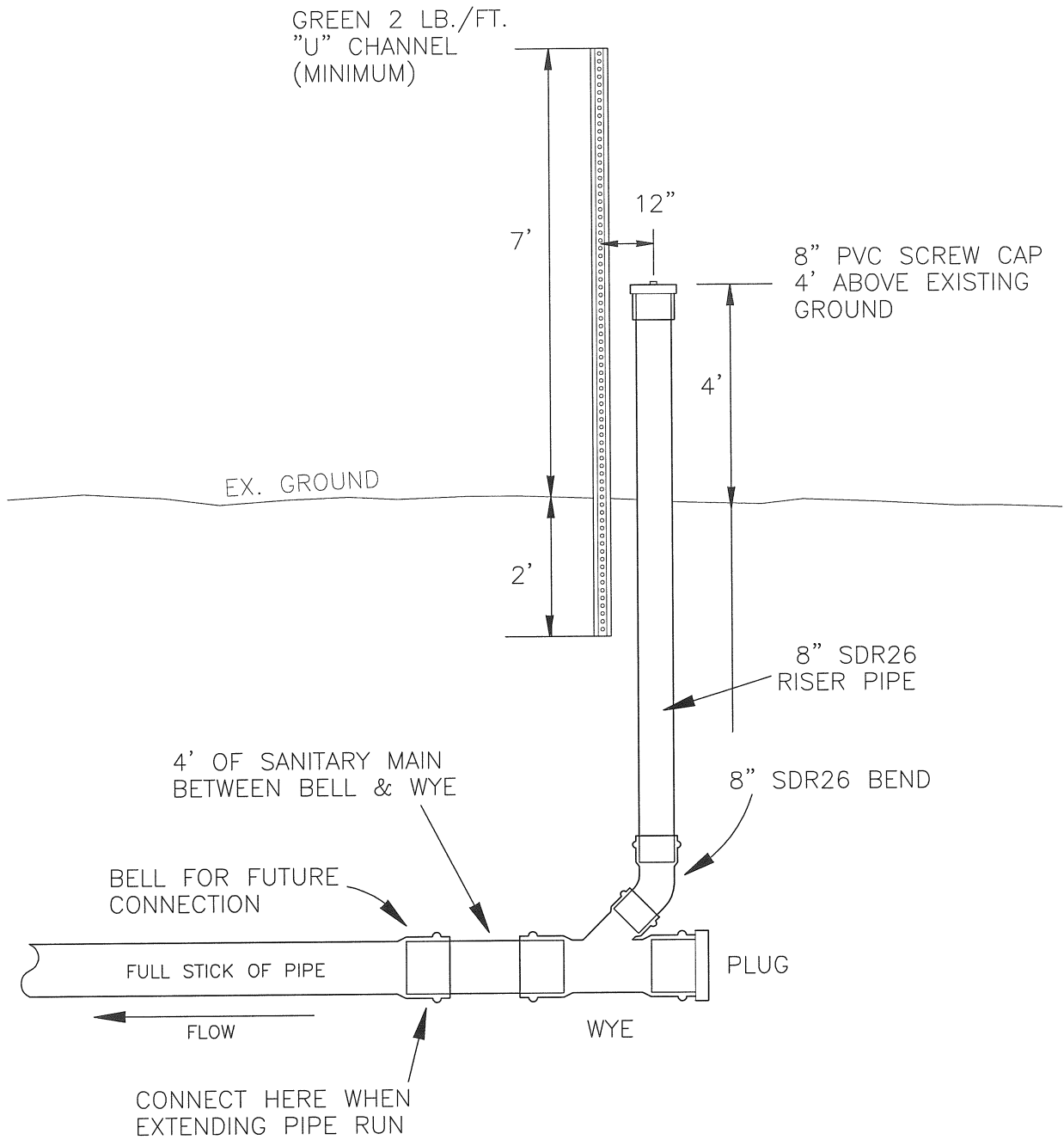
NOTE:
 STEP SHALL BE CONSTRUCTED OF 1/2" REINFORCING
 ROD AND COMPLETELY ENCASED IN A CORROSION
 RESISTANT RUBBER OR POLYPROPYLENE PLASTIC,
 WHICH WILL RESIST DETERIORATION FROM HYDROGEN
 SULFIDE OR OTHER CHEMICALS AND GASES
 ENCOUNTERED IN MANHOLE APPLICATION.
 ALSO, STEP SHALL HAVE A VERTICAL RESISTANCE OF
 400 LBS., AND A PULLOUT RESISTANCE OF 1000 LBS.
 SUCH AS: THE WEDG-LOC STEP BY DELTA PIPE
 PRODUCTS OR APPROVED EQUAL.

SECTION NO.	1200	DRAWING NO.	5.12
REV.D.	March, 2000		
<i>MANHOLE STEP DETAIL</i>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BED	DATE	2-21-2012



WAC MANHOLE DETAIL

SECTION NO.	1200	DRAWING NO.	5.13
REV.D.	MARCH, 2000		
<i>STANDARD DETAIL WASTEWATER ACCESS CHAMBERS (WAC's)</i>			
CITY OF FARGO ENGINEERING DEPARTMENT			
APPROVED	BEO	DATE	2-21-2012



SECTION NO. 1200	DRAWING NO. 5.14
REV.D. 2012	
SANITARY SEWER CLEANOUT DETAIL	
CITY OF FARGO ENGINEERING DEPARTMENT	
APPROVED <i>BEO</i>	DATE <i>2-21-2012</i>