PRIVATE DEVELOPMENT STANDARDS

for

City of St. Francis

Prepared By:

BOLTON & MENK
Engineers & Surveyors

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PRIVATE DEVELOPMENT STANDARDS

ST. FRANCIS, MN

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CONSTRUCTION STANDARDS SUMMARY

Private Development Standards

City of St. Francis

SANITARY SEWER

- Sanitary sewer design shall conform to the latest edition of the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers.
- Sanitary sewer extension design shall consider each residence to include 3.2 people on the average.
- Design sewage flow rates shall be 100 gallons per person per day.
- Design discharge flows for commercial and industrial developments shall be determined on a case by case basis.
- All sanitary sewer extensions shall be laid as low as practical to minimize the need for lift stations.
- Lift stations shall be designed to City of St. Francis Lift Station Standards.
- Provide full depth to plat line or beyond for future. Set manhole at plat line.
- SDR 35 PVC or better pipe.
- Main line sewer pipe 20' deep to 26' of deep shall be SDR 26. Sanitary Sewer proposed at depths greater than 26' will be looked on a case per case basis. Analysis of soil types and proposed materials must be provided by the developer's engineer during the plan review.
- Manhole depth shall not exceed 35 feet.
- Precast manholes with integral base and plastic coated steps required.
- Casting assembly shall be Neenah R-1733 self seal lid lettered “Sanitary Sewer” with two concealed pick holes and no lug.
- All sanitary sewer manhole castings shall be adjusted with Ladtech H.D.P.E. adjusting rings.
- Green space crossings shall begin and end in roadways unless otherwise approved. Avoid locating manholes in green space.
- All sanitary sewer manholes installed outside of the bituminous roadway surfaces shall be marked with Flex Stake EZ Drive Markers –GREEN in color with diamond grade reflective tape placed around the top and 18-inches below the top of the marker.
- Maximum distance between manholes shall be 400 LF unless otherwise approved.
- Service shall be stubbed to10 LF beyond the R.O.W. line.
- Depth at end of service line shall be a maximum of 10 feet.
- Mark end of service with a steel “T” post with the top 1-foot painted GREEN. Install a 2” x 2” wood marker with a locating rod from pipe invert to within 6” of the finished grade.
- GREEN tracer wire is required along sanitary sewer service lines and PVC forcemain
- All new sanitary sewer mains shall be jetted, vacuumed, and televised after manholes have been adjusted to bituminous base course elevation and prior to acceptance by the City. The City Engineer shall be provided with 2 copies of televising DVDs.
- All sanitary sewer forcemain shall be hydrostatically tested at 100 PSI for two (2) hours.

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WATERMAIN

- The design shall be in accordance with Minnesota Department of Health and the Ten State Standards.
- Valve wrenches, curb stop wrenches, and hydrant wrenches shall be provided to the St. Francis Public Works Department prior to the City acceptance of the improvements.
- Valves shall be set as to provide isolation to each 15-20 lots. When tying into existing main begin with a valve, unless within a multi-phased project. Valves shall be placed at a maximum spacing of 800 feet.
- Valves shall be placed throughout the distribution system so that each portion may be isolated with the least interruption of service. Generally, valves shall be placed at each roadway intersection or intersection of water mains.
- Only when looping a water main is impractical, in the City's opinion, will dead end mains be allowed. No dead end mains greater than 600 feet in length shall be considered.
- Plan for 400 LF centerline measured spacing on hydrants. Set hydrants 5-feet from the back of curb, near radius points at intersections, or at property lines along a street segment. Avoid setting hydrant valves in sidewalks or trails.
- Fire hydrants shall typically be located at the intersection Point of Tangent, or offset 10 feet along the tangent when there is a catch basin at this point.
- Standard material shall be 8" – 10" PVC AWWA C-900 or Ductile Iron Pipe, Class 52, all mains 12" or larger shall be Ductile Iron Pipe, Class 52. Watermain shall be sized to meet pressure and flow requirements.
- All fire hydrants shall be Clow Medalliaon ® F2545 with 16" break off section. The hydrant lead shall contain a 6" gate valve. Color and threads shall match City of St. Francis Standards. A Hydrafinder® red and white stripe shall be included. 8'6" bury depth typical. All hydrants shall be purchased from licensed distributors of Clow hydrants. All hydrant bolts shall be stainless steel.
- Watermain shall have 8' (min.) of cover, standard.
- Residential services (1") for Copper Pipe shall be 1" Type K Copper; Ford "EM2-80-56", 8-foot curb box with 78" rod; Ford "B22-444M-NL" curb stop, (ball type), Ford "FB600-4- NL" corporation stop. All services with PVC watermain shall have a stainless steel saddle. Services 1.5" and larger for DIP watermain shall have a stainless steel saddle.
- Residential services (1") for Polyethylene Pipe shall be 1" CTS ; Ford "EM2-80-56", 8-foot curb box with 78" rod; Ford "B44-444M-Q-NL" curb stop, (ball type), Ford "FB1000-4-Q-NL" corporation stop. All services with PVC watermain shall have a stainless steel saddle. Services 1.5" and larger for DIP watermain shall have a stainless steel saddle.
- BLUE tracer wire shall be provided along non-conductive mains and services.
- Curb stop box shall be set at 10' beyond the R.O.W. line and marked with a steel fence post with the top 1-foot painted BLUE.
- Mega Lugs® and/or coated rods are required for tying watermains.
- All fittings and bends greater than 11-1/4 degrees shall be properly restrained.
- Off street gate valves shall be marked with BLUE Flex Stake EX Drive Markers with diamond grade reflective tops placed around the top and 18-inches below the top of the marker.
- Plan for and provide for complete flushing of all new watermain. No dead ends without a hydrant or temporary flushing capabilities.
- Green space crossings shall have valves in roadway at each end. Also plan green space crossings so as to avoid bends or mechanical joints in green space.
- All valves shall include stainless steel bolts.

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- All valves shall include a gate valve extension stem, extended to within 8” to 12” from the top of the valve box.
- All valve boxes shall be set so as to provide 6” of elevation adjustment each way.
- Hydrants installed below water table shall have factory plugged drain holes and shall be furnished with a BLUE pumper nozzle.
- Irrigation services may be installed for common areas of developments. Only one service is allowed per development without prior permission of the Public Works Department. The minimum size of the irrigation service shall be 2 inches in diameter.

STORM SEWER

- All stormwater facilities shall be designed in accordance with City of St Francis Zoning Ordinances- “Chapter 93 Stormwater Management- Stormwater Pollution Prevention”.
- Infiltration basins shall be utilized to the extent possible.
- Storm drainage analysis shall consider the downstream effects to the limits of the receiving water. Drainage designs must not cause hardship to downstream properties.
- Drainage facilities for major storms (100-year recurrence runoff flows) shall provide at least one foot of the highwater level to the lowest opening of any residences or structures used for public, commercial or industrial purposes.
- Sedimentation basins shall be designed in accordance with the "Best Management Practices for Urban Runoff- Chapter 5” as published by the by the MPCA.
- Storm ponds shall be labeled with the bottom, NWL, HWL = 100 year and overflow elevations.
- All stormwater detention facilities must have a forebay to remove coarse grained particles prior to discharge into a watercourse or storage basin.
- Design hydrology can be the rational method or Soil Conservation Service methods. Other methods may be used with prior approval. The rational method cannot be used for volume or hydrograph calculations.
- Minor drainage facilities shall carry the 10-year recurrence runoff flows. Minor facilities include street capacity to the top of the curb, cross-culverts, storm sewers, and swales to the limits of the easement.
- Hydraulic calculations for pipe systems shall be based on the 10-year storm.
- Storm sewers shall be designed for a design storm minimum velocity of 2 feet per second.
- The minimum storm sewer pipe size shall be 12 inches in its least dimension.
- The minimum roadway culvert size shall be 18 inches in its least dimension.
- The minimum driveway culvert size shall be 15 inches in its least dimension.
- Driveway culverts shall have adequate length to allow 4 horizontal to 1 vertical side slopes for the driveway.
- Driveway culverts shall have flared end sections.
- Driveway culverts may be RCP or corrugated steel pipe.
- Storm sewer and culvert outlets shall be designed to prevent erosion.
- All cross culverts and flared end inlets to storm sewers shall have trash racks.
- All storm sewer aprons shall be concrete. Tie last three joints.
- All flared end sections, with the exception of driveway culverts, must have GRAY Flex Stake EZ Drive Marker with diamond grade reflective tape placed around the top and 18-inches below the top of the marker.
- All storm sewer lines existing outside of the road R.O.W shall be contained within a utility easement a minimum of 20-feet in width.

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- RCP shall be used under all public roadways unless other pipe is approved by the City Engineer.
- HDPE pipe will not be allowed.
- Storm sewer manhole castings shall be Neenah R-1733 lettered "Storm Sewer".
- All storm sewer manhole castings shall be adjusted with Ladtech H.D.P.E. adjusting rings. All catch basin castings shall be adjusted with concrete adjusting rings. Installation of concrete rings shall include wrapping the rings with Type IV geotextile fabric, and mortaring the rings, inside and out, with one-half inch of approved non-shrink grout.
- Catch basin castings in roadway shall be bicycle safe, R-3250-1, or approved equal.
- All catch basins shall be ramped with bituminous mixture as part of the non-wearing course placement. The catch basins shall be marked with a steel fence post to note locations after the installation of the bituminous base course.
- Catch basins shall be located at the Point of Tangent or along the Tangent to collect stormwater prior to crosswalks.
- All off-street manholes must have GREEN Flex Stake EZ Drive Markers with diamond grade reflective tape placed around the top and 18-inches below the top of the marker.
- All storm sewer structures placed immediately prior to pond inlets must be constructed with a sump a minimum of 3-feet in depth. Access must be provided to all sump structures.
- All storm sewer structures shall have integral pre-cast concrete base sections. Separate base slabs will not be permitted unless specifically approved by the City Engineer.
- Riprap material shall be Granite, unless Geolink is approved for use by the City Engineer.
- Storm ponds must be contained within Outlots
- Access must be provided to all storm sewer structures, flared end sections, pipes, and ponds. Access may be provided via grading easements such that gradients do not exceed 8.00%

STREETS

- Streets shall be designed with a minimum grade of 0.5% and a maximum grade of 7.0%.
- The maximum slope of approach grade tangent at street intersections shall be 3.0% between 100 and 50 feet from the intersection; within 50 feet of the intersection the maximum slope shall be 1.0% for residential streets, and 0.5% for collector streets unless approved otherwise.
- Minimum length of vertical curves shall meet a 30 mile per hour design speed.
- Minimum grade for circumference of cul-de-sac of 0.5%.
- Intersection radii shall be 20 feet on urban sections and 30 feet on rural sections.
- Cul-de-sacs shall be constructed with a minimum 50 foot radius, and with entrance radii of 100 feet.
- Cul-de-sac streets shall not exceed 600 feet from the center of the intersection to the end of the cul-de-sac right-of-way.
- Intersections shall meet at 90 degrees except for extreme hardship cases.
- Provide 100' of profile for existing streets proposed for extension.
- All plans shall be submitted with street cross-sections.
- Street pavement sections shall be designed in accordance with Minnesota Department of Transportation standards for a 7-ton pavement for residential streets. All other roads shall be designed for 9-ton loading. The absolute minimum pavement section shall be 8 inches of Class 5 aggregate base with 3-1/2 inches of bituminous pavement. Pavement shall consist of a 2 inch base course and a 1.5 inch wear course. The 1.5 inch wear course shall be placed the following construction season.

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- Wear course shall be placed after one freeze-thaw cycle.
- Through residential streets shall be 38-feet face to face. All other local residential streets shall be 32-feet face-to-face. These widths are subject to the approval of the City Engineer.
- Standard curb shall be B618 on collector streets and for commercial/industrial areas.
- Local or through residential streets may have surmountable curb in accordance with the City's standard detail. All other streets shall have B618 concrete curb and gutter.
- Boulevards shall be graded to 2.00% or greater.
- Sidewalks shall be located along one side of all streets; cul-de-sacs may be excluded. Sidewalks shall be 5" thick and 5' wide with a 1' set back from the property line.
- Bituminous walks may be included in place of concrete sidewalks. Bituminous walks shall be 8-feet wide, with 3-inches of bituminous pavement and 6-inches of class 5 aggregate base.
- Shared-Use paths shall be 10' wide and set back 2' minimum from the property line or a minimum of 4 feet from back of curb. Material shall be determined at time of preliminary platting.
- All urban commercial or industrial zoned streets and all through residential streets, urban collector, and arterial streets shall have a 5-foot wide sidewalk on one side.
- Rural street sections shall have 12 foot driving lanes, 4 foot shoulders, 4:1 (H:V) slope to ditch, and 3:1 or flatter backslopes.
- Mailboxes shall be clustered in groups of 4 or more. Mailbox locations in cul-de-sacs shall be in the neck of the cul-de-sac.
- All catch basins shall be ramped with bituminous mixture as part of the non-wearing course placement.
- Raising of manholes shall be at the direction of the City Engineer. All sanitary sewer manholes covered by the base course shall be brought to grade immediately after the base course is placed. The manholes shall be raised again just prior to the final lift of bituminous. Raising of manholes is done for emergency access, cleaning, and testing.
- All gate valves covered by the base course shall be adjusted to ½" below the base course immediately following placement. The valves shall be raised again prior to the final lift of bituminous.
- The City of St. Francis will enforce a $500 penalty for each casting or valve box not adjusted to ½" below the bituminous wearing course where a bituminous patch is required to properly adjust the structures.
- Density testing and Test Rolling shall be conducted on prepared subgrade prior to placing Class 5 aggregate base and on prepared Class 5 aggregate base prior to paving bituminous base.
- Traffic control shall satisfy MNMUTCD Standards.
- Temporary traffic control shall conform to requirements of MnDOT's "Temporary Traffic Control Zone Layouts" latest field edition.

GRADING AND EROSION CONTROL

- Provide at least two bench marks for each project and NAVD Datum information on construction plan sheets.
- Minimum overland drainage grading shall be 1.00%.
- Emergency overflows shall be clearly noted and planned for all low points.
- Low floors for homes shall be 1' above the ordinary high water level or the highest known water level whichever is greater.

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- Construct storm ponds or temporary ponds early in grading. Silt fence shall be installed at the HWL after ponds have been completed.
- Erosion control shall be in place prior to the start of any work.
- Erosion and sedimentation control shall intercept all runoff by silt fence, diversion berms, and temporary sedimentation basins prior to leaving the site.
- All finished slopes steeper than 2 horizontal to 1 vertical shall require either erosion control blanket or sod, and shall be stapled.
- Wetlands to be preserved shall be encircled with silt fence prior to the start on any work. Leave a minimum of 15' vegetation buffer (or more as required by ordinance).
- All existing City owned right-of-way, easement or other property that is disturbed shall be revegetated with sod or seed & blanket at the discretion of the City and City Engineer.
- Sod or seed & blanket a minimum of 4 feet behind back of curb where no sidewalk exists. In areas where sidewalk or trail is constructed, sod or seed & blanket between the back of curb and the sidewalk or trail. All areas disturbed by street and utility construction shall be seeded and mulched.
- All areas adjacent to concrete walk or paved trail shall include one standard roll of sod (2 feet) adjacent to the back of walk or trail.
- All green-space areas including ditches, yards, and other areas where vegetation is required shall include a minimum of 4-inches of topsoil.
- Seed mixture 240/250/260 shall be used for sites that will be subsequently disturbed for building construction and for rural roadside ditches.
- Rock entrances shall be installed for all new home construction sites.
- Street sweeping shall be required on all projects. The Developer shall include provisions to sweep streets during construction. The Contractor shall be sweep the streets with 7 days written notice from the City or City Engineer. If the Developer doesn't complete the sweeping within 7 days, the City shall cause the sweeping to be completed and charge the cost to the developer.
- All ponds must be constructed to the elevations shown on the plans. Prior to acceptance by the City of St. Francis, all elevations must be verified which will require the removal of any water existing in the ponds to verify pond bottom elevations.
- All retaining walls that exceed 4' of vertical height shall be designed by a Structural Engineer, licensed in the State of Minnesota.

OTHER APPLICABLE CITY CODES

- No equipment on City parks or out-lots without City approval.
- A representative of the City of St. Francis must be present when accessing City of St. Francis Utilities.
- All construction activities including punch list completion require a representative of the City of St. Francis to be present. Work will not be approved nor accepted without a representative present.
- Access to Outlots and parks shall be graded such that gradients do not exceed 8.00%.
- Two year development warranty period for streets starts after all punch list items have been completed and the development has been accepted by the City. All utilities are subject to a two-year warranty period from the same date as noted above.

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POLICY FOR COMPLETION OF PUNCH LIST ITEMS

The following policy, approved by the St. Francis City Council upon adoption of the Development Standards is being implemented to ensure projects and developments within the City of St. Francis are being completed in a timely manner.

- Prior to completion of the project, the City Engineer will prepare a "List of Items to be Completed" for the Contractor's information.
- After completion of the "Items to be Completed" for the project, the St. Francis City Engineer will prepare a "Final Project Punchlist" of items to be completed for a particular project/development before the City will allow the development to enter its warranty period. The Developer will be given 30 days to complete the punch list items.
- Following the 30-day period, the City will complete the items using Developer escrow and/or Letter of Credit dollars if "Final Project Punchlist" items remain to be completed.
- Prior to the release of Development escrows and or Letter of Credit, the Developer shall submit a 2-year street maintenance bond and a 2-year utility maintenance bond in the amount of 25% of the certified construction costs.
- After all "Final Project Punchlist" items have been completed, the 2-year street warranty period and 2-year utility warranty period will begin.
- Prior to the expiration of the 2-year street and 2-year utility warranty period, the Development/Project will be inspected and any outstanding warranty items will be forwarded to the Developer/Contractor for completion within 30 days.
- After the 30 days, if the warranty items are not complete, the City will complete using Developers maintenance bonds.
- Upon completion of the warranty items and acceptance of the project, the City will release any remaining escrow dollars to the Developer.

The 30-day deadline for completion of punch list items would be set during a normal construction season.

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CITY OF ST. FRANCIS

Instructions for Installation of Water Meter, Remote Wire and Meter Horn

It is the responsibility of the plumbing contractor to install water meter, horn, wire and remote.

Water meter, horn, wire and remote will be furnished by the City and can be picked up at the Public Works building. The applicant shall pay all cost associated with these components.

- Water service must be flushed before the meter is installed!
- Meter must be installed in the mechanical room, no more than ten (10) feet away from the floor drain.
- Meter must be installed in a horizontal position.
- Meter shall be placed at least twelve inches (12") above the finished floor.
- A valve must be installed on both sides of the meter.
- Remote must be installed within 1-foot of the electrical meter.
- Wire must be stapled at intervals not to exceed three feet (3'), must be inside of wall or floor joist. Staples rated for wiring with a rounded crown must be used. Black electrical tape on copper pipe no more than two feet (2') apart. Wire used shall be solid copper AWG, size 18 by 3 conductor, color-coded. Staples used shall be Arrow number T-25 for wiring up to ¼-inch in diameter 9/16-inch long or equal.

The Building Official at the plumbing inspection will inspect the meter installation; at which time water will be left off and meter sealed.

Curb stop must be inspected and approved prior to Building Final; call Public Works at 763-233-5200.

The City shall charge the contractor for labor and material if improperly installed.

If you have any questions, call the Public Works at 763-233-5200 or the Building Department at 763-235-2317.

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CITY OF ST. FRANCIS

Requirements for Installation of Sewer & Water from Curb Stop to House

WATER:

1) No curb stops in the driveway. If a curb stop is placed in the driveway, contact the Public Works Department at 763-233-5200 or the Building Inspector at 763-235-2317 before starting work.
2) The curb stop must have concrete block placed under it.
3) Water line must be a minimum of one-inch (1") Type K copper or CTS Polyethylene water service pipe.
4) #12 AWG solid copper steel (CCS) wire with 30 mil high density polyethylene (HDPE) insulating jacket, color BLUE must be along non-conductive water services for locating purposes.
5) Water lines must be insulated if less than seven and one-half feet (7.5') deep with 2 layers of two-inch (2") thick by four foot (4') wide polystyrene insulation; water lines between six feet (6') and six and one-half feet (6.5') deep must be insulated with 2 layers of (2") thick by six-foot (6') wide polystyrene insulation ; water lines between five feet (5') and six feet (6') deep must be insulated with 2 layers of (2") thick by eight-foot (8') wide polystyrene insulation; water lines less than five feet (5') deep must be insulated with 2 layers of (2") thick by ten-foot (10') wide polystyrene insulation. No water lines shall be left in service if less than 4.5 feet in depth.
6) The water must have an inside valve.
7) No couplings allowed unless approved by the City of St. Francis including the area from the curb stop to the first valve in the house.
8) Water line must be flushed after installation.
9) After inspection by the City, water must be shut off at the curb stop.
10) All curb boxes must have a rod installed.
11) Curb box top must be level with surface.
12) If water line is installed during the winter and can't be tested by turning on the water, air testing must be done at the time of the initial inspection; minimum 80 psi for 15 minutes.

SEWER:

1) Sewer line must be SDR 26 ASTM SPEC D3034 or PVC Schedule 40 and no less than four-inches (4") in diameter.
2) Sewer must have a clean out within two feet (2') of the outside wall and every seventy-five feet (75') thereafter. Clean out must have a minimum metal one-foot (1') stake installed next to it. At no time may the outside clean out be located under a structure/deck unless it is a minimum forty-eight inches (48") above grade.
3) #12 AWG solid copper steel (CCS) wire with 30 mil high density polyethylene (HDPE) insulating jacket, color GREEN must be run along the sewer service for locating purposes.
4) Sewer line must have a minimum one-eighth inch (1/8") per foot slope.
5) Industrial buildings must have a testing/sampling manhole on service line to building.

GENERAL REQUIREMENTS:

1) Contractor shall obtain a permit from the City prior to starting work; the Contractor will be notified of the permit fee.
2) Contractor shall provide the City of St. Francis with a certificate of insurance and excavator's performance bond in the amount of $5,000.00 before starting the work.

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3) Contractor must have work inspected by the Public Works Department. Curb stop/box must be inspected and approved by the Public Works Department prior to Building Final. Please schedule inspections through the Public Works Department by calling 763-233-5200.
4) All trenches must meet OSHA standards.
5) The City shall charge the Contractor for labor and material if improperly installed.

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Detail #9-301A	Rural Mailbox Installation Detail
Detail # 9-303	Typical Bench Detail
Detail # 9-304	Trash Receptacle
Detail # 9-600	Sewer & Water Service Record Drawing

Mn/DOT Standard Plan Sheets

Sheets 1-5	Mn/DOT ADA/PROWAG Pedestrian Ramp Details

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TECHNICAL

SPECIFICATIONS

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SECTION 02220 - REMOVING PAVEMENT AND MISCELLANEOUS STRUCTURES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the removal of pavement and miscellaneous structures as indicated on the drawings or as specified herein.

1.2 SPECIFICATIONS REFERENCES

A. Mn/DOT Specification Section 2104 shall apply to the removal of pavement and miscellaneous structures, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.3 SUBMITTALS

A. No exception to the referenced specification is made.

PART 2 -- PRODUCTS

2.1 NO EXCEPTION TO THE REFERENCED SPECIFICATION IS MADE.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Remove existing bituminous, curb and gutter, walks, drives, steps and other specified items where shown on the plans and/or required for the construction of the project.

B. Saw cut bituminous and concrete surfaces prior to excavation, to produce a clean-cut breakage joint.

C. Dispose of all concrete and bituminous removal items, rubbish and debris outside of the construction zone. It shall be the Contractor's responsibility to secure all required permits and pay all fees associated with the disposal of the material and to secure the disposal site.

D. Remove existing mailboxes, street signs and similar structures, which must be removed to construct the project. Restore these facilities to the original location or a location designated by the City, when work has progressed past the location of the structure. The Contractor shall reinstall or replace those structures, which are damaged or lost during the course of construction with new materials or components.

E. The Contractor shall take full responsibility to protect structures or other surface improvements from damage that are not to be removed. If damage to these facilities occurs due to the construction of the project, the Contractor shall replace or repair them.

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F. The City will designate which existing hydrants, valves and boxes, manhole castings and other items removed as part of the construction, are to be salvaged. All other items shall be disposed of by the Contractor.

G. In general, all existing watermain, sanitary sewer and storm sewer pipe being replaced by new improvements shall be considered as debris and removed during the construction process. In certain instances, existing pipes may be abandoned in place, with the approval of the City Engineer.

H. Where existing pipes are to be abandoned in place, the exposed pipe ends shall be bulkheaded shut with a watertight non-shrink concrete grout at a thickness of not less than one pipe diameter.

I. All wells existing within a proposed Development shall be sealed by a Certified Well Driller licensed in the State of Minnesota. A copy of the sealing records shall be submitted to the City Engineer after approval of the Minnesota Department of Health.

******END OF SECTION******

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SECTION 02230 - CLEARING AND GRUBBING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to clearing and grubbing trees, stumps and brush as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2101 shall apply to clearing and removing trees, stumps and brush, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 NO EXCEPTION TO THE REFERENCED SPECIFICATION IS MADE.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. All trees, stumps, brush, seed, grass, roots or other undesirable material within the construction limits shall be disposed of by the Contractor.

B. Disposal methods shall be approved by the City Engineer and shall meet all local, State and federal regulations.

C. Burning or burial will not be allowed within city limits.

D. The Contractor shall take full responsibility to protect structures or other surface improvements from damage that are not to be removed. If damage to these facilities occurs due to the construction of the project, the Contractor shall replace or repair them.

******END OF SECTION******

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SECTION 02240 - DEWATERING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the dewatering of trenches as necessary to construct the elements shown on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2451.3C shall apply to the dewatering of trenches, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS – NOT USED

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The Contractor shall furnish and install all necessary discharge piping and obtain all permits, easements, rights-of-way, etc. to convey and discharge the water at a sufficient distance from the project area to eliminate recharge of the ground water at the project site.

B. Water from dewatering operations shall not be discharged where it will pond or cause damage to cropland or personal property due to the presence of standing or flowing water.

C. The Contractor shall be responsible for obtaining all necessary permits required for dewatering prior to beginning of dewatering. The Contractor shall submit a dewatering plan for the discharge showing the discharge location, energy dissipation, and water quality treatment to the City Engineer for approval prior to beginning discharge. The discharge rate, location, and water quality shall be in compliance with all local, State, and Federal requirements.

D. Existing and/or proposed sanitary system(s) shall not be used as an outlet for the dewatering operations.

******END OF SECTION******

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SECTION 02310 - EXCAVATION & EMBANKMENT - SITE GRADING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the excavation and embankment of the site improvements as indicated on the drawings or as specified herein.

1.2 DEFINITIONS

A. Building Pad - The area under any proposed building, or an area delineated on the plans as the site for a future building.

B. Building Pad Hold-Down - The elevation that the proposed building pad is to be constructed to. This elevation does not represent the finished grade elevation of the proposed building.

C. Compacted Volume (CV) – The volume of material actually placed as determined by computing the difference between original and final cross-sections by the average end area method.

D. Excavated Volume (EV) – The volume of material actually excavated as determined by computing the difference between original and final cross-sections by the average end area method.

E. Excess Material - Material that is not needed to complete the earthwork balance.

F. Structural Improvements - For the purposes of this specification, structural improvements shall refer to any roadway, sidewalk, trail, building, sign, or other improvements requiring suitable soil to support the anticipated loadings.

G. Subcut - Excavation performed below the proposed subgrade or building pad hold-down elevation shown on the plans for the purposes of removing unsuitable material.

H. Subgrade - The top surface of a roadbed upon which the pavement structure (including aggregate base and/or granular subbase) is to be constructed. This is also a general term denoting the soil foundation upon which a proposed improvement is to be placed.

I. Suitable Material - Sand, silty sand or low plasticity clay soils with no organic content. The City Engineer shall make the final determination as to what material will be considered suitable.

J. Topsoil - Any soil, generally black in color, containing organic material.

K. Unsuitable Material - Soil with organic content including topsoil, swamp deposits, peat, muck, or other material deemed by the City Engineer to be unsuitable for fill or embankment construction.

1.3 SPECIFICATION REFERENCES

A. Mn/DOT Specification No. 2105 shall apply to the excavation and embankment for the site improvements, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

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1.4 GEOTECHNICAL CONSULTANT

A. The Developer/ Contractor shall obtain the services of a Licensed Geotechnical Engineer to observe the construction of embankments and excavation for site grading.

PART 2 -- PRODUCTS

2.1 MATERIALS

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

B. All unsuitable excess excavated material, with the exception of topsoil shall become the property of the Developer/Contractor and shall be removed from the site and disposed of at a site secured by the Developer/Contractor.

C. Excavated material unsuitable for embankment and backfill construction shall become the property of the Developer/Contractor and shall be removed from the site and disposed of at a site secured by the Developer/Contractor.

D. Material for use in backfilling subgrade excavations shall be select material from the excavation, Select Granular Borrow, or other coarse aggregate found to be in general compliance by the City Engineer. Aggregate base, Class 5 may also be used at the direction of the City Engineer.

PART 3 -- EXECUTION

3.1 GENERAL

A. Excavated topsoil and suitable material for reuse in the project shall be segregated and stockpiled at a site selected by the Contractor.

B. All excavations shall be kept free of water during the placement of fill.

C. The Contractor shall utilize methods and equipment for excavating that will minimize the disturbance to the subgrade. The use of backhoes rather than scrapers or front-end loaders may be required to minimize repeated passes of equipment over wet subgrade soils.

D. At the end of each day the Contractor shall eliminate surface indentations, including those caused by sheepsfoot rollers and tractor cleats, and roll the surface with a steel wheel or rubber tired roller.

E. Sufficient common excavation shall be utilized by the Contractor to replace the soil shrinkage from excavation, which occurs through the course of construction handling and compaction. The Contractor shall make his own estimate of the amount of shrinkage that will occur.

F. Topsoil

1. Topsoil shall be salvaged and stockpiled in locations shown on the plans or in areas requiring final turf establishment, as approved by the City Engineer.
2. Once the salvaged topsoil is stockpiled, the Contractor shall make an estimate of any potential shortage or surplus of topsoil possible in meeting the other provision of this Contract and notify the City Engineer of the estimate.
3. The first priority in re-distributing the topsoil on site shall be to meet the minimum depths required over the entire project area.

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4. In areas requiring final turf establishment with no proposed or anticipated structural improvements (building pads, etc.), topsoil shall be spread uniformly to a minimum depth of 4-inches.

5. In areas requiring final turf establishment with proposed or anticipated structural improvements (building pads, etc.), topsoil shall be spread to a depth of 2 to 4-inches.

6. In areas not requiring final turf establishment with proposed or anticipated structural improvements, no topsoil shall be placed.

G. Material suitable for curb backfill shall be segregated and stockpiled at a site selected by the Contractor. Following curb construction, the material shall be placed behind the curb, allowing for a minimum of 4-inches of topsoil.

H. In areas where filling above the existing grade is necessary to establish the final designed elevation, the Contractor shall fully remove the topsoil and organic material to the level of stabile underlying sand or clay prior to backfilling with suitable embankment material.

I. The Contractor shall make his own determination as to whether the proposed grading has been completed according to the plans. When the Contractor determines that the grading has been completed, he will notify the City Engineer. Neither the City nor the City Engineer will provide any intermediate acceptance of the grading improvements until all of the grading has been completed and all topsoil has been spread.

3.2 EXCAVATION AND EMBANKMENT IN AREAS WITH PROPOSED STRUCTURAL IMPROVEMENTS.

A. All vegetation, topsoil, organic, or other unsuitable materials shall be excavated from the area below the structural improvement. Due to the variability of soils, the depth of the excavation in these areas is expected to vary significantly throughout the site. The excavated area shall be inspected by the City Engineer and a Geotechnical Engineer as specified in Field Quality Control.

B. Subcut excavations shall be laterally oversized a distance of one (1) foot beyond the edges of the proposed structural improvement for each foot of excavation depth (1:1 oversizing). The extents of the structural improvement areas shown on the plans do not necessarily show this 1:1 oversizing.

C. Fill placed from the bottom of the subcut to the subgrade or building pad hold down elevation shall be selected material from the excavation or borrow material. Such material shall consist of suitable material as defined above. Clay fill shall be moisture-conditioned to within 2% above or below the optimum moisture content determined from the Standard Proctor compaction test.

D. The embankment material shall be spread in 6 to 8 inch loose lifts.

E. Frozen material will not be allowed for roadway or building pad construction. The Engineer shall approve locations for placement of frozen material.

F. In all roadway and pavement areas, the Contractor shall perform a roll test on the subgrade prior to placing any portion of the pavement structure. The roll test shall be performed with a fully-loaded tandem truck. Soils which rut or deflect 1-inch or more shall be corrected by scarifying, drying, and recompacting the soils. Subgrade excavation shall only be performed as directed by the City Engineer.

G. Subgrade excavation shall be performed only when the City Engineer, Geotechnical Consultant, and the Contractor agree that the inplace soil cannot be made suitable by scarifying, drying, and recompacting. Such excavation shall be backfilled with suitable excess common excavation material, stabilizing aggregate, or select granular borrow, as directed by the City Engineer. If the Contractor proceeds without approval from the City Engineer, all work and material to restore the roadbed to the proper grade shall be at the Contractor's expense.

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3.3 EXCAVATION AND EMBANKMENT IN AREAS WITH NO PROPOSED STRUCTURAL IMPROVEMENTS

A. Topsoil or unsuitable material may be used to construct embankments in areas with no proposed structural improvements. The Contractor shall notify the City Engineer of any areas where topsoil thickness is planned to exceed 10-inches in depth. The excavation and embankment construction shall be inspected by the City Engineer and a Geotechnical Engineer.

3.4 COMPACTION

A. All embankment grading shall be compacted using:

1. Under areas with proposed paved or structural improvements, Specified Density Method :

(a) 100% Standard Proctor dry density within 3 feet of the proposed sub-grade or building pad hold-down elevation.

(b) 95% of the maximum Standard Proctor dry density below 3 feet from the proposed sub-grade or building pad hold-down elevation.

2. Under areas with no proposed paved or structural improvements, Quality Compaction Method.

3.5 SOURCE QUALITY CONTROL

A. The Contractor shall arrange for having the following testing performed:

1. One (1) gradation test per each 500 tons or 275 cubic yards (CV) of select granular borrow.
2. One (1) gradation test per each 500 tons or 275 cubic yards (CV) of other stabilizing aggregate.

B. All testing shall be performed by an independent testing laboratory approved by the City Engineer.

3.6 FIELD QUALITY CONTROL

A. The Contractor shall arrange for and pay all costs associated with having the following testing and inspections, with written certification, performed:

1. Areas with Proposed Structural Improvements:

(a) One (1) compaction test (including Standard Proctor) per each 500 SY per each 3 foot of depth of embankment.

(b) Building Pads shall have a minimum of one (1) compaction test (including Standard Proctor) per each 3 foot of depth of embankment for each pad.

(c) Inspection following the removal of unsuitable material and prior to placement of embankment material to insure that all topsoil and unsuitable material has been removed, and that the exposed subgrade has sufficient bearing capacity for the anticipated structural improvement.

B. The Contractor shall notify the City Engineer 24 hours prior to completing the removal of topsoil and unsuitable material in areas with proposed structural improvements to insure that appropriate inspection may be performed.

C. All testing shall be performed by an independent testing laboratory. All inspection shall be performed under the direct supervision of a licensed Geotechnical Engineer who shall provide written certification of the results.

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D. Samples for testing shall be taken from material in place, in building sites and/or paved areas. All sampling methods shall be approved by the City Engineer.

E. The Contractor shall coordinate the site grading and inform the City Engineer when the roadway subgrade is ready for density testing prior to installing any aggregate base. The City Engineer may order some subgrade correction prior to allowing the installation of aggregate base.

F. Should any of the specified tests or inspections fail, the Contractor may arrange and pay for additional tests or inspections as may be necessary to satisfy the City Engineer that the specified requirements have been met.

*****END OF SECTION******

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SECTION 02315 – APPLICATION OF WATER

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the excavation and embankment of the site improvements as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCE

A. Mn/DOT Specification No. 2130 shall apply to the application of water, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 NO EXCEPTION TO THE REFERENCED SPECIFICATION IS MADE.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The Contractor shall secure his own source of water. The Contractor may contact the Owner to determine whether water is available from the Owner and the associated cost.

B. The Contractor shall apply water as may be required to obtain proper compaction for all dust control, street construction, and embankment construction.

C. The Contractor shall NOT apply water in quantity or rate sufficient to cause erosion.

******END OF SECTION******

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SECTION 02316 – APPLICATION OF CHLORIDE

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the application of calcium chloride for dust control as indicated on the drawings or as specified herein.

1.2 METHOD OF MEASUREMENT AND PAYMENT

A. No exception to the referenced specification is made.

1.3 SPECIFICATION REFERENCES

A. Mn/DOT Specification No. 2131 shall apply to the application of calcium chloride, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. General

1. Calcium chloride solution or magnesium chloride solution shall be used for dust control. Chloride in dry form will not be allowed.

B. Calcium chloride

1. Calcium chloride shall be 38% calcium chloride concentration

C. Magnesium chloride

1. Magnesium chloride shall be 32% magnesium chloride concentration

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The City shall be notified 48 hours prior to applying calcium chloride solution.

B. The application rate for the calcium chloride solution or magnesium chloride solution shall be 0.30 gallons per square yard.

******END OF SECTION******

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SECTION 02320 - TRENCH EXCAVATION, BEDDING AND BACKFILL

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to maintenance of utility service, trench excavation, bedding and backfill necessary for the construction of underground utilities and structures, as indicated on the drawings or as specified herein.

1.2 DEFINITIONS

A. Excess Material - Material that is not needed to complete the earthwork balance.

B. Suitable Material - Sand, silty sand or low plasticity clay soils with no organic content. The Engineer shall make the final determination as to what material will be considered suitable.

C. Unsuitable Material - Soil with organic content including topsoil, swamp deposits, peat, muck, or other material deemed by the Engineer to be unsuitable for fill or embankment construction.

D. Flexible Pipe Materials – For the purposes of this specification section, flexible pipe materials shall include the following:

1. Polyvinyl chloride (PVC) pipe – solid wall and profile wall pipe.
2. High density polyethylene pipe – solid wall and profile wall pipe.
3. Corrugated steel or aluminum pipe.
4. Centrifugally cast, glass-fiber-reinforced, polymer mortar (CCFRPM) pipe.

E. Rigid Pipe Materials – For the purposes of this specification section, rigid pipe materials shall include the following:

1. Reinforced concrete pipe.
2. Reinforced concrete box culverts.
3. Ductile iron pipe.

1.3 SPECIFICATION REFERENCES

A. Reference CEAM Specification No. 2600 shall apply to excavating, installing bedding, and backfilling all trench excavation construction necessary for the completion of work, except as modified herein.

1. All references to Mn/DOT specifications shall mean the specific edition, including Supplemental Specifications and Technical Memoranda.
2. CEAM Specification 2600.3.A1 Maintenance of Traffic is hereby deleted; Maintenance & Control of Traffic shall be approved by the City Engineer.
3. CEAM Specification 2600.3.A2 Establishing Line and Grade shall be modified by individual sections of these Specifications or other project specifications.
4. CEAM Specification 2600.3.A3 Protection of Surface Structures:

(a) Street signs shall be considered as items of essential service.

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(b) The last sentence in the third paragraph is deleted.

5. CEAM Specification 2600.3.A5 Removal of Surface Improvements - All rubble and debris to be disposed of off-site, shall be disposed of at a location secured by the Contractor and in a manner in compliance with applicable Local, State and Federal regulations.

6. CEAM Specification 2600.3.B3 Excavation Limits and Requirements - OSHA limitations shall also apply to the top of trench width determination. The seven day written notice is waived if changing soil conditions and OSHA compliance apply.

7. CEAM 2600.3.C1 Jacking/Boring - The Contractor is responsible for protecting all existing utilities above the elevation of the pipe invert minus 2 times the wall thickness of the casing pipe being installed. In addition, bentonite materials shall not be permitted to flow back into the excavation during the non-open cut construction.

8. CEAM 2600.3.F1 Turf Restoration is hereby deleted, See Section 02920 of these Specifications.

9. CEAM 2600.3.F1 Pavement Restoration is hereby deleted, See applicable sections of these Specifications.

B. Reference Mn/DOT Specification No. 2451 shall apply to granular materials for foundation, bedding and encasement of utility line construction, except as modified herein.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.4 SUBMITTALS

A. No exception to the referenced specification is made.

PART 2 -- PRODUCTS

2.1 GRANULAR MATERIALS

A. Granular Bedding and Encasement - Bedding and encasement materials used in the pipe zone area (6" below the pipe to 12" over the pipe) shall meet the same gradation and specification as granular backfill, below.

B. Granular Backfill - Granular backfill material to be used above the pipe zone up to the top of subgrade if unsuitable native material is encountered shall conform with Mn/DOT Specification 3138, Class 3, modified to permit the following gradation limits. The use of the material shall be reviewed by the City Engineer prior to the installation of the material.

Sieve Size	Percent Passing
1½”	100
# 4	35 - 100
# 10	20 - 80
# 40	5 - 40
# 200	0 - 15

C. Granular Foundation - Granular foundation material (rock) shall meet Mn/DOT specification 2451for aggregate bedding as modified below. This material may be required for stabilization of the

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foundation below the pipe bottom, around the pipe fittings and under fire hydrants. The material shall be crushed rock meeting the following gradation by weight. The use of the material shall be reviewed by the City Engineer prior to the installation of the material.

Sieve Size	Percent Passing
2”	100
1½”	95 - 100
¾	20 - 60
# 4	0 - 5

2.2 TRACER WIRE

A. Tracer wire shall meet the requirements of the following:

1. #12 AWG solid copper clad steel (CCS) wire with 30 mil high density polyethylene (HDPE) insulating jacket. Tracer wire is color coded GREEN or BLUE for each utility – See applicable sections of these specifications.

B. Connectors

1. Connectors shall be “wire nut” or “twist on” type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

C. Tracer wire access box shall be as manufactured by Valvco, or approved equal.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Temporary Service

1. It will be necessary to maintain utility service during the construction period. Before proceeding with the project, the Contractor shall establish a work plan and submit the plan to the appropriate utility personnel and the City Engineer for review and comment. The plan shall outline the method to be used to maintain service to the affected consumers and estimate the duration of any anticipated interruptions of service. The Contractor is the sole party responsible to notify the Utility and consumers who may be affected by limitations and/or interruption of utility service.
2. Temporary watermain serving more than 4 residences shall be 4-inch diameter. Each service shall have a shut off valve. Commercial and industrial temporary watermain shall be a minimum of 6-inch diameter. All temporary water usage shall be metered.
3. Planned service interruptions shall not exceed six (6) hours in any 72 hour period unless previously approved by the Utility.
4. **The Contractor shall coordinate water main shut-downs with the water utility at least 24 hours prior to the requested shut-down.**
5. If needed, the Contractor shall furnish, install and maintain equipment to bypass and control the storm and/or sanitary sewer flow around the construction zone. Failure to operate and maintain

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the bypass equipment could result in direct damage claims as well as consequential damage claims to the Contractor.

3.2 TRACER WIRE INSTALLATION

A. Tracer wire shall be installed along all PVC watermain, sanitary sewer forcemain, sanitary sewer services, and non-conductive water services.

B. At junctions of non-conductive pipe materials with conductive pipe materials, the Contractor shall electrically connect the conductive material with the tracer wire adjacent to the non-conductive material.

C. Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.

D. Extend tracer wire to ground surface at locations specified in the details. Methods will vary depending on the type of utility pipe being installed - See applicable section for details.

E. The Contractor shall successfully complete a conductivity test of the installed tracer wire system prior to final acceptance.

3.3 EXCAVATION AND PREPARATION OF TRENCH

A. Interference and Protection of Underground Structures

1. If an existing utility is shown on the plans and there is no bid item for removing and restoring, or working around the utility, the Contractor shall be required to remove and restore, or protect the utility.
2. The inverts of existing sewers (storm & sanitary), culverts, subdrains, etc. shall be protected during construction. The Contractor is responsible to inspect and clean, if necessary, all lines which have become compromised by the construction operations.

B. Excavation Limits and Requirements

1. The trench for all flexible pipe shall be undercut six-inches below the pipe barrel to permit the installation of granular bedding or foundation material.
2. The trench for all rigid pipe shall be undercut a minimum of three-inches below the pipe barrel, or as noted in the pipe bedding details, to permit the installation of granular bedding or foundation material.
3. The Contractor shall install and operate a dewatering system to maintain all trenches free of water wherever necessary. The Contractor shall make his own subsurface investigations and determine what dewatering methods to utilize to prevent such damage.
4. The Contractor shall be responsible for any damage to adjacent structures or buildings caused by the dewatering operations
5. Use of granular foundation material in lieu of performing dewatering is permitted, at the Contractor's expense unless previously approved by the City Engineer.
6. All excess excavated material shall become the property of the Contractor and be removed from the site and disposed of at a site secured by the Contractor.

3.4 INSTALLATION OF PIPE AND FITTINGS

A. The Contractor shall keep accurate records as to the location of the service connections, field tile, utility crossings, etc., either constructed or encountered during the construction. Measurements to

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service lines shall be taken from the two nearest permanent structures (i.e., hydrants, valves, manholes, buildings) as directed by the City Engineer. Final payment for the project will not be made until the information is in the possession of the City Engineer.

B. When connection to an existing conduit is required at an existing or proposed manhole, the Contractor shall expose and verify the elevation of the existing conduit prior to laying any pipe toward, or away from, the connection point. If the elevation of the existing conduit does not match the elevation shown on the plans, the Contractor shall notify the City Engineer, at which time the City Engineer may adjust the proposed grades.

C. Connection and Assembly of Joints

1. For sanitary sewer, watermain, forcemains, and culverts, all joints shall be watertight.
2. For storm sewers and subdrains, all joints shall not permit the intrusion of soil or backfill materials.

D. Bulkheading Open Pipe Ends

1. The Contractor shall furnish, install and maintain a temporary, water-tight plug adequately blocked in place to prevent flooding of the existing downstream sewer system. The plug shall be placed at the beginning of the project or at the end of each working day at the end of the day's operation.
2. When flows are diverted from an existing sewer or tile to be abandoned in place, the Contractor shall construct a water-tight plug on the open end of the abandoned pipe.
3. Permanent watertight plugs shall be constructed with an approved concrete grout with a thickness of not less than 1 pipe diameter.

3.5 BEDDING AND BACKFILLING OPERATIONS

A. Flexible Pipe Materials

1. Unless otherwise shown on the plans, the pipe shall be bedded and backfilled with granular material compacted to 95% Standard Proctor Density or as recommended by the pipe manufacturer, whichever is denser, from 6-inches below the bottom of the pipe to 12-inches above the top of the pipe, the full width of the trench. The Contractor shall bed and backfill the pipe as shown on the plan details.
2. Where the trench foundation has been found to be unstable and not suitable for bedding, the trench shall be undercut until acceptable conditions are found. The Contractor shall then install compacted foundation material to meet the line and grade specified on the plan.
3. Unless otherwise shown on the plans, select native material may be used as a trench backfill above the granular bedding up to the bottom of the subgrade except in those conditions where the top of the pipe is less than 12-inches from the bottom of the subgrade in which case granular material compacted to 100% Standard Proctor Density shall be used as trench backfill the full width of the trench to the bottom of the subgrade excavation zone.

B. Rigid Pipe Materials

1. Unless otherwise shown on the plans, in ordinary or stable trench conditions, the bottom of the trench shall be first excavated to a depth of approximately 15 percent of the outside pipe diameter below the established grade for the bottom of the pipe. Then the bottom of the trench shall be further excavated to allow for the placement of 6” of granular bedding for a width of at least 60 percent of the outside diameter of the pipe. Pipe shall be placed on the bottom of the pre-shaped excavated trench. The bottom of the excavated trench shall be shaped to fit the circumference of

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the pipe up to 0.15 of the outside diameter of the pipe. The Contractor shall encase the pipe from the 0.15 outside diameter to the 0.60 diameter height of the pipe with granular material compacted to 95% Standard proctor Density or as recommended by the pipe manufacturer, whichever is denser.

2. Where the trench foundation has been found to be unstable and not suitable for bedding, the trench shall be undercut until acceptable conditions are found. The Contractor shall then install compacted foundation material to meet the line and grade specified on the plan.

3. Unless otherwise shown on the plans, select native material may be used as trench backfill above the granular bedding up to the bottom of the subgrade except in those conditions where the top of the pipe is less than 12-inches from the bottom of the subgrade in which case granular material compacted to 100% Standard proctor Density shall be used as trench backfill the full width of the trench to the bottom of the subgrade excavation zone.

C. Structures

1. All manholes, catch basins, valve boxes, water vaults, headwalls and miscellaneous structures shall be backfilled with granular backfill material and shall be compacted with a hand operated motorized compactor. The maximum lift thickness shall be 6-inches.

D. All trench backfill shall be compacted in accordance with the Specified Density Method:

1. Under areas with proposed paved or structural improvements:

(a) 100% Standard Proctor from the proposed pavement subgrade elevation down 3 feet.

(b) 95% Standard Proctor from the bottom of excavation up to 3 feet below the subgrade elevation

2. Under areas with no proposed paved or structural improvements:

(a) 95% Standard Proctor

3.6 SOURCE QUALITY CONTROL

A. The Contractor shall arrange for having the following testing performed:

(a) One (1) gradation test per each 500 tons or 275 cubic yards (CV) of granular material.

3.7 FIELD QUALITY CONTROL

A. The Contractor shall arrange for having the following testing performed:

1. One (1) compaction test (including Standard Proctor) on subgrade per each 300 lineal feet of trench per 3 feet of depth

B. The Contractor shall cooperate fully with the individuals performing the tests.

C. Samples for testing shall be taken from material in place, in the trench at locations approved by the City Engineer. All sampling methods shall be approved by the City Engineer.

D. Should any of the specified tests fail, the Contractor may arrange and pay for additional tests as may be necessary to satisfy the City Engineer that the requirements have been met.

******END OF SECTION******

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SECTION 02330 - EXCAVATION AND EMBANKMENT - ROADWAY & PAVEMENT

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performance of all work and services necessary or incidental to the excavation and embankment for roadways and pavements as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2105 shall apply to excavation and embankment, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

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

B. Excavated material unsuitable for embankment and backfill construction shall become the property of the Developer/Contractor and shall be removed from the site and disposed of at a site secured by the Developer/Contractor.

C. Material for use in backfilling subgrade excavations shall be Select Granular Borrow or other material found to be in general compliance by the City Engineer. Aggregate base, Class 5 may also be used at the direction of the City Engineer.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. At the end of each day the Contractor shall eliminate surface indentations, including those caused by sheep foot rollers and tractor cleats, and roll the surface with a steel wheel or rubber tired roller.

B. Subgrade excavation shall be performed, as directed by the City Engineer, for the removal of any unstable soils which may be encountered. Such excavation shall be backfilled with suitable excess common excavation material or stabilizing aggregate as directed by the City Engineer. If the Contractor proceeds without approval from the City Engineer or City, all work and material to restore the roadbed to the proper grade shall be at the Contractor's expense.

C. Once the subgrade has been tested and accepted by the City Engineer, no traffic or construction equipment shall be permitted to operate directly on the subgrade without the prior approval of the City Engineer. All equipment shall be restricted to operating only in areas where the aggregate base has been installed to its full design depth.

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D. Material suitable for curb backfill shall be segregated and stockpiled at a site selected by the Contractor. Following curb construction, the material shall be placed behind the curb to the subgrade level of the topsoil.

E. The Contractor shall salvage and stockpile all topsoil removed during the course of the construction. This topsoil shall be used where required for turf establishment as directed by the City Engineer.

F. Sufficient excavated material shall be utilized by the Contractor to replace loss volume due to soil shrinkage from trench excavation, which may occur through the course of construction. The Contractor shall make his own determination of the amount of shrinkage that will occur.

G. All embankment shall be compacted using the Specified Density Method:

1. Under areas with proposed paved or structural improvements:
   (a) 100% Standard Proctor from the proposed pavement subgrade elevation down 3 feet.
   (b) 95% Standard Proctor from the bottom of excavation up to 3 feet below the subgrade elevation
2. Under areas with no proposed paved or structural improvements:
   (a) 95% Standard Proctor

3.2 SOURCE QUALITY CONTROL

A. The Contractor shall arrange for having the following testing performed:

1. One (1) gradation test per each 500 tons or 275 cubic yards (CV) of select granular borrow.
2. One (1) gradation test for stabilizing aggregate.

B. Samples for testing shall be taken from material in stock at locations approved by the City Engineer. All sampling methods shall be approved by the City Engineer.

3.3 FIELD QUALITY CONTROL

A. "Blue top" stakes shall be provided by the Developer/Contractor at 50 foot intervals to confirm that the subgrade is constructed to the required grades and elevations. Methods other than "blue top" staking may be allowed, if approved by the City Engineer.

B. The Contractor shall arrange for and pay all costs associated with having the following testing performed:

1. One (1) compaction test (including Standard Proctor) on subgrade per each 500 SY of roadway per each 3 feet of subgrade excavation depth.

C. All testing shall be performed by an independent testing laboratory approved by the City Engineer.

D. The Contractor shall cooperate fully with the individuals performing the tests.

E. Samples for testing shall be taken from material in place, in the roadway at locations approved by the City Engineer. All sampling methods shall be approved by the City Engineer.

F. Should any of the specified tests fail, the Contractor may arrange and pay for additional tests as may be necessary to satisfy the City Engineer that the requirements have been met.

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******END OF SECTION******

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SECTION 02335 - SUBGRADE PREPARATION

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performance of all work and services necessary or incidental to the subgrade preparation as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2112 shall apply to the subgrade preparation, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 NO EXCEPTION TO THE REFERENCED SPECIFICATION IS MADE.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. At the end of each day, and prior to the placement of aggregate base, the Contractor shall eliminate surface indentations, including those caused by sheeps foot rollers and tractor cletes, and roll the surface with a steel wheel or rubber tired roller.

B. The Contractor shall disc, scarify, shape and compact the upper twelve (12) inches of the street subgrade or existing base, adding water or drying as may be necessary to give uniform and desired density.

C. If the subgrade is unstable and the instability is due to excessive moisture, the subgrade shall be scarified and dried over a reasonable time period. When the material has reached acceptable moisture limits, the material shall be returned to the roadbed and compacted into place to the proper elevation. The roadbed will once again be tested. If the material continues to be unstable, the City Engineer may authorize the removal of the undesirable material as subgrade excavation.

D. Once the subgrade has been test rolled and accepted by the Engineer, no traffic or construction equipment shall be permitted to operate directly on the subgrade without the prior approval of the Engineer. All equipment shall be restricted to operating only in areas where the aggregate base has been installed to its full design depth. In the event that inclement weather occurs after a test roll, and prior to placement of the aggregate base or first course of bituminous, the test roll shall be voided and a new test roll shall be performed.

E. The subgrade shall be compacted in accordance with the Specified Density Method:

1. Under areas with proposed paved or structural improvements:
   (a) 100% Standard Proctor from the proposed pavement subgrade elevation down 3 feet.
   (b) 95% Standard Proctor from the bottom of excavation up to 3 feet below the subgrade elevation

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2. Under areas with no proposed paved or structural improvements:

   (a) 95% Standard Proctor

3.2 FIELD QUALITY CONTROL

A. "Blue top" stakes shall be provided by the Contractor/Developer at 50 foot intervals to confirm that the subgrade is constructed to the required grades and elevations. Methods other than "blue top" staking may be allowed, if approved by the City Engineer.

B. The compacted subgrade shall be test rolled using a fully loaded aggregate truck (tandem) in a pattern approved by the Engineer. The subgrade stability shall be considered adequate when the surface shows less than one (1) inch of yielding or rutting after one pass, or as otherwise approved by the Engineer.

C. The Contractor shall arrange for and pay all costs associated with having the following testing performed:

   1. One (1) compaction test (including Standard Proctor) on subgrade per 500 SY of roadway.

D. All testing shall be performed by an <u>independent</u> testing laboratory approved by the City Engineer.

E. The Contractor shall cooperate fully with the individuals performing the tests.

F. Samples for testing shall be taken from material in place, in the roadway at locations approved by the City Engineer. All sampling methods shall be approved by the City Engineer.

G. Should any of the specified tests fail, the Contractor may arrange and pay for additional tests as may be necessary to satisfy the City Engineer that the requirements have been met.

******END OF SECTION******

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SECTION 02340 – GEOTEXTILE FABRIC – ROAD CONSTRUCTION

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to geotextile fabric - road construction as indicated on the drawings or as specified herein. This material will only be used if unstable areas are encountered, as determined by the Engineer.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. The fabric to meet the requirements of Mn/DOT 3733, Type V, unless otherwise shown on the plans.

2.2 SOURCE QUALITY CONTROL

A. The Contractor shall furnish certified copies of manufacturer's test results on geotextile samples indicating conformance to the required specifications. The test results shall be furnished to the Engineer at least ten (10) days prior to the intended installation date.

B. The Engineer may make random checks to assure compliance with the specifications.

C. Non-conforming products will be subject to rejection.

D. Approved materials will be accepted on the basis of brand name labeled on the geotextile itself or its container.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Prior to installing geotextile fabric, the prepared subgrade surface shall be relatively smooth and free of stones, sticks or other debris or irregularities that could puncture the geotextile.

B. If multiple pieces of geotextile are required, adjacent strips shall be field or factory sewn with “J” stitching. In lieu of sewing, an 18" strip overlap is permitted provided there is no potential for the geotextile strips to separate.

C. Wrinkles and folds in the geotextile shall be removed by stretching and staking, as required.

D. The geotextile shall be secured to prevent displacement during subsequent operations.

E. No traffic or construction equipment will be permitted to operate directly on the geotextile.

F. Once the geotextile is placed and prior to the placing of aggregate cover, the Contractor shall allow the Engineer sufficient time to conduct a personal observation of the geotextile to determine that no holes, rips, tears or similar defects have occurred and that sewing/overlap have been properly installed. All defects determined during the observation shall be patched or replaced prior to placing aggregate cover.

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G. The aggregate cover shall be end dumped onto the geotextile. The initial deposit of material may be graded to the design thickness but at no time shall equipment be allowed on the geotextile with less than eight (8) inches of aggregate cover. Following compaction of the initial layer, all remaining material shall be placed as specified.

H. Construction shall be conducted parallel to road alignment. Vehicular turning shall not be allowed on the first lift of cover material, unless approved by the Engineer. All ruts that form during the construction shall be immediately filled to maintain the minimum aggregate cover.

I. Unless otherwise shown on the plans, the geotextile fabric shall be placed to the back of the curb or to the outside edge of the edge drain filter trench, whichever is closest to the centerline of the roadway.

******END OF SECTION****

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SECTION 02370 - EROSION & SEDIMENT CONTROL

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to storm water management as indicated on the plans, as specified herein or as directed by the Engineer.

B. The Contractor, Developer, and City Engineer shall identify a person(s) knowledgeable and experienced in the application of erosion and sediment control BMP's who will oversee the implementation of the SWPPP.

C. Minnesota Pollution Control Agency (MPCA) - General Storm Water Permit for Construction Activity (MN R100001)

1. The **Developer** shall develop a **Storm Water Pollution Prevention Plan (SWPPP)** in accordance with Part III (Storm Water Discharge Design Requirements) of the National Pollutant Discharge Elimination System (NPDES)/State Disposal System Permit. The SWPPP shall be included in the project plans.
2. As a condition of the Award, the Contractor shall be a co-permittee and assume the role of "**Operator**" under the NPDES Permit.
3. The Developer/Contractor will initiate the permit and pay the required fee.
4. For **storm water** discharges from construction activities where the **Owner** or **Operator (Contractor)** changes, the new **Owner** or **Operator** can implement the original **SWPPP** created for the project, implement an amended version of the original SWPPP, or develop and implement their own **SWPPP**.
5. **Permittee(s)** shall ensure that their **SWPPP** meets all terms and conditions of this permit and that their activities do not render ineffective another party's **erosion prevention** and **sediment control Best Management Practices (BMP's)**.
6. The Contractor shall maintain copies of the SWPPP on the project site at all times and comply with all provisions contained therein, including performing the required inspections of the erosion control devices and maintaining an Inspector's Log for the MPCA Storm Water Permit. An Inspector's Log form is attached in the Appendix to these specifications.
7. The Contractor shall be responsible for keeping the on-site SWPPP documents current and updated to reflect changing conditions as construction progresses.
8. Process Summary:
   (a) Owner *Awards Contract* to Contractor.
   (b) The Contractor shall review the SWPPP and may propose changes or a new SWPPP to the Engineer for review and comment, and the Owner for approval. Changes may be recommended by the Contractor, Engineer, and/or Owner at any time during the construction period to address changing conditions.
      (1) During the review and modification period, on-site Erosion Control shall comply with or exceed the current SWPPP. Pending review or approval by the Engineer and/or Owner shall not alleviate the Contractor's responsibility to install necessary BMP's to address site issues.
      (2) Once a SWPPP is modified and/or amended, the Contractor shall distribute new copies to the Developer, the City Engineer, the on-site project supervisor and the resident project representative.

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(c) Contractor acknowledges the *Notice of Award* and provides the Owner and City Engineer with the contact information for the Contractor's designated SWPPP contact to be used by the Owner for the on-line Stormwater Permit Application. Required information includes; Name, Title, Business Mailing Address, Phone Number and Email for the designated individual.

(d) Prior to construction activity commencing, the Owner/Contractor shall submit the Permit Application to the MPCA.

(e) No work shall begin until permit authorization is received.

(f) Work shall follow the sequence of major activities outlined in the SWPPP.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2573 shall apply to temporary erosion and sediment control. In addition to the materials referenced in Mn/DOT Section 2573, the following additional references are made:

1. Mn/DOT Specification Section 2575.3N – Rapid Stabilization
2. Mn/DOT Specification Section 3883, Erosion Control Netting
3. Mn/DOT Specification Section 3884, Hydraulic Soil Stabilizer
4. Mn/DOT Specification Section 3885, Erosion Control Blanket
5. Mn/DOT Specification Section 3888, Erosion Stabilization Mat

B. Mn/DOT Specification Section1717.2 shall apply to erosion control.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Erosion Control

1. See Section 02920

B. Bale checks shall not be used.

C. Sediment Control

1. Inlet Protection

(a) Inlet Protection shall conform to the detail shown on the plans. Alternate inlet protection devices listed on the Mn/DOT approved products list may be acceptable upon approval of the City Engineer.

PART 3 -- EXECUTION

3.1 GENERAL

A. Construction and/or installation of all appropriate erosion & sediment control devices shall be completed prior to any soil disturbing activities.

B. Prior to construction, the Owner, Engineer and Contractor shall observe and document the existing storm water outfall system and discharge area. All sediment deposits not documented prior to the construction shall be assumed to have originated from the project site and shall be removed and disposed of by the Contractor.

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C. Prior to construction, the Owner, Engineer and Contractor shall review the project to identify critical areas that could require rapid stabilization during the construction process, and develop mitigation and rapid stabilization plans to be incorporated into the SWPPP.

D. Exit areas or roads shall be kept clean of excess soil by routine sweeping.

3.2 CONSTRUCTION REQUIREMENTS

A. The Contractor shall control drainage, erosion, and sediment on the project including: haul roads, temporary construction, waste disposal sites, plant and storage locations, and borrow pits, other than commercially operated sources.

B. If Contractor fails to install and/or perform the appropriate erosion and sediment control practices, as determined by the Engineer, the Engineer may issue a written order to the Contractor. The Contractor shall respond within 24 hours with sufficient personnel, equipment and/or materials and conduct the **required work or be subject to a $ 500 per calendar day deduction for non-completion.**

C. When the Engineer determines that the erosion and/or sediment control practices installed by the Contractor have failed, the Contractor shall correct the cause and alleviate all sediment deposition, to the fullest extent possible. If the corrective action is not taken in a timely manner, the Engineer may issue a written order to the Contractor. The Contractor shall respond within 24 hours with sufficient personnel, equipment and/or materials and conduct the **required work or be subject to a $ 500 per calendar day deduction for non-completion.**

D. Contractor shall be responsible for removing all sediment deposits including, but not limited to, drainage ways, stormwater basins, or catch basins and re-stabilize the areas where sediment removal results in exposed soil. The removal and stabilization shall take place within 7 calendar days of discovery unless precluded by legal, regulatory, or physical access restraints. If precluded, removal and stabilization must take place within 7 calendar days of obtaining access. The Contractor is responsible for contacting all local, regional, State, and Federal authorities and property owners and obtaining applicable rights of entry, approvals, and/or permits.

3.3 TRAINING

A. Contractor shall ensure the individual(s) designated for this project to perform the duties described below have been trained in accordance with Minnesota Pollution Control Agency (MPCA) General Storm Water Permit for Construction Activity (MN R100001) training requirements.

1. Individual(s) overseeing implementation of, revising, and amending the SWPPP and individual(s) performing inspections. One of these individual(s) must be available for an on-site inspection within 72 hours upon request by the MPCA.
2. Individual(s) performing or supervising the installation, maintenance and repair of BMP's. At least one individual on a project must be trained in these job duties.

B. Documentation must be incorporated by the Contractor into the SWPPP or be available within 72 hours upon request and must include:

1. Name of the personnel associated with this project that attended the training.
2. Dates of training, name of instructor(s), and entity providing training.
3. Content of training course or workshop (including number of hours of training).

******END OF SECTION******

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STORM WATER POLLUTION PREVENTION PLAN - INSPECTION LOG

Project Title: _____ Owner: _____

Permit ID: C000_____ General Contractor: _____

The Contractor is REQUIRED to maintain this record throughout the project.

Inspectors should enter their initials, type, date, and time of the inspection in the blanks provided. After inspecting each shaded area, inspectors should check each box, and make any necessary comments regarding their findings in the blanks provided below and on the back of this sheet.

Refer to the MPCA's *Compliance Guide for Erosion and Sediment Control* during inspection.

	Type of Inspection		**Date and Time of Inspection**				**Weather**		**Areas to be Inspected**			
Name of Inspector	Routine Weekly	24 Hr after rain event	Month	Day	Year	Time (AM/PM)	Temperature (degrees Farenheit)	Rainfall Amount (inches)	All erosion and sediment control BMPs	Temporary Sedimentation Basins	Drainage ditches and other waters of the State	Construction Site Exits
Comments:												
Comments:												
Comments:												
Comments:												
Comments:												
Comments:												
Comments:												
Comments:												
Comments:												
Comments:												

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SECTION 02375 - GEOFIBER EROSION CONTROL MATS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the installation of geofiber erosion control mats as shown on the drawings, as specified herein, and/or as specified by the City Engineer.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 3888 shall apply, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Geofiber erosion mats shall be manufactured of synthetic fibers for the stabilization of erosion-prone slope surfaces. All geofiber mats shall be filamentous, nylon material with not less than 0.5 percent by weight of carbon black and minimum filament diameter of 0.40 mm. Mat weight shall be approximately 0.75 pounds per square yard with a minimum mat thickness of 0.70 inches. Tensile strengths in the mat roll length and width directions shall be a minimum of 140 and 80 kilograms per meter, respectively.

B. The mat material shall be ENKAMAT, type 7020 as manufactured by American Enka Company, or approved equal conforming to the specified characteristics.

C. Staples for anchoring the erosion mats shall be No. 11 gage, or heavier, wire, “U”-shaped with a length of not less than 18 inches from the top of the curve to the end of the staple and a head width of 2 inches.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Where shown on the Plans, the Contractor shall furnish and install a geofiber erosion control matting as shown in the detail on the Plans.

B. The Contractor shall fill and grade the designated surface to the line and grade shown on the Plans to form a shallow swale in the detention pond bank.

C. The geofiber mats shall be installed along the graded area where shown on the Plans and marked in the field by the City Engineer. Starting at the upper end, roll out the center mat along the center of the swale. Repeat with side strips overlapping the center strip or subsequent inside strips by 3-inches. Place staples along the overlap at 3 to 5 foot intervals. Staked, shingle style joints with a 6-inch minimum overlap shall be used where roll length make transverse joints unavoidable.

D. All outside edges including upstream and downstream end of the mats shall be stapled and anchored to a depth of 12-inches and extended outward another 12-inches at the 12-inch bury depth to prevent undercutting of mats. Contractor shall conform to manufacturer’s recommendations regarding use of check slots.

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******END OF SECTION******

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SECTION 02377 - RIPRAP

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to construct the rip-rap and rubber membrane as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2511 shall apply to the construction of rock rip-rap, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. All rip-rap shall be Granite. Class III rip-rap shall be used for 12-inch to 21-inch diameter pipes. Class IV rip-rap shall be used for all pipes larger than 21-inches in diameter.

B. Larger rip-rap may be required for river outlets or channel stabilization. All river outlets or channel stabilization shall be approved on a case by case basis by the City Engineer.

C. The rubber membrane material shall be 45 mil thickness.

D. GeoLink PL 61 216 interlocking block, or approved equal can be used in place of rip-rap in areas specifically approved by the City Engineer.

E. ArmorFlex Articulating Concrete Block Mats, may be used for stabilization in areas approved by the City Engineer.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. When placing rip-rap around flared-end-sections, the rip-rap must be placed such that no rip-rap exists above the apron flow-lines.

B. Rip-rap shall be installed per detail 3-600. The rip-rap shall be installed such that the outlet is a minimum of 4-inches lower than the flared end and the discharge point.

C. If Geolink is approved by the City Engineer, installation shall be per manufacturer recommendations and per detail 3-602.

D. If cable concrete is approved by the City Engineer, installation shall be per Manufacturor's recommendations and the details included in this manual.

E. Rip-rap shall be installed to extended to the bottom of all ponds.

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3.2 RIP RAP FOR CHANNEL AND STREAMBANK STABILIZATION

A. Rip rap and Geolink shall be keyed in to the top of the bank as noted on the details,

******END OF SECTION******

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SECTION 02445 - JACK & AUGER STEEL CASING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the construction of a steel casing as indicated on the drawings or as specified herein.

B. Alternative methods for casing pipes are allowed. Trenchless installation of STEEL, PVC or HDPE casing pipe is allowed if approved by the City Engineer.

1.2 SPECIFICATION REFERENCES

A. See Mn/DOT Specification 2105 for Quality Compaction Methods.

B. Mn/DOT Policy Position Statement / Mn/DOT Policy Guideline / Procedures for Accommodation of Utilities on Highway Right-of-Way (dated July 27, 1990 – revised November 8, 2005)

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.3 SUBMITTALS

A. Casing pipe

1. Certificate of Compliance

B. Casing spacers (plastic)

1. Certificate of Compliance

PART 2 -- PRODUCTS

2.1 MATERIALS

A. STREET AND HIGHWAY CROSSINGS- STEEL CASING

1. Casing pipe shall be welded steel pipe, new material with minimum yield strength of 35,000 PSIG (pounds per square inch gauge). The following minimum wall thickness shall be used:

Outside Casing Diameter	Minimum Wall Thickness
12" to 28"	0.250"
30” to 34"	0.375"
36" to 60"	0.500"

A. CASING SPACERS

1. Domestic water or sanitary forcemain applications

(a) Phoenix Plastic Casing Spacers, or approved equal.

2. Sanitary sewer gravity applications

(a) Wood spacers may be used in lieu of plastic spacers if approved by the City Engineer.

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PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The Contractor shall jack and auger a steel casing using equipment that encases the hole as the earth is removed. Boring without the concurrent installation of the casing pipe will not be permitted. All joints in the casing pipe shall be welded throughout the full circumference of the casing.

B. Casing pipe shall be installed in such a manner that will not disrupt traffic.

C. The introduction of water into the excavation is prohibited.

D. The Contractor shall install the carrier pipe through the casing pipe using supports or cradles constructed of permanent materials to support the entire length of the carrier pipe in the casing. Support material shall be installed both under and over the carrier pipe to prevent shifting of the pipe. The line and grade at any point within the carrier pipe shall not vary by more than 0.05 foot from the line and grade designated. Following the installation of the carrier pipe in the casing, place 4" PVC riser pipes at both ends of the casing pipe and extend the PVC risers to the surface. Fill annular space at both ends with an appropriate concrete grout to form a watertight seal. The casing pipe and riser pipes shall be completely filled with sand. Riser pipes shall then be cut off a minimum of 1' below finished grade. Glue PVC caps to the top of each riser pipe.

******END OF SECTION******

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SECTION 02446 - TRENCHLESS PIPELINE

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to trenchless pipeline construction. Various methods will be considered, providing they can generally follow the design profile in constructing the pipeline from the starting access point to the ending access point without the need to excavate an intermediate access.

B. The INSTALLER for all forms of trenchless pipeline installation shall meet or exceed the experience requirements as stated in CEAM 2600.3.C2.

1.2 SPECIFICATION REFERENCES

A. Reference CEAM Specification No. 2600.3 Non-Open Cut Pipe Installation shall apply, except as modified herein or as shown on the plans.

B. For carrier pipe and fitting materials, see the following specification sections as appropriate:

1. Section 02510 – Domestic Water System
2. Section 02530 – Pipe Sewers – Sanitary
3. Section 02535 – Forcemains
4. Section 02630 – Pipe Sewers - Storm

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.3 SUBMITTALS

A. Items Included with the Bid

1. The diameter, wall thickness and type of material to be used for each trenchless installation. Pipe strength determination shall include calculations based on new material properties and long term properties.
2. The manufacturer's certificates of compliance with provisions of the referenced standards and these specifications.
3. A copy of the license or certificate verifying the trenchless construction equipment manufacturer's or licensor's approval of the INSTALLER.
4. Evidence of the INSTALLER's experience including a list of similar projects (i.e., flat grade gravity, in and out of rock, size, materials, etc., as applicable) completed within the previous 2 years.
5. In lieu of the requirement of previous experience by the INSTALLER with the technique and equipment associated with trenchless pipeline construction, the manufacturer of the trenchless construction equipment may provide an experienced representative on site during the set-up, fusing, trenchless construction, back reaming, and insertion phases of the entire project.
   (a) If the Bidder anticipates exercising this option, a statement from the manufacturer of the trenchless construction equipment agreeing to this requirement shall be included with the bid.

B. Construction Profile

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1. The Contractor shall monitor and plot the constructed pipeline profile to scale throughout the length of the trenchless construction.
   (a) The horizontal profile shall be on a consistent scale where 1 inch measures no more than 100 feet.
   (b) The Contractor shall note on the profile any deviations (horizontal or vertical) from the planned alignment which encroach on the separation space as required by CEAM 2600.3.A2.
   (c) The Contractor shall note on the profile any horizontal deviations in excess of 4 feet from the planned alignment.
   (d) The vertical profile shall be on a consistent scale where 1 inch measures no more than 10 feet.
2. Duplicate copies of the profile shall be submitted.

C. Casing Pipe Material – Certificate of Compliance.

D. Casing Spacers (Plastic) – Certificate of Compliance

E. Tracer Wire – Certificates of Compliance

F. Tracer Wire Pedestals – Certificates of Compliance

PART 2 -- PRODUCTS

2.1 GENERAL

A. Products listed in this section are for casing pipe only. See applicable sections for carrier pipe materials.

2.2 CASING PIPE

A. STEEL CASING PIPE

1. Casing pipe shall be welded steel pipe, new material, with a minimum yield strength of 35,000 PSIG (pounds per square inch gauge). The following minimum wall thickness shall be used:

Outside Casing Diameter	Minimum Wall Thickness
12" to 28"	0.250"
30" to 34"	0.375"
36" to 60"	0.500"

B. HIGH DENSITY POLYETHYLENE (HDPE) CASING PIPE

1. The pipe material shall be extra high molecular weight, high density polyethylene (EHMW-HDPE, PE 4710) conforming with the minimum structural standards of ASTM D3350 with cell classification 445574C as manufactured by Performance Pipe, Driscoplex 4000 (DIPS)/ 4100 (IPS) Series, or equal. All HDPE pipe material shall meet the requirements of ASTM F714.
2. The pipe to be used shall be (HDPE) pressure pipe conforming to the requirement of AWWA C-906. The grade used shall be resistant to aggressive soils or corrosive substances present. Unless otherwise specified, the dimensions and tolerances of the pipe barrel should conform to ductile iron or cast iron pipe equivalent outside diameters.

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3. The dimension ratio (DR) shall be 11.
4. Pipe shall include “BLUE” color stripes for water system casing or “GREEN” color stripes for sewers along the entire length of the pipe to identify the utility as part of the appropriate utility system.
5. HDPE pipe shall have butt-fused joints with the internal fusing bead removed.
6. The Contractor shall verify the lengths of conduit necessary in the field before fabrication.

C. FUSIBLE C905™ – HIGHWAY CASING

1. The pipe material shall be Fusible C905 PVC pipe as manufactured by Underground Solutions (www.undergroundsolutions.com). ASTM D 1784-02. with cell classification 12454. The formulation for extrusion of Fusible C-900™/C-905™/PVC™ shall be compounded to the specific proprietary recipe for Fusible pipe, and meet the requirements of PPI TR-2.
2. Butt joint fused PVC pressure pipe conforming to AWWA C905 shall be DR-25. The pipe may conform to either IPS or DIP sizing. However, structurally stronger pipe may be required to ensure resistance to pulling stresses.
3. Pipe fusing shall meet manufacturer requirements. See Section 02446 Paragraph 1.3.A Items to be Included with the Bid.
4. A manufacturer's representative shall be present during fusing and installation of the casing.
5. The bid form assumes a bell and spigot pipe is used for the carrier pipe. If the carrier pipe is fused PVC and as long as the minimum inside diameter of the casing pipe is four (4) inches greater than the outside diameter of the largest outside diameter of the carrier pipe a smaller size of PVC casing can be substituted.

2.3 CASING SPACERS

A. Domestic water or sanitary forcemain

1. The casing spacers shall be Phoenix Plastic Casing Spacers, or approved equal.

B. Sanitary sewer gravity applications

1. Wood spacers may be used in lieu of plastic spacers if approved by the City Engineer.

2.4 TRACER WIRE

A. Tracer wire shall meet the requirements of the following:

1. 1/8” galvanized aircraft wire clear PVC Coated to 3/16”.
2. #12 AWG copper clad steel (CCS) wire with 30 mil high density polyethylene (HDPE) insulating jacket.
3. GREEN jacket color in sewer applications, BLUE in potable water applications

B. Connectors

1. Connectors shall be “wire nut” or “twist on” type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

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2.5 TRACER WIRE RISERS:

A. Tracer Wire Risers shall be as noted in the details. Rhino Triview pedestals shall be required for tracer wire risers.

PART 3 -- EXECUTION

3.1 TRACER WIRE INSTALLATION

A. The installation of any non-conductive mains and/or services that will not extend in a straight line between manholes, catch basin or other surface structures shall include the installation of tracer wire in accordance with the details shown on the plans.

B. Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.

C. At each end of the casing, the tracer wire shall be brought to the surface and attached to the tracer wire pedestal. All connections shall receive a coat of an approved bituminous rust preventative material such as Koppers 505, or equal.

D. Tracer wire pedestals shall be provided near each end of the casing pipe as directed by the Engineer.

E. Tracer wire pedestals shall be provided along a trenchless pipeline at spacing not to exceed 1000 feet.

F. The Contractor shall perform under Engineer's observation a conductivity test of the installed tracer wire system prior to final acceptance. Inability of the wire to conduct electricity at 30 volts or less due to Contractor's failure to install in accordance with manufacturer's recommendations and limitations may result in reduced payment or other means of mapping shall be provided by the contractor at no cost to the owner.

G. Directionally drilled pipe shall have **two (2) tracer wires** installed on opposite sides of the pipe with the pipe. Wires shall be securely taped to the pipe barrel every twenty (20) feet.

3.2 CONSTRUCTION REQUIREMENTS:

A. FUSING/FABRICATION

1. Polyethylene Pipe

(a) The pipe shall be assembled and joined at the site using the butt-fusion method to provide a leak proof joint prior to insertion. All equipment and procedures used shall be in strict compliance with the manufacturer's recommendations and specifications.

(b) Threaded or solvent welded joints or connections are not permitted.

(c) Fusing shall be performed by personnel certified as fusion technicians by the manufacturer of the polyethylene pipe and/or the fusing equipment.

(d) The butt-fused joints shall maintain true alignment and shall have uniform roll-back beads from the fusing process. The joint shall be watertight and shall have a tensile strength equal to that of the pipe.

(e) Adequate cooling time shall be allowed prior to the release of the pressure from the fusing unit.

(f) All joints shall be subject to acceptance by the Engineer prior to insertion.

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(g) All defective joints shall be cut out and replaced.

B. BLOCKING AND ANCHORING OF PIPE

1. A thrust block of cast-in-place concrete, which covers the installed fitting, is not permitted. Pre-cast concrete thrust blocks and other restraining devices such as adjustable rods or cables, shall be provided at all bends or wherever the pipe changes direction.

C. INSTALLATION OF PIPELINES THROUGH CASINGS

1. The Contractor shall install the carrier pipe through the casing pipe using supports or cradles constructed of permanent materials to support the entire length of the carrier pipe in the casing. Support material shall be uniformly spaced and located on three sides of the carrier pipe to prevent shifting of the pipe as detailed on the Plans. The line and grade at any point within the carrier pipe shall not vary by more than 0.5 foot from the horizontal plan line and 0.2 foot from the vertical grade.
2. Following the installation of the carrier pipe in the casing, place 4" PVC riser pipes at both ends of the casing pipe and extend the PVC risers to the surface. Fill annular space at both ends with an appropriate concrete grout to form a watertight seal. The casing pipe and riser pipes shall be completely filled with sand. Riser pipes shall then be cut off 1' below finished grade. Glue PVC caps to the top of each riser pipe.

D. TRENCHLESS METHODOLOGY

1. The remaining specifications in this section pertain to directional drilling techniques as the most common type of trenchless technology. Other trenchless technologies may also be used, provided that the Contractor submits a set of specifications for the proposed alternate technology.

(a) DRILLING EQUIPMENT

(1) The installation shall be by a steerable drilling tool capable of installing continuous runs of pipe, without intermediate pits for a minimum distance of 350 feet.

(b) DRILLING

(1) The Contractor shall initially drill a pilot hole that follows the route of the pipeline to be constructed.

(2) The Contractor shall monitor the route taken by the drilling unit utilizing the downhole survey calculation methods discussed in API Bulletin D20 entitled *Directional Drilling Survey Calculation Methods and Terminology*. A surface monitoring system may be allowed in lieu of the downhole calculation method. Approval of surface monitoring shall be at the discretion of the Engineer based on the Engineer's evaluation of the particular system proposed for use.

(3) The Contractor shall provide the Engineer with an "asbuilt" profile of the pilot hole prior to the back reaming and pipe insertion as which time the Engineer shall review it for tolerance compliance.

(4) The back reamer shall be designed to create a void in the surrounding soil through which the new pipe may be threaded.

(5) The size of the reaming tool shall be in accordance with the manufacturer's specifications to achieve the sizing indicated on the plans, or in the Schedule of Unit Prices.

(6) Upon commencement, pipe insertion shall be continuous and without interruption from one structure to another, except as approved by the Engineer.

(c) INSERTION

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(1) Drill holes shall only be allowed at locations approved by the Engineer.

(2) In so far as possible, the equipment used shall be located in such a way as to minimize the noise impact on surrounding properties.

(3) The Contractor shall utilize a disconnect swivel which shall be set to limit the stress within the pipe to less than its elastic limit.

(4) The Contractor shall install all necessary pulleys, rollers, bumpers, alignment control devices and other equipment necessary to protect the pipe from damage during insertion. Dragging the pipe on the ground is not permitted. All break over bends should be made with a radius long enough to insure that the pipe is not overstressed.

(5) Lubrication, as recommended by the manufacturer, may be used during installation.

(6) Buoyancy control may be used during pull back.

(7) The manufacturer's recommended cooling/relaxation time, but not less than 4 hours, shall pass after insertion is complete and before the connection of services, sealing of the annular space, and/or the backfilling of the insertion pit. A sufficient excess of new pipe, but not less than four inches (4") shall protrude into terminating structures.

(8) The annular space at each structure shall be sealed with a material recommended by the manufacturer for a minimum of eight inches (8") to form a smooth, uniform, watertight joint.

(9) Under no circumstance shall the pipe be stressed beyond its elastic limit.

3.3 FIELD QUALITY CONTROL

A. TOLERANCES

1. General

(a) Terminating connections to existing structures and conduits shall be made with a smooth grade for the adjacent 50 feet and shall permit the appropriate hydraulic operation at the conduit connection.

(b) Periodically, the Engineer may require the Contractor to excavate a verification pit to expose the conduit for the Engineer to determine compliance with the line and grade specified. As long as tolerances are being met, as determined by the Engineer, the frequency shall not exceed 2 excavations in each 500 feet or be required in obviously inaccessible locations. The Contractor shall then backfill, compact and restore the surface of the excavation.

2. Pressure Systems

(a) Horizontal alignment of the finished profile shall be within 0.5 feet of the planned alignment.

(b) Vertical alignment of the finished profile shall be within 0.5 feet of the planned vertical alignment but in no event shall the invert elevation be closer to the existing ground surface or the future proposed ground surface, whichever is lower, than the minimum bury depth shown on the plans.

(c) The final vertical alignment shall not conflict with future proposed gravity conduit grades shown on the plans, if any.

(d) The final vertical alignment of forcemains shall not have high points which could permit the development of air locks at any location other than those identified on the plans.

3. Gravity Systems

(a) Horizontal alignment of the finished profile shall be within 0.5 feet of the planned alignment.

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(b) Vertical alignment of the finished profile shall be within 0.2 feet of the planned vertical alignment but in no event shall the invert elevation prevent the appropriate hydraulic operation with upstream or downstream conduits.

(c) The final vertical alignment shall not have sags that could permit sediment to accumulate at any location.

(d) The final vertical alignment shall not conflict with future proposed gravity conduit grades shown on the plans, if any.

(e) The final vertical alignment of gravity conduits (storm and sanitary) shall not be shallower than the basement elevations of adjoining properties less adequate vertical distance to allow gravity piping from the basement to reach the installed conduit.

B. POST TELEVISING

1. After completion of the project, the Contractor shall perform a televised inspection of the line. Refer to the requirements in Section 02530 – Pipe Sewers Sanitary or 2630 - Pipe Sewers Storm.

C. PRESSURE TESTING

1. Trenchless conduit used as carrier pipe:

   (a) Watermain – Refer to the requirements in Section 02510 – Domestic Water Systems.

   (b) Forcemain – Refer to the requirements in Section 02535 – Forcemains.

2. Trenchless conduit used as casing pipe:

   (a) Casings – No pressure test required.

******END OF SECTION******

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SECTION 02510 - DOMESTIC WATER SYSTEM

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to water main and service line construction as indicated on the drawings or as specified herein.

1.2 METHODS

A. Trench excavation, bedding and backfill, see Section 02320 of these Specifications.

B. Trenchless installation, see Section 02446 of these Specifications.

1.3 SPECIFICATION REFERENCES

A. Reference Section 02320 of these Specifications for trench excavation, bedding and backfill, except as modified herein.

B. Reference CEAM Specification No. 2611 shall apply to the water main and service line construction, except as modified herein.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.4 SUBMITTALS

A. Work plan for temporary service.

B. Pipe- Certificates of Compliance

C. Service Piping and associated components- Certificates of Compliance

D. Valves, Valve Housings, and Hydrants- Certificates of Compliance

E. Tracer Wire and Pedestals- - Certificates of Compliance

F. Weather cap for tracer wire PVC pipes at hydrants

PART 2 -- PRODUCTS

2.1 OPEN CUT WATER MAIN MATERIAL

A. The following water pipe materials will be allowed for use on this project:

1. Ductile Iron Pipe, Class 52 with conductive gaskets or conductivity strips.
2. Polyvinyl Chloride (PVC) pressure pipe conforming to the current requirements of AWWA C900 (DR 18) for pipe diameters 4” through 10”. Pipe shall be manufactured in cast iron outside diameters and shall have integral bell and spigot with elastomeric gasket conforming to ASTM D3139. The pipe and components shall meet the requirements of ANSI/NSF 61 for the conveyance of potable water.

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2.2 TRENCHLESS PIPE MATERIAL & STRUCTURAL REQUIREMENTS

A. All pipe shall be made from virgin material. No rework except that obtained from the manufacturer's own production of the same formulation shall be used.

B. The pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign material, blisters, and/or other deleterious faults.

C. Any section of pipe with a gash, blister, abrasion, nick scar, or other deleterious fault greater than 10 percent (10%) of the wall thickness, shall not be used and must be removed from the site. However, a defective portion of pipe, as defined above may be cut out and butt-fused in accordance with the procedures herein.

D. Any section of pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing and/or handling shall not be used and shall be removed from site.

E. The actual inside barrel diameter of the pipe used for pressure pipe shall not be less than that of C 900 DR18 for sizes 4-inch to 12-inch and C905 DR25 for sizes 14-inch to 24-inch.

F. Fusible C900/C905™

1. As manufactured by Underground Solutions (www.undergroundsolutions.com). ASTM D 1784-02. with cell classification 12454. The formulation for extrusion of Fusible C-900™/C-905™/PVC™ shall be compounded to the specific proprietary recipe for Fusible pipe, and meet the requirements of PPI TR-2.

2. Butt joint fused PVC pressure pipe conforming to the current requirements of AWWA C900 (DR 18) for pipe diameters 4" through 12" or AWWA C905 (DR 25) for pipe diameters 14" through 24". However, structurally stronger pipe may be required to ensure resistance to pulling stresses. Pipe shall be manufactured in cast iron outside diameters. The pipe and components shall meet the requirements of ANSI/NSF 61 for the conveyance of potable water.

3. Pipe fusing shall meet manufacturer requirements. See Section 02446 Submittals regarding Items to be Included With the Bid.

4. A manufacturer's representative shall be present during fusing and installation.

G. Restrained Joint DIP Pipe and Fittings

1. Flex-Ring Joint Pipe (DIP), as manufactured by American Ductile Iron Pipe or equal. The pipe shall be pressure pipe with a 350 psi working pressure for diameters up to and including 12 inch, and 250 psi for diameters 14 inch to and including 20 inch. Structurally stronger pipe may be needed to ensure resistance to damaging stresses relative to the trenchless construction technique.

2. Joints shall be Flex-Ring Restrained Joint couplings as manufactured by American Ductile Iron Pipe or equal.

H. High Density Polyethylene (HDPE) Pipe and Fittings

1. The pipe material shall be extra high molecular weight, high density polyethylene (EHMW-HDPE, PE4710) conforming with the minimum structural standards of ASTM D3350 with cell classification 445574C as manufactured by Performance Pipe, Drisoplex 4000 (DIPS) Series, or equal. All HDPE pipe material shall meet the requirements of ASTM F714.

2. The pipe to be used shall be (HDPE) pressure pipe conforming to the requirement of AWWA C-906. The grade used shall be resistant to aggressive soils or corrosive substances present. Unless

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otherwise specified, the dimensions and tolerances of the pipe barrel shall conform to ductile iron pipe equivalent outside diameters.

3. The dimension ratio (DR) shall be 11.
4. Pipe shall include "BLUE" color stripes along the pipe.
5. HDPE pipe shall have butt-fused joints.
6. The Contractor shall verify the lengths of conduit necessary in the field before fabrication.
7. Polyethylene fittings and adaptors shall be butt-fused, EHMW-HDPE, PE4710 meeting the same resin requirements as specified for the pipeline. In addition, the fittings shall meet the applicable requirements of AWWA C906 and ASTM D3261.
8. Mechanical joint pressure pipe joints shall be restrained using ductile iron clamps (series Ebaa Iron, Inc. or equal) supplied with a sufficient number of ductile iron bolts to restrain the working and test pressures for this application.

2.3 WATER MAIN FITTING MATERIALS

A. The following pressure pipe fitting materials will be allowed for use on this project:

1. Mechanical Class 350 ductile iron fittings shall be used.
2. All fittings shall be coated with a 6-8 mil nominal thickness fusion bonded epoxy conforming to the requirements of ANSI/AWWA C550 and C116/A21-16.
3. All fittings, valves, hydrants and retaining rods shall be protected by using sacrificial zinc anode caps, 6 ounces, as manufactured by Trumbull, or an approved equal. Contractors shall supply 2 Anode Caps per mechanical joint gland installed.
4. All Restraining devices (megalugs) shall be coated with a 6-8 mil nominal thickness, fusion bonded epoxy conforming to the requirements of ANSI/ AWWA C550 and C116/A21.16.
5. All fittings, valves, hydrants, etc. shall be secured utilizing COR-BLUE T-BOLTS as manufactured by NSS Industries or approved equal.
6. Adaptors, back-up rings, and oversize sleeves shall be provided for transitions and connections to dissimilar types of pipe materials. All sleeve fittings shall be long mechanical joint.
7. Quality control of all fitting manufacturers shall conform to the requirements of International Organization for Standardization (ISO).

B. All fittings shall have been manufactured in the year of construction or prior calendar year.

2.4 TRACER WIRE

A. Tracer wire shall meet the requirements of the following:

1. #12 AWG solid copper clad steel (CCS) wire with 30 mil high density polyethylene (HDPE) insulating jacket, color BLUE.
2. Weathercap
   (a) The weathercap for the top of the PVC pipe at hydrants shall have a downward tilted face with 3 holes.

B. Connectors

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1. Connectors shall be “wire nut” or “twist on” type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

C. Tracer wire access boxes shall be as manufactured by Valvco, or approved equal.

2.5 FIRE HYDRANTS

A. Hydrants shall be Clow Medallion, Model F2545, with safety flange and stem coupling. The bury length shall be 8'-6", unless otherwise noted in the plans. The Contractor shall install the hydrant so that the center of the nozzle is 19-3/8 inches above the finished grade. The hydrant shall be painted red.

1. Fire hydrants shall be 5-1/4 inch Medallion model as manufactured by Clow Valve Company, and shall conform to AWWA C502.

2. Hydrants shall be furnished in conformance with the following supplementary requirements:

(a) Five-inch (nominal diameter) main valve opening of the type that opens against water pressure with a pentagonal operating nut with one-inch sides (nominal 1.5 inches point of pentagon to opposite side), and opening counterclockwise (left).

(b) Barrels shall be one piece, non-jacket type, with bottom of traffic flange set 2-½ inches above finish grade, 19-3/8 inch nozzle height above finish grade, and with mechanical joint connection at the base for connecting to a 6 inch pipe for hydrant lead.

(c) Hydrant bury depth measured from the **top** of the branch pipe connection to the finished ground line shall be 8’-0”. For clarification, this typically requires an 8’-6” hydrant.

(d) Hydrants shall have two outlet nozzles for 2-1/2 inch (I.D.) hose connection and one outlet nozzle for 4-1/2 (I.D.) pumper connection. Threads shall conform to NFPA No. 194 (ANSI B26) and shall be: hose connection – 7-1/2 threads per inch, 3.062 inch nominal outside diameter (National Standard Thread); pumper connection - 4 threads per inch, 5-3/4 inch nominal outside diameter (National Standard Thread). Nozzle caps shall be nut type with chain.

(e) Hydrant operating mechanisms shall be provided with “O” ring seals preventing entrance of moisture and shall be lubricated through an opening in the operating nut or bonnet.

(f) Drain holes shall be left open unless indicated otherwise, if so, indicated the hydrant shall be tagged "Pump After Use". The pumper nozzle cap shall also be painted BLUE with factory approved paint, equivalent to the paint on the remainder of the hydrant. It must be marked at the time of installation.

(g) Every fire hydrant shall be supplied with a Hydra Finder five foot (5’) location flag. The flag shall be alternating white and red reflective coating.

(h) Hydrant shall have Stainless Steel nuts and bolts.

(i) Two 2½-inch (2½”) hose connections with threads conforming to A.S.A.B. 26 for “National (American) Standard Fire Hose Coupling Screw Threads”.

(j) One 4-inch (4”) pumper connection with threads conforming to A.S.A.B. 26 for “National (American) Standard Fire Hose Coupling Screw Threads”.

(k) Pentagon operating nut, measuring 1-inch (1”) on flat.

(l) Drain holes shall be plugged when placed below the water table. A tag shall be attached to the hydrant stating “drain holes plugged” and the hydrant pumper nozzle cap shall be painted BLUE.

(m) Standard nozzle caps with chains.

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(n) Left hand opening.

(o) Aluminum plate to indicate depth of bury.

B. All hydrants shall have been manufactured in the year of construction or prior calendar year.

C. The local fire department shall be contacted before ordering hydrants to obtain the correct nozzle threads and type of operating nut and cap bolts.

D. The Developer shall supply a hydrant wrench for each project.

E. All hydrants shall be supplied with a hydrant flag (Hydrafinder by Rodon Corporation).

F. Hydrants shall be painted after installation. Paint shall be Riley Paint (Phone No. 1-800-635-2663) No. LP3931 Holmdel Red TC or approved equal. Hydrant shall be painted to grade.

G. Blow Off Hydrants shall be painted with M4137 Hydrant National Blue Hi-Solids Uraguard w/1% accelerator Acrylic Enamel – MF Product No. 43-41424MX as manufactured by Sheboygan. Hydrants shall be painted after installation. Hydrant shall be painted to grade.

H. All hydrants, immediately after installation, shall be "tagged" with a "Yellow" disc installed on the pumper nozzle indicating that the hydrant is "Out of Service" until all testing requirements have been satisfied and the hydrant is placed in service.

2.6 VALVE AND VALVE HOUSING

A. All water valves shall have been manufactured in the year of construction or prior calendar year.

B. All nuts and bolts shall be 304 stainless steel.

C. Valve Housing

1. Valve Boxes: Valve boxes shall be 5 ¼ inch diameter shaft suitable for 8 feet of cover over the top of the water main. Boxes shall be cast iron screw type two piece or three piece boxes with the word "WATER on the lid, and furnished with a stay-put cover. The shaft shall be 5 1/4" inside diameter. Valve boxes shall be Tyler 6850, or approved equal.

2. All valve box assemblies shall be furnished with a valve umbrella anchorage assembly. The valve umbrella anchorage assembly shall be manufactured by Adaptor, Inc., Oak Crest, WI, or equivalent.

3. Valve boxes shall be installed so that when a 4"O.D. Aluminum pipe with a cut out at the bottom of the pipe for the operating nut, is inserted in the valve box after the valve box has been adjusted to final height, it fits over the operating nut.

4. High Density Polyethylene valve housings will not be allowed.

D. Gate Valves

1. All valves up to and including 12" diameter to be furnished and installed on the water main shall be , non-rising stem, iron body, resilient-sealed gate valves, with two-inch square opening nut rated for a 200 psi working pressure conforming to the current editions of AWWA C-509. Double disc type valves (AWWA C-500) will not be allowed.

(a) All nuts and bolts shall be 304 stainless steel.

(b) Working pressure rating of 200 psi for all sizes.

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(c) Double ring stem seal, one above and below the stem seal.

(d) Weather seal on bonnet cover.

(e) Non-rising stem.

(f) Mechanical joints for typical installation. Tapping sleeve assemblies require flange by mechanical joint.

(g) Manufacturers: American, Mueller, Kennedy, or equal.

(h) All valves shall be for buried service.

2. Operating Nut Risers shall extend from the operating nut on the valve to the top of the valve box. The riser shall terminate with a 2-inch square operating nut between 8" and 12" below the top of the valve box cover. The riser shall have adequate strength to operate the valve. Operating nut Risers shall be painted with a shop applied primer and exterior epoxy paint.

3. The Developer shall supply one gate valve wrench to the City for each project.

E. Butterfly Valves

1. All valves greater than 12 inch diameter shall be butterfly valves conforming to the referenced specification and the following supplemental specifications.

(a) Double O-ring or split V type stem seal

(b) Traveling nut type operator permanently sealed and lubricated

(c) All butterfly valves shall be manufactured with the rubber seat bonded to the body. Valve discs shall be furnished with 316 stainless steel seating edge.

(d) Manufacturers: Dresser, Pratt, or equal

2. Valve operating stems with 2” square nut shall extend to within 1-foot of the surface.

F. Valve Markers

1. All water valves placed outside the roadway bituminous surface shall be marked with a FlexStake EZ Drive type marker with Diamond Grade Reflection Tape placed around the top and 18 inches below the top of the stake. Water shall be marked with BLUE stakes.

2.7 WATER SERVICE PIPE AND FITTINGS

A. General

1. Water service pipe and fittings shall conform to the provisions of 2611.2D, AWWA C800 and the following:

2. Valves and fitting models to vary according to water main pipe size. See mfg. catalogue data.

3. Water service pipe shall be run continuous for up to 100'. Joints on services over 100' must be reviewed and approved by the City Engineer.

4. All water service products shall comply with “Reduction of Lead in Drinking Water Act” legislation, which is commonly referred to as “no-lead” brass.

B. Service Pipe and Fittings

1. Water service pipe and fittings shall conform to the provisions of 2611.2D and the following:

(a) Saddles shall be provided for all corporation stops if PVC is installed.

(b) Saddles shall be provided for all corporation stops larger than 1 inch if DIP pipe is installed.

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2. Copper Service Pipe Notes & Specifications:

   (a) Copper pipe shall conform to ASTM B88, Seamless Copper Water Tubing, Type K, Soft Annealed Copper.

   (b) Copper water service pipe connections shall be flared type.

3. High Density Polyethylene (HDPE) Service Pipe Notes & Specifications

   (a) HDPE pipe shall conform to Grade PE-3408 or PE-4710 pipe and shall be rated for 200 PSI working pressure, SDR 9.

   (b) HDPE pipe shall conform to ASTM D-1248 & D-2737 for Copper Tube Size, outside diameter controlled.

   (c) HDPE water service pipe connections shall be compression type.

   (d) HDPE pipe shall be permanently marked at 2' intervals indicating Mfg., PE Material Type, Date of Manufacture, etc.

   (e) Type 304 stainless steel pipe inserts / stiffeners shall be furnished and installed in the ends of the PE pipe at all connections. Inserts shall meet requirements of AWWA C901 and ASTM 240-92B, unless otherwise shown on the plans.

4. Tracer Wire

   (a) #12 AWG solid copper clad steel (CCS) wire with 30 mil high density polyethylene (HDPE) insulating jacket, color BLUE.

5. The Utility should be contacted before ordering to verify the manufacturers' type and style. The water service materials style commonly used by the Utility are to be considered as a basis for quality are:

Copper Water Service Pipe (1-inch and 1.5"-inch Service Pipe Only):

WATER SERVICE PIPE & APPURTENANCES			
ITEM:	**SERVICE PIPE SIZE**	**FLARED TYPE Valves & Fittings For TYPE K COPPER PIPE**	
		FORD MODEL #	
Corporation Stop		**FORD**	
	1"	FB600-4-NL	
	1.5"	FB600-6-NL	
Tapping Saddle		FORD for DIP WMN	FORD for PVC WMN
	1"	F202	FS303
	1.5"	F202	FS303
Curb Stop		FORD	
	1"	B22-444M-NL	
	1.5"	B22-666M-NL	

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Curb Box	1.5" Diam. Base Tap for 1.0" to 1.25" Curb Stops	FORD 8'- EM2-80-56
Curb Box	2.0" Diam. Base Tap for 1.5" to 2" Curb Stops	FORD 8'- EM2-80-57

All copper fittings shall be flared type. Compression type will not be allowed.

Polyethylene Water Service Pipe, CPS (1-inch, 1.5-inch and 2-inch service pipe):

WATER SERVICE PIPE & APPURTENANCES		
ITEM:	**SERVICE PIPE SIZE**	**COMPRESSION TYPE Valves & Fittings For POLYETHYLENE PIPE**
		FORD MODEL #
Corporation Stop		**FORD**
	1"	FB1000-4-Q-NL
	1.5"	FB1000-6-Q-NL
	2"	FB1000-7-Q-NL
Tapping Saddle		FORD for DIP WMN / FORD for PVC WMN
	1"	F202 / FS303
	1.5"	F202 / FS303
	2"	F202 / FS303
Curb Stop		FORD
	1"	B44-444M-Q-NL
	1.5"	B44-666M-Q-NL
	2"	B44-777M-Q-NL
Curb Box	1.5" Diam. Base Tap for 1.0" to 1.25" Curb Stops	FORD 8'- EM2-80-56
Curb Box	2.0" Diam. Base Tap for 1.5" to 2" Curb Stops	FORD 8'- EM2-80-57

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6. Curb Box: Minneapolis pattern base, 78 inch stationary rod, 12 inch box adjustment from 7 to 8 feet, lid with pentagon plug, and 1 ¼" I.D. upper section.

C. The listed fittings are to be considered as a basis for quality. The Utility should be contacted before ordering to verify the manufacturers' type and style.

D. Wrenches and Keys: The Contractor shall provide the Owner with one 3-foot curb box shutoff rod for each project.

2.8 RESTRAINED JOINT RETAINER GLANDS

A. No exception to the referenced specification is made.

2.9 POLYETHYLENE ENCASEMENT

A. The Contractor shall furnish and install 8 mil polyethylene encasement for all hydrant riser pipes in accordance with the referenced specification.

2.10 POLYSTYRENE INSULATION

A. Insulation shall be 2-inches thick. Two layers of 2-inch insulation shall be required.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Temporary Service

1. Before proceeding with the project, the Contractor shall establish a work plan and submit the plan to the utility personnel and City Engineer for review and comment. The plan shall outline the method to be used to maintain service to the affected consumers and estimate the duration of any anticipated interruptions of service. The Contractor is the sole party responsible to notify the Utility and consumers who may be affected by limitations and/or interruption of water service. Planned service interruptions shall not exceed six (6) hours in any 72 hour period unless previously approved by the Utility.
2. Temporary watermain serving more than 4 residences shall be 4-inch diameter. Each service shall have a shut off valve.
3. Temporary watermain serving commercial and industrial areas shall be a minimum of 6-inch diameter.
4. The Contractor shall supply a water meter to accurately measure the quantity of water used for temporary service. A water meter shall be placed at all connections between the City's water system and the temporary service pipe.
5. **The Contractor shall include water main shut-downs with the water utility at least 24 hours prior to the requested shut-down.**
6. **If the Contractor fails to provide water service to affected residents within the constraints specified above, an amount equal to $ 500.00 may be deducted from the amount due the Contractor for each occurrence.**

3.2 INSTALLATION OF PIPE AND FITTINGS

A. Aligning and Fitting of Pipes

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1. The Contractor, together with the utility's personnel, shall jointly examine and operate all curb stops and mainline valves prior to final acceptance.

B. Blocking and Anchoring of Pipe

1. A thrust block of cast-in-place concrete, which covers the installed fitting, is not permitted. Pre-cast concrete thrust blocks and other restraining devices such as adjustable rods or cables, shall be provided at all bends, tees, hydrants and plugged crosses or wherever the water main changes direction or dead ends. Valves shall be tied to the nearest tee.
2. Hydrants shall be tied to the watermain using mega lug type restraining glands AND thrust blocking OR mega lug type restraining glands AND metal restraining tie rods.

C. Polystyrene Insulation

1. The Contractor shall install polystyrene insulation in those areas where the water main or services may be susceptible to frost or freezing, or as directed by the City Engineer.
2. Unless otherwise specified in the Plans, Specifications, and Specific Requirements, board dimensions shall measure 8 foot long, 4 foot wide, and 2 inches thick or greater.
3. Rigid insulation board shall be placed within the pipe encasement zone, 6 inches above the pipe. Prior to placement of the insulation, encasement material shall be compacted until there is no further visual evidence of increased consolidation or the density of the compacted layer conforms to the density requirements specified in the Specific Requirements, then leveled and lightly scarified to a depth of 2 inches. Encasement zone material placed below the insulation shall be free of rock or stone fragments measuring 1-2 inches or greater.
4. Insulation boards shall be placed on the scarified material with the long dimension parallel to the centerline of the pipe. Boards placed in a single layer shall be overlapped at least 6 inches on all sides to eliminate continuous joints for the full depth of the insulation. If two or more layers of insulation boards are used, each layer shall be placed to cover the joints layer immediately below with an overlap of at least 6 inches.
5. The Contractor shall exercise caution to ensure that all joints between boards are tight during placement and backfilling with only extruded ends placed end-to-end or edge-to-edge. Broken or damaged material shall be removed and replaced.
6. The first layer of material placed over the insulation shall be 12 inches in depth, free of rock or stone fragments measuring 1-2 inches or greater. The material shall be placed in such a manner that construction equipment does not operate directly on the insulation and shall be compacted with equipment which exerts a contact pressure of less than 80 psi. The first layer shall be compacted until there is no further visual evidence of increased consolidation or the density of the compacted layer conforms to the density requirements specified.
7. Polystyrene insulation shall have a minimum thickness of 4". The insulation shall be 2 layers of 2-inch insulation with joints staggered a minimum of 1-foot.
8. Rigid foam insulation shall be placed between the watermain and storm or sanitary sewer where adequate vertical clearance cannot be maintained. The insulation shall be placed on a bed of sand and sand shall be placed above the insulation to isolate the insulation from rocks and other sharp objects. The minimum thickness of 4" of insulation required shall be achieved by using 2 layers of insulation, the second layer shall be placed perpendicular to first layer and the joints shall be offset.

D. Polyethylene Encasement

1. Polyethylene encasement for hydrants is required.

E. Water Service Installation

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1. Water service lines complete with all required appurtenances shall be installed in accordance with all pertinent requirements for main line installations and as supplemented as follows.

   (a) It shall be the responsibility of the Contractor to keep an accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe endings. Tap locations shall be recorded in reference to survey line stationing. Curb boxes shall be tied to definable landmarks such as building corners, fire hydrants, manholes and telephone pedestals. Pipe terminals at the property line shall be marked on the ground surface with a steel fence post. The marker shall be placed on the dead side of the curb stop and shall extend from the service to 4 feet above grade with the top 1 foot painted BLUE.

   (b) Water service lines shall be installed in accordance with Minnesota Department of Health standards. Where water service lines are installed alongside of sanitary or storm sewer service lines, installation shall maintain the minimum specified clearances between pipelines and provide proper and adequate bearing for all pipes and appurtenances. For separate installation, the trench width shall be not less than two feet. Subject to minimum clearances, the water lines may be laid in a common trench excavated principally for sewer installation, either by widening the trench as necessary or by providing a shelf in the trench wall where ground stability will permit.

   (c) Unless otherwise specified, installation of water service lines shall provide for not less than eight feet of cover over the top of the pipe and for not less than 18 inches of clearance between pipelines. Also, at least 6 inches of clearance shall be maintained in crossing over or under other structures. Where the service pipe may be exposed to freezing due to insufficient cover or exposure from other underground structures, the water pipe shall be insulated as directed by the Engineer.

2. Service trenches shall be restored and compacted as specified for pipelines.

3. Field flaring for copper water service pipe shall be performed with current standards of the plumbing industry and manufacturer recommendations.

4. The Contractor shall keep accurate records as to the location of the service connections, as specified in the referenced specification. Final payment for the project will not be made until the information is in the possession of the City.

5. No warranty is expressed or implied as to the location, size or material type of existing service lines. The Contractor shall furnish and install all fittings required to make the connections.

6. The Contractor shall install new service pipe, at 8 foot bury depth, from the corporation stop to 10-feet beyond the property line, or as shown on the plans, or as directed by the City Engineer.

7. The corporation stops shall be opened prior to complete backfilling to verify that no leakage occurs in the service line.

8. The water services shall be flushed after installation.

F. Tracer Wire Installation

1. Trace wire shall be installed along all PVC or PE pipe unless noted otherwise. The tracer wire shall be considered incidental to the water service construction. The installation of any non-conductive mains and/or services shall include the installation of tracer wire in accordance with the details shown on the plans.

2. The wire shall be of adequate length to be trimmed to 2 feet above the finished elevation at the hydrant or tracer wire access box. It is recommended that during construction, the Contractor periodically test the trace wire being installed, to ensure continuity. Upon completion of the project the Contractor shall test the trace wire in accordance with requirements of this section.

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3. At junctions of non-conductive water main materials with conductive water main materials, the Contractor shall electrically connect the conductive water main with the tracer wire adjacent to the non-conductive material.

4. The installation of any non-conductive mains and/or services shall be installed with tracer wire in accordance with the details shown on the plans.

   (a) Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.

   (b) The wire shall be electrically tied to each valve by extending the wire to ground surface inside the tracer wire access box and attaching it to the box with stainless steel screws. The wire shall be electrically tied to each hydrant assembly by extending the wire up the hydrant and securely attaching it to one of the break-off flange bolts. All connections shall receive a coat of an approved bituminous rust preventative material such as Koppers 505, or equal.

5. The Contractor shall successfully complete a conductivity test of the installed tracer wire system prior to final acceptance.

3.3 FIELD QUALITY CONTROL

A. Electrical Conductivity Test

1. Conductive Pipe Materials

   (a) See the referenced Specification CEAM 2611.3.F

2. Non-conductive Pipe Materials

   (a) The conductivity requirements shall be to demonstrate the electrical continuity of the tracer wire.

   (b) 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.

3.4 HYDROSTATIC TESTING AND DISINFECTION

A. Hydrostatic tests shall be conducted in accordance with the referenced specification. These tests shall be conducted prior to the bacteriological tests required with the disinfection of the main.

B. Water services, including corporation and curb stops, shall be tested. The Contractor may choose to include services at the time of watermain testing or as a separate operation at a reduced pressure of 100 psig. If performed separately, testing shall be done with the corporation stops open.

C. The Contractor shall disinfect the watermain in accordance with the provisions of AWWA Standard Specification C-651, Disinfecting Watermains. After performing and obtaining passing hydrostatic test results, two samples of the water, taken 24 hours apart, shall be taken from each section of the new pipe and sent to an approved testing laboratory to establish the bacteriological conditions prior to placing the line in service. In the event unsatisfactory results are obtained, the Contractor shall take whatever steps are necessary to correct the sanitary conditions. The Contractor shall then re-take the bacteriological tests until satisfactory results are obtained. The Contractor shall be responsible for all costs associated with the required testing.

1. After final flushing and before the water main is placed in service, samples shall be collected from the end of the main and each branch line for testing for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater, and shall show the absence of

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coliform organisms. Upon notice, the City shall schedule bacteriological sampling and testing by their contracted independent laboratory. Sample sets shall be at a rate of one per every 1200 feet of pipe. A higher rate of sampling may be required to include all branch line (ie. Dead-Ends and Cul-de-sacs included). If water in the pipe does not meet the Minnesota Department of Health requirements, disinfection procedure shall be repeated until meeting the requirements. Acceptance forms from the governing agency shall be furnished to the Engineer.

2. The Contractor shall draw the sample with the Engineer present.

3. The contractor shall provide sampling locations to meet the required test frequency.

D. A representative of the City of St. Francis shall be notified a minimum of 24 hours prior to any flushing operations and shall be present at the time of flushing. Flushing durations will be recorded and the corresponding water usage will be billed at the current City rate at the time of flushing. The Contractor shall be responsible for all associated water usage costs.

Note: After testing the hydrant shall be shut off and a cap loosened to allow hydrant drainage or the hydrant shall be pumped dry. Tighten cap after drainage.

******END OF SECTION******

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SECTION 02516 - DOMESTIC WATER SERVICES TO BUILDINGS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to water service and fire line construction between the curb stop and/or gate valve and the building.

1.2 METHODS

A. Trench excavation, bedding and backfill, see Section 02320 of these Specifications.

B. Trenchless installation, see Section 02446 of these Specifications.

1.3 SPECIFICATION REFERENCES

A. Reference Section 02320 of these Specifications for trench excavation, bedding and backfill, except as modified herein.

B. Reference CEAM Specification No. 2611 shall apply to the water main and service line construction, except as modified herein.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.4 PERMITS, BONDS AND INSURANCE

A. The Contractor shall obtain a permit from the City prior to starting work; the Contractor will be notified of the permit fee.

B. The Contractor shall provide the City of St. Francis with a certificate of insurance and excavator's performance bond in the amount of $5,000.00 before starting the work.

1.5 QUALITY CONTROL

A. The Contractor shall have the work inspected by the Public Works Department (763-233-5200).

B. All trenches shall meet OSHA Standards.

C. The City will charge the Contractor for all labor and materials needed to correct work that has been improperly installed.

1.6 SUBMITTALS

A. Work plan for temporary service.

B. Pipe- Certificates of Compliance

C. Service Piping and associated components- Certificates of Compliance

D. Valves, Valve Housings, and Hydrants- Certificates of Compliance

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E. Tracer Wire and Pedestals- - Certificates of Compliance

F. Weather cap for tracer wire PVC pipes at hydrants

PART 2 -- PRODUCTS

2.1 PRODUCTS FURNISHED BY THE CITY

A. The following materials will be furnished by the City:

1. Water Meter
2. Meter Horn
3. Remote Reader
4. Remote Wire

2.2 WIRE STAPLES

A. Staples, rated for wiring, with a rounded crown shall be used. Arrow number T-25 for wiring up to ¼ inch in diameter, 9/16 inch long or equal.

2.3 OPEN CUT WATER MAIN MATERIAL

A. The following water pipe materials will be allowed for use:

1. Ductile Iron Pipe, Class 52 with conductive gaskets or conductivity strips.

2. Polyvinyl Chloride (PVC) pressure pipe conforming to the current requirements of AWWA C900 (DR 18) for pipe diameters 4" through 10". Pipe shall be manufactured in cast iron outside diameters and shall have integral bell and spigot with elastomeric gasket conforming to ASTM D3139. The pipe and components shall meet the requirements of ANSI/NSF 61 for the conveyance of potable water.

2.4 TRENCHLESS PIPE

A. See Section 02510.

2.5 WATER MAIN FITTING MATERIALS

A. The following pressure pipe fitting materials will be allowed for use on this project:

1. Mechanical Class 350 ductile iron fittings shall be used.
2. All fittings shall be coated with a 6-8 mil nominal thickness fusion bonded epoxy conforming to the requirements of ANSI/AWWA C550 and C116/A21-16.
3. All fittings, valves, hydrants and retaining rods shall be protected by using sacrificial zinc anode caps, 6 ounces, as manufactured by Trumbull, or an approved equal. Contractors shall supply 2 Anode Caps per mechanical joint gland installed.
4. All Restraining devices (megalugs) shall be coated with a 6-8 mil nominal thickness, fusion bonded epoxy conforming to the requirements of ANSI/ AWWA C550 and C116/A21.16.
5. All fittings, valves, hydrants, etc. shall be secured utilizing COR-BLUE T-BOLTS as manufactured by NSS Industries or approved equal.

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6. Adaptors, back-up rings, and oversize sleeves shall be provided for transitions and connections to dissimilar types of pipe materials. All sleeve fittings shall be long mechanical joint.

7. Quality control of all fitting manufacturers shall conform to the requirements of International Organization for Standardization (ISO).

B. All fittings shall have been manufactured in the year of construction or prior calendar year.

2.6 TRACER WIRE

A. Tracer wire shall meet the requirements of the following:

1. #12 AWG solid copper clad steel (CCS) wire with 30 mil high density polyethylene (HDPE) insulating jacket, color BLUE.

B. Connectors

1. Connectors shall be “wire nut” or “twist on” type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

C. Tracer wire access box shall be as manufactured by Valvco, or approved equal.

2.7 FIRE HYDRANTS

A. Hydrants shall be Clow Medallion, Model F2545, with safety flange and stem coupling. The bury length shall be 8'-6", unless otherwise noted in the plans. The Contractor shall install the hydrant so that the center of the nozzle is 19-3/8 inches above the finished grade. The hydrant shall be painted red.

1. Fire hydrants shall be 5-1/4 inch Medallion model as manufactured by Clow Valve Company, and shall conform to AWWA C502.

2. Hydrants shall be furnished in conformance with the following supplementary requirements:

(a) Five-inch (nominal diameter) main valve opening of the type that opens against water pressure with a pentagonal operating nut with one-inch sides (nominal 1.5 inches point of pentagon to opposite side), and opening counterclockwise (left).

(b) Barrels shall be one piece, non-jacket type, with bottom of traffic flange set 2-½ inches above finish grade, 19-3/8 inch nozzle height above finish grade, and with mechanical joint connection at the base for connecting to a 6 inch pipe for hydrant lead.

(c) Hydrant bury depth measured from the **top** of the branch pipe connection to the finished ground line shall be 8’-0”. For clarification, this typically requires an 8’-6” hydrant.

(d) Hydrants shall have two outlet nozzles for 2-1/2 inch (I.D.) hose connection and one outlet nozzle for 4-1/2(I.D.) pumper connection. Threads shall conform to NFPA No. 194 (ANSI B26) and shall be: hose connection – 7-1/2 threads per inch, 3.062 inch nominal outside diameter (National Standard Thread); pumper connection - 4 threads per inch, 5-3/4 inch nominal outside diameter (National Standard Thread). Nozzle caps shall be nut type with chain.

(e) Hydrant operating mechanisms shall be provided with “O” ring seals preventing entrance of moisture and shall be lubricated through an opening in the operating nut or bonnet.

(f) Drain holes shall be left open unless indicated otherwise, if so, indicated the hydrant shall be tagged "Pump After Use". The pumper nozzle cap shall also be painted BLUE with factory

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approved paint, equivalent to the paint on the remainder of the hydrant. It must be marked at the time of installation.

(g) Every fire hydrant shall be supplied with a Hydra Finder five foot (5') location flag. The flag shall be alternating white and red reflective coating.

(h) Hydrant shall have Stainless Steel nuts and bolts.

(i) Two 2½-inch (2½") hose connections with threads conforming to A.S.A.B. 26 for "National (American) Standard Fire Hose Coupling Screw Threads".

(j) One 4-inch (4") pumper connection with threads conforming to A.S.A.B. 26 for "National (American) Standard Fire Hose Coupling Screw Threads".

(k) Pentagon operating nut, measuring 1-inch (1") on flat.

(l) Drain holes shall be plugged when placed below the water table. A tag shall be attached to the hydrant stating "drain holes plugged" and the hydrant pumper nozzle cap shall be painted BLUE.

(m) Standard nozzle caps with chains.

(n) Left hand opening.

(o) Aluminum plate to indicate depth of bury.

B. All hydrants shall have been manufactured in the year of construction or prior calendar year.

C. The local fire department shall be contacted before ordering hydrants to obtain the correct nozzle threads and type of operating nut and cap bolts.

D. The Developer shall supply a hydrant wrench for each project.

E. All hydrants shall be supplied with a hydrant flag (Hydrafinder by Rodon Corporation).

F. Hydrants shall be painted after installation. Paint shall be Riley Paint (Phone No. 1-800-635-2663) No. LP3931 Holmdel Red TC or approved equal. Hydrant shall be painted to grade.

G. All hydrants, immediately after installation, shall be "tagged" with a "Yellow" disc installed on the pumper nozzle indicating that the hydrant is "Out of Service" until all testing requirements have been satisfied and the hydrant is placed in service.

2.8 VALVE AND VALVE HOUSING

A. All water valves shall have been manufactured in the year of construction or prior calendar year.

B. All nuts and bolts shall be 304 stainless steel.

C. Valve Housing

1. Valve Boxes: Valve boxes shall be 5 ¼ inch diameter shaft suitable for 8 feet of cover over the top of the water main. Boxes shall be cast iron screw type two piece or three piece boxes with the word "WATER on the lid, and furnished with a stay-put cover. The shaft shall be 5 1/4" inside diameter. Valve boxes shall be Tyler 6850, or approved equal.

2. All valve box assemblies shall be furnished with a valve umbrella anchorage assembly. The valve umbrella anchorage assembly shall be manufactured by Adaptor, Inc., Oak Crest, WI, or equivalent.

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3. Valve boxes shall be installed so that when a 4"O.D. Aluminum pipe with a cut out at the bottom of the pipe for the operating nut, is inserted in the valve box after the valve box has been adjusted to final height, it fits over the operating nut.

4. High Density Polyethylene valve housings will not be allowed.

D. Gate Valves

1. All valves up to and including 12" diameter to be furnished and installed on the water main shall be , non-rising stem, iron body, resilient-sealed gate valves, with two-inch square opening nut rated for a 200 psi working pressure conforming to the current editions of AWWA C-509. Double disc type valves (AWWA C-500) will not be allowed.

   (a) All nuts and bolts shall be 304 stainless steel.

   (b) Working pressure rating of 200 psi for all sizes.

   (c) Double ring stem seal, one above and below the stem seal.

   (d) Weather seal on bonnet cover.

   (e) Non-rising stem.

   (f) Mechanical joints for typical installation. Tapping sleeve assemblies require flange by mechanical joint.

   (g) Manufacturers: American, Mueller, Kennedy, or equal.

   (h) All valves shall be for buried service.

2. Operating Nut Risers shall extend from the operating nut on the valve to the top of the valve box. The riser shall terminate with a 2-inch square operating nut between 8" and 12" below the top of the valve box cover. The riser shall have adequate strength to operate the valve.

3. The Developer shall supply one gate valve wrench to the City for each project.

E. Butterfly Valves

1. All valves greater than 12 inch diameter shall be butterfly valves conforming to the referenced specification and the following supplemental specifications.

   (a) Double O-ring or split V type stem seal

   (b) Traveling nut type operator permanently sealed and lubricated

   (c) All butterfly valves shall be manufactured with the rubber seat bonded to the body. Valve discs shall be furnished with 316 stainless steel seating edge.

   (d) Manufacturers: Dresser, Pratt, or equal

2. Valve operating stems with 2” square nut shall extend to within 1-foot of the surface.

F. Valve Markers

1. All water valves placed outside the roadway bituminous surface shall be marked with a FlexStake EZ Drive type marker with Diamond Grade Reflection Tape placed around the top and 18 inches below the top of the stake. Water shall be marked with BLUE stakes.

2.9 WATER SERVICE PIPE AND FITTINGS

A. General

1. Water service pipe and fittings shall conform to the provisions of 2611.2D, AWWA C800 and the following:

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2. Valves and fitting models to vary according to water main pipe size. See mfg. catalogue data.
3. Water service pipe shall be run continuous for up to 100'. Joints on services over 100' must be reviewed and approved by the City Engineer.
4. All water service products shall comply with "Reduction of Lead in Drinking Water Act" legislation, which is commonly referred to as "no-lead" brass.

B. Service Pipe and Fittings

1. Water service pipe and fittings shall conform to the provisions of 2611.2D and the following:
   (a) Saddles shall be provided for all corporation stops if PVC is installed.
   (b) Saddles shall be provided for all corporation stops larger than 1 inch if DIP pipe is installed.
2. Copper Service Pipe Notes & Specifications:
   (a) Copper pipe shall conform to ASTM B88, Seamless Copper Water Tubing, Type K, Soft Annealed Copper.
   (b) Copper water service pipe connections shall be flared type.
3. High Density Polyethylene (HDPE) Service Pipe Notes & Specifications
   (a) HDPE pipe shall conform to Grade PE-3408 or PE-4710 pipe and shall be rated for 200 PSI working pressure, SDR 9.
   (b) HDPE pipe shall conform to ASTM D-1248 & D-2737 for Copper Tube Size, outside diameter controlled.
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   (a) #12 AWG solid copper clad steel (CCS) wire with 30 mil high density polyethylene (HDPE) insulating jacket, color BLUE.
5. The Utility should be contacted before ordering to verify the manufacturers' type and style. The water service materials style commonly used by the Utility are to be considered as a basis for quality are:

Copper Water Service Pipe (1-inch and 1.5"-inch Service Pipe Only):

WATER SERVICE PIPE & APPURTENANCES		
ITEM:	**SERVICE PIPE SIZE**	**FLARED TYPE Valves & Fittings For TYPE K COPPER PIPE**
		FORD MODEL #
Corporation Stop		**FORD**
	1"	FB600-4-NL
	1.5"	FB600-6-NL

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Tapping Saddle		FORD	FORD
		for DIP WMN	for PVC WMN
	1"	F202	FS303
	1.5"	F202	FS303
Curb Stop		FORD	
	1"	B22-444M-NL	
	1.5"	B22-666M-NL	
Curb Box	1.5" Diam. Base Tap for 1.0" to 1.25" Curb Stops	FORD 8'- EM2-80-56	
Curb Box	2.0" Diam. Base Tap for 1.5" to 2" Curb Stops	FORD 8'- EM2-80-57	

All copper fittings shall be flared type. Compression type will not be allowed.

Polyethylene Water Service Pipe, CPS (1-inch, 1.5-inch and 2-inch service pipe):

WATER SERVICE PIPE & APPURTENANCES			
ITEM:	**SERVICE PIPE SIZE**	**COMPRESSION TYPE Valves & Fittings For POLYETHYLENE PIPE**	
		FORD MODEL #	
Corporation Stop		**FORD**	
	1"	FB1000-4-Q-NL	
	1.5"	FB1000-6-Q-NL	
	2"	FB1000-7-Q-NL	
Tapping Saddle		FORD	FORD
		for DIP WMN	for PVC WMN
	1"	F202	FS303
	1.5"	F202	FS303
	2"	F202	FS303

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Curb Stop		FORD
	1"	B44-444M-Q-NL
	1.5"	B44-666M-Q-NL
	2"	B44-777M-Q-NL
Curb Box	1.5" Diam. Base Tap for 1.0" to 1.25" Curb Stops	FORD 8'- EM2-80-56
Curb Box	2.0" Diam. Base Tap for 1.5" to 2" Curb Stops	FORD 8'- EM2-80-57

6. Curb Box: Minneapolis pattern base, 78 inch stationary rod, 12 inch box adjustment from 7 to 8 feet, lid with pentagon plug, and 1 ¼" I.D. upper section.

C. The listed fittings are to be considered as a basis for quality. The Utility should be contacted before ordering to verify the manufacturers' type and style.

D. Wrenches and Keys: The Contractor shall provide the Owner with one 3-foot curb box shutoff rod.

2.10 RESTRAINED JOINT RETAINER GLANDS

A. No exception to the referenced specification is made.

2.11 POLYETHYLENE ENCASEMENT

A. The Contractor shall furnish and install 8 mil polyethylene encasement for all hydrant riser pipes in accordance with the referenced specification.

2.12 POLYSTYRENE INSULATION

A. Insulation shall be 2-inches thick. Two layers of 2-inch insulation shall be required.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Temporary Service

1. Before proceeding with the project, the Contractor shall establish a work plan and submit the plan to the utility personnel and City Engineer for review and comment. The plan shall outline the method to be used to maintain service to the affected consumers and estimate the duration of any anticipated interruptions of service. The Contractor is the sole party responsible to notify the Utility and consumers who may be affected by limitations and/or interruption of water service. Planned service interruptions shall not exceed six (6) hours in any 72 hour period unless previously approved by the Utility.
2. Temporary watermain serving more than 4 residences shall be 4-inch diameter. Each service shall have a shut off valve.
3. Temporary watermain serving commercial and industrial areas shall be a minimum of 6-inch diameter.

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4. The Contractor shall supply a water meter to accurately measure the quantity of water used for temporary service. A water meter shall be placed at all connections between the City's water system and the temporary service pipe.

5. **The Contractor shall include water main shut-downs with the water utility at least 24 hours prior to the requested shut-down.**

6. **If the Contractor fails to provide water service to affected residents within the constraints specified above, an amount equal to $ 500.00 may be deducted from the amount due the Contractor for each occurrence.**

3.2 INSTALLATION OF PIPE AND FITTINGS

A. Aligning and Fitting of Pipes

1. The Contractor, together with the utility's personnel, shall jointly examine and operate all curb stops and mainline valves prior to final acceptance.

B. Blocking and Anchoring of Pipe

1. A thrust block of cast-in-place concrete, which covers the installed fitting, is not permitted. Pre-cast concrete thrust blocks and other restraining devices such as adjustable rods or cables, shall be provided at all bends, tees, hydrants and plugged crosses or wherever the water main changes direction or dead ends. Valves shall be tied to the nearest tee.

2. Hydrants shall be tied to the water main using mega lug type restraining glands AND thrust blocking OR mega lug type restraining glands AND metal restraining tie rods.

C. Polystyrene Insulation

1. The Contractor shall install polystyrene insulation in those areas where the water main or services may be susceptible to frost or freezing, or as directed by the City Engineer.

2. Unless otherwise specified in the Plans, Specifications, and Specific Requirements, board dimensions shall measure 8 foot long, 4 foot wide, and 1-1/2 inches thick or greater.

3. Rigid insulation board shall be placed within the pipe encasement zone, 6 inches above the pipe. Prior to placement of the insulation, encasement material shall be compacted until there is no further visual evidence of increased consolidation or the density of the compacted layer conforms to the density requirements specified in the Specific Requirements, then leveled and lightly scarified to a depth of 2 inches. Encasement zone material placed below the insulation shall be free of rock or stone fragments measuring 1-2 inches or greater.

4. Insulation boards shall be placed on the scarified material with the long dimension parallel to the centerline of the pipe. Boards placed in a single layer shall be overlapped at least 6 inches on all sides to eliminate continuous joints for the full depth of the insulation. If two or more layers of insulation boards are used, each layer shall be placed to cover the joints layer immediately below with an overlap of at least 6 inches.

5. The Contractor shall exercise caution to ensure that all joints between boards are tight during placement and backfilling with only extruded ends placed end-to-end or edge-to-edge. Broken or damaged material shall be removed and replaced.

6. The first layer of material placed over the insulation shall be 12 inches in depth, free of rock or stone fragments measuring 1-2 inches or greater. The material shall be placed in such a manner that construction equipment does not operate directly on the insulation and shall be compacted with equipment which exerts a contact pressure of less than 80 psi. The first layer shall be compacted until there is no further visual evidence of increased consolidation or the density of the compacted layer conforms to the density requirements specified.

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7. Polystyrene insulation shall have a minimum thickness of 4". The insulation shall be 2 layers of 2-inch insulation with joints staggered a minimum of 1-foot.

8. Rigid foam insulation shall be placed between the watermain and storm or sanitary sewer where adequate vertical clearance cannot be maintained. The insulation shall be placed on a bed of sand and sand shall be placed above the insulation to isolate the insulation from rocks and other sharp objects. The minimum thickness of 4" of insulation required shall be achieved by using 2 layers of insulation, the second layer shall be placed perpendicular to first layer and the joints shall be offset.

D. Polyethylene Encasement

1. Polyethylene encasement for hydrants is required

E. Water Service Installation

1. Water service lines complete with all required appurtenances shall be installed in accordance with all pertinent requirements for main line installations and as supplemented as follows.

   (a) It shall be the responsibility of the Contractor to keep an accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe endings. Tap locations shall be recorded in reference to survey line stationing. Curb boxes shall be tied to definable landmarks such as building corners, fire hydrants, manholes and telephone pedestals. Pipe terminals at the property line shall be marked on the ground surface with a steel fence post. The marker shall be placed on the dead side of the curb stop and shall extend from the service to 4 feet above grade with the top 1 foot painted BLUE.

   (b) Water service lines shall be installed in accordance with Minnesota Department of Health standards. Where water service lines are installed alongside of sanitary or storm sewer service lines, installation shall maintain the minimum specified clearances between pipelines and provide proper and adequate bearing for all pipes and appurtenances. For separate installation, the trench width shall be not less than two feet. Subject to minimum clearances, the water lines may be laid in a common trench excavated principally for sewer installation, either by widening the trench as necessary or by providing a shelf in the trench wall where ground stability will permit.

   (c) Unless otherwise specified, installation of water service lines shall provide for not less than eight feet of cover over the top of the pipe and for not less than 18 inches of clearance between pipelines. Also, at least 6 inches of clearance shall be maintained in crossing over or under other structures. Where the service pipe may be exposed to freezing due to insufficient cover or exposure from other underground structures, the water pipe shall be insulated as directed by the Engineer.

2. Field flaring shall be preformed with current standards of the plumbing industry and manufacturer recommendations.

3. The Contractor shall keep accurate records as to the location of the service connections, as specified in the referenced specification.

4. No warranty is expressed or implied as to the location, size or material type of existing service lines. The Contractor shall furnish and install all fittings required to make the connections.

5. The Contractor shall install new service pipe, at 8 foot bury depth, from the corporation stop to the building, or as directed by the City Engineer.

6. The water services shall have a valve installed inside the building. No couplings are allowed between the curbstop and the valve inside the building unless approved by the City of St. Francis.

7. The water services shall be constructed after the main has been hydrostatically tested and disinfected.

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8. The corporation stops shall be opened prior to complete backfilling to verify that no leakage occurs in the service line.

9. The water service shall be flushed after installation.

10. After inspection by the City the curb stop shall be shut off.

F. Tracer Wire Installation

1. Trace wire shall be installed along all PVC or PE pipe unless noted otherwise. The tracer wire shall be considered incidental to the water service construction. The installation of any non-conductive mains and/or services shall include the installation of tracer wire in accordance with the details shown on the plans.

2. The wire shall be of adequate length to be trimmed to 2 feet above the finished elevation at the hydrant or tracer wire access box. It is recommended that during construction, the Contractor periodically test the trace wire being installed, to ensure continuity. Upon completion of the project the Contractor shall test the trace wire in accordance with requirements of this section.

3. At junctions of non-conductive water main materials with conductive water main materials, the Contractor shall electrically connect the conductive water main with the tracer wire adjacent to the non-conductive material.

4. The installation of any non-conductive mains and/or services shall be installed with tracer wire in accordance with the details shown on the plans.

   (a) Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.

   (b) The wire shall be electrically tied to each valve by extending the wire to ground surface inside the tracer wire access box and attaching it to the box with stainless steel screws. The wire shall be electrically tied to each hydrant assembly by extending the wire up the hydrant and securely attaching it to one of the break-off flange bolts. All connections shall receive a coat of an approved bituminous rust preventative material such as Koppers 505, or equal.

5. The Contractor shall successfully complete a conductivity test of the installed tracer wire system prior to final acceptance.

3.3 INSTALLATION OF WATER METER AND REMOTE READER

A. It is the responsibility of the plumbing contractor to install the water meter, horn, wire and remote reader.

B. The water service shall be flushed prior to installation of the meter.

C. The meter shall be installed in the mechanical room, no more than 10-feet from a floor drain.

D. The meter shall be installed in a horizontal position.

E. The meter shall be installed at least 12-inches above the finished floor.

F. A valve shall be installed on both sides of the meter.

G. Remote must be installed within 1-foot of the electrical meter.

H. The remote wiring shall be stapled at intervals not to exceed 3-feet on inside of the wall or floor joist. Staples rated for wiring with a rounded crown must be used. Black electrical tape on copper pipe no more than two-feet (2') apart. Wire used shall be solid copper AWG, size 18 by 3 conductor, color-

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coded. Staples used shall be Arrow number T-25 for wiring up to 1/4-inch in diameter 9/16-inch long or equal.

I. The City Building Official will inspect the meter installation during the plumbing inspection. After the installation is approved, the meter shall be sealed and the water left on.

J. The curb stop must be inspected and approved prior to the Building Final: Call the Public Works Department at 763-233-5200 for the inspection.

K. The City shall charge the contractor for labor and material if they have to correct improper installations.

L. Questions should be directed to the Public Works Department at 763-233-5200 or the Building Department at 763-235-2317.

3.4 FIELD QUALITY CONTROL

A. No exception to the referenced Specification is made.

3.5 HYDROSTATIC TESTING AND DISINFECTION

A. Hydrostatic tests shall be conducted in accordance with the referenced specification. These tests shall be conducted prior to the bacteriological tests required with the disinfection of the main.

B. Water services, including corporation and curb stops, shall be tested. The Contractor may choose to include services at the time of watermain testing (150 psi) or as a separate operation at a reduced pressure of 100 psig. If performed separately, testing shall be done with the corporation stops open.

C. The Contractor shall disinfect the watermain in accordance with the provisions of AWWA Standard Specification C-651, Disinfecting Watermains. After performing and obtaining passing hydrostatic test results, two samples of the water, taken 24 hours apart, shall be taken from each section of the new pipe and sent to an approved testing laboratory to establish the bacteriological conditions prior to placing the line in service. In the event unsatisfactory results are obtained, the Contractor shall take whatever steps are necessary to correct the sanitary conditions. The Contractor shall then re-take the bacteriological tests until satisfactory results are obtained. The Contractor shall be responsible for all costs associated with the required testing.

1. After final flushing and before the water main is placed in service, samples shall be collected from the end of the main and each branch line for testing for bacteriological quality in accordance with Standard Methods for the Examination of Water and Wastewater, and shall show the absence of coliform organisms. Upon notice, the City shall schedule bacteriological sampling and testing by their contracted independent laboratory. Sample sets shall be at a rate of one per every 1200 feet of pipe. A higher rate of sampling may be required to include all branch line (ie. Dead-Ends and Cul-de-sacs included). If water in the pipe does not meet the Minnesota Department of Health requirements, disinfection procedure shall be repeated until meeting the requirements. Acceptance forms from the governing agency shall be furnished to the Engineer.
2. The Contractor shall draw the sample with the Engineer present.
3. The contractor shall provide sampling locations to meet the required test frequency.

3.6 HYDROSTATIC TESTING FOR FIRE SERVICE MAINS

A. Hydrostatic tests shall be conducted in accordance with Building Code Requirements for all fire suppression systems. Hydrostatic tests shall be completed at 200 p.s.i. with no drop in pressure over a

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2-hour test. These tests shall be conducted prior to the bacteriological tests required with the disinfection of the main.

3.7 FIELD QUALITY CONTROL- ELECTRICAL CONDUCTIVITY TEST OR EQUIVALENT

A. Electrical Conductivity Test

1. Conductive Pipe Materials

(a) See the referenced Specification CEAM 2611.3.F

2. Non-conductive Pipe Materials

(a) The conductivity requirements shall be to demonstrate the electrical continuity of the tracer wire.

(b) 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.

B. The Contractor shall have all work inspected by the Public Works Department (763-233-5200).

******END OF SECTION******

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SECTION 02525 - WELL SEALING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to well sealing as shown on the drawings, as specified herein, and/or as specified by the Engineer.

B. If the Minnesota Department of Health requires sampling of the well(s) to be sealed, the actual cost of testing shall be borne by the Owner. The Contractor shall coordinate all necessary efforts to secure samples and arrange for the appropriate testing at a testing lab approved by the Department of Health and the Engineer.

1.2 SPECIFICATION REFERENCES

A. The Contractor shall seal all wells in conformance with the well sealing procedures in the State of Minnesota *Guide to Water Wells & Borings*, Chapter 4725. The requirements are identified in Section 4725.3850 including filling the unused hole or well and, if possible, removing the casing.

B. Work shall only be performed by a contractor licensed or registered in accordance with part 4725.0475.

C. Mn/DOT Specification Section 2021 shall apply to mobilization (included in the Appendix for Bidder's reference).

D. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. All salvaged materials shall remain the property of the Contractor.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The Owner shall guarantee the Contractor access to each site.

B. The Contractor shall complete the Well Table listed below for each well sealed.

WELL TABLE

Well #	Dia.	Pump Type	Depth	Current Site (Yard, field, well house)	Site Restoration Requirements (Sod, Seed, etc.)

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C. The Contractor shall provide the City of St. Francis and City Engineer a copy of the Well Sealing record upon completion.

******END OF SECTION******

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SECTION 02530 - PIPE SEWERS – SANITARY

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to sanitary sewer and service lateral construction as indicated on the drawings or as specified herein.

1.2 METHODS

A. Trench excavation, bedding and backfill, see Section 02320 of these Specifications.

B. Trenchless installation, see Section 02446 of these Specifications.

1.3 SPECIFICATION REFERENCES

A. Reference Section 02320 of these Specifications for trench excavation, bedding and backfill, except as modified herein.

B. Reference CEAM Specification No. 2621 shall apply to the gravity sewers and service laterals construction, except as modified herein.

C. Reference Mn/DOT Specification No. 2506 shall apply to manholes and castings, except as modified herein.

D. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.4 SUBMITTALS

A. Work plan for temporary service

B. Two (2) copies of the final DVD and log of post construction televised inspection.

C. Sanitary sewer manholes – Shop Drawings.

D. Sanitary sewer castings – Certificates of Compliance.

E. Sanitary Sewer Pipe – Certificates of Compliance.

F. Tracer Wire and Tracer Wire Access Box – Certificates of Compliance.

PART 2 -- PRODUCTS

2.1 SEWER PIPE AND FITTINGS

A. Under Existing or Proposed Buildings

1. All underground sewers installed through areas to be occupied by buildings shall comply with all appropriate provisions of the State of Minnesota Plumbing Code, Minnesota Rules Chapter 4715.0570.
2. Permitted pipe materials shall be: (The 6B designations are from the plumbing code.):

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(a) 6B (1), PVC Schedule 40, un-threaded, ASTM D2665, with fabricated fittings ASTM D3311.

(b) 6B (3), PVC Schedule 40 (14 - 24 inch only), ASTM D1785, with ASTM D3311 fittings.

(c) 6B (4), PVC Schedule 40 and 80, SDR 21 and SDR 26 (6 inch and larger)

B. All pipe and fittings must be laid on a continuous granular bed. Installation must comply with ASTM D2321.

C. Solid Wall Polyvinyl Chloride (PVC) Pipe

1. 4" through 6" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 26, unless otherwise specified on the plans.

2. 8" through 15" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 35, for depths of less than 20 feet, unless otherwise specified on the plans. The SDR for depths exceeding 20 feet shall be 26, unless otherwise specified on the plans.

3. Over 15" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM F679 with a minimum wall thickness for a minimum pipe stiffness of 46, for pipe depths less than 18 feet. For depths greater than 18 feet, polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM F679 with a minimum wall thickness for a minimum pipe stiffness of 115.

4. WYES: All wyes and tees shall be heavy wall and shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 26, unless otherwise specified on the plans.

5. The connection shall be push-on with elastomeric gasketed joints, which are bonded to the inner walls of the gasket recess of the bell socket.

6. The pipe grade used shall be resistant to aggressive soil and corrosive substances in accordance with the requirements of ASTM D-543.

D. Ductile Iron Pipe (DIP)

1. No exception to the referenced specification.

2.2 MANHOLES

A. Precast Concrete Manholes

1. Sanitary sewer manholes shall conform to the Mn/DOT Standard Plate No. 4007C, unless otherwise shown on the plans, including integral base sections and rubber gasketed tongue and groove joints. All pipe openings shall have an integral cast watertight seal.

2. Integral cast bases shall be required for all manholes.

3. Manhole inverts shall be preformed to direct sewage to the downstream invert. “Tee” inverts will not be allowed.

4. Reinforced polypropylene plastic steps shall be furnished for all sanitary sewer manholes.

5. All rebar for anti-buoyancy collars shall be cast integral with the base section unless otherwise approved by the City Engineer.

B. Castings

1. All casting assemblies shall meet the certification requirements of the Minnesota Department of Transportation and be manufactured by a Mn/DOT approved source.

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2. The type of casting assembly to be used shall be Neenah R-1733 self seal lid lettered, “Sanitary Sewer” with two concealed pick holes and no lug.

C. Adjusting Rings

1. Only Ladtech H.D.P.E adjusting rings or approved equal, with approved butyl rubber sealant, shall be permitted for manholes.

2.3 TRACER WIRE

A. Tracer wire shall meet the requirements of the following:

1. #12AWG solid copper or copper clad steel (CCS) wire with 30mil high density polyethylene (HDPE) insulating jacket, color GREEN.

B. Connectors

1. Connectors shall be “wire nut” or “twist on” type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

C. Tracer wire access box shall be as manufactured by Valvco, or approved equal.

PART 3 -- EXECUTION

3.1 INSTALLATION OF PIPE AND FITTINGS

A. Sanitary Main Installation

1. Sanitary sewer plugs shall be installed upstream of all connections to existing sanitary sewers.
2. Sewer plugs installed in sanitary sewers shall not be removed prior to approval of the City Public Works Department or City Engineer.

B. Sewer Service Installation

1. The Contractor shall dye water test all existing sanitary sewer service line connections cut, severed or encountered during the construction to determine whether they are still active. Those service lines, which are no longer in use, shall be abandoned by plugging the severed upstream end with a suitable watertight plug.
2. The exact number of service connections, i.e., new service lines or connection to existing service lines, is unknown. The quantities listed on the proposal are approximate. Final payment shall be based upon the number constructed for the various diameter of services constructed.
3. The Contractor shall keep accurate records as to the location of the service connections constructed. Measurements to service line shall be taken from the two nearest permanent structures (i.e., hydrants, valves, manholes, buildings) as directed by the City Engineer. Final payment for the project will not be made until the information is in the possession of the City.
4. The Contractor shall install new service pipe from the wye branch to 10-feet beyond the property line, as shown on the plans.
5. At the end of all services, which are not immediately connected to working services, the Contractor shall furnish and install a wood or metal post which extends to just below the ground surface. If wood is used, there shall be attached to the top of the post a 6" x 2" metal piece, capable of being located by a metal detector from the ground surface. Additionally, all ends of

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sanitary sewer services shall be marked with a steel "T" fence post. Posts shall be painted GREEN.

6. All commercial and industrial sanitary sewer services shall be a minimum of 6-inches in diameter.

C. Tracer Wire Installation

1. The installation of any service pipes shall include the installation of tracer wire in accordance with the details shown on the plans.
2. At junctions of non-conductive pipe materials with conductive pipe materials, the Contractor shall electrically connect the conductive material with the tracer wire adjacent to the non-conductive material.
3. Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.
4. The wire shall be electrically tied to the locating box by extending the wire to ground surface inside and attaching it with stainless steel screws. All connections shall receive a coat of an approved bituminous rust preventative material such as Koppers 505, or equal.
5. The Contractor shall successfully complete a conductivity test of the installed tracer wire system prior to final acceptance.

3.2 MANHOLE STRUCTURE

A. Connect to Existing Sanitary Sewer

1. When connection to an existing sanitary sewer is made at an existing or proposed manhole, the Contractor shall expose and verify the elevation of the existing sewer prior to laying any sanitary sewer to, or from, the connection point. If the elevation of the existing sewer does not match the elevation shown on the plans, the Contractor shall notify the City Engineer, at which time the City Engineer may adjust the proposed grades.
2. Connections to existing sanitary sewers shall be watertight.
3. Connections to existing structures shall be watertight. The installation of Kor-N-Seal boots, or equal, shall be required.

B. Outside Drop Manhole

1. All pipe materials used to construct the drop section and the incoming pipe shall be ductile iron.
2. Ductile iron pipe shall extend from the tee to 2 feet beyond the point where the elevation of the virgin soil becomes uniform 6 inches below the invert elevation of the incoming pipe.
3. A section of pipe shall extend a minimum of 6" beyond the interior wall of the manhole at the top of the drop. The top ½ of the pipe shall be cut off.

C. Inside Drop Manhole

1. All pipe materials used to construct the drop section and the incoming pipe shall be ductile iron.
2. Ductile iron pipe shall extend from the tee to 2 feet beyond the point where the elevation of the virgin soil becomes uniform 6 inches below the invert elevation of the incoming pipe.
3. All work shall be completed as noted on the details.

D. Raise / Lower Existing Manhole

1. Raising and/or lowering an existing manhole to meet a proposed finished rim elevation is performed when the addition and/or deletion of 2" adjusting rings will not exceed a maximum of 3

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rings. Typically, it will require: the removal of the manhole cone section or the concrete slab top; the addition, removal, or exchange of barrel sections; the replacement of the cone section or the concrete slab top; the installation of the proper number of adjusting rings; and the replacement of the manhole casting and frame.

E. Manhole Construction

1. Manhole bases shall be set on a minimum of 6-inches of foundation material.

F. Miscellaneous Work

1. When H.D.P.E adjusting rings are used, the sealant material and method shall be according to Manufacturer's specifications. A maximum of 3 individual adjusting rings shall be used. Taller 6" or 12" rings shall be used where adjustment requires more than three 2" rings.
2. All manholes placed outside the roadway bituminous surface shall be marked with a FlexStake EZ Drive type marker with Diamond Grade Reflection Tape placed around the top and 18 inches below the top of the stake. Sanitary shall be marked with GREEN stakes.

3.3 FIELD QUALITY CONTROL

A. Deflection test

1. No exception to the referenced specification is made.

B. Sanitary sewer leakage testing

1. Leakage tests shall be conducted as described in the referenced specification. However, leakage testing will not be necessary where existing services are connected directly to the new sewer as it is being constructed.

C. Air Testing

1. No exception to the referenced specification is made.

D. Televising

1. Televising is required after deflection testing has been completed and the sanitary sewer manhole castings have been adjusted to ½" below the bituminous base course.
2. Immediately prior to televising, the televisor shall discharge sufficient clear water into the pipe to clean the pipe and assist in identifying sags and mis-alignment.
3. Televising shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by close circuit television. All televising video shall be in color. The interior of the pipeline shall be carefully inspected to determine the location of any conditions which may indicate improper installation. Each individual reach of pipe shall be identified as a 'chapter' on the DVD.
4. Two (2) DVD's and suitable logs shall be kept of all televising and later submitted to the City Engineer.
5. If, upon the review of the submitted DVD's and log, a mis-alignment or debris is discovered, the Contractor shall repair the deficiency and re-televise the deficient section of pipe. All re-televising shall be included on the original televising DVD's and reports submitted. Separate DVD's for re-televised sections of pipe will not be accepted.

E. Sanitary Sewer Cleaning

1. All newly installed mains shall be jetted and vacuumed prior to acceptance by the City.

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2. Sanitary sewer mains shall be cleaned with equipment capable of removing debris from the lines prior to it entering downstream sections of pipe i.e. vacuuming.
3. Sanitary sewer mains shall be cleaned after manhole castings have been raised in the Bituminous Base Course. If after Bituminous wearing course is placed and debris is found in Manholes, additional jetting and vacuuming will be required.
4. Contractor shall be responsible for obtaining water necessary for all cleaning operations and any costs associated with water acquisition. Permission to access City utilities must be approved by the Public Works Director.
5. All debris removed from the sanitary sewer mains shall be disposed of at an approved off-site disposal facility.

******END OF SECTION******

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SECTION 02535 – FORCEMAINS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to force main construction as indicated on the drawings or as specified herein.

1.2 METHODS

A. Trench excavation, bedding and backfill, see Section 02320.

B. Trenchless installation, see Section 02446.

1.3 SPECIFICATION REFERENCES

A. Reference Section 02320 of these Specifications for trench excavation, bedding and backfill, except as modified herein.

B. Reference CEAM Specification No. 2611 shall apply to the force main construction, except as modified herein.

C. Reference CEAM Specification 2621.3G for pipe deflection.

D. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 OPEN CUT FORCE MAIN PIPE AND FITTING MATERIALS

A. Pressure Polyvinyl Chloride (PVC) Pipe

1. Polyvinyl Chloride (PVC) pressure pipe conforming to the current requirements of AWWA C900 (DR 18) for pipe diameters 4” through 12”.

B. High Density Polyethylene (HDPE) Pipe and Fittings

1. The pipe material shall be extra high molecular weight, high density polyethylene (EHMW-HDPE, PE4710) conforming with the minimum structural standards of ASTM D3350 with cell classification 4455744C, as manufactured by Performance Pipe, DriscoPlex 4000 (DIPS) Series, or equal. All HDPE pipe material shall meet the requirements of ASTM F714.
2. The pipe to be used shall be (HDPE) pressure pipe conforming to the requirement of AWWA C-906. The grade used shall be resistant to aggressive soils or corrosive substances present.. Unless otherwise specified, the dimensions and tolerances of the pipe barrel should conform to ductile iron pipe equivalent outside diameters (4000 series).
3. The dimension ratio (DR) shall be 17.
4. Pipe shall include “GREEN” color stripes along the pipe.
5. HDPE pipe shall have butt-fused joints.
6. The Contractor shall verify the lengths of conduit necessary in the field before fabrication.

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7. Polyethylene fittings and adaptors shall be butt-fused, EHMW-HDPE, PE4710 meeting the same resin requirements as specified for the pipeline. In addition, the fittings shall meet the applicable requirements of AWWA C906 and ASTM D3261.

8. Mechanical joint forcemain joints shall be restrained using ductile iron clamps (series 15PF00 or 2000PV Ebaa Iron, Inc. or equal) supplied with a sufficient number of ductile iron bolts to restrain the working and test pressures for this application. Internal pipe stiffeners must be used.

C. Pressure Pipe Joint Restraint Clamps

1. The clamps (Series 6500 Ebaa Iron, Inc.) shall be ductile iron and supplied with a sufficient number of ductile iron bolts to restrain working and test pressures for this application.

D. Pipe Fitting Materials

1. The following pressure pipe fitting materials will be allowed for use on this project:

(a) Mechanical Class 350 ductile iron fittings shall be used.

(b) All fittings shall be coated with a 6-8 mil nominal thickness fusion bonded epoxy conforming to the requirements of ANSI/AWWA C550 and C116/A21.16.

(c) All fittings, valves, and retaining rods shall be protected by using sacrificial zinc anode caps, 6 ounces, as manufactured by Trumbull, or an approved equal. Contractors shall supply 2 Anode Caps per mechanical joint gland installed.

(d) All Restraining devices (megalugs) shall be coated with a 6-8 mil nominal thickness, fusion bonded epoxy conforming to the requirements of ANSI/ AWWA C550 and C116/A21.16.

(e) All fittings, valves, hydrants, etc., shall be secured utilizing COR-BLUE T-BOLTS as manufactured by NSS Industries or approved equal.

(f) Adaptors, back-up rings and oversize sleeves shall be provided for transitions and connections to dissimilar types of pipe materials. All sleeve fittings shall be long mechanical joint.

(g) Quality control of all fitting manufacturers shall conform to the requirements of International Organization for Standardization (ISO).

2. All fittings shall have been manufactured in the year of construction or prior calendar year.

2.2 TRENCHLESS PIPE MATERIAL & STRUCTURAL REQUIREMENTS

A. All pipe shall be made from virgin material. No rework except that obtained from the manufacturer's own production of the same formulation shall be used.

B. The pipe shall be homogenous throughout and shall be free of visible cracks, holes, foreign material, blisters, and/or other deleterious faults.

C. Any section of pipe with a gash, blister, abrasion, nick scar, or other deleterious fault greater than 10 percent (10%) of the wall thickness, shall not be used and must be removed from the site. However, a defective portion of pipe, as defined above, may be cut out and butt-fused in accordance with the procedures herein.

D. Any section of pipe having other defects such as concentrated ridges, discoloration, excessive spot roughness, pitting, variable wall thickness or any other defect of manufacturing and/or handling shall not be used and shall be removed from site.

E. INTERNAL PIPE DIAMETERS

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1. The actual inside barrel diameter of the pipe used for pressure pipe shall not be less than that of AWWA C900 DR 18 for the corresponding nominal pipe size.

F. FORCEMAIN APPLICATIONS

1. Fusible C900/C905™

(a) As manufactured by Underground Solutions (www.undergroundsolutions.com). ASTM D 1784-02. with cell classification 12454. The formualtion for extrusion of Fusible C-900™/C-905™/PVC™ shall be compounded to the specific proprietary recipe for Fusible pipe, and meet the requirements of PPI TR-2.

(b) Butt joint fused PVC pressure pipe conforming to AWWA C900 for 150 psi pressure rating (DR 18). However, structurally stronger pipe may be required to ensure resistance to pulling stresses.

(c) Pipe fusing shall meet manufacturer requirements.

(d) A manufacturer's representative shall be present during fusing and installation.

2. High Density Polyethylene (HDPE) Pipe and Fittings

(a) The pipe material shall be extra high molecular weight, high density polyethylene (EHMW-HDPE, PE4710) conforming with the minimum structural standards of ASTM D3350 with cell classification 4455744C, as manufactured by Performance Pipe, DriscoPlex 4000 (DIPS) Series, or equal. All HDPE pipe material shall meet the requirements of ASTM F714.

(b) The pipe to be used shall be (HDPE) pressure pipe conforming to the requirement of AWWA C-906. The grade used shall be resistant to aggressive soils or corrosive substances present.. Unless otherwise specified, the dimensions and tolerances of the pipe barrel should conform to ductile iron or cast iron pipe equivalent outside diameters.

(c) The dimension ratio (DR) shall be 17.

(d) Pipe shall include “GREEN” color stripes along the pipe.

(e) HDPE pipe shall have butt-fused joints.

(f) The Contractor shall verify the lengths of conduit necessary in the field before fabrication.

(g) Polyethylene fittings and adaptors shall be butt-fused, EHMW-HDPE, PE4710 meeting the same resin requirements as specified for the pipeline. In addition, the fittings shall meet the applicable requirements of AWWA C906 and ASTM D3261.

(h) Mechanical joint pressure pipe joints shall be restrained using ductile iron clamps (series Ebaa Iron, Inc. or equal) supplied with a sufficient number of ductile iron bolts to restrain the working and test pressures for this application.

2.3 AIR RELIEF MANHOLES

A. Precast Concrete Air Relief Manholes

1. All manholes shall conform to the Mn/DOT Standard for the design type shown on the plans including integral base sections and rubber gasketed tongue and groove joints. All pipe openings shall have integral cast watertight seal.

B. Castings

1. All casting assemblies shall meet the certification requirements of the Minnesota Department of Transportation and be manufactured by a Mn/DOT approved source.

2. The type of casting assembly to be used shall be Neenah R-1733 self sealing lid lettered, “Sanitary Sewer” with two concealed pick holes and no lug.

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2.4 ADJUSTING RINGS

A. Only Ladtech H.D.P.E adjusting rings or approved equal, with approved mastic, shall be permitted for manholes.

2.5 AIR AND VACUUM RELEASE VALVES

A. The air and vacuum release valve shall be equal to APCO Model 402 with a 2-inch inlet. The air and vacuum release valve shall be equipped with blow-off valves, quick disconnect couplings, 6-feet of hose and a 2-inch shut-off valve. A 2-inch saddle shall be used on the force main for connection of the air and vacuum release valve.

2.6 VALVE AND VALVE HOUSING

A. All valves shall have been manufactured in the year of construction or prior calendar year.

B. All nuts and bolts shall be 304 stainless steel.

C. Valve Housing

1. Cast-iron screw type valve boxes shall be installed where indicated on underground valves. The cast-iron valve boxes shall be of either the two-piece or three-piece style and shall be furnished with a stay-put cover with raised letters indicating "SEWER." The shaft shall be 5 1/4" inside diameter. Valve boxes shall be Tyler 6850, or approved equal.
2. All valve box assemblies shall be furnished with a valve umbrella anchorage assembly. The valve umbrella anchorage assembly shall be manufactured by Adaptor, Inc., Oak Crest, WI, or equivalent.
3. Valve boxes shall be installed so that when a 4"O.D. Aluminum pipe with a cut out at the bottom of the pipe for the operating nut, is inserted in the valve box after the valve box has been adjusted to final height, it fits over the operating nut.
4. High Density Polyethylene valve housings will not be allowed.

D. Gate Valves

1. All valves up to and including 12" diameter to be furnished and installed on the water main shall be , non-rising stem, iron body, resilient-sealed gate valves, with two-inch square opening nut rated for a 200 psi working pressure conforming to the current editions of AWWA C-509-or AWWA C-515. Double disc type valves (AWWA C-500) will not be allowed.
   (a) All nuts and bolts shall be 304 stainless steel.
   (b) Working pressure rating of 200 psi for all sizes.
   (c) Double ring stem seal, one above and below the stem seal.
   (d) Weather seal on bonnet cover.
   (e) Non-rising stem.
   (f) Mechanical joints for typical installation. Tapping sleeve assemblies require flange by mechanical joint.
   (g) Manufacturers: American, Mueller, Kennedy, or equal.
   (h) All valves shall be for buried service.

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2. Operating Nut Risers shall extend from the operating nut on the valve to the top of the valve box. The riser shall terminate with a 2-inch square operating nut between 8" and 12" below the top of the valve box cover. The riser shall have adequate strength to operate the valve.

3. The Developer shall supply one gate valve wrench to the City for each project.

E. Valve Markers

1. All valves placed outside the roadway bituminous surface shall be marked with a FlexStake EZ Drive type marker with Diamond Grade Reflection Tape placed around the top and 18 inches below the top of the stake. Forcemain valves shall be marked with GREEN stakes.

2.7 TRACER WIRE

A. Tracer wire shall meet the requirements one of the following:

1. #12AWG solid copper or copper clad steel (CCS) wire with 30mil high density polyethylene (HDPE) insulating jacket, color GREEN.

B. Connectors

1. Connectors shall be “wire nut” or “twist on” type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

C. Tracer Wire Risers shall be as noted in the details. Rhino Triview pedestals shall be required for tracer wire risers.

2.8 POLYETHYLENE ENCASEMENT

A. No exception to the referenced specification is made.

2.9 POLYSTYRENE INSULATION

A. Insulation shall be 2-inches thick. Two layers of 2-inch insulation shall be required.

PART 3 -- EXECUTION

3.1 INSTALLATION OF PIPE AND FITTINGS

A. Aligning and Fitting of Pipes

1. The Contractor, together with the utility's personnel, shall jointly examine and operate all forcemain components prior to final acceptance.

B. Blocking and Anchoring of Pipe

1. A thrust block of cast-in-place concrete, which covers the installed fitting, is not permitted. Pre-cast concrete thrust blocks and other restraining devices such as restrained joint retainer glands, shall be provided at all bends or wherever the force main changes direction, valves shall be tied to the nearest forcemain fitting.

C. Polystyrene Insulation

1. See Section 02510 for insulation methods.

D. Polyethylene Encasement

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1. No polyethylene encasement for the main or appurtenances is required unless identified in the plans.

E. Tracer Wire Installation

1. Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.

2. The wire shall be brought to the ground surface at ends of casing pipes, bends in the forcemain, or at a maximum spacing of 1000 feet. Tracer wire risers shall be provided as shown in the details. All connections shall receive a coat of an approved bituminous rust preventative material such as Koppers 505, or equal.

3. The Contractor shall successfully complete a conductivity test of the installed tracer wire system prior to final acceptance.

F. Manhole Markers:

1. All valves placed outside the roadway bituminous surface shall be marked with a FlexStake EZ Drive type marker with Diamond Grade Reflection Tape placed around the top and 18 inches below the top of the stake. Forcemain valves shall be marked with GREEN stakes.

G. Methods

1. Trench excavation, bedding and backfill, see Section 02320.

2. Trenchless installation, see Section 02446.

3.2 FIELD QUALITY CONTROL

A. Electrical Conductivity Test

1. Non-conductive Pipe Materials

(a) The conductivity requirements shall be to demonstrate the electrical continuity of the tracer wire.

(b) 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.

B. The Engineer may require the Contractor to demonstrate that the forcemain meets the requirements of CEAM Specification 2621.3G for pipe deflection.

C. The Engineer may require the Contractor to perform a hydrostatic pressure test as specified in CEAM Specification 2611.3G to a pressure of 100 p.s.i.

******END OF SECTION******

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SECTION 02537 - SANITARY SEWER SERVICES TO BUILDINGS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to sanitary sewer and service lateral construction as indicated on the drawings or as specified herein.

1.2 METHODS

A. Trench excavation, bedding and backfill, see Section 02320 of these Specifications.

B. Trenchless installation, see Section 02446 of these Specifications.

1.3 SPECIFICATION REFERENCES

A. Reference Section 02320 of these Specifications for trench excavation, bedding and backfill, except as modified herein.

B. Reference CEAM Specification No. 2621 shall apply to the gravity sewers and service laterals construction, except as modified herein.

C. Reference Mn/DOT Specification No. 2506 shall apply to manholes and castings, except as modified herein.

D. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.4 PERMITS, BONDS AND INSURANCE

A. The Contractor shall obtain permit from the City prior to starting work; the Contractor will be notified of the permit fee.

B. The Contractor shall provide the City of St. Francis with a certificate of insurance and excavator's performance bond in the amount of $5,000.00 before starting the work.

1.5 QUALITY CONTROL

A. The Contractor shall have the work inspected by the Public Works Department (763-233-5200).

B. All trenches shall meet OSHA Standards.

C. The City will charge the Contractor for all labor and materials needed to correct work that has been improperly installed.

1.6 SUBMITTALS

A. Work plan for temporary service

B. Two (2) copies of the final DVD and log of post construction televised inspection.

C. Sanitary sewer manholes – Shop Drawings.

D. Sanitary sewer castings – Certificates of Compliance.

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E. Sanitary Sewer Pipe – Certificates of Compliance.

F. Tracer Wire and Tracer Wire Access Box – Certificates of Compliance.

PART 2 -- PRODUCTS

2.1 SEWER PIPE AND FITTINGS

A. Under Existing or Proposed Buildings

1. All underground sewers installed through areas to be occupied by buildings shall comply with all appropriate provisions of the State of Minnesota Plumbing Code, Minnesota Rules Chapter 4715.0570.
2. Permitted pipe materials shall be: (The 6B designations are from the plumbing code.):
   (a) 6B (1), PVC Schedule 40, un-threaded, ASTM D2665, with fabricated fittings ASTM D3311.
   (b) 6B (3), PVC Schedule 40 (14 - 24 inch only), ASTM D1785, with ASTM D3311 fittings.
   (c) 6B (4), PVC Schedule 40 and 80, SDR 21 and SDR 26 (6 inch and larger)
3. All pipe and fittings must be laid on a continuous granular bed. Installation must comply with ASTM D2321.

B. Solid Wall Polyvinyl Chloride (PVC) Pipe

1. 4" through 6" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 26, unless otherwise specified on the plans.
2. 8" through 15" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 35, for depths of less than 20 feet, unless otherwise specified on the plans. The SDR for depths exceeding 20 feet shall be 26, unless otherwise specified on the plans.
3. Over 15" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM F679 with a minimum wall thickness for a minimum pipe stiffness of 46, for pipe depths less than 18 feet. For depths greater than 18 feet, polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM F679 with a minimum wall thickness for a minimum pipe stiffness of 115.
4. WYES : All wyes and tees shall be heavy wall and shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 26, unless otherwise specified on the plans.
5. The connection shall be push-on with elastomeric gasketed joints, which are bonded to the inner walls of the gasket recess of the bell socket.
6. The pipe grade used shall be resistant to aggressive soil and corrosive substances in accordance with the requirements of ASTM D-543.

C. Ductile Iron Pipe (DIP)

1. No exception to the referenced specification.

2.2 MANHOLES

A. Precast Concrete Manholes

1. Sanitary sewer manholes shall conform to the Mn/DOT Standard Plate No. 4007C, unless otherwise shown on the plans, including integral base sections and rubber gasketed tongue and groove joints. All pipe openings shall have integral cast watertight seal.

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2. Integral cast bases shall be required for all manholes.

3. Manhole inverts shall be preformed to direct sewage to the downstream invert. "Tee" inverts will not be allowed.

4. Reinforced polypropylene plastic steps shall be furnished for all sanitary sewer manholes.

5. All rebar for anti-buoyancy collars shall be cast integral with the base section unless otherwise approved by the City Engineer.

B. Castings

1. All casting assemblies shall meet the certification requirements of the Minnesota Department of Transportation and be manufactured by a Mn/DOT approved source.

2. The type of casting assembly to be used shall be Neenah R-1733 self seal lid lettered, "Sanitary Sewer" with two concealed pick holes and no lug.

C. Adjusting Rings

1. Only Ladtech H.D.P.E adjusting rings or approved equal, with approved butyl rubber sealant, shall be permitted for manholes.

2.3 TRACER WIRE

A. Tracer wire shall meet the requirements of the following:

1. #12 AWG solid copper clad steel (CCS) wire with 30 mil high density polyethylene (HDPE) insulating jacket, color GREEN.

B. Connectors

1. Connectors shall be "wire nut" or "twist on" type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

C. Tracer wire access box shall be as manufactured by Valvco, or approved equal.

PART 3 -- EXECUTION

3.1 INSTALLATION OF PIPE AND FITTINGS

A. Sanitary Main Installation

1. Sanitary sewer plugs shall be installed upstream of all connections to existing sanitary sewers.

2. Sewer plugs installed in sanitary sewers shall not be removed prior to approval of the City Public Works Department or City Engineer.

B. Sewer Service Installation

1. The Contractor shall dye water test all existing sanitary sewer service line connections cut, severed or encountered during the construction to determine whether they are still active. Those service lines, which are no longer in use, shall be abandoned by plugging the severed upstream end with a suitable watertight plug.

2. The exact number of service connections, i.e., new service lines or connection to existing service lines, is unknown. The quantities listed on the proposal are approximate. Final payment shall be based upon the number constructed for the various diameter of services constructed.

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3. The Contractor shall keep accurate records as to the location of the service connections constructed. Measurements to service line shall be taken from the two nearest permanent structures (i.e., hydrants, valves, manholes, buildings) as directed by the City Engineer. Final payment for the project will not be made until the information is in the possession of the City.

4. The Contractor shall install new service pipe from the wye branch to 10-feet beyond the property line, as shown on the plans.

5. At the end of all services, which are not immediately connected to working services, the Contractor shall furnish and install a wood or metal post which extends to just below the ground surface. If wood is used, there shall be attached to the top of the post a 6" x 2" metal piece, capable of being located by a metal detector from the ground surface. Additionally, all ends of sanitary sewer services shall be marked with a steel "T" fence post. Posts shall be painted GREEN.

6. All commercial and industrial sanitary sewer services shall be a minimum of 6-inches in diameter.

C. Tracer Wire Installation

1. The installation of service pipes shall include the installation of tracer wire in accordance with the details shown on the plans.

2. At junctions of non-conductive pipe materials with conductive pipe materials, the Contractor shall electrically connect the conductive material with the tracer wire adjacent to the non-conductive material.

3. Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.

4. The wire shall be electrically tied to the locating box by extending the wire to ground surface inside and attaching it with stainless steel screws. All connections shall receive a coat of an approved bituminous rust preventative material such as Koppers 505, or equal.

5. The Contractor shall successfully complete a conductivity test of the installed tracer wire system prior to final acceptance.

3.2 MANHOLE STRUCTURE

A. Connect to Existing Sanitary Sewer

1. When connection to an existing sanitary sewer is made at an existing or proposed manhole, the Contractor shall expose and verify the elevation of the existing sewer prior to laying any sanitary sewer to, or from, the connection point. If the elevation of the existing sewer does not match the elevation shown on the plans, the Contractor shall notify the City Engineer, at which time the City Engineer may adjust the proposed grades.

2. Connections to existing sanitary sewers shall be watertight.

3. Connections to existing structures shall be watertight. The installation of Kor-N-Seal boots, or equal, shall be required.

B. Outside Drop Manhole

1. All pipe materials used to construct the drop section and the incoming pipe shall be ductile iron.

2. Ductile iron pipe shall extend from the tee to 2 feet beyond the point where the elevation of the virgin soil becomes a uniform 6 inches below the invert elevation of the incoming pipe.

3. A section of pipe shall extend a minimum of 6" beyond the interior wall of the manhole at the top of the drop. The top ½ of the pipe shall be cut off.

C. Inside Drop Manhole

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1. All pipe materials used to construct the drop section and the incoming pipe shall be ductile iron.
2. Ductile iron pipe shall extend from the tee to 2 feet beyond the point where the elevation of the virgin soil becomes uniform 6 inches below the invert elevation of the incoming pipe.
3. All work shall be completed as noted on the details.

D. Raise / Lower Existing Manhole

1. Raising and/or lowering an existing manhole to meet a proposed finished rim elevation is performed when the addition and/or deletion of 2" adjusting rings will not exceed a maximum of 3 rings. Typically, it will require: the removal of the manhole cone section or the concrete slab top; the addition, removal, or exchange of barrel sections; the replacement of the cone section or the concrete slab top; the installation of the proper number of adjusting rings; and the replacement of the manhole casting and frame.

E. Manhole Construction

1. Manhole bases shall be set on a minimum of 6-inches of foundation material.

F. Miscellaneous Work

1. When H.D.P.E adjusting rings are used, the sealant material and method shall be according to Manufacturer's specifications. A maximum of 3 individual adjusting rings shall be used. Taller 6" or 12" rings shall be used where adjustment requires more than three 2" rings.
2. All manholes placed outside the roadway bituminous surface shall be marked with a FlexStake EZ Drive type marker with Diamond Grade Reflection Tape placed around the top and 18 inches below the top of the stake. Sanitary shall be marked with GREEN stakes.

3.3 FIELD QUALITY CONTROL

A. Deflection test

1. No exception to the referenced specification is made.

B. Sanitary sewer leakage testing

1. Leakage tests shall be conducted as described in the referenced specification. However, leakage testing will not be necessary where existing services are connected directly to the new sewer as it is being constructed.

C. Air Testing

1. No exception to the referenced specification is made.

D. Televising

1. Televising is required after deflection testing has been completed and the sanitary sewer manhole castings have been adjusted to ½" below the bituminous base course.
2. Immediately prior to televising, the televisor shall discharge sufficient clear water into the pipe to clean the pipe and assist in identifying sags and mis-alignment.
3. Televising shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by close circuit television. All televising video shall be in color. The interior of the pipeline shall be carefully inspected to determine the location of any conditions which may indicate improper installation. Each individual reach of pipe shall be identified as a 'chapter' on the DVD.

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4. Two (2) DVD's and suitable logs shall be kept of all televising and later submitted to the Engineer.

5. If, upon the review of the submitted DVD's and log, a mis-alignment or debris is discovered, the Contractor shall repair the deficiency and re-televise the deficient section of pipe. All re-televising shall be included on the original televising DVD's and reports submitted. Separate DVD's for re-televised sections of pipe will not be accepted.

E. Sanitary Sewer Cleaning

1. All newly installed mains shall be jetted and vacuumed prior to acceptance by the City.

2. Sanitary sewer mains shall be cleaned with equipment capable of removing debris from the lines prior to it entering downstream sections of pipe i.e. vacuuming.

3. Sanitary sewer mains shall be cleaned after manhole castings have been raised in the Bituminous Base Course. If after Bituminous wearing course is placed and debris is found in Manholes, additional jetting and vacuuming will be required.

4. Contractor shall be responsible for obtaining water necessary for all cleaning operations and any costs associated with water acquisition. Permission to access City utilities must be approved by the Public Works Director.

5. All debris removed from the sanitary sewer mains shall be disposed of at an approved off-site disposal facility.

F. The Contractor shall have all work inspected by the Public Works Department (763-233-5200).

******END OF SECTION******

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SECTION 2600
STANDARD SPECIFICATIONS
FOR
TRENCH EXCAVATION
AND
BACKFILL/SURFACE RESTORATION
1999 EDITION

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SECTION 2600
STANDARD SPECIFICATIONS FOR
TRENCH EXCAVATION & BACKFILL/SURFACE RESTORATION

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2600 STANDARD SPECIFICATIONS FOR TRENCH EXCAVATION & BACKFILL/SURFACE RESTORATION

2600.1 DESCRIPTION

This work shall consist of the excavation, backfilling, and restoration of existing surface improvements for the purposes of installing new and/or relocating or adjusting existing underground utilities.

Use of the term "Plans, Specifications and Special Provisions" within this specification shall be construed to mean those documents which compliment, modify, or clarify these specifications and are accepted as an enforceable component of the Contract or Contract Documents. All references to Mn/DOT Specifications shall mean the latest published edition of the Minnesota Department of Transportation Standard Specifications for Construction, as modified by any Mn/DOT Supplemental Specification edition published prior to the date of advertisement for bids. All reference to other Specifications of AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition available on the date of advertisement for bids.

2600.2 MATERIALS

A 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 by the material manufacturer or as indicated in the Plans, Specifications, or Special Provisions**.**

A1 Granular Material Gradation Classifications

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

Foundation materials shall have 100 percent by weight passing the 1-1/2 inch sieve and a maximum of 10 percent by weight passing the No. 4 sieve.

Backfill materials shall consist of existing trench materials, except as otherwise specified in this specification or in the Special Provisions**.**

Bedding and encasement materials for flexible pipe, where improved pipe foundation is not required, shall meet the requirements of Mn/DOT Specification 3149.2B1, Granular Borrow, except that 100 percent by weight shall pass the one-inch sieve.

A gradation report from an approved Independent Testing laboratory of the proposed granular materials shall be furnished to the Engineer before any of the granular materials are delivered to the project.

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A2 Granular Material Use Designations

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 designations 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.

B Piling

Piling shall be constructed in accordance with the provisions of Mn/DOT Specification 2452 and special plan details relating to piling.

C Insulation

Main Insulation shall be extruded rigid board material having a thermal conductivity of 0.23 BTU/hour/square foot/degree Fahrenheit/per inch thickness, maximum, at 40âF mean, a comprehensive strength of 35 psi minimum, and water absorption of 0.25 percent by volume minimum. Unless otherwise specified in the Plans, specifications, or Special Provisions, board dimensions shall measure 8 feet long, 2 or 4 feet wide, and 1, 1-1/2, 2, or 3 inches thick.

D Geotextile Fabric

Geotextile fabric shall meet the requirements of Mn/DOT Specification 3733 and be used as required by the Plans, Specifications, and Special Provisions.

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2600.3 CONSTRUCTION REQUIREMENTS

A General Provisions

A1 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 the field manual of Temporary Control Zone Layouts of the Minnesota Manual of Uniform Traffic Control Devices and Mn/DOT Specifications 1404 and 1710, and the Special Provisions. Neither road closures nor detours shall be permitted unless specified in the Special Provisions or authorized by the Engineer. Where road closures or detours are permitted by the Engineer, the Engineer shall determine the appropriate agencies, boards, or departments the Contractor must notify prior to taking the action and the proper advance notice to be provided to each body.

Compliance with this requirement shall not be construed to relieve the Contractor from the responsibility of notifying agencies or institutions whose services may be predicated upon a roadway being opened to traffic or whose services would be hindered if a roadway is closed to traffic. Such agencies or institutions shall include, but not be limited to, the police department, the fire department, municipal bus service, school bus service, and ambulance service. The Contractor shall keep the required agencies informed of changing traffic patterns and detour situations.

A2 Establishing Line and Grade

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 25-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, if negligent in providing necessary protection, shall bear the full cost of any restaking.

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. Following construction of a work shaft on tunnel installations, the line and grade shall be transferred down the shaft and be projected into and throughout the length of each tunnel heading.

Unless otherwise specified in the Plans, Specifications, and Special Provisions, the water main shall generally be placed with the minimum specified cover. However, a greater depth may be

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required to clear existing storm and sanitary sewers and sewer services, and no additional compensation shall be provided for such adjustments.

In locations where sewer is in direct conflict with existing water main and water services the water main and water services shall be lowered to provide at least 18 inches of vertical distance between the top of the water main or service and the bottom of the sanitary or relocated in accordance with the Plans.

Water mains crossing above storm or sanitary sewers shall be laid to provide a separation of at least18 inches between the bottom of the water main and the top of the sewer. When local conditions prevent a vertical separation as described, the following construction shall be used:

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

(2) Watermain passing under sewers shall, in addition, be protected by providing:

(a) a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main;

(b) adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking of the Water mains;

(c) a length of water pipe shall be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

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

(1) The bottom of the water main 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 water main standards of construction and shall be pressure tested to assure water tightness prior to backfilling.

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

A3 Protection of Surface Structures

All surface structures and features located outside the permissible excavation limits for underground installations, together with those within the construction areas which are indicated in the Plans as being saved, shall be properly protected against damage and shall not be disturbed or removed without approval of the Engineer. Within the construction limits, as required, the removal of improvements such as paving, curbing, walks, turf, etc., shall be subject to acceptable

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replacement after completion of underground work, with all expense of removal and replacement being borne by the Contractor to the extent that separate compensation is not specifically provided for in the Contract.

Obstructions such as street signs, guard posts, small culverts, mailboxes, and other items of prefabricated construction may be temporarily removed during construction provided that essential service is maintained in a relocated setting as approved by the Engineer and that nonessential items are properly stored for the duration of construction. Upon completion of the underground work, all such items shall be replaced in their proper setting at the sole expense of the Contractor.

The Contractor shall be responsible for protection of existing overhead utilities and poles. This shall include arranging with the utility and paying the utility for holding poles that will be close to the edge of any trench. Holding of poles and repair of any damage to these facilities shall be considered incidental to the project with no additional compensation allowed. If relocation or removal of these facilities is required, the Owner will contact the concerned utility and pay for the relocation or removal at no additional expense to the Contractor.

In the event of damage to any surface improvements, either privately or publicly owned, in the absence of construction necessity, the Contractor will be required to replace or repair the damaged property to the satisfaction of the Engineer and without cost to the Owner.

A4 Interference of Underground Structures

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

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

Wherever alterations are required as a result of unforeseen underground interferences not due to any fault or negligence of the Contractor, the Engineer will issue a written order covering any additional or extra work involved and specifying the revised basis of payment, if any. Any alterations made strictly for the convenience of the Contractor, shall be subject to prior approval and shall be at the Contractor's expense.

No extra compensation will be allowed for delays caused by the interference of underground structures.

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A5 Removal of Surface Improvements

Removal of surface improvements in connection with trench excavation shall be limited to actual needs for installation of the pipeline and appurtenances, based on the allowable trench widths and any other controls imposed in connection with the work. Removal operations shall be coordinated effectively with the excavation and installation operations as will cause the least practical disruption of traffic or inconvenience to the public. The debris resulting from removals shall become the property of the Contractor and shall be disposed of by the Contractor in accordance with Mn/DOT Specification 2104. Removal debris shall not be deposited at locations that will block access to fire hydrants, private driveways, or other essential service areas, nor obstruct surface drainage. Removal and final disposal of debris shall be accomplished as a single operation wherever possible and, in any event, the debris shall be removed from the site before starting the excavating operations.

Removal of concrete or bituminous structures shall be by methods producing clean-cut breakage to prescored lines as will preserve the remaining structure without damage. Removal equipment shall not be operated in a manner that will cause damage to the remaining structure or adjoining property. Where not removed to an existing joint, concrete structures shall be sawed along the break lines to a minimum depth of one-third of the structure depth.

Any reusable materials generated during the work, such as aggregate, sod, topsoil, shall be segregated from other waste materials and be stockpiled so as to maintain suitability and permit proper reuse.

The use of drop weight equipment for breaking pavement will be allowed to the extent that the Contractor shall assume full responsibility for any damages caused thereby. The pavement breaking operation shall not be allowed to become a nuisance to the public or a source of damage to underground or adjacent structures. The Engineer reserves the right to order discontinuance of drop weight breaking operations at any time.

A6 Temporary Service Measures

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.

B Excavation and Preparation of Trench

B1 Operational Limitations and Requirements

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

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will be exposed in sufficient time to make adjustments without resorting to extra work or unnecessary delay.

Where possible, excavated materials shall be placed in areas that will not block existing vehicle and pedestrian traffic and drainage ways. The Contractor shall review proposed methods of operation with the Engineer prior to beginning the work.

All installations shall be accomplished by open trench construction except for short tunnel sections approved by the Engineer and with the exception that boring and jacking or tunnel construction methods shall be employed where so specifically required by the Plans, Specifications, or Special Provisions.

Installation of pipe through tunnel excavations will be allowed only where the surface structure can be properly supported and the backfill restored to the satisfaction of the Engineer.

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

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

B2 Classification and Disposition of Materials

Excavated materials will be classified for payment only to the extent that the removal of materials classified by the Engineer as Rock will be paid for as provided in the Special Provisions or shown in the Proposal. All other materials encountered in the excavations, with the exception of items classified for payment as structure removals, will be considered as Unclassified Excavation and unless otherwise specified in the Plans, Specifications, and Special Provisions, no additional compensation shall be provided for their removal.

Unclassified materials shall include muck, rubble, wood debris, and boulder stone, masonry or concrete fragments less than one cubic yard in volume, together with other miscellaneous matter that can be removed effectively with power operated excavators without resorting to drilling and blasting.

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

Excavated materials will be classified for reuse as being either Suitable or Unsuitable for backfill or other specified use, subject to selective controls. All suitable materials shall be reserved for backfill to the extent needed, and any surplus remaining shall be utilized for other construction 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. Unless otherwise specified in the Plans, Specifications, and Special Provisions, material handling as described above shall be considered incidental with no additional compensation provided.

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 excavations as would create hazardous conditions, nor shall any material be placed so as to block the access to emergency services. All materials considered unsuitable by the Engineer, for any use on the project, shall be immediately removed from the project and be disposed of as arranged for by the Contractor at no extra cost to the Contract.

B3 Excavation Limitations and Requirements

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

Excavations shall be extended below the bottom of structure as necessary to accommodate any required Granular Foundation material. When rock or unstable foundation materials are encountered at the established grade, additional materials shall be removed as specified or ordered by the Engineer to produce an acceptable foundation. Unless otherwise indicated or directed, rock shall be removed to an elevation at least six inches below the bottom surface of the pipe barrel and below the lowest projection of joint hubs. All excavations below grade shall be to a minimum width equal to the outside pipe diameter plus two feet. Rock shall be removed to such additional horizontal dimensions as will provide a minimum clearance of six inches on all sides of appurtenant structures such as valves, housings, access structures, etc.

Where no other grade controls are indicated or established for the pipeline, the excavating and foundation preparations shall be such as to provide a minimum cover over the top of the pipe as specified. Trench widths shall allow for at least six inches of clearance on each side of the joint

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hubs. The maximum allowable width of the trench at the top of pipe level shall be the outside diameter of the pipe plus two feet, subject to the considerations for alternate pipe loading set forth below. The width of the trench at the ground surface shall be held to a minimum to prevent unnecessary destruction of the surface structures.

The maximum allowable trench width at the level of the top of pipe may be exceeded only by approval of the Engineer, after consideration of pipe strength and loading relationships. Any alternate proposals made by the Contractor shall be in writing, giving the pertinent soil weight data and proposed pipe strength alternate, at least seven days prior to the desired date of decision. Approval of alternate pipe designs shall be with the understanding that there will be no extra compensation allowed for any increase in material or construction costs.

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 and/or a higher strength pipe than that required by the Plans, Specifications, and Special Provisions in order to satisfy design requirements, without additional compensation.

B4 Sheeting and Bracing Excavations

All excavations shall be sheeted, shored, and braced as will meet all requirements of the applicable safety codes and regulations; comply with any specific requirements of the Contract; and prevent disturbance or settlement of adjacent surfaces, foundations, structures, utilities, and other properties. Any damage to the work under contract or to adjacent structures or property caused by settlement, water or earth pressures, slides, cave-ins, or other causes due to failure or lack of sheeting, shoring, or bracing or through negligence or fault of the Contractor in any manner shall be repaired at the Contractor's expense and without delay.

Where conditions warrant extreme care, the Plans, Specifications, and Special Provisions may require special precautions to protect life or property, or the Engineer may order the installation of sheet piling of the interlocking type or direct that other safety measures be taken as deemed necessary. Failure of the Engineer to order correction of improper or inadequate sheeting, shoring, or bracing shall not relieve the Contractor's responsibilities for protection of life, property, and the work.

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

Sheeting, shoring and bracing materials shall be removed only when and in such manner as will assure adequate protection of the inplace structures and prevent displacement of supported grounds. Sheeting and bracing shall be left in place only as required by the Plans, Specifications, and Special Provisions or ordered by the Engineer. Otherwise, sheeting and bracing may be removed as the backfilling reaches the level of respective support. Wherever sheeting and bracing is left in place, the upper portions shall be cut and removed to an elevation of three feet or more below the established surface grade as the Engineer may direct.

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

B5 Preparation and Maintenance of Foundations

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

In excavations made below grade to remove rock or unstable materials, the backfilling to grade shall be made with available suitable materials unless placement of Granular Foundation or Bedding material is specified and provided for or is ordered by the Engineer. Placement of the backfill shall be in relatively uniform layers not exceeding 8 inches in loose thickness. Each layer of backfill shall be compacted thoroughly, by means of approved mechanical compaction equipment, as will produce uniform pipe support throughout the full pipe length and facilitate proper shaping of the pipe bed.

Where placement of foundation materials will not provide an adequate foundation for laying pipe due to the instability of the existing materials and where ordered by the Engineer, the Contractor shall place Geotextile Type I fabric on top of the unstable materials prior to placing foundation materials. Sufficient geotextile fabric shall be used to completely enclose the foundation materials and pipe.

It shall be the Contractor's responsibility to notify the Engineer of changing soil conditions which may be of poor bearing capacity and when organic soils are encountered. Where utilities are placed on unstable soils without notification of the Engineer, the Contractor shall be responsible for all repairs and correction of the installation without further compensation.

Where the foundation soil is found to consist of materials that the Engineer considers to be so unstable as to preclude removal and replacement to a reasonable depth to achieve solid support, a suitable foundation shall be constructed as the Engineer directs in the absence of special requirements in the Plans, Specifications, and Special Provisions. The Contractor may be required to furnish and drive piling and construct concrete or timber bearing supports or other work as may be ordered by the Engineer.

Care shall be taken during final subgrade shaping to prevent any over-excavation. Should any low spots develop, they shall only be filled with approved material, which shall have optimum moisture content and be compacted thoroughly without additional compensation to the Contractor. The finished subgrade shall be maintained free of water and shall not be disturbed

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during pipe lowering operations except as necessary to remove pipe slings. The discharge of trench dewatering pumps shall be directed to natural drainage channels or storm water drains. Draining trench water into sanitary sewers or combined sewers will not be permitted.

The Contractor shall install and operate a dewatering system of wells or points to maintain pipe trenches free of water wherever necessary or as directed by the Engineer to meet the intent of these specifications. Unless otherwise specified in the Plans, Specifications, and Special Provisions, such work shall be considered incidental.

All costs of excavating below grade and placing foundation or bedding aggregates as required shall be included in the bid prices for pipe items to the extent that the need for such work is indicated in the Contract provisions and the Proposal does not provide for payment under separate Contract Items. Any excavation below grade and any foundation or bedding aggregates required by order of the Engineer in the absence of Contract requirements will be compensated for separately.

If examination by the Engineer reveals that the need for placement of foundation aggregate was caused by the Contractor's manipulation of the soils in the presence of excessive moisture or lack of proper dewatering, the cost of the corrective measures shall be borne by the Contractor.

C Non Open Cut Pipe Installation

C1 Jacking/Boring

The terms "auger", "boring", "jack", "jacking", and "tunneling" in the proposal, specifications, and plans refers only to non-open cut construction. The Contractor shall inspect and verify soil conditions to his own satisfaction in order to determine the type of construction to employ. During the construction, the Contractor shall be responsible for protecting all existing utilities above the pipe invert.

The minimum diameter of the casing pipe shall be four (4) inches greater than the outside diameter of the bell of the carrier pipe. For any installation beneath a railroad, the top of the casing pipe shall not be closer than the specified dimensions indicated in the permit.

If the Contractor elects to install steel casing, the minimum wall thickness shall be as specified on the Plans, in the Special Provisions, or in the applicable Permit. Where required by the Engineer, two 17-pound anode packs shall be attached to the casing for corrosion protection.

A 1-1/2 inch pipe shall be forced along the top of the casing pipe. The front end of this pipe shall be 18 inches behind the front end of the casing pipe. A mixture of water and bentonite clay shall be forced through this pipe at all times during the casing installation to fill any voids that may be present above the casing pipe. Upon completion of the casing installation, this pipe shall be slowly withdrawn while bentonite is forced through the pipe to fill any remaining voids.

The Contractor shall prevent excavated materials from flowing back into the excavation during the non-open cut construction. This shall include the use of a shield conforming to the size and

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shape of the casing that will prevent materials from flowing into the leading edge of the casing. The machine used shall be capable of controlling line and grade and shall conform to the size and shape of the casing pipe.

No jacking/augering of pipe will be allowed below the water table unless the water table has been lowered sufficiently to keep the water below the pipe being installed. The use of water under pressure (jetting) or puddling will not be permitted to facilitate jacking/augering operations.

If any installation is augered, the head shall be approved by the Engineer and the auger shall be located six (6) inches behind the lead edge of the casing or carrier pipe.

If a void develops, the jacking/augering shall be stopped immediately and the void shall be filled by pressure grouting. The grout material shall consist of a sand-cement slurry of at least two sacks of cement per cubic yard and a minimum of water to assure satisfactory placement.

Skids and blocking shall be used as necessary to install the carrier pipe to the proper line and grade inside the casing pipe. Voids between carrier and casing pipes shall be filled with sand and the casing pipe sealed at both ends with a suitable material to prevent water or debris from entering the casing pipe.

C2 Directional Boring

Direction boring/drilling installation shall be accomplished where required on the Plans or in the Special Provisions to minimize disturbance of existing surface improvements. The installer shall have a minimum of three years of experience in this method of construction and have installed at least 1,000 feet of 8-inch or larger diameter pipe to specified grades. The field supervisor employed by the Contractor shall have at least three years of experience and shall be at the site at all times during the boring/drilling installation, and be responsible for all of the work.

The Contractor shall submit boring/drilling pit locations to the Engineer before beginning construction.

The drilling equipment shall be capable of placing the pipe as shown on the plans. The installation shall be by a steerable drilling tool capable of installing continuous runs of pipe, without intermediate pits, a minimum distance of 200 feet. The guidance system shall be capable of installing pipe within 1-1/2 inch of the plan vertical dimensions and 2 inches of the plan horizontal dimensions. The Contractor shall be required to remove and reinstall pipes which vary in depth and alignment from these tolerances.

Pull back forces shall not exceed the allowable pulling forces for the pipe being installed. Drilling fluid shall be a mixture of water and bentonite clay. Disposal of excess fluid and spoils shall be the responsibility of the Contractor.

D Placement of Insulation

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Rigid insulation board shall be placed within the pipe encasement zone, 6 inches above the pipe. Prior to placement of the insulation, Granular Borrow (MnDOT 3149) shall be leveled and compacted until there is no further visual evidence of increased consolidation or the density of the compacted layer conforms to the density requirements specified in the Special Provisions, then leveled and lightly scarified to a depth of 1/2 inch. Borrow material placed above and below the insulation shall be free of rock or stone fragments measuring 1-1/2 inches or greater.

Insulation boards shall be placed on the scarified material with the long dimension parallel to the centerline of the pipe. Boards shall be placed in a single layer with tight joints. No continuous joints or seams shall be placed directly over the pipe. If two or more layers of insulation boards are used, each layer shall be placed to cover the joints of the layer immediately below.

The Contractor shall exercise precaution to insure that all joints between boards are tight during placement and backfilling with only extruded ends placed end to end or edge to edge.

The first layer of material placed over the insulation shall be 6 inches in depth, free of rock or stone fragments measuring 1-1/2 inches or greater. The material shall be placed in such a manner that construction equipment does not operate directly on the insulation and shall be compacted with equipment which exerts a contract pressure of less than 80 psi. The first layer shall be compacted to conform to the density requirements specified in the Special Provisions.

E Pipeline Backfilling Operations

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

The backfilling shall be accomplished with the use of Suitable Materials selected from the excavated materials to the extent available and practical. Should the materials available within the trench section be unsuitable or insufficient, without loading and hauling or the employment of unreasonable measures, the required additional materials shall be furnished from outside sources as an Extra Work item in the absence of any Special Provision requirements.

Suitable Material shall be defined as a mineral soil free of foreign materials (rubbish, debris, etc.), frozen clumps, oversize stone, rock, concrete or bituminous chunks, and other unsuitable materials, that may damage the pipe installation, prevent thorough compaction, or increase the risks of after settlement unnecessarily. Material selection shall be such as to make the best and fullest utilization of what is available, taking into consideration particular needs of different backfill zones. Material containing stone, rock, or chunks of any sort shall only be utilized where and to the extent there will be no detrimental effects.

Within the pipe bedding and encasement zones described as that portion of the trench which is below an elevation one foot above the top of the pipe, the materials placed shall be limited in

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particle size to 1-1/2 inches maximum in the case of pipe of 12 inches in diameter or less and to 2 inches maximum in the case of larger pipe. Above these zones, the placement of material containing stones, boulders, chunks, etc. greater than 8 inches in any dimension shall not be allowed.

All flexible pipe shall be bedded in accordance with ASTM Specification D2321, "Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe". This shall include placement of granular bedding and encasement materials from a point six inches below the bottom of pipe to a point twelve inches above the top of the pipe. Placement and compaction of bedding and encasement materials around the pipe shall be considered incidental to the installation of the pipe. Where existing soils do not meet the requirements of bedding and encasement materials, the Contractor shall furnish the required granular materials.

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

Backfill materials shall be carefully placed in uniform loose thickness layers up to 12 inches thick spread over the full width and length of the trench section to provide simultaneous support on both sides of the pipeline. Granular backfill may be placed in 12 inch layers above an elevation one foot above the top of the pipe, and with the provision that, by authority and at the discretion of the Engineer in consideration of the demonstrated capability of special type vibrating compactors, the stated maximums may be increased.

Each layer of backfill material shall be compacted effectively, by approved mechanical or hand methods, until there is no further visual evidence of increased consolidation or the density of the compacted layer conforms to the density requirements specified in the Special Provisions. Compaction of the inplace layer shall be completed acceptably before placing material for a succeeding layer thereon. The manner of placement, compaction equipment, or procedure effectiveness shall be subject to approval of the Engineer.

All surplus or waste materials remaining after completion of the backfilling operations shall be disposed of in an acceptable manner within 24 hours after completing the backfill work on each particular pipeline section. Disposal at any location within the project limits shall be as specified, or as approved by the Engineer; otherwise, disposal shall be accomplished outside the project limits at the Contractor's discretion. The backfilling and surplus or waste disposal operations shall be a part of the work required under the pipeline installation items, not as work that may be delayed until final cleanup.

Compaction of backfill within Roadbed areas shall meet the density requirements of Mn/DOT Specification 2105. Compaction of backfill in all other areas shall be as required in the Special Provisions.

Until expiration of the guarantee period, the Contractor shall assume full responsibility and expense for all backfill settlement and shall refill and restore the work as directed to maintain an

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acceptable surface condition, regardless of location. All additional materials required shall be furnished without additional cost to the Owner.

Any settlement of road surfaces that are either placed under this Contract or by others under either public or private contract; that are in excess of one inch, as measured by a ten foot straight edge; and that are within the guarantee period shall be considered failure of the mechanical compaction. The Contractor shall be required to repair such settlement including all items placed by others.

F Restoration of Surface Improvements

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 the absence of specific payment provisions, as separate Contract Items, the restoration work shall be compensated for as part of the work required under those Contract Items which necessitated the destruction and replacement or repair, and there will be no separate payment. If separate pay items are provided for restoration work, only that portion of the repair or reconstruction which was necessitated by the Contract work will be measured for payment. Any improvements removed or damaged unnecessarily or undermined shall be replaced or repaired at the Contractor's expense.

F1 Turf Restoration

Turf restoration shall be accomplished by sod placement except where seeding is specifically allowed or required.

Topsoil shall be placed to a minimum depth of four inches under all sod and in all areas seeded. The topsoil material used shall be light friable loam containing a liberal amount of humus and shall be free of heavy clay, coarse sand, stones, plants, roots, sticks and other foreign matter. Topsoil meeting these requirements shall be selected from the excavated materials to the extent available and needed.

All turf establishment work shall be done in substantial compliance with the provisions of Mn/DOT Specification 2575 using seed mixtures as specified in the Special Provisions or Proposal.

F2 Pavement Restoration

The inplace pavement structure (including base aggregates) shall be restored in kind and depth as previously existed, using base aggregates salvaged from the excavated materials to the extent

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available and needed, and with new materials being provided for reconstruction of the concrete or bituminous surface courses.

If, through no fault of the Contractor in failing to reserve sufficient aggregate materials from the excavations, there should be insufficient quantity of suitable aggregate to reconstruct the pavement base courses, the additional materials required will be furnished by the Owner at its expense, or the Contractor will be ordered to furnish the additional materials from outside sources. Placement of any additional aggregate materials delivered to the site by the Owner or of any additional materials furnished by the Contractor shall be an incidental expense, as will also be the disposal of any excess materials resulting therefrom, unless special payment provisions are otherwise agreed upon.

Reconstruction of aggregate base courses and concrete or bituminous surface courses shall be in substantial compliance with all applicable Mn/DOT Specifications pertaining to the item being restored. The materials used shall be comparable to those used in the inplace structure, and the workmanship and finished quality shall be equal to that of new construction to the fullest extent obtainable in consideration of operational restrictions.

Existing concrete and bituminous surfaces at the trench wall shall be sawed or cut with a cutting wheel to form a neat edge in a straight line before surfaces are to be restored. Sawing or cutting may be accomplished as a part of the removal or prior to restoration at the option of the Contractor. However, all surface edges will be inspected prior to restoration.

F3 Restoration of Miscellaneous Items

Wherever any curbing, curb and gutter sections, pedestrian walks, fencing, driveway surfacing, or other improvements are removed or in any way damaged or undermined, they shall be restored to original condition by repair or replacement as the Engineer considers necessary. Replacement of old materials will be acceptable only to the extent that existing quality can be fully achieved, such as in the case of fencing. Otherwise new materials shall be provided and placed as the Engineer directs. Workmanship and finished quality shall be equal to that of new construction, where new materials are used, to the extent obtainable in consideration of operational restrictions.

A proper foundation shall be prepared before reconstructing concrete or bituminous improvements. Unless otherwise directed, granular material shall be placed to a depth of at least four inches under all concrete and bituminous items. No direct compensation will be made for furnishing and placing this material even though such course was not part of the original construction.

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G Maintenance and Final Cleanup

All subgrade surfaces shall be maintained acceptably until the start of surfacing construction or restoration work, and until the work has been finally accepted. Additional materials shall be provided and placed as needed to compensate for trench settlement and to serve as temporary construction pending completion of the final surface improvements.

Final disposal of debris, waste materials, and other remains or consequences of construction, shall be accomplished intermittently as new construction items are completed and shall not be left to await final completion of all work. Cleanup operations shall be considered as being a part of the work covered under the Contract Items involved and only that work which cannot be accomplished at any early time shall be considered as final cleanup work not attributable to a specific Contract Item.

If disposal operations and other cleanup work are not conducted properly as the construction progresses, the Engineer may withhold partial payments until such work is satisfactorily pursued or he may deduct the estimated cost of its performance from the partial estimate value.

Maintenance of sodded and seeded areas shall include adequate watering for plant growth and the replacement of any dead or damaged sod as may be required for acceptance of the work.

2600.4 METHOD OF MEASUREMENT

All items will be measured separately according to design designation as indicated in the Pay Item name and as may be detailed and defined in the Plans, Specifications, or Special Provisions. Complete-in-Place items shall include all component parts thereof as described or required to complete the unit, but excluding any excesses covered by separate Pay Items

A Rock Excavation

Rock Excavation shall be measured by volume in cubic yards. Depth shall be measured from the top of the rock to a point six inches below the outside barrel of the pipe and width shall be the inside diameter of the pipe plus twenty-four inches (12" from each side). The minimum width of measurement shall be four feet.

B Granular Materials

Granular materials furnished and placed as special foundation, bedding, encasement, or backfill construction will be measured by weight or volume of material furnished by the Contractor from outside sources and placed within the limits defined. Unless otherwise specified, volume will be determined by vehicular measure (loose volume) at the point of delivery. Measurements will not include any materials required to be placed as a component part of other Contract Items as may be specified.

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C Geotextile Fabric

Where geotextile fabric is used for improving pipe foundation, it shall be measured by the square foot of material installed.

D Piling

Piling shall be measured according to the provisions of Mn/DOT Specification 2452.

D1 Pile Bents

Pile bents shall be measured as a unit and shall include all materials and labor required, except the pile.

E Insulation

Rigid board insulation shall be measured on a square foot basis installed to the specified thickness noted on the Plans, Specifications, and Special Provisions and shall include all materials, equipment, and labor required for placement.

2600.5 BASIS OF PAYMENT

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

When special aggregate backfill materials are required to be furnished and placed to comply with the indicated Laying Conditions, the costs shall be included for payment as part of the pipe items without any direct compensation. Otherwise, the furnishing of aggregate materials for backfill by order of the Engineer in the absence of such requirements will be compensated for as an Extra Work item.

In the absence of special payment provisions, all costs of restoring surface improvements as required, disposal of surplus or waste materials, maintenance and repair of completed work, and final cleanup operations shall be incidental to the Contract Items under which the costs are incurred.

Granular materials furnished for foundation, bedding, cover, or backfill placement as specified in connection with pipe or structure items will only be paid for as separate Contract Items to the extent that the Proposal contains specific Pay Items. Otherwise the furnishing and placing of granular materials as specified shall be incidental to the pipe or structure item without any direct compensation being made.

******END OF SECTION******

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SECTION 02610 - PIPE CULVERTS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary to construct pipe culverts as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Reference Section 02320 of these Specifications for trench excavation, bedding and backfill, except as modified herein.

B. Mn/DOT Specification Section 2501 shall apply to the construction of pipe culvert and appurtenance items, except as modified herein.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 CULVERT PIPE AND FITTINGS- UNDER ROADWAYS, TRAILS, AND FOR STORM PONDS

A. Reinforced Concrete Pipe (Mn/DOT 3236)

1. Reinforced concrete pipe. (RCP), fittings and specials shall conform with the requirements of Mn/DOT Specification 3236 (Reinforced Concrete Pipe) for the type, size and strength class specified. The joints for RCP shall be rubber gasketed conforming to Mn/DOT Standard Plate 3006.
2. Aprons shall be tied back three joints.

2.2 CULVERT PIPE AND FITTINGS- UNDER DRIVEWAYS

A. Aluminized Corrugated Steel Pipe

1. Pipe material shall meet MnDOT Specification 3222.

2.3 CULVERT MARKERS

A. All flared end sections, roadway culverts, and trail culverts shall be marked with a FlexStake EZ Drive type marker with Diamond Grade Reflection Tape placed around the top and 18 inches below the top of the stake. Flared ends and culverts shall be marked with GRAY stakes.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The Contractor shall install a clay (or an approved impermeable equal) collar around all culverts at a point approximately 4 feet from each apron. The collar shall fill the breadth and height of the trench for a minimum length of 3 feet. A manufactured collar may be used if specifically approved by the City Engineer.

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B. All flared end sections, roadway culverts, and trail culverts shall be marked with a GRAY culvert marker.

******END OF SECTION******

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SECTION 2611
STANDARD SPECIFICATIONS
FOR
WATER MAIN AND SERVICE LINE INSTALLATION
1999 EDITION

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STANDARD SPECIFICATIONS FOR
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2611 STANDARD SPECIFICATIONS FOR WATER MAIN AND SERVICE LINE INSTALLATION

2611.1 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.

Use of the term "Plans, Specifications and Special Provisions" within this specification shall be construed to mean those documents which compliment, modify, or clarify these specifications and are accepted as an enforceable component of the Contract or Contract Documents. All references to Mn/DOT Specifications shall mean the latest published edition of the Minnesota Department of Transportation Standard Specifications for Construction, as modified by any Mn/DOT Supplemental Specification edition published prior to the date of advertisement for bids. All reference to other Specifications of AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition available on the date of advertisement for bids.

The following American Water Works Association (AWWA) Specifications have been referenced in this Specification:

C104 American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

C105 American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems

C110 American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids

C111 American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

C115 American National Standard for Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

C150 American National Standard for Thickness Design of Ductile-Iron Pipe

C151 American National Standard for Ductile-Iron Pipe, Centrifugally Case, for Water or Other Liquids

C153 American National Standard for Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm Through 610 mm) and 54 In. Through 64 In. (1,400 mm Through 1,600 mm), for Water Service

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C301 AWWA Standard for Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids

C304 AWWA Standard for Design of Prestressed Concrete Cylinder Pipe

C500 AWWA Standard for Metal-Seated Gate Valves for Water Supply Service (Includes addendum C500a-95.)

C502 AWWA Standard for Dry-Barrel Fire Hydrants (Includes addendum C502a-95.)

C504 AWWA Standard for Rubber-Seated Butterfly Valves

C509 AWWA Standard for Resilient-Seated Gate Valves for Water Supply Service (Includes addendum C509a-95.)

C600 AWWA Standard for Installation of Ductile-Iron Water Mains and Their Appurtenances

C605 AWWA Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

C651 AWWA Standard for Disinfecting Water Mains

C800 AWWA Standard for Underground Service Line Valves and Fittings

C900 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution (Includes addendum C900a-92.)

C901 AWWA Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service

C905 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In., (350mm Through 1,200mm), for Water Transmission and Distribution

C906 AWWA Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In., for Water Distribution

C907 AWWA Standard for Polyvinyl Chloride (PVC) Pressure Fittings for Water - 4 In. Through 8 In. (100mm Through 200mm)

Service installations shall include either Branch Service Lines or Tapped Service Lines in accordance with the standards set forth herein.

Tapped Service installations shall include all water service lines less than three inches nominal inside diameter pipe. The component parts of a tap service installation shall include a corporation

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stop coupling complete with water main tap and saddle where required; a curb stop coupling complete with service box; and copper piping extending from the corporation stop to the curb stop coupling and beyond to the property line or to the limits as established by the Engineer. Tapped Service lines shall be installed at the size specified in the Plans, Specifications, and Special Provisions.

Branch Service installations shall include all water service lines of three inches nominal inside diameter pipe and larger. The component parts of a branch service installation shall include a tapping sleeve and valve or a tee connection and valve complete with valve box, and piping extending from the water main connection, to the property line or to the limits as specified by the Engineer.

All references to Gray Iron material shall be construed to include both Gray Iron and Ductile Iron products, except where one or the other is specified, and all references to Polyvinyl Chloride pipe shall be construed to include only pressure pipe complying with AWWA C-900 or C-905. All references to "structure" shall include any man-made object that is not otherwise exempted by special terminology or definition.

2611.2 MATERIALS

All materials required for this work shall be new material conforming to requirements of the reference specifications for the class, kind, type, size, grade, and other details indicated in the Contract. Unless otherwise indicated, all required materials shall be furnished by the Contractor. If any options are provided for, as to type, grade, or design of the material, the choice shall be limited as may be stipulated in the Plans, Specifications, or Special Provisions.

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

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

A Certificate of Compliance shall be furnished stating that the materials furnished have been tested and are in compliance with the specification requirements.

A Water Pipe Materials

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.

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Al Ductile Iron Pipe and Ductile Iron and Gray Iron Fittings

The pipe furnished shall be Ductile Iron pipe fittings furnished shall be of the Ductile Iron or Gray Iron type as specified for each particular use of installation. When Gray Iron is specified, either type may be furnished. Gray Iron may not be substituted for Ductile Iron unless specifically authorized in the Special Provisions.

Ductile iron pipe shall conform to the requirements of AWWA C115 or C151 for water and thickness design shall conform to AWWA C 150. In addition, the pipe shall comply with the following supplementary provisions:

(1) Fittings shall conform to the requirements of AWWA C110 OR 153 (Gray Iron and Ductile Iron Fittings) (Ductile Iron Compact Fittings) for the joint type specified.

(2) Unless otherwise specified all pipe and fittings shall be furnished with cement mortar lining meeting the requirements of AWWA C104 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.

(3) Rubber gasket joints for Ductile Iron Pressure Pipe and fittings shall conform to AWWA C111.

A2 Prestressed Concrete Cylinder Pipe and Fittings

Prestressed Concrete Cylinder pipe, fittings and specials shall conform to the requirements of AWWA C-301 and C-304 (Prestressed Concrete Pressure Pipe, Steel Cylinder Type) for the size, working pressure, external loading, laying condition, and other design considerations indicated in the Plans, Specifications, and Special Provisions.

The Contractor shall furnish plans and specifications to the pipe manufacturer giving such special details and other information as are necessary for manufacture of the pipe, fittings, and specials in accordance with the specific requirements of the project.

A3 Polyvinyl Chloride (PVC) Pressure Pipe and Fittings

Polyvinyl chloride (PVC) pressure pipe, produced by a continuous extrusion process employing a prime grade of unplasticized polyvinyl chloride, shall conform to the requirements of AWWA C-900 for the size, grade, and pressure class indicated on the Plans, Specifications, and Special Provisions. Fittings shall conform to AWWA C907 and C908. The grade used shall be resistant to aggressive soils or corrosive substances in accordance with the requirements of ASTM D-543. Unless otherwise specified, the dimensions and tolerances of the pipe barrel should conform to ductile iron or cast iron pipe equivalent outside diameters.

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A4 Polyethylene (PE) Pressure Pipe and Fittings

Polyethylene pressure pipe and fittings shall conform to the requirements of AWWA C906 for the size and pressure class indicated on the Plans, Specifications and Special Provisions. Unless otherwise specified, the dimensions and tolerances of the pipe barrel should conform to Ductile Iron pipe equivalent outside diameters. The method of joining material shall be by the Thermal Butt- Fusion Method.

The standard HDPE fittings shall be standard commercial products manufactured by injection molding or by extrusion and machining, or, shall be fabricated from PE pipe conforming to this specification. The fittings shall be fully pressure rated by the manufacturer to provide a working pressure equal to the pipe, for 50 years service at 73.4 degrees Fahrenheit with an included 2:1 safety factor. The fittings shall be manufactured from the same resin type, grade, and cell classification as the pipe itself. The manufacture of the fittings shall be in accordance with good commercial practice to provide fittings homogeneous throughout and free from crack, holes, foreign inclusions, voids, or other injurious defects. The fittings shall be as uniform as commercially practicable in color, opacity, density and other physical properties. The minimum "quick-burst" strength of the fittings shall not be less than that of the pipe with which the fitting is to be used.

B Fire Hydrants

Fire hydrants shall be of the type, size, and construction specified in the Plans and shall conform to the applicable requirements of AWWA C-502.

Unless otherwise specified in the Plans, Specifications, and Special Provisions, hydrants shall be furnished in conformance with the following supplementary requirements:

(1) Hydrants shall have a five-inch (nominal diameter) main valve opening of the type that opens against water pressure.

(2) Hydrant barrels shall be two piece, non-jacket type, with flanged joint above finished grade line and with mechanical joint connection at the hub end for joining a six-inch ductile iron branch pipe.

(3) Hydrant bury length, measured from the bottom of the branch pipe connection to the finished ground line at the hydrant, shall be 8'-6".

(4) Hydrants shall have two outlet nozzles for 2-1/2 inch (I.D.) hose connection and one outlet nozzle for 4 inch (I.D.) steamer connection. All outlet nozzle threads shall be National Standard Fire-Hose Coupling Screw Threads (NFPA 1963).

(5) Hydrant operating mechanisms shall be provided with "O" ring seals preventing entrance of moisture and shall be lubricated through an opening in the operating nut or bonnet.

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(6) Hydrants shall be provided with outlets for drainage in the base or barrel, or between the base and barrel, unless the Special Provisions require that drain outlets be omitted or plugged.

(7) The hydrant operating nut shall be rotated counterclockwise to open.

(8) Detailed drawings, catalog information, and maintenance data shall be furnished as requested by the Engineer.

C Valves and Valve Housing

Cl Valve Housings

Valve housings shall be of ductile or cast iron, High Density Polyethylene or masonry construction as specified in the Plans, Specifications, and Special Provisions for the particular valve size or installation. Masonry manhole or vault type units shall be constructed in accordance with the provisions of Mn/DOT Specification 2506. Precast Concrete Manholes shall conform to ASTM Specification C-478 suitable for HS 20 traffic loading for all units located in driving areas. Ductile or cast iron valve boxes and all castings for manhole or vault type units shall conform to the requirements of Mn/DOT Specification 3321.

C2 Gate Valves

Gate Valves shall be manufactured and furnished in accordance with an approved pattern and shall conform to all applicable requirements of AWWA C-500 or AWWA C-509, together with such supplementary requirements as may be covered in the Plans, Specifications, and Special Provisions or the provisions hereof. Unless otherwise specified, the gate valves furnished shall comply with the following supplementary requirements:

(1) Gate valves meeting the requirements of AWWA C-500 shall be two-faced, double disc type, with parallel seats. Gate valves meeting the requirements of AWWA C-509 shall be single disc type with resilient seat bonded or mechanically attached to either the gate or valve body. All valves shall be provided with a two-inch square operating nut opening counterclockwise and mechanical joint ends.

(2) All gate valves shall be non-rising stem type furnished with O-Ring stem seals.

(3) All gate valves 16 inches or larger in size shall be arranged for operation in the horizontal position and shall be equipped with bypass valves.

(4) All gate valves 12 inches or larger in size shall be equipped with approved barrel type rugged gate position.

(5) All gears on gate valves shall be cut tooth steel gears, housed in heavy ductile or cast iron extended type grease cases of approved design.

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(6) All gate valves shall have an open indicating arrow, the manufacturer's name, pressure rating and year of manufacture cast on the valve bodies.

C3 Butterfly Valves

Butterfly valves shall be manufactured in conformance with all applicable requirements of AWWA C-504 for 150 p.s.i. working pressure minimum, together with such supplementary requirements as may be covered in the Plans, Specifications, and Special Provision or the provisions hereof. Unless otherwise specified, the butterfly valves furnished shall comply with the following supplementary requirements.

(1) The butterfly valves shall be short body of ductile or cast iron with mechanical joint ends.

(2) The butterfly valves shall be rubber seated with ductile or cast disc, non-rising stem type furnished with O-ring stem seals.

(3) The butterfly valves shall be equipped with a two-inch square operating nut opening counterclockwise.

(4) The butterfly valves shall be designed for direct burial installation.

(5) All butterfly valves shall have an open indicating arrow, the manufacturer's name, pressure rating and year of manufacture on the valve bodies.

D Water Service Pipe and Fittings

Water service pipe of 3 inches or larger inside diameter shall conform to the requirements for Ductile Iron Pipe and Ductile Iron and Gray Iron Fittings as set forth under the provisions of 2611.2A1, and Polyvinyl Chloride Pressure Pipe as set forth under the provisions of 2611.2A3, and Polyethylene pipe as set forth under the provision of 2611.2A4.

Water service pipe of less than 3 inches in inside diameter shall conform to the requirements of ASTM B 88 for Seamless Copper Water Tube, Type K, Soft Annealed temper, Polyethylene Pipe as per AWWA C901 or Polyvinyl Chloride Pipe and fittings as per a ASTM D1785, D2241, D2466, D2467 and D2740 as specified on the Proposal or in the Special Provisions.

Corporation stops, saddles, curb stops, and curb stop service boxes shall conform to the requirements of AWWA C800 be as detailed in the Plans, Specifications, and Special Provisions or approved designations. All fittings for copper tubing shall be cast brass, having uniformity in wall thickness and strength, and shall be free of defects affecting serviceability. All copper pipe fittings shall be flared or compression type. All threads for underground service line fittings shall conform to the requirements of AWWA C-800. Each fitting shall be permanently and plainly marked with the name or trademark of the manufacturer.

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Curb stop service boxes shall be gray iron castings conforming to the requirements of ASTM A 48 for Class 20 or higher tensile strength and shall have 18 inches of vertical adjustment for the cover depth specified in the Plans, Specifications, and Special Provisions.

E Polyethylene Encasement Material

Polyethylene encasement material shall conform to the requirements of AWWA C-105 for tube type installation and 8 mil nominal film thickness.

F Restrained Joint Retainer Glands

Where water main joint restraint is required by the use of retainer glands, the retainer glands shall be American, US Pipe or Mega-Lug type, ductile iron, and be designed to withstand the design pressures indicated in the Plans, Specifications, and Special Provisions.

All nuts, bolts, and tie rod type restraints shall be stainless steel or coated with an approved rustproofing material.

G Mortar

Mortar for use in masonry construction shall be an air-entrained mixture of one part Masonry Cement (Type I) and two 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. Mortar shall meet the requirements of ASTM C270.

H Concrete

Concrete for cast-in-place masonry construction shall be produced and furnished in accordance with the provisions of Mn/DOT 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.

2611.3 CONSTRUCTION REQUIREMENTS

A Installation of Pipe and Fittings

Installation of ductile iron water mains and their appurtenances shall conform to the requirements of AWWA C-600 Specifications, the Plans, Specifications and Special Provisions.

Prestressed concrete cylinder pipe and their appurtenances shall conform to the requirements of AWWA C301 and C304. The installation shall be to the bedding and backfill conditions specified in the Plans, Specifications, or Special Provisions.

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Installation of Polyvinyl Chloride (PVC) pipe and their appurtenances shall conform to the requirements of AWWA C900. The installation shall be to the bedding and backfill conditions specified by the Manufacturer, Plans, Specifications, or Special Provisions.

Installation of Polyethylene Pipe and their appurtenances shall conform to the requirements of AWWA C906. The installation shall be to the bedding and backfill conditions specified by the Manufacturer, Plans, Specifications, or Special Provisions.

Installation of pipe and fittings shall also conform to the following general guidelines:

Al Inspection and Handling

Proper and adequate implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. 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 to have cracks, flaws or other defects. The Engineer shall inspect the damaged material and have the right to reject any materials found to be unsatisfactory. The Contractor shall promptly remove all rejected material from the site.

All materials shall be handled carefully, as will prevent damage to protective coatings, linings, and joint fittings; preclude contamination of interior areas; and avoid jolting contact, dropping, or dumping.

While suspended and before being lowered into laying position, each pipe section and appurtenant unit shall be inspected by the Contractor to detect damage or unsound conditions that may need corrective action or be cause for rejection. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection.

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

A2 Pipe Laying Operations

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper placement and joining of the pipe and fittings at the prescribed grade and alignment without unnecessary hindrance. All foreign matter or dirt shall be removed from the inside of the pipe and fittings before they are lowered into position in the trench, and they 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.

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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.

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.

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.

At all times when pipe laying is not in progress, including noon hour and overnight periods, all open ends of the pipe line shall be closed by watertight plugs or other means approved by the Engineer. If water is present in the trench, the seals shall remain inplace until the trench is pumped completely dry.

When connecting to existing stubs, the Contractor shall take every precaution necessary to prevent dirt or debris from entering the existing lines. All necessary work to make the connection shall be done at no additional compensation, except where noted otherwise.

A3 Aligning and Fitting 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. The electric-arc cutting method, using carbon or steel rod, will be approved for use on larger size ductile or gray pipe where mechanical cutters are not available. 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.

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Connection and assembly of joints shall be accomplished during the setting, aligning, and fitting operations, in accordance with the provisions of Section 2611.2D, to the extent that the jointing requirements will permit.

A4 Blocking and Anchoring of Pipe

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 or tie rods, in accordance with the requirements of the Plans, Specifications, and Special Provisions.

In the absence of other specified requirements for reaction backing or restraining devices, the following provisions shall apply:

(l) All horizontal bends exceeding 20 degrees deflection, and all caps, plugs, and branch tees shall be provided with concrete buttress blocking.

(2) All vertical bends exceeding 20 degrees deflection shall be provided with concrete buttress blocking at the low points and with metal tie rod or strapping restraints at the high points.

(3) Offset bends made with standard offset fittings need not be strapped or buttressed.

Hardwood blocking shall only be used as temporary reaction backing until acceptable permanent reaction blocking or restraining devices have been installed. Blocking shall be nominal 2-inch timber having an area equivalent to at least four times the area of the surface of the cap or plug it restrains.

Concrete buttresses shall be poured against firm, undisturbed ground and shall be formed in such a way that the joints will be kept free of concrete and remain accessible for repairs. The concrete mix used in buttress construction shall meet the requirements for Grade B concrete in conformance with Mn/DOT Specification Section 2461. Buttress dimensions shall be a minimum of 12 inches in thickness, and the minimum area, in square feet shall be as follows.

PIPE SIZE	TEE OR PLUG	1/4 BEND	1/8 BEND	1/32 BEND 1/16 BEND
6”	2.9	3.1	1.6	0.8
8”	3.7	5.3	2.9	1.4
10”	5.7	8.1	4.4	2.2
12”	8.1	13.4	6.6	3.2
16”	15.1	21.4	11.6	5.9
20”	23.2	30.2	18.1	9.3
24”	33.6	48.5	26.1	13.3

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Contractors are instructed to size concrete buttress blocking on fittings and dead ends where the blocking must withstand the pressure of larger main line fittings equipped with reducers, for the larger sized main line thrust and not for smaller fitting size only. This is of particular importance on tees and crosses where the main size is reduced on the run from large to small size by use of reducers.

All metal parts of tie rod or strap type restraints shall be galvanized or coated with other approved asphaltic type rustproofing.

All necessary fittings, bands, tie rods, nuts, and washers, and all labor and excavation required for installation of reaction restraints shall be furnished at the Contractor's expense with no direct compensation provided therefore.

A5 Polyethylene Encasement of Pipeline

Wherever so required by the Plans, Specifications, or Special Provisions, the pipeline, including valves, fittings, and appurtenances, shall be fully encased in polyethylene film meeting the requirements of these Specifications. The film shall be furnished in tube form for installation on pipe and all pipe-shaped appurtenances such as bends, reducers, off- sets, etc. Sheet film shall be provided and used for encasing all odd-shaped appurtenances such as valves, tees, crosses, etc.

The polyethylene tubing shall be installed on the pipe prior to being lowered into the trench. Tubing length shall be sufficient to provide a minimum overlap at all joints of one foot or more. Overlap may be accomplished with a separate sleeve tube placed over one end of the pipe prior to connecting another section of pipe, or by bunching extra overlap material at the pipe ends in accordion fashion. After completing the pipe jointing and positioning the overlap material, the overlap shall be secured in place with plastic adhesive tape wrapped circumferentially around the pipe not less than three turns.

After encasement, the circumferential slack in the tubing film shall be folded over at the top of the pipe to provide a snug fit along the barrel of the pipe. The fold shall be held in place with plastic adhesive tape applied at intervals of approximately three feet along the pipe length. Also, any rips, punctures, or other damage to the tubing shall be repaired as they are detected. These repairs shall be made with adhesive tape and overlapping patches cut from sheet or tubing material.

At odd-shaped appurtenances such as gate valves, the tubing shall overlap the joint and be secured with tape, after which the appurtenant piece shall be wrapped with a flat film sheet or split length of tubing by passing the sheet under the appurtenance and bringing it up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Wherever encasement is terminated, it shall extend for at least two feet beyond the joint area.

Openings in the tubing for branches, service taps, air valves and similar appurtenances shall be made by cutting an X-shaped slit and temporarily folding back the film. After installing the

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appurtenance, the cut tabs shall be secured with tape and the encasement shall be completed as necessary for an odd-shaped appurtenance.

Unless otherwise specified in the Plans, Specifications, and Special Provisions, hydrants encased in polyethylene tubing shall have plugged drain outlets.

B Connection and Assembly of Joints

Where rubber gasketed joints are specified, care shall be taken during the laying and setting of piping materials to insure 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.

B1 Ductile Iron Pressure Pipe and Fitting Joints

Ductile iron pressure pipe and fitting joints shall conform to AWWA C-111.

B1a 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.

B1b 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 end 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

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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.

Unless otherwise specified, the bolts shall be tightened by means of a suitable torque-limiting wrench to within a foot-pound range of: 45 to 60 for 5/8 inch bolts; 75 to 90 for 3/4 inch bolts; 85 to 100 for 1 inch bolts; and 105 to 120 for 1-1/4 inch bolts. After tightening, all exposed parts of the bolts and nuts shall be completely coated with an approved asphaltic type rust preventive material.

B1c Flanged Joints

Flanged joints shall be installed only in above grade or exposed locations and shall conform to the requirements of AWWA C115 Specifications, the Plans, Specifications and Special Provisions. Flanged joints shall have full face gaskets.

B2 Prestressed Concrete Cylinder Pipe Joints

Unless otherwise indicated, all pipe and appurtenances shall be joined by means of the rubber gasketed bell and spigot connection in accordance with AWWA C301 or C304 and with the recommendations of the pipe manufacturer and the provisions hereof. All contact surfaces of the steel bell and spigot assembly shall be thoroughly lubricated with approved material before the connection is made.

After the joint has been set in the home position, the outside joint recess shall be filled with cement grout, poured into place by means of a paper or cloth diaper. The grout shall contain at least one part Portland cement for each two parts of sand. Care shall be taken in pouring the grout to assure complete filling of the recess around the entire pipe circumference.

B3 Polyvinyl Chloride Pipe Joints

B3a Push-On Joints

The circular rubber gasket shall be bonded to the inner wall of the gasket recess of the bell socket. Installation of pipe spigot into the bell socket shall conform to the requirements for Ductile Iron Push-On Joints as set forth under the provisions of 2611.3B1a

B4 Polyethylene Pipe Joints

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Polyethylene pipe joints shall conform to the requirements of AWWA C-906, and shall be made by the Thermal Butt-Fusion Method.

C Water Service Installations

Water service facilities consisting of Tap Service Lines and Branch Service Lines, complete with all required appurtenances, shall be installed as required by in the Plans, Specifications, and Special Provisions, in accordance with all pertinent requirements for main line installations together with the provisions hereof.

It shall be the responsibility of the Contractor to keep an accurate record of the location, depth and size of each service connection and other pertinent data such as the location of curb stops and pipe endings. Tap locations shall be recorded in reference to survey line stationing. Curb stops shall be tied to definable land marks such as building corners, lot corner markers, etc. Pipe terminals at the property line shall be marked to the ground surface with a suitable wood timber 4 by 4 inch, 8 feet long set vertically into the ground with the top 2 feet painted blue. Approved record keeping forms will be furnished by the Engineer and the completed records shall be submitted by the Contractor upon completion of the work.

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 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. For separate installation, the trench width shall be not less than two feet. Subject to minimum clearances, the water lines may be laid in a common trench excavated principally for sewer installation, either by widening the trench as necessary or by providing a shelf in the trench wall where ground stability will permit. When water service pipe is placed in a common trench with sewer service pipe, the sewer service pipe shall be constructed of materials and with joints equivalent to water main standards.

Water service lines shall be installed to provide for the specified cover over the top of the pipe and with not less than 18 inches of clearance between pipelines. A minimum 3 inches of clearance shall be maintained in crossing over or under other structures. Where the service pipe may be exposed to freezing due to insufficient cover or exposure from other underground structures, the water pipe shall be insulated as directed by the Engineer.

C1 Tee Branch Service Lines

Tee branch service piping shall be of the type, size, and wall thickness specified. The pipe and appurtenances shall have rubber gasketed push-on or mechanical joints. Tee branch service lines shall be provided as required by the Plans.

Installation of tee branch service facilities shall be in accordance with all applicable requirements of these specifications as pertain to the mainline installations.

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C2 Tapped Service Lines

Service piping shall be of the size and type specified. Unless otherwise specified, minimum pipe size for tap service installations shall be one inch nominal inside diameter. Larger size pipe may be specified for commercial and industrial uses or for some domestic service as specifically identified.

Installation of service facilities shall be in accordance with all applicable requirements of these specifications as pertain to the mainline installations, subject to the exceptions and supplementary provisions set forth hereinafter.

Unless otherwise indicated, service piping may be laid directly on any solid foundation soil that is free of stones and hard lumps. However, when specified or ordered, aggregate materials shall be furnished and placed as necessary to secure proper foundation drainage, pipe covering, or backfill support.

Tapped service piping of 3/4 inch to and including 1-1/4 inches in diameter shall be installed in one piece without intermediate joint couplings between the corporation stop and the curb stop. Service pipe of 1-1/2 inches in diameter and larger shall be furnished in standard roll lengths to eliminate any intermediate joints. When full roll lengths are less than the service length the rolls may be joined with approved couplings.

Unless otherwise specified, connection of tapped service lines to the water main shall be made at an angle of not more than 22 degrees from the horizontal. A double wrap of Teflon tape shall be placed on the corporation stop threads prior to installation in the main. Expansion loops shall be directed downward or horizontal from the tap.

Unless otherwise indicated, tap service lines shall be installed on a straight line at right angles to the water main or property line as directed by the Engineer. In the absence of specific requirements, the service line shall be terminated at the property line, where it shall be connected to an existing line or, in the case of undeveloped property, it shall be capped, plugged, or peened as approved by the Engineer.

The flaring of copper tubing ends shall be accomplished only with the use of the proper size and type of tools as designed for the purpose. Tubing shall be cut squarely and all edge roughness shall be removed prior to flaring. All couplings shall be tightened securely, so the flared end fits snugly against the bevel of the fitting without leakage. The flared joint couplings shall be made up without the use of jointing compounds.

The service pipe and curb stop coupling depth shall be such as to maintain not less than the specified minimum cover. The service box shall be connected to or centered over the curb stop and be firmly supported on concrete blocking as required by the Plans, Specifications, and Special Provisions. Clearance shall be provided so the service box does not rest on the water pipe. Service boxes shall be installed plumb. The service boxes shall be brought to proper surface grade when the final ground surface has been established.

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D Setting Valves, Hydrants, Fittings and Specials

Valves, hydrants, fittings, and specials shall be provided and installed as required by the Plans, Specifications, and Special Provisions, with the exact locations and setting as directed by the Engineer, and with each installation accomplished in accordance with the requirements for installation of mainline pipe to the extent applicable. Support blocking, reaction backing, and anchorage devices shall be provided as required by the Plans, Specifications, and Special Provisions, or as otherwise ordered by the Engineer.

Hydrants shall be installed plumb, with the height and orientation of nozzles as shown in the Plans or as directed by the Engineer. Unless otherwise specified, the hydrants shall be connected to the mainline pipe with 6-inch diameter ductile iron pipe, controlled by an independent valve.

When a hydrant with an open drain outlet is set in clay or other impervious soil, a drainage pit of at least one cubic yard shall be excavated below and around the hydrant base and the pit shall be filled with Foundation Material to a level six inches above the drain outlet. Two layers of tar paper, or other material approved by the Engineer, shall be carefully placed over the rock to prevent backfill material from entering voids in the rock drain. Hydrants located where the groundwater table is above the drain outlet shall have the outlet drain hole plugged or the drain tube cut off to prevent draining, and shall be equipped with a tag stating, "Pump After Use".

Valve boxes shall be centered over the valve wrench nut and be installed plumb, with the box cover flush with the surface of the finished pavement or at such other level as may be directed.

Masonry valve pit structures, for valves with exposed gearing or operating mechanisms, shall be constructed in accordance with the details shown in the Plans and with the applicable provisions of these Specifications.

Drainage blow-offs, air vents, and other special appurtenances shall be provided and installed as required by the Plans, Specifications, and Special Provisions.

All dead ends shall be closed with approved plugs or caps and shall be equipped with suitable blow-off facilities.

E Disinfection of Water Mains

Before being placed in service, the completed water main shall be disinfected. Disinfection materials and procedures, and the collection and testing of water samples, shall be in accordance with the provisions of AWWA C-651. After the final flushing the water shall be tested for bacteriologic quality and found to meet the standards prescribed by the Minnesota Department of Health.

Where an existing water main is cut for the installation of any fitting, the pipe and fittings proposed to be installed shall be disinfected prior to installation as follows:

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(1) The interior of the pipe and fittings shall be cleaned of all dirt and foreign material.

(2) The interior of the pipe and fittings shall be thoroughly swabbed or sprayed with a 1 percent minimum hypochlorite solution.

Unless otherwise indicated in the Plans, Specifications, and Special Provisions, the Contractor shall furnish all materials and perform the disinfecting, flushing, and testing as necessary for meeting the water quality requirements. The flushing operations and the form of chlorine and method of application to be used shall be subject to approval by the Engineer.

F Electrical Conductivity Test

The Contractor shall perform a conductivity test within one week after completion of pressure testing of the main on all iron pipe water mains to establish that electrical thawing may be carried out in the future The system (pipeline, valves, fittings and hydrants) shall be tested for electrical continuity and current capacity. The electrical test shall be made after the hydrostatic pressure test and while the line is at normal operating pressure. Backfilling shall have been completed. The line may be tested in sections of convenient length as approved by the Engineer.

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

Insufficient current or intermittent current or arcing, indicated by large fluctuation of the ammeter needle, shall be evidence of defective contact in the pipeline. The cause shall be isolated and corrected. Thereafter, the section in which the defective test occurred shall be retested as a unit and shall meet the requirements.

Sources of Direct Current for these tests may be motor generators, batteries, arc welding machines, etc. Direct Current arc welding machines will probably be the usual source. These machines are available in adequate capacity for these tests and are equipped with controls for regulating the current output. All such equipment shall be furnished by the Contractor, subject to the approval of the Engineer.

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

Connections for the test shall be made at hydrants. The hydrants shall be in the open position with the caps on during the test. The cable shall be clamped to the body of the hydrant.

Note: After the test the hydrant shall be shut off and a cap loosened to allow hydrant drainage or the hydrant shall be pumped dry. Tighten cap after drainage.

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

G Hydrostatic Testing of Water Mains

After the pipe has been laid, including fittings and valves and blocking, all newly-laid pipe or any valved section thereof, unless directed otherwise by the Engineer, shall be subject to hydrostatic pressure of 150 pounds per square inch. The duration of each such test shall be at least two hours.

Each section of pipe to be tested shall be filled with water and all air expelled at the highest point. The required taps to expel air or to fill the water main shall be supplied and installed by the Contractor and shall be 3/4 inch and shall include an approved service saddle when required.

The test apparatus shall be applied at the lowest elevation on the section to be tested. The apparatus shall be connected to the main at a service tap or special tap location.

The pressure gauge shall be a standard pressure gauge. The dial shall register from 0 - 200 psi and have a dial size of 4 1/2 inches with 1 psi increments.

The hydrostatic test, pressure requirement for an acceptable test shall be a maximum pressure drop of 2 psi during the last hour of the two hour pressure test.

If this test requirement cannot be met, the Contractor shall investigate the cause, make corrections, and retest until the pressure drop requirement can be met.

Only if several consecutive tests indicate a consistent pressure drop and only after the Contractor has made numerous attempts to resolve the problem, acceptable to the Engineer, may the Contractor request in writing and the Engineer consider the use of the leakage test. The leakage test may be performed by the Contractor to determine the magnitude of the leak, however, meeting the leakage allowance shall not automatically be considered acceptance, in lieu of the pressure test, for the section being tested. Final acceptance shall be at the discretion of the Engineer.

When allowed, the leakage test shall be performed in accordance with AWWA C-600, Section 4.1.5, 4.1.6 and the line will be accepted as per Section 4.1.7.

H Operational Inspection

At the completion of the project and in the presence of the Engineer and the Contractor, representatives of the Owner shall operate all valves, hydrants, and water services to ascertain that the entire facility is in good working order; that all valve boxes are centered and valves are

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opened; that all hydrants operate and drain properly; that all curb boxes are plumb and centered; and that water is available at all curb stops.

2611.4 METHOD OF MEASUREMENT

All items will be measured separately according to design designation as indicated in the Pay Item name and as may be detailed and defined in the Plans, Specifications, or Special Provisions. Pipe will generally be designated by size (inside diameter or span), strength class, kind or type, and laying condition. Payment shall include all component parts thereof as described or required to complete the unit, but excluding any item covered by a separate pay item. Lineal measurement of piping will include the running length of any special fittings (tees, wyes, bends, gates, etc.) installed within the line of measure between specified terminal points.

A Water Pipe

Mainline pipe and service pipe of each kind and size will be measured separately by the overall length along the axis of the pipeline, from beginning to end of each installation and without regard to intervening valves or specials. Terminal points of measure will be the spigot or cut end, base of hub or bell end, center of valves or hydrants, intersecting centers of tee or wye branch service connections, and center of corporation stop or curb stop couplings.

B Valves

Valves of each size and type will be measured separately as complete units, including the required manhole or valve box setting.

C Corporation Stops

Corporation stops of each size and type will be measured separately by the number of units installed, including the water main tap and saddle.

D Curb Stops

Curb stops of each size and type will be measured separately by the number of units installed, including the required curb box.

E Hydrants

Hydrants will be measured by the number of units installed.

F Air Vents

Air vents of each type and size will be measured separately by the number of complete units installed, including the required manhole or valve box setting.

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G Rearrangement of Inplace Facilities

The removal, relocation, extension, or adjustment of existing inplace facilities will be measured, as indicated in the Proposal.

H Polyethylene Encasement

Polyethylene encasement of pipe will be measured by the linear foot of pipe encased of each specified size.

I Ductile and Gray Iron Fittings

Ductile Iron and Gray Iron fittings shall be measured by the pound without joint accessories or on an each basis as specified on the Proposal or in the Special Provisions.

The standard weight of Ductile Iron and Gray Iron fittings, for payment basis, shall be as published in AWWA C-110.

J Polyvinyl Chloride or Polyethylene

Polyvinyl Chloride or Polyethylene fittings shall be measured on an each basis as specified and shown on the Proposal or in the Special Provisions.

K Access Structures

Access structures, such as valve boxes, service boxes, manholes and vaults, will be measured for payment only when and to the extent that the Proposal contains specific items therefore. Otherwise, the required structures are included for payment as part of the pipe appurtenance (Gate Valve, Curb Stop, Air Vent, etc.) item which is served. When applicable, measurement will be by the number of individual units installed of each type and design.

2611.5 BASIS OF PAYMENT

Payment for construction of water distribution facilities will be made as detailed in the method of measurement and as shown on the Bid Proposal or detailed in the Special Provisions. Payment shall include all costs of furnishing and installing the complete facility as required by the Plans, Specifications, and Special Provisions.

Payment shall be made for Water Main Pipe, Service Pipe, and Tapped Service Pipe, of each size and kind at the appropriate Contract prices per linear foot installed All costs of pipeline disinfection, leakage testing, pipe jointing materials, dead end plugs and caps, making connections to existing facilities, blocking and anchorage materials, and other work necessary for proper installation of pipe as specified shall be included for payment as part of the pipe item,

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without any direct compensation being made therefore unless specific pay items are included on the Proposal.

Payment shall be made for Valves, Corporation Stops, Curb Stops, Hydrants, Air Vents, Polyethylene Encasement, Insulation, and other specially identified appurtenant items, at the appropriate Contract prices per unit of measure for each size and type or kind installed. Access structures such as Valve Boxes, Service Boxes, Manholes, and Vaults will be paid for as separate items only when separate pay items are included on the Proposal.

Payment for rearrangement of inplace facilities or vertical offset of proposed facilities shall be made under specially named items at the appropriate Contract prices per unit of measure and shall be compensation in full for all costs of performing the work as specified.

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

When special aggregate backfill materials are required to be furnished and placed to comply with the indicated Laying Conditions, the costs thereof shall be included for payment as part of the pipe items without any direct compensation therefore.

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

******END OF SECTION******

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SECTION 02620 - SUBSURFACE DRAINS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary to construct subsurface drains as indicated on the drawings or as specified herein.

B. Infiltration Networks: This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary to construct subsurface drains for underground pipe infiltration networks. All infiltration systems shall be approved by the City Engineer.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification No. 2502 shall apply to the subsurface drains, except as modified herein.

B. Specification Section 02630 of the specifications for infiltration network components not referenced in this section.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.3 SUBMITTALS

A. Pipe Materials

1. Piping and fittings – Certificates of Compliance

(a) Drain hole pattern shall be provided for piping in the infiltration network

B. Tracer Wire –Certificates of Compliance

C. Granular Material

(a) Gradation test results, prior to providing material for the project, for each type of filter rock used for the project.

(b) Additional Gradation tests as identified in the Source Quantity Control section of this specification.

D. Geotextile Fabric – Certificates of Compliance

PART 2 -- PRODUCTS

2.1 SUBSURFACE PIPE AND FITTINGS

A. Perforated PVC drain pipe, SDR35 (ASTM D3034)

B. Perforated PVC drain pipe, A-2000 (ASTM D2412)

C. Perforated corrugated polyethylene drainage tubing, PE (ASTM D3350) (4-inch or 6-inch diameter only)

D. Cleanout caps on inspection tees shall be cast iron screw in type.

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2.2 INFILTRATION PIPE SYSTEMS:

A. Piping Materials

1. Perforated PVC drain pipe, SDR35 (ASTM D3034)
2. Perforated PVC drain pipe, A-2000 (ASTM D2412)
3. Cleanout caps on inspection tees shall be cast iron screw in type.

B. Drain holes:

1. 3 drain holes shall be provided in the lower 1/3 of the pipe to allow for drainage to the filter aggregate. A set of 3 holes shall be provided at 3" (center to center) intervals along the pipe.
2. The holes shall be drilled at a minimum of 5/8" diameter along the bottom portion of the pipe. One row shall be along the invert of the pipe.
3. Hole locations and pattern may be modified if perforated pipe is provided. Perforations shall include 3.68 square inches of open area per lineal foot of pipe. One row of holes shall be drilled along the invert of pipe.
4. Drain hole layout noted is the minimum required for underground drainage systems. Drain hole layout shall be approved by the City Engineer with hydraulic calculations.

2.3 MANHOLES

A. Storm sewer manholes in infiltration networks shall be as specified in Section 02630 – Pipe Sewers – Storm. Integral cast bases and flexible watertight seals shall be provided.

B. All manholes shall include a 3-foot sump.

2.4 GEOTEXTILE FABRIC

A. Geotextile fabric to be used in the infiltration area and/or the pipe trench shall be Type II.

2.5 GRANULAR MATERIALS (EDGE DRAIN)

A. The filter aggregate shall conform to the requirements of Mn/DOT 3149-2H for coarse filter aggregate.

2.6 GRANULAR MATERIALS (INFILTRATION NETWORKS)

A. All granular materials for infiltration networks shall be approved by the City Engineer.

B. Infiltration Rock/ Pipe Bedding in Infiltration System:

1. Granular Foundation - Granular foundation material (rock) shall meet Mn/DOT specification 2451for aggregate bedding as modified below. The material shall be crushed rock meeting the following gradation by weight. The use of the material shall be reviewed by the City Engineer prior to the installation of the material.

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Sieve Size	Percent Passing
2”	100
1½”	95 - 100
¾	20 - 60
# 4	0 - 2

2.7 TRACER WIRE

1. #12 AWG solid copper or copper clad steel (CCS) wire with 30 mil high density polyethelyne (HDPE) insulating jacket. Tracer wire for storm sewer shall be coated GREEN.

B. Connectors

1. Connectors shall be “wire nut” or “twist on” type connectors filled with silicone waterproofing sealant suitable for direct bury applications according to UL 486D test standard. Connectors shall be DryConn™ connectors as manufactured by King Innovation or approved equal.

C. Tracer wire access box shall be as manufactured by Valvco, or approved equal.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Geo-textile fabric sock shall not be installed

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

C. The Contractor shall install and operate a dewatering system to maintain all trenches free of water wherever necessary. The Contractor shall be responsible for any damage to adjacent structures or buildings caused by the dewatering operations. The Contractor shall make his own subsurface investigations and determine what dewatering methods to utilize to prevent such damage.

D. Existing inverts shall be protected during construction. If debris enters culverts or sewers, it shall be the responsibility of the Contractor to clean.

E. Inspection tees shall be installed flush with the finished boulevard grade. Inspection Tees shall be placed at high points and at 200’ intervals along the pipe.

F. Where subdrains are connected to catch basins or manholes, rodent protection shall be installed.

3.2 INFILTRATION NETWORK

A. Geotextile Fabric shall be installed as shown on the details in the plan set.

B. Filter aggregate shall be installed per the detail in the plan set from 6-inches over the top of the pipe to 24” below the invert of the pipe. Filter aggregate shall be installed to a depth of 1-foot below the invert of the pipe with the manhole. Cover filter aggregate on three sides with Geotextile Fabric as shown in the detail.

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C. Manholes

1. All infiltration networks shall include a pretreatment sump manhole. The manhole shall include a 3-foot sump.

3.3 TRACER WIRE

A. The installation of any non-conductive mains and/or services shall include the installation of tracer wire in accordance with the details shown on the plans.

B. At junctions of non-conductive pipe materials with conductive pipe materials, the Contractor shall electrically connect the conductive material with the tracer wire adjacent to the non-conductive material.

C. Approximately 1% slack shall be maintained in the wire by installing 101 feet of wire for each 100 feet of pipe length.

D. The wire shall be extended to the surface at bends or manholes by extending the wire to a tracer wire access box. The tracer wire shall be coiled on a stainless steel fastener.

E. The Contractor shall successfully complete a conductivity test of the installed tracer wire system prior to final acceptance.

******END OF SECTION******

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SECTION 2621
STANDARD SPECIFICATIONS
FOR
SANITARY SEWER
AND
STORM SEWER INSTALLATION
1999 EDITION

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SECTION 2621
STANDARD SPECIFICATIONS FOR
SANITARY SEWER AND STORM SEWER INSTALLATION

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2621 STANDARD SPECIFICATIONS FOR SANITARY SEWER AND STORM SEWER INSTALLATION

2621.1 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.

Use of the term "Plans, Specifications, and Special Provisions" within this specification shall be construed to mean those documents which compliment, modify, or clarify these specifications and are accepted as an enforceable component of the Contract or Contract Documents. All references to Mn/DOT Specifications shall mean the latest published edition of the Minnesota Department of Transportation Standard Specifications for Construction as modified by any Mn/DOT Supplemental Specifications issued before the date of advertisement for bids. All references to other Specifications of AASHTO, ASTM, ANSI, AWWA, etc. shall mean the latest published edition available on the date of advertisement for bids.

The following specifications have been referenced in this Specification:

AASHTO M198 Specification for Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

AASHTO M294 Specification for Corrugated Polyethylene Pipe, 300-to 1200-mm Diameter

ASTM A48 Specification for Gray Iron Castings

ASTM A74 Specification for Cast Iron Soil Pipe and Fittings

ASTM C76 Specification for Reinforced Concrete Pipe

ASTM C270 Mortar for Unit Masonry

ASTM C361 Specification for Reinforced Concrete Low Head Pressure Pipe

ASTM C425 Specification for Compression Joints for VCP and Fittings

ASTM C443 Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

ASTM C478 Specification for Precast Reinforced Concrete Manhole

ASTM D543 Test Method for Resistence of Plastic to Chemicals

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ASTM C564 Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings

ASTM C700 Specification for Vitrified Clay Pipe

ASTM D2321 Recommended Practice for Installation of Flexible Thermo-plastic Sewer Pipe

ASTM D2751 Specification for ABS Pipe and Fittings

ASTM D3034 Specification for PVC Sewer Pipe and Fittings

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

ASTM F679 Specification for Large-Diameter PVC Sewer Pipe and Fittings

ASTM F949 Specification for Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

AWWA C104 American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C110 American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids

AWWA C111 American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115 American National Standard for Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

AWWA C150 American National Standard for Thickness Design of Ductile-Iron Pipe

AWWA C151 American National Standard for Ductile-Iron Pipe, Centrifugally Case, for Water or Other Liquids

AWWA C153 American National Standard for Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm Through 610 mm) and 54 In. Through 64 In. (1,400 mm Through 1,600 mm), for Water Service

2621.2 MATERIALS

All materials required for this work shall be new material conforming to requirements of the referenced 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.

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If any options are provided for, as to type, grade, or design of the material, the choice shall be limited as may be stipulated in the Plans, Specifications, or Special Provisions.

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

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.

A Sewer Pipe and Service Line Materials

All pipe furnished for main sewer and service line installations shall be of the type, kind, size, and class indicated for each particular line segment as shown in the Plans 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 products specifically manufactured for this purpose and subject to approval by the Engineer.

A1 Vitrified Clay Pipe and Fittings

Vitrified clay extra strength pipe and fittings shall conform to the requirements of ASTM M-65 for the size and type and class specified, subject to the following supplementary provisions:

(1) Unless otherwise specified, the pipe and fittings shall be non-perforated, full circular type, either glazed or unglazed.

(2) All pipe and fittings manufactured with bell-and-spigot ends shall be furnished with factory fabricated compression joints conforming to the requirements of ASTM C-425.

(3) In lieu of the bell-and-spigot jointing requirements, the pipe and fittings may be furnished with plain ends, in which case the jointing shall be by means of compression couplings conforming to the requirements of ASTM C-425, Type B.

(4) All clay pipe fittings (wyes, tees, bends, plugs, etc.) shall be of the same pipe class and joint design as the pipe to which they are to be attached.

(5) Pipe and fittings manufactured to the standards of AASHTO 52; 65 may be accepted by prior approval of the Engineer.

A2 Ductile Iron Pipe and Ductile Iron and Gray Iron and Fittings

The pipe furnished shall be Ductile Iron pipe and fittings furnished shall be of the Ductile Iron or Gray Iron type as specified for each particular use of installation. When Gray Iron is specified,

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either type may be furnished. Gray Iron may not be substituted for Ductile Iron unless specifically authorized in the Special Provisions.

Ductile iron pipe shall conform to the requirements of AWWA C115 or C151 for water and thickness design shall conform to AWWA C150. In addition, the pipe shall comply with the following supplementary provisions:

(1) Fittings shall conform to the requirements of AWWA C110 OR 153 (Gray Iron and Ductile Iron Fittings or Ductile Iron Compact Fittings) for the joint type specified.

(2) Unless otherwise specified, all pipe and fittings shall be furnished with cement mortar lining meeting the requirements of AWWA C104 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.

(3) Rubber gasket joints for Ductile Iron Pressure Pipe and fittings shall conform to AWWA C111.

A3 Reinforced Concrete Pipe and Fittings

Reinforced concrete pipe, fittings and specials shall conform with the requirements of ASTM C-76 (Reinforced Concrete Pipe) with rubber O-ring or profile joints for the type, size, and strength class specified, subject to the following supplementary provisions:

(1) All branch fittings such as tees, wyes, etc. shall be cast as integral parts of the pipe. All fittings and specials shall be of the same strength class as the pipe to which they are attached.

(2) Joints shall meet the requirements of ASTM C-361.

(3) Lift holes will not be permitted unless specifically authorized in the Plans, Specifications, and Special Provisions

A4 Corrugated Steel Pipe and Fittings

Corrugated steel pipe and fittings shall conform to the requirements of Mn/DOT Specification 3226 (Corrugated Steel Pipe) for the type, size and sheet thickness specified. When specifically provided for in the Plans, Specifications, and Special Provisions, the galvanized steel pipe and fittings shall be furnished with special aramid fiber bonded, bituminous, or plastic coating or concrete lining as required.

A5 Polyvinyl Chloride Pipe and Fittings

Smooth walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 and ASTM F-679 for the size, standard dimension ratio (SDR), and strength requirements indicated on the Plans, Specifications, and Special Provisions. The grade used shall

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be resistant to aggressive soils or corrosive substances in accordance with the requirements of ASTM D-543. Unless otherwise specified, all pipe and fittings shall be SDR 35 and connections shall be push-on with elastomeric gasketed joints which are bonded to the inner wall of the gasket recess of the bell socket.

Corrugated polyvinyl chloride pipe and fittings with smooth interior shall conform with the requirements of ASTM F-949 for the size and wall thickness indicated on the Plans, Specifications, and Special Provisions. Unless otherwise specified, all pipe and fittings shall be push-on with snug fit elastomeric joints meeting tightness requirements of ASTM D-3212.

A6 Cast Iron Soil Pipe

Unless otherwise specified in the Plans, Specifications, and Special Provisions, cast iron soil pipe shall be service weight pipe meeting the requirements of ASTM A-74 and the Plans, Specifications, and Special Provisions. Unless otherwise specified, pipe joints shall be push-on, sealed with elastomeric gaskets, meeting the requirements of ASTM C-564.

A7 Acrylonitrile-Butadiene-Styrene Pipe

Acrylonitrile-Butadiene-Styrene (ABS) solid wall pipe and fittings shall conform to the requirements of ASTM D-2751 for 4 inch and 6 inch diameter and shall be gasket seal joints, assembled as recommended by the pipe manufacturer. Solvent cemented joints, assembled as recommended by the pipe manufacturer, shall be provided only where specifically indicated in the Plans, Specifications, and Special Provisions.

A8 Dual-Wall Corrugated Polyethylene Pipe

Dual-Wall Corrugated Polyethylene Pipe shall conform to the requirements of AASHTO M-294 and Design 18 of the AASHTO Standard Specifications for Highway Bridges for storm sewer pipe sizes 12-inch through 36-inch. Joints shall be water-tight unless the engineer approves a soil-tight joint. Pipe manufacture, water-tight joint testing, and installation shall conform to current Mn/DOT requirements and/or as indicated in the Plans, Specifications, and Special Provisions.

B 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:

(1) Casting assemblies or dimensions, details, weights, and class shall be as indicated in the detailed drawings for the design designation specified. Unless otherwise specified, the castings shall be Class 30 or better.

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(2) Lid-to-frame surfaces on round casting assemblies shall be machine milled to provide true bearing around the entire circumference.

(3) 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.

(4) A Certificate of Compliance shall be furnished with each shipment of castings stating that the materials furnished have been tested and are in compliance with the specification requirements.

(5) Unless otherwise specified, sanitary sewer manholes in areas subject to flooding by surface water shall have self-sealing lids and recessed pick holes.

(6) Unless otherwise specified, sanitary sewer manhole lids shall have recessed pick holes.

C Precast Concrete Manhole and Catch Basin Sections

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, Mn/DOT 2506 and the following supplementary provisions:

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

(2) Joints of manhole riser sections shall be tongue and groove with rubber "O" ring or profile joints provided on sanitary sewer manholes. Sanitary sewer inlet and outlet pipes shall be joined to the manhole with a gasketed, flexible, watertight connection or any watertight connection arrangement that allows differential settlement of the pipe and manhole wall to take place.

(3) 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.

(4) A Certificate of Compliance shall be furnished with each shipment of precast manhole and catch basin sections stating that the materials furnished have been tested and are in compliance with the specification requirements.

(5) Lift holes will not be permitted in precast manholes.

D Concrete

Concrete for cast-in-place masonry construction shall be produced and furnished in accordance with the requirements of Mn/DOT Specification 2461 for the mix designation indicated in the Plans. 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.

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E Mortar

Mortar for use in masonry construction shall be an air-entrained mixture of one part Masonry cement, Type S, and two parts mortar sand, with sufficient water to produce proper consistency, and with sufficient air-entraining agent added to maintain an air content within the range of 7 to 10 percent. Mortar shall meet the requirements of ASTM C-270.

2621.3 CONSTRUCTION REQUIREMENTS

A Installation of Pipe and Fittings

A1 Inspection and Handling

Proper and adequate implements, tools, and facilities satisfactory to the Engineer shall be provided and used by the Contractor for the safe and convenient prosecution of the work. 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 to have cracks, flaws or other defects. The Engineer shall inspect the damaged materials and have the right to reject any materials found to be unsatisfactory. The Contractor shall promptly remove all rejected material from the site. All materials shall be handled carefully, as will prevent damage to protective coatings, linings, and joint fillings; preclude contamination of interior areas; and avoid jolting contact, dropping, or dumping.

All work and materials are subject to tests by the Owner at such frequency as may be determined by the Engineer.

While suspended and before being lowered into laying position, each pipe section and appurtenant unit shall be inspected by the Contractor to detect damage or unsound conditions that may need corrective action or be cause for rejection. The Contractor shall inform the Engineer of any defects discovered and the Engineer will prescribe the required corrective actions or order rejection.

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

A2 Pipe Laying Operations

Trench excavation and bedding preparations shall proceed ahead of pipe placement as will permit proper laying and joining of the units at the prescribed grade and alignment without unnecessary deviation or hindrance.

All foreign matter or dirt shall be removed from the inside of the pipe and fittings before they are lowered into position in the trench and they shall be kept clean by approved means during and

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after laying. The sewer materials shall be carefully lowered into laying position by the use of suitable restraining devices. Under no circumstances shall the pipe be dropped 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.

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.

Unless otherwise permitted by the Engineer, bell and spigot pipe shall be laid with the bell ends facing upgrade and the laying shall start on the downgrade end and proceed upgrade. 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 the top with hand operated mechanical tamping devices or by hand. The joint areas shall remain exposed and precautions shall be taken to prevent the soil from entering the joint space, until the joint seal is effected. Backfill in the bell area shall be left loose.

Connection of pipe to existing lines or previously constructed manholes or catch basins shall be accomplished as shown in the Plans or as otherwise approved by the Engineer. Where necessary to make satisfactory closure or produce the required curvature, grade or alignment deflections at joints shall not exceed that which will assure tight joints and comply with any limitations recommended by the pipe manufacturer.

Entrance of foreign matter into pipeline openings shall be prevented at all times to the extent that suitable plugs or covering can be kept in place over the openings without interfering with the installation operations.

Installation of thermoplastic pipe shall conform to ASTM D-2321.

A3 Connection and Assembly of Joints

All pipe and fitting joints shall fit tightly and be fully closed. Spigot ends shall be marked as necessary to indicate the point of complete closure. All joints shall be soil tight, as the minimum requirement, and shall be watertight in all sanitary sewer pipe lines and in all storm sewer pipe lines installed within the limits of a paved street or highway traffic lanes. Where specified, the joints in certain assemblies shall be made structurally integral by being completely encased in concrete to form a rigid watertight unit as indicated in the standard drawings.

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All joints shall be sealed as follows, subject to such other approved method as the Engineer may authorize as being an acceptable alternative:

(1) Concrete pipe and fitting joints - compression type rubber gasket seals conforming to the requirements of ASTM C-443, ASTM C-361 or AASHTO M-198 for circular pipe, or as otherwise approved by the Engineer in the case of non-circular pipe sections.

(2) PVC pipe, and ABS solid wall pipe and fittings assembled gasket seal joints.

(3) Corrugated smooth wall PVC and corrugated-double wall HDPE pipe and fittings - assembled push-on gasketed joints shall pass performance tests as listed in ASTM D-3212. Solvent welds shall not be permitted.

(4) Vitrified clay pipe and fittings - factory fabricated compression seals or compression type couplings.

(5) Corrugated steel pipe and fittings - sealed with approved type compression seals.

A4 Bulkheading Open Pipe Ends

All pipe and fitting ends left open for future connection shall be bulkheaded by approved methods prior to backfilling. Unless otherwise specified or approved, all openings of 24 inches in diameter or less shall be closed off with prefabricated plugs or caps and all openings larger than 24 inches in diameter shall be closed off with masonry bulkheads.

Prefabricated plugs and caps shall be of the same material as the pipe material, or an approved alternate material, and they shall be installed with watertight seal as required for the pipeline joints. Masonry bulkheads shall be constructed with clay or concrete brick to a wall thickness of eight inches.

Bulkheads installed for temporary service during construction may be constructed with two- inch timber planking securely fastened together and adequately braced, as an alternate to the masonry construction.

B Appurtenance Installations

Appurtenance items such as aprons, trash guards, gates and castings shall be installed where and as required by the Plans and in accordance with such standard detail drawings or supplementary requirements as may be specified.

Casting assemblies installed on manhole or catch basin structures shall be set in a full mortar bed and be adjusted to the specified elevation without the use of shims or blocking.

Sewer aprons shall be subject to all applicable requirements for installation of pipe. All aprons and outfall end sections shall have the last three sections tied. Two tie bolt fasteners shall be

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placed in each of the last three joints, one on each side of top center at the 60 degree point (from vertical). Tie bolt diameter shall be: 1/2 inch for 12" to and including 21" pipe; 5/8 inch for 24" to and including 36" pipe; 3/4 inch for 42" to and including 54" pipe; and 1" for 60" and larger pipe. The tie bolts shall be of a design approved by the Engineer.

C Sewer Service Installations

Main sewer service connections and building service sewer pipe shall be installed as provided for in the Contract and as may be directed by the Engineer. The sewer service connections and pipe lines shall be installed in conformance with all applicable requirements of the main sewer installation and as more specifically provided for herein.

The Engineer, with the assistance of the Contractor, shall keep accurate records of all service installations as to type, location, elevation, point of connection and termination, etc. This service record shall be maintained jointly by the Contractor and Engineer on forms provided by the Engineer. The service installations shall not be backfilled until all required information has been obtained and recorded.

The main sewer service connection shall consist of installing a Branch Tee or Wye section in the main sewer line at designated locations or providing an insert type Saddle Tee in a pipe cutout where and as permitted or required in lieu of the built-in fitting. Orientation of service connection fitting shall be as shown in the standard drawings unless otherwise directed by the Engineer.

Where the depth of cover over the main sewer invert is greater than 15 feet (or such other maximum as may be indicated), the service connection shall be extended upward by means of a Service Riser Section in accordance with the details shown in the standard drawings.

Unless otherwise specified, service pipe shall be installed at right angles to the main sewer and at a straight line grade to the property line. The standard and minimum grades shall be a uniform rise of one inch in four feet for sanitary service lines and one inch in eight feet for storm sewer service lines. These minimum grades may be reduced (by not more than one-half pitch) where the Engineer so approves in the case of restrictive elevation differences.

Building service pipe lines shall generally be kept as deep as required to serve the building elevation and maintain the specified minimum pipe grades. Pipe bends shall be provided as necessary to bring the service lines to proper location and grade. Pipe bends shall not exceed 22-1/2 degrees without approval of the Engineer.

Unless otherwise indicated, service pipe installation shall terminate at property line or as designated on the Plans, with a gasketed plug placed in the end, at which point the Contractor shall furnish and set a 4 x 4 inch wooden timber 6 feet to 8 feet in length embedded 4 feet below grade, or approved steel post to mark the exact end of pipe. The timber or post shall be set vertically, with the top 2 feet painted green.

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Wherever service line connections to the main sewer are permitted or required to be made by the open cut-out method in the absence of a built-in Tee or Wye fitting, the connection shall be made by using an approved type of Saddle Tee fitting. The pipe cut-out shall be made with an approved type coring machine or by other approved methods producing a uniform, smooth circular cut-out as required for proper fit. The cut-out discs shall be retrieved and shall not be allowed to remain within the main sewer pipe. The Saddle Tee shall be securely fastened to the main sewer pipe by means of epoxy resin or other approved adhesive. The entire connection fitting shall be encased in concrete to a minimum thickness of six inches and as may be shown in the standard drawings.

Wherever service line connections to the main sewer are required to be made by means of built-in Branch Tee or Wye fittings, the Contractor shall, in the absence of such fitting, remove a section of the main sewer pipe and replace it with the required Branch Tee or Wye section connected by means of an approved sleeve coupling.

Sanitary sewer service lines shall not be connected to a manhole at an elevation more than 24 inches above the crown of the outgoing sewer. Where the elevation difference is greater than 24 inches, the connection shall be made by means of an Outside Drop Connection in accordance with the details shown in the standard drawings.

All pipe and fitting openings at temporary terminal points shall be fitted with suitable plugs or shall be bulkheaded as required for the main sewer pipe.

D Manhole and Catch Basin Structures

Manholes, catch basins, and other special access structures shall be constructed at designated locations as required by the Plans and in accordance with any standard detail drawings or special design requirements given therefor.

Unless otherwise specified or approved, manholes and catch basins shall be constructed on a precast or cast-in-place concrete base and the barrel riser sections, cone section and top adjusting rings shall all be of precast concrete. All units shall be properly fitted and sealed to form a completely watertight structure. Barrel and cone height shall be such as to permit placement of at least two and not more than six standard two-inch precast concrete adjusting rings or as shown on the plan immediately below the casting assembly.

Unless otherwise specified or approved, manholes and catch basins shall have an inside barrel diameter at the bottom of 48 inches minimum and the inside diameter at the top of the cone section and all adjusting rings shall be of the same size and shape as the casting frame. Casting assemblies shall be as specified in the Plans. Catch basin grate elevation shall be adjusted as necessary to maintain the required dip below normal gutter grade, as shown on the plans.

Concrete cast-in-place base shall be poured on undisturbed or firmly compacted foundation material which shall be trimmed to proper elevation. The bottom riser section shall be set in fresh concrete or mortar and all other riser section joints of the tongue and groove design shall be

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sealed with rubber gaskets. The concrete base under an outside drop connection shall be monolithic with the manhole base.

Wherever special designs so require or permit, and as otherwise may be approved by the Engineer, a precast concrete base may be used or the structure may be constructed with solid sewer brick or block units or with cast-in-place concrete. Any combination of cast-in-place concrete and brick or block mortar construction will be allowed and may be required where it is impossible to complete the construction with standard precast manhole sections.

All annular wall space surrounding the inplace storm sewer pipes shall be completely filled with mortar or concrete, and the inside bottom of each manhole and catch basin shall be shaped with fresh concrete to form free flow through invert troughs as directed.

E Reconnecting Existing Facilities

Disposition of abandoned facilities and reconnection of existing facilities shall be as provided for in the Plans, Specifications, and Special Provisions.

F Sanitary Sewer Leakage Testing

All sanitary sewer lines, including service connections, shall be substantially watertight and shall be tested for excessive leakage upon completion and before connections are made to the service by Others. Each test section of the sewer shall be subjected to exfiltration testing, either by hydrostatic or air test method as described below and at the Contractor's option. The requirements set forth for maximum leakage shall be met as a condition for acceptance of the sewer section represented by the test.

If the ground water level is greater than three feet above the invert elevation of the upper manhole and the Engineer so approves, infiltration testing may be allowed in lieu of the exfiltration testing, in which case the allowable leakage shall be the same as would be allowed for the Hydrostatic Test.

All testing shall be performed by the Contractor without any direct compensation being made therefor, and the Contractor shall furnish all necessary equipment and materials, including plugs and standpipes as required.

F1 Air Test Method

The pipeline shall be sealed with plug whose sealing length is greater than the diameter of the pipe and constructed in such a nature that it will not require external blocking or bracing and maintain a seal against the line's test pressure.

All wyes, tees, outlets or ends of lateral streets shall be suitably capped and braced to withstand the internal pressures. Such caps or plugs shall be easily removable.

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One plug shall be tapped for the air supply hose and the return air pressure hose. The air supply hose, connected from the compressor to the plug shall be a throttling valve, bleeding valve and shut off valve for control. The air pressure tap shall have a sensitive pressure gauge, 0 to 10 psi range, protected by a gauge cock and a pressure relief valve set at 10 psi.

In performing the test, air is added slowly to the pipeline until pressure inside the pipeline reaches 4.0 psi. If air is added too rapidly, the test accuracy will decrease because a change in temperature also has an effect on the change in pressure. When the air pressure inside the pipeline reaches 4.0 psig above external hydrostatic pressure, the supply air is stopped. A minimum two-minute time interval is allowed for the temperature difference to stabilize before the actual test is performed. If the air pressure drops below 3.5 psig during this time interval, more air will be supplied to the pipeline and throttled to maintain a pressure between 3.5 psig and 4.0 psig for a minimum of two minutes after which time the supply air will be shut off.

The portion of line being tested shall be accepted if the portion under test does not lose air at a rate greater than 0.0015 cfm per square foot (for PVC) or 0.003 cfm per square foot (for RCP) per internal pipe end area at an average pressure of 3.0 psig greater than any back pressure exerted by groundwater that may be over the pipe at the time of test.

The test shall be accomplished by determining the time in minutes for the pressure to decrease from 3.5 psig to 3.0 psig greater than the average groundwater that may be over the pipe. That time shall not be less than the time shown on the given diameter in the following table:

Pipe Diameter in Inches Minutes for PVC Minutes for RCP

PIPE DIAMETER IN INCHES	**MINUTES FOR**	
	PVC	**RCP**
4	1.9	1.0
6	2.8	1.4
8	3.8	1.9
10	4.7	2.4
12	5.7	2.9
15	7.1	3.4
18	8.5	4.3
21	9.9	5.0
24	11.3	5.7

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If the pipeline fails to meet the requirements of the test, the Contractor shall, at their own expense, determine the source of leakage and then repair or replace all defective material and/or workmanship.

In determining the pressure greater than the average groundwater, the groundwater height in feet above the pipeline must be measured.

When the water elevation has been established, the height in feet above the pipeline shall be divided by 2.31 and that pressure added to gauge pressure of test.

A table for converting water height to gauge pressure is as follows:

Groundwater Level over Top of Pipeline	Added Pressure to be Applied to Gauge Pressure Readings (PSIG)
1 foot	0.43 psig
2 feet	0.86 psig
3 feet	1.29 psig
4 feet	1.72 psig
5 feet	2.16 psig
6 feet	2.59 psig
7 feet	3.01 psig
8 feet	3.44 psig
9 feet	3.87 psig
10 feet	4.30 psig

F2 Hydrostatic Test Method

After bulkheading the test section, the pipe shall be subjected to a hydrostatic pressure produced by a head of water at a depth of three feet above the invert elevation of the sewer at the manhole of the test section. In areas where ground water exists, this head of water shall be three feet above the existing water table.

The water head shall be maintained for a period of one hour during which time it will be presumed that full absorption of the pipe body has taken place, and thereafter for an extended period of one hour the water head shall be maintained as the test period. During the one hour test

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period, the measured water loss within the test section, including service stubs, shall not exceed the Maximum Allowable Loss (in Gallons Per Hour per 100 Feet of Pipe) given below for the applicable Main Sewer Diameter.

Main Sewer Diameter	Maximum Allowable Loss*
(In Inches)	(In Gallons Per Hour Per 100 Feet)
6	0.5
8	0.6
10	0.8
12	1
15	1.2
18	1.4
21	1.7
24 & Larger	1.9

* Based on 100 Gallons Per Day Per Pipe Diameter Inch Per Mile

If measurements indicate exfiltration within a test action section is not greater than the allowable maximum, the section will be accepted as passing the test.

F3 Test Failure and Remedy

In the event of test failure on any test section, testing shall be continued until all leakage has been detected and corrected to meet the requirements. All repair work shall be subject to approval of the Engineer. Introduction of sealant substances by means of the test water will not be permitted.

Unsatisfactory repairs or test results may result in an order to remove and replace pipe as the Engineer considers necessary for test conformance. All repair and replacement work shall be at the Contractor's expense.

G Deflection Test

Deflection tests shall be performed on all plastic gravity sewer pipes. The test shall be conducted 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 nine-point mandrel (Mn/DOT Technical Memorandum 98-24-B-01 or latest revision) 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 line will be considered acceptable if the mandrel can progress through the line without binding. 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.

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

G1 Test Failure and Remedy

In the event of test failure on any test section, the section shall be replaced, with all repair work subject to approval of the Engineer. The replaced section shall be retested for leakage and deflection in conformance with the specifications contained herein. All repairs, replacement, and retesting shall be at the Contractor's expense.

H Televising

Sewer line televising may be required by the Engineer, at the cost of the Contractor, if visual inspection, leakage testing, or deflection testing indicate the sewer has not been constructed in accordance with these specifications and the requirements of the Plans, Specifications, and Special Provisions.

2621.4 METHOD OF MEASUREMENT

All items will be measured separately according to design designation as indicated in the Pay Item name and as may be detailed and defined in the Plans, Specifications, or Special Provisions. Pipe will generally be designated by size (inside diameter or span), strength class, kind or type, and laying condition. Complete-in-place items shall include all component parts thereof as described or required to complete the unit, but excluding any excesses covered by separate Pay Items. Linear measurement of piping will include the running length of any special fittings (tees, wyes, elbows, gates, etc.) installed within the line of measure between specified terminal points.

A Sewer Pipe

Sewer pipe of each design designation will be measured by length in linear feet along the line of pipe. Terminal points of measurement will be the pipe end at free outlets; the point of connection with inplace pipe; the center of manholes or catch basins; the point of centerline intersections at branch fittings; or the point of juncture with other appurtenances or units as defined.

Separation of quantities according to "depth zone classification", when so designated in the Pay Item, will be determined by depth of pipe invert below the ground surface profile.

B Manholes

Manholes of each design designation will be measured by number of each constructed complete-in-place, including the base and castings as required, but excluding any excess depth greater than 8.0 feet measured from top of manhole cover to invert elevation of lowest pipe.

Excess manhole depth of each design designation will be measured by the linear foot difference in depth between the 8.0 feet allowed as standard and the actual increased depth as constructed.

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C Catch Basins

Catch basins of each design designation will be measured by number of each constructed complete-in-place, including the base and castings as required, but excluding any excess depth greater than 5.0 feet measured from top of grate (low point) to invert elevation of lowest outlet pipe.

Excess catch basin depth of each design designation will be measured by the linear foot difference in depth between the 5.0 feet allowed as standard and the actual increased depth as constructed.

D Outside Drop Connection

Outside drop connections of each design will be measured by number of each constructed complete-in-place, including granular encasement, fittings, and any special piping details as required, including two holes into existing manholes for the drop connection, but excluding any excess vertical drop greater than 2.0 feet measured between invert of high pipe inlet and invert of low pipe outlet.

Excess drop connection depth will be measured by the linear foot difference in vertical drop between the 2.0 feet allowed as standard and the actual increased vertical drop as constructed.

E Service Connection

Service Connections of each design will be measured by number of each constructed complete-in-place as specified.

F Service Pipe

Service pipe of each design will be measured separately by length in linear feet, horizontally along the line of installation, between the service end and the point of juncture with the main pipe connection fitting.

G Special Pipe Fittings

Special pipe fittings (wyes, tees, bends, etc.) of each design designation will be measured by number of each installed complete-in-place as specified, but excluding any such fittings required to be installed as a component part of any other Work Unit.

H Appurtenant Items

Appurtenant items such as aprons, trash guards, gates and other prefabricated units or assemblies as identified by Pay Item name will be measured separately by number of each installed complete-in-place as specified.

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2621.5 BASIS OF PAYMENT

Payment for sewer pipe and service pipe items at the Contract prices per linear foot of pipe of each design shall be compensation in full for all costs of providing a complete-in-place pipeline, including excavation, foundation preparation, backfilling, leakage testing, restoration of surface improvements, disposal of surplus or waste materials, final cleanup, and such other work as may be specified, but excluding the construction of other structures or special sections and the placement of special fittings, appurtenances or materials specifically designated for payment under other Contract Items.

Payment for manhole, catch basin, outside drop connection, service connection, and other structures as specified, at the Contract prices per structure, shall be compensation in full for all costs of constructing each unit complete-in-place as specified, including all required castings, special fittings, base or encasement, and appurtenant materials as specified for the complete structure or section, but excluding such additional work as may be designated for payment under other Contract Items.

Where the specified standard manhole, catch basin, or outside drop connection depths are exceeded, the excess depth of each design will be paid for separately as linear footage items and payment at the Contract prices therefor shall be compensation in full for all costs of providing the extra depth.

Special pipe fittings such as wyes, tees and bends will be paid for as separate Contract Items to the extent they are required to be installed in the sewer pipe and service pipe lines and not as a component part of a complete-in-place structure (outside drop connections, service connections, etc.)

Appurtenant items such as aprons, trash guards, drainage gates, and other prefabricated units or assemblies and specials as designated will be paid for as separate Contract Items to the extent they are not included as a component part of any complete-in-place structure.

******END OF SECTION******

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SECTION 02630 - PIPE SEWERS – STORM

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to storm sewer construction as indicated on the drawings or as specified herein.

1.2 METHODS

A. Trench excavation, bedding and backfill, see Section 02320 of these Specifications.

B. Trenchless installation, see Section 02446 of these Specifications.

1.3 SPECIFICATION REFERENCES

A. Mn/DOT Specification No. 2506 shall apply to manholes, catch basins and castings, except as modified herein.

B. Reference Section 02320 of these Specifications for trench excavation, bedding and backfill, except as modified herein.

C. CEAM Specification No. 2621 shall apply to construction of pipe sewers, except as modified herein.

D. Mn/DOT Specification No. 2503 shall apply to measurement and payment of pipe sewers, except as modified herein.

E. Mn/DOT Standard Plates Manual with latest revisions.

F. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 SEWER PIPE AND FITTINGS

A. Under Existing or Proposed Buildings

1. All underground sewers installed through areas to be occupied by buildings shall comply with all appropriate provisions of the State of Minnesota Plumbing Code, Minnesota Rules Chapter 4715.0550.
2. Permitted pipe materials shall be: (The 6B, 5M, etc. designations are from the plumbing code.):
   (a) 6B (1), PVC Schedule 40, un-threaded, ASTM D2665, with fabricated fittings ASTM D3311.
   (b) 6B (3), PVC Schedule 40 (14 - 24 inch only), ASTM D1785, with ASTM D3311 fittings.
   (c) 6B (4), PVC Schedule 40 and 80, SDR 21 and SDR 26 (6 inch and larger)
   (d) 5M, Reinforced concrete pipe, C-76.
   (e) 5N, Reinforced and pre-stressed concrete pipe, pressure type and fittings.
3. All pipe and fittings must be laid on a continuous granular bed. Installation must comply with ASTM D2321.

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B. Reinforced Concrete Pipe (Mn/DOT 3236)

1. Reinforced concrete pipe. (RCP), fittings and specials shall conform with the requirements of Mn/DOT Specification 3236 (Reinforced Concrete Pipe) for the type, size and strength class specified. The joints for RCP shall be rubber gasketed conforming to Mn/DOT Standard Plate 3006.
2. Reinforced concrete pipe shall be required from the concrete apron to the nearest upstream storm sewer structure.
3. Aprons shall be tied back three joints.

C. Solid Wall Polyvinyl Chloride (PVC) Pipe (Mn/DOT 3245)

1. 4" through 15" Diameters: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM D-3034 for the Standard Dimension Ratio (SDR) of 26.
2. Over 15" Diameter to 24" Diameter: Smooth-walled polyvinyl chloride pipe and fittings shall conform with the requirements of ASTM F679 with a minimum wall thickness for a minimum pipe stiffness of 115.
3. The connection shall be push-on with elastomeric gasketed joints, which are bonded to the inner walls of the gasket recess of the bell socket.
4. The pipe grade used shall be resistant to aggressive soil and corrosive substances in accordance with the requirements of ASTM D-543.

D. Open Profile Wall Polyvinyl Chloride (PVC) Pipe

1. Diameters 10-inches through 24-inches open profile wall polyvinyl chloride pipe shall conform to the requirements of ASTM-F949, Contech A-2000 or approved equal.
2. All joints shall be of the bell and spigot type with elastomeric seals and conform to the requirements of ASTM-D3212. Gaskets shall be factory installed and chemically bonded to the bell end of the pipe.

E. Flexible Pipe Jointing

1. Pipe joints for solid wall and profile wall polyvinyl chloride (PVC) pipe shall be in accordance with ASTM 3212 - 89. This includes the flexible elastomeric seals being rated at sustaining an internal pressure of 10.8 psi for 10 minutes.

2.2 MANHOLES & CATCH BASINS

A. Precast Concrete Manholes and Catch Basin Section

1. Storm sewer manholes shall conform to the Mn/DOT Standard for the design type shown on the plans.
2. Reinforced polypropylene plastic steps shall be furnished for all storm sewer manholes five feet or more in depth.
3. All storm sewer structures shall have integral precast concrete base sections. Separate base slabs will not be permitted unless specifically approved by the City Engineer.
4. Flexible watertight seals shall be provided for all catch basins with PVC pipe inlets.

B. Sump Manholes:

1. All storm sewer structures placed immediately prior to pond inlets must be constructed with a sump a minimum of 3-feet in depth. Access must be provided to all sump structures.

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C. Castings

1. All casting assemblies shall meet the certification requirements of the Minnesota Department of Transportation and be manufactured by a Mn/DOT approved source.
2. The type of casting assembly to be used shall be Neenah R 1733 lid lettered “Storm Sewer.”
3. The type of curb and gutter catch basin casting assembly to be used shall be Neenah R-3250-1, unless otherwise specified on the plan.

D. Adjusting Rings

1. Ladtech H.D.P.E. adjusting rings or approved equal, with approved mastic, shall be required for manholes.
2. Concrete adjusting rings shall be permitted for adjusting catch basins located in the curb.

2.3 MORTAR

A. Mortar shall be Mn/DOT approved non-shrink grout or other product approved by the City Engineer.

2.4 MANHOLE AND CULVERT MARKERS

A. All flared end sections, roadway culverts, and trail culverts shall be marked with a FlexStake EZ Drive type marker with Diamond Grade Reflection Tape placed around the top and 18 inches below the top of the stake. Flared ends and culverts shall be marked with GRAY stakes.

B. All manholes placed outside the roadway bituminous surface shall be marked with a FlexStake EZ Drive type marker with Diamond Grade Reflection Tape placed around the top and 18 inches below the top of the stake. Storm shall be marked with GREEN stakes.

PART 3 -- EXECUTION

3.1 MANHOLE STRUCTURE

A. Raise / Lower Existing Manhole

1. Raising and/or lowering an existing manhole to meet a proposed finished rim elevation is performed when the addition and/or deletion of 2" adjusting rings will not exceed a maximum of 3 rings. Typically, it will require: the removal of the manhole cone section or the concrete slab top; the addition, removal, or exchange of barrel sections; the replacement of the cone section or the concrete slab top; the installation of the proper number of adjusting rings; and the replacement of the manhole casting and frame.

B. Miscellaneous Work

1. When H.D.P.E adjusting rings are used, the sealant material and method shall be according to Manufacturer’s specifications.

3.2 CATCH BASIN STRUCTURE

A. After construction of the bituminous base course pavement the contractor shall mark all catch basins with a 7-foot steel post driven 2-feet into the ground. These posts shall be removed after construction of the bituminous wearing course pavement.

B. Placing Castings and Adjusting Rings

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1. The Contractor shall bring catch basins to grade. If concrete adjusting rings are used, place two strips of bituminous mastic covering 50% of the ring. Grout catch basin castings inside and out with ½ inch of mortar. If HDPE adjusting rings are used, the Contractor shall use manufacture's approved butyl rubber sealant.

2. Geotextile Fabric; Mn/DOT Type IV Geotextile Fabric shall be placed / wrapped around the top of all catch basin castings extending from 3/4th up the casting assembly to 18-inches below the top of the cone of the structure or overlapped 18-inches on the lid of the catch basin.

C. Miscellaneous work.

1. If concrete adjusting rings are used, plaster all adjusting rings inside and out, with a minimum thickness of ½-inch of mortar. A maximum of 3 individual adjusting rings shall be used. Taller 6" or 12" rings shall be used where adjustment requires more than three 2" rings.

2. If H.D.P.E adjusting rings are used, the sealant material and method shall be in accordance with manufacture's recommendations.

3.3 UTILITY MARKER POSTS FOR MANHOLES AND FLARED END SECTIONS

A. All manholes placed outside the roadway bituminous surface shall be marked with a FlexStake EZ Drive type marker. Storm shall be marked with GREEN stakes.

B. All flared end sections, roadway culverts, and trail culverts shall be marked with a GRAY culvert marker stake.

3.4 FIELD QUALITY CONTROL

A. Deflection test - No exception to the referenced specification is made.

B. Televising

1. Televising is required for storm sewers if flexible pipe is installed.

2. Televising details:

(a) Televising is required after deflection testing has been completed and the sanitary sewer manhole castings have been adjusted to ½" below the bituminous base course.

(b) Immediately prior to televising, the televisor shall discharge sufficient clear water into the pipe to clean the pipe and assist in identifying sags and mis-alignment.

(c) Televising shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by close circuit television. All televising video shall be in color. The interior of the pipeline shall be carefully inspected to determine the location of any conditions which may indicate improper installation. Each individual reach of pipe shall be identified as a 'chapter' on the DVD.

(d) Two (2) DVD's and suitable logs shall be kept of all televising and later submitted to the Engineer.

(e) If, upon the review of the submitted DVD's and log, a mis-alignment or debris is discovered, the Contractor shall repair the deficiency and re-televise the deficient section of pipe. All re-televising shall be included on the original televising DVD's and reports submitted. Separate DVD's for re-televised sections of pipe will not be accepted.

******END OF SECTION******

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SECTION 02660 - DETENTION POND EXCAVATION & EMBANKMENT

PART 1 -- GENERAL

1.1 GENERAL

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the construction of storm water detention ponds as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2105.1 through 2105.3 shall apply to all excavation and embankment, except as modified in these Special Provisions.

B. Reference to "roadway" and "roadbed" in the MN/DOT Specifications shall be used interchangeably with "dike" and/or "embankment."

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

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

B. Unsuitable excess excavated material shall become the property of the Developer/Contractor and shall be removed from the pond site and disposed of at a site secured by the Contractor.

C. Excavated material unsuitable for embankment and backfill construction shall become the property of the Contractor and shall be removed from the site and disposed of at a site secured by the Contractor.

D. Frozen material will not be allowed for pond construction.

E. Clay borrow or other cohesive material may be used at the discretion of the City Engineer for pond embankments. Material placed in pond areas that will extend under roadway embankments shall be Select Granular Borrow or select native material.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

D. GENERAL

1. Infiltration areas shall be clearly marked and fenced off to preserve the infiltration capacity of the soil. If the area is compacted or silt and sediment deposition occur as a result of Contractor's actions or Contractor's failure to properly protect the area, the Contractor shall be responsible for corrective actions as directed by the City Engineer as necessary to restore the design function of the area at no additional cost to the Owner.
2. The Contractor shall salvage and stockpile all topsoil removed during the course of the construction. This topsoil shall be used where required for turf establishment.

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A. EXCAVATION/EMBANKMENT CONSTRUCTION

1. At the end of each day the Contractor shall eliminate surface indentations, including those caused by sheep foot rollers and tractor cleats, and roll the surface with a steel wheel or rubber tired roller.
2. The Contractor shall disc and scarify the upper twelve (12) inches of the pond subgrade prior to application of topsoil.
3. Design contours representing the finished surface are shown on the grading plan at this site. The Contractor shall excavate, haul, place and compact the material as needed to be within +/- 0.2' of the finished subgrade of the site.
4. Embankments shall be constructed in eight-inch (loose thickness) lifts.
5. All embankments and subcuts shall be compacted using the Specified Density Method. Testing shall be by the Contractor. Compacted density shall be at least 95% of ASTM:D698-78, Standard Proctor Density. Certified copies of all density test reports shall be provided to the City Engineer.
6. Topsoil unsuitable for protection layer construction can be used as embankment material beyond the four to one pond slopes.
7. All excavations shall be kept free of water.
8. All areas shall be subcut to provide for 4 inches of topsoil. The top of the topsoil shall be the design elevation shown on the grading plan.
9. All rock six-inches and larger encountered during any embankment construction shall be removed and disposed of as directed by City Engineer.
10. All embankment shall be compacted using the Specified Density Method:
    (a) Under areas with proposed paved or structural improvements:
        (1) 100% Standard Proctor from the proposed pavement subgrade elevation down 3 feet.
        (2) 95% Standard Proctor from the bottom of excavation up to 3 feet below the subgrade elevation
    (b) Under areas with no proposed paved or structural improvements:
        (1) 95% Standard Proctor

3.2 SOURCE QUALITY CONTROL

A. The Contractor shall arrange for having the following testing performed:

1. One (1) gradation test per each 500 tons or 275 cubic yards (CV) of borrow.
2. One (1) Standard Proctor test per each 500 cubic yards of clay borrow.

B. All testing shall be performed by an independent testing laboratory approved by the City Engineer.

C. Samples for testing shall be taken from material at locations approved by the City Engineer. All sampling methods shall be approved by the City Engineer.

3.3 FIELD QUALITY CONTROL

A. The Contractor shall arrange for the following testing performed:

1. At least two Standard Proctor Density tests shall be conducted in accordance with ASTM D-698 on each type of soil used in the construction of the pond to establish the moisture density relationship.

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2. Field density tests shall be conducted at the rate of one test per 1500 cubic yards of placed material (compacted volume).

B. All testing shall be performed by an independent testing laboratory approved by the City Engineer.

C. The Contractor shall cooperate fully with the individuals performing the tests.

D. Samples for testing shall be taken from material in place at locations approved by the City Engineer. All sampling methods shall be approved by the City Engineer.

E. Should any of the specified tests fail, the Contractor may arrange and pay for additional tests as may be necessary to satisfy the City Engineer that the specified density requirements have been met.

F. Copies of all test results with maps of testing locations shall be submitted to the City Engineer.

G. All required soils tests and pond bottom surveys must be approved by the City Engineer prior to pond prefill.

****** END OF SECTION ******

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SECTION 02705 - MANHOLES & CATCH BASINS - ADJUST CASTING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to adjusting a casting assembly frame and ring or valve box as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2506 shall apply to adjusting frame and ring, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 ADJUSTING RINGS

1. Only Ladtech H.D.P.E. adjusting rings or approved equal, with approved butyl rubber sealant, shall be permitted for manholes.
2. Concrete adjusting rings shall be used for catch basins located in the curb.

2.2 GEOTEXTILE FABRIC

1. Geotextile Fabric (Type IV) shall be used for wrapping concrete adjusting rings.

2.3 PAVING RINGS

A. Only one piece paving rings as distributed by ESS BROTHERS, or approved equal, shall be permitted for the adjustment of castings beneath bituminous surfaces.

2.4 MORTAR

A. Mortar shall be Mn/DOT approved non-shrink grout or other product approved by the City Engineer.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The Contractor shall bring catch basins to grade. If concrete adjusting rings are used, place two strips of bituminous mastic covering 50% of the ring. Install geotextile fabric and grout catch basin castings inside and out with ½ inch of mortar. If HDPE adjusting rings are used, the Contractor shall use manufacture's approved butyl rubber sealant.

B. Geotextile Fabric; Mn/DOT Type IV Geotextile Fabric shall be placed / wrapped around the top of all catch basin castings extending from 3/4th up the casting assembly to 18-inches below the top of the cone of the structure as noted in the details.

C. All inverts of manholes and valves boxes shall be cleaned of debris and gravel which may have fallen into the structures as a result of construction.

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D. Finished grade of the casting or valve box in paved areas shall be according to the following, unless otherwise specified on the plans:

	Distance Below Adjacent Concrete Pavement	Distance Below Adjacent Bituminous Pavement	Distance Below Adjacent Gravel Surface/Green Area
City Streets	1/8" to 1/4"	1/2”	1"
County Highways	1/8" to 1/4"	1/4" to 3/8"	1"
State Highways	1/8" to 1/4"	1/4" to 3/8"	1"
Sidewalks	1/8"	1/8"	1"
Parking Areas	1/8"	1/2”	1"

E. In no case shall the casting or valve box extend above the finished surface.

F. Raising and/or lowering an existing manhole to meet a proposed finished rim elevation is performed when the addition and/or deletion of 2" adjusting rings will not exceed a maximum of 3 rings. Typically, it will require the removal of the manhole cone section or concrete slab top; the addition, removal or exchange of barrel sections; replacement of the cone section or the flat slab top; installation of the proper number of adjusting rings; and replacement of the manhole frame and casting. In some cases, the existing structure may require saw cutting.

G. After installation of the bituminous base course, all catch basins shall be marked with a steel fence post on the boulevard. The posts shall be removed after the bituminous wearing course placement.

H. The City of St. Francis will enforce a **$500 penalty** for each casting not adjusted to ½” below the bituminous wearing course where a patch is required in the bituminous wearing course to properly adjust the casting.

******END OF SECTION******

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SECTION 02720 - AGGREGATE BASE

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to construct the aggregate base course as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2211 shall apply to the construction of aggregate base, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. When no percent crushing is designated in the *Schedule of Prices*, the material to be used shall conform to the Specifications for Aggregate Base Class 5 modified so that the percent passing the No. 200 sieve shall be 5 to 10 percent.

B. Materials included here consists of new aggregate surfacing, Class 5 aggregate base, aggregate bedding (rock), bedding and encasement material. If additional rock is used to provide a coarser Class 5 gradation, the added materials must pass the Los Angeles Rattler (L.A.R.) test. The percent crushed shall also be tested on the aggregate surfacing or aggregate base class 5 samples.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. At the end of each day the Contractor shall eliminate surface indentations, including those caused by sheep foot rollers and tractor cleats, and roll the surface with a steel wheel or rubber tired roller.

B. The depth and class of aggregate base to be constructed shall be as shown on the plans. Aggregate base construction shall take place only after the street subgrade condition and grade has been examined by the City Engineer.

C. All aggregate base shall be compacted using the Specified Density Method:

1. Under areas with proposed paved or structural improvements:
   (a) 100% Standard Proctor from the proposed pavement subgrade elevation down 3 feet.
   (b) 95% Standard Proctor from the bottom of excavation up to 3 feet below the subgrade elevation
2. Under areas with no proposed paved or structural improvements:
   (a) 95% Standard Proctor

D. The compacted subgrade shall be test rolled using a fully loaded aggregate truck (tandem) in a pattern approved by the Engineer. The subgrade stability shall be considered adequate when the surface shows

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less than one-half (1/2) inch of yielding or rutting after one pass, or as otherwise approved by the Engineer.

3.2 SOURCE QUALITY CONTROL

A. The Contractor shall arrange for having the following testing performed:

1. One (1) gradation test for each 500 tons or 275 cubic yards (CV) of each class of aggregate base.
2. Crushing tests in accordance with the Mn/DOT Schedule of Materials Control.
3. Aggregate quality tests in accordance with the Mn/DOT Schedule of Materials Control.

B. Samples for testing shall be taken from material in stock at locations approved by the City Engineer. All sampling methods shall be approved by the City Engineer.

C. Should any of the specified tests fail, the Contractor may arrange and pay for additional tests as may be necessary to satisfy the City Engineer that the requirements have been met.

3.3 FIELD QUALITY CONTROL

A. "Blue top" stakes shall be provided by the Contractor at 50 foot intervals to confirm that the subgrade is constructed to the required grades and elevations. Methods other than "blue top" staking may be allowed, if approved by the City Engineer.

B. The Contractor shall arrange for having the following testing performed:

1. One (1) compaction test (including Standard Proctor) for each 500 SY of each class of aggregate base.

C. All testing shall be performed by an independent testing laboratory approved by the City Engineer.

D. The Contractor shall cooperate fully with the individuals performing the tests.

E. Samples for testing shall be taken from material in place, in the roadway at locations approved by the City Engineer. All sampling methods shall be approved by the City Engineer.

F. Should any of the specified tests fail, the Contractor may arrange and pay for additional tests as may be necessary to satisfy the City Engineer that the requirements have been met.

******END OF SECTION******

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SECTION 02730 - AGGREGATE SURFACING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to construct the aggregate surfacing / shouldering as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2118 shall apply to the construction of aggregate surfacing, except as modified herein.

B. Mn/DOT Specification Section 2221 shall apply to the construction of aggregate shouldering, except as modified herein.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Materials included here consist of new aggregate surfacing, Class 5 aggregate material. If additional rock is used to provide a coarser Class 5 gradation, the added materials must pass the Los Angeles Rattler (L.A.R.) test. The percent crushed shall also be tested on the aggregate surfacing or aggregate base class 5 samples.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. At the end of each day the Contractor shall eliminate surface indentations, including those caused by sheep foot rollers and tractor cleats, and roll the surface with a steel wheel or rubber tired roller.

B. The depth and class of aggregate surfacing to be constructed shall be as shown on the plans. Aggregate surfacing construction shall take place only after the subgrade or aggregate base condition and grade has been examined by the City Engineer.

C. All aggregate surfacing shall be compacted using the Specified Density Method:

1. Under areas with proposed paved or structural improvements:

(a) 100% Standard Proctor.

3.2 SOURCE QUALITY CONTROL

A. The Contractor shall arrange for and pay all costs associated with having the following testing performed:

1. One (1) gradation test for each 500 tons or 275 cubic yards (CV) of each class of aggregate.
2. One (1) percent crushing test (if required by the City Engineer).
3. One (1) aggregate quality test (if required by the City Engineer).

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B. Samples for testing shall be taken from material in stock at locations approved by the City Engineer. All sampling methods shall be approved by the City Engineer.

C. The Contractor shall cooperate fully with the individuals performing the tests.

3.3 FIELD QUALITY CONTROL

A. The Contractor shall arrange for and pay all costs associated with having the following testing performed:

1. One (1) compaction test (including Standard Proctor) on subgrade per each 500 SY of each class of aggregate surfacing and/or shouldering.

B. All testing shall be performed by an independent testing laboratory approved by the City Engineer.

C. The Contractor shall cooperate fully with the individuals performing the tests.

D. Samples for testing shall be taken from material in place, in the roadway at locations approved by the City Engineer.

E. Should any of the specified tests fail, the Contractor may arrange and pay for additional tests as may be necessary to satisfy the City Engineer that the requirements have been met.

******END OF SECTION******

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SECTION 02740 - PLANT-MIXED BITUMINOUS SURFACING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the construction of plant-mixed bituminous surfacing utilizing the Mn/DOT Gyratory Design Specification (2360) as indicated on the plans or as specified herein.

B. This is a Certified Plant Project. The supplier shall have sufficient testing facilities and qualified personnel including Certified Technicians. If requested by the Engineer, the required tests shall be performed in a timely manner and with a good quality control program.

1.2 SPECIFICATION REFERENCE

A. Plant mixed asphalt pavement shall conform to the current Mn/DOT Specification 2360 Plant Mixed Asphaltic Pavement Gyratory Design Specifications, dated March 5, 2012.

http://www.dot.state.mn.us/materials/bituminousdocs/Specifications/2012/2360-2012.pdf

B. Mn/DOT Specification Section 2357 shall apply to the construction of bituminous tack coat, except as modified herein.

C. Mn/DOT Section 02360.3D.1.q: The maximum payment factor for density is 100%.

D. Aggregates for bituminous mixtures shall conform to the current Mn/DOT Specification 3139 Graded Aggregate for Bituminous Mixtures, dated February 4, 2011. Copies of Mn/DOT's current specifications may be downloaded and printed from Mn/DOT's web site at:

E. Unless noted otherwise, the provisions in this Section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Bituminous Tack Coat:

1. The bituminous material for tack coat will be limited to one of the following kinds of emulsified asphalt. However, the Engineer may authorize the use of medium cure cutback asphalt (MC-250) during the early and late construction season when it is anticipated the air temperature may drop below 32 degrees Fahrenheit. Cutback asphalt shall be used only when approved by the Engineer.

   (a) Emulsified Asphalt

      (1) Anionic SS-1, SS-1h

      (2) Cationic CSS-1, CSS-1h

   (b) Cutback Asphalt:

      (1) Medium Cure Liquid Asphalt MC-250

2. Only Certified Sources are allowed for use. Mn/DOT's Certified Source List is located at the following link: http://www.dot.state.mn.us/products/index.html.

B. Bituminous material and aggregate shall be as shown on the typical sections in the plans.

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PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The bituminous base course shall be ramped at all cross drains, curb inlets, and pedestrian ramps during placement. Storm sewer catch basins located in concrete curb and gutter shall be ramped. Bituminous ramp shall be installed integral with the bituminous base course. All ramping shall be milled prior to placement of bituminous wear course.

B. Bituminous Tack Coat

1. The tack coat shall not be applied when the road surface or weather conditions are unsuitable as determined by the Engineer.
2. At the time of applying bituminous tack coat material, the road surface shall be dry and clean and all necessary repairs or reconditioning work shall have been completed as provided for in the Contract and approved by the Engineer.
3. Unless otherwise indicated in the Plans or provisions, the bituminous tack coat material shall be applied within the application rates shown in the table below as based on pavement type or condition and type of bituminous material. The Engineer shall approve the time and rate of application. Only a Mn/DOT certified asphalt emulsion supplier is allowed to dilute the emulsion. When diluted, the supplier shall provide asphalt emulsion diluted 1 part emulsion to 1 part water. Dilution of asphalt emulsion in the field is not allowed. The Engineer may waive the tack coat requirement when multiple lifts are paved on the same day.

Tack Coat Application Rates

Pavement Type or Condition	Application Rate - gallons/sy		
	Undiluted Emulsion SS-1, SS-1H, CSS-1, CSS-1H	Diluted Emulsion (1 part Emulsion to 1 part water) [1] SS-1, SS-1H, CSS-1, CSS-1H	MC Cutback[2] MC-250
New HMA	**0.03 – 0.05**	**0.06 – 0.10**	**0.03 – 0.05**
Aged HMA[3] or Un-milled PCC	**0.05 – 0.08**	**0.10 – 0.15**	**0.05 – 0.08**
Milled HMA or Milled PCC	**0.07 – 0.10**	**0.14 – 0.20**	**0.07 – 0.10**

[1]As provided by the asphalt emulsion supplier

[2]When approved by the Engineer

[3]Older than 1 year

4. The temperature of the bituminous material at the time of application shall be approved by the Engineer, within the limits specified following:
   (a) SS-1, SS-1H, CSS-1, CSS-1H .....**70 to 160° F**
   (b) MC-250 .....**165 to 220° F**

C. The bituminous wearing course shall be constructed in the construction season following the season in which the underground utilities, aggregate base and bituminous base course have been constructed.

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D. The Contractor is required to use the self-propelled pneumatic tire roller as an intermediate roller on the wearing courses.

E. Cut the adjacent asphalt surface prior to construction of the bituminous surface course to obtain a clean, vertical, solid edge.

F. Compaction of all bituminous mixtures shall be by the Ordinary Compaction Method.

3.2 SOURCE QUALITY CONTROL

A. The bituminous mix shall be designed using Contractor Trial Mix Designs. A current Mn/DOT mix design may be accepted provided it represents the aggregate source and bituminous plant being used for the project, and is approved by the Engineer. No bituminous mixture shall be placed without an approved mix design.

B. Testing of the material bituminous tack coat may be required, if determined by the Engineer, that the material appears suspect.

3.3 FIELD QUALITY CONTROL

A. Cores for lift thickness verification, in the base course only, shall be taken as approved by the City Engineer. Sample locations shall be designated by the Engineer and made with a drilling device that produces clean sharp, vertical edges.

B. Lift Thickness Tolerances:

1. Lift thickness tolerances shall be as specified in Table 2360-26 of the referenced specification.
2. If any cores indicate lift thicknesses outside of the specified tolerances, the Contractor may, at its own cost and expense, take additional core samples to further define the extent of the deficiency.
3. The Engineer shall calculate deficient pavement areas using the locations and thickness results of all core samples and prorating the thickness profile.
4. At the discretion of the Engineer as an alternative to removal and replacement, the Engineer may allow a $1.00 deduction per square yard will be made for each 1/8-inch deficiency of thickness beyond the specified tolerances.
5. Reduction in payment for bituminous courses constructed to more than the maximum permissible thickness shall be in accordance with Mn/DOT Section 2360.3.E, except that the thickness tolerances specified herein apply.

C. Testing:

1. For projects with 2000 tons or less of a particular mix type, delete Tables 2360-10 and 2360-11 of the referenced specification and substitute the following:

Production Test	Sampling and Testing Rates (each mix type)	Test Reference (Laboratory Manual unless otherwise indicated)	Spec Section
Bulk Specific Gravity	Divide the planned production by 500. Round up to the next whole number	1806	2360.2.G.7.b
Maximum Specific Gravity		1807	2360.2.G.7.c
Air Voids (calculated)		1808	2360.2.G.7.d
Asphalt Content		1853	2360.2.G.7.a
Add AC/Total AC Ratio (calculated)		1853	2360.2.G.7.a

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Adj. AFT (Calculated)		1854	2360.2.E.7.e
Gradation	1 gradation per 500 tons or portion thereof (at least one per day)	1203	2360.2.G.7.f
Coarse Aggregate Angularity	1 test per 500 tons or portion thereof. If CAA >8% of requirement, 1 sample per day but test 1 per week.	1214	2360.2.G.7.g
Fine Aggregate Angularity (FAA)	1 test per 500 tons or portion thereof. If FAA >5% of requirement, 1 sample per day but test 1 per week.	1213	2360.2.G.7.h
Fines to Effective Asphalt Ratio (calculated)	Divide the planned production by 500. Round up to the next whole number	1203 & 1853	2360.2.G.7.f & 2360.2.G.7.a
TSR	As directed by the Engineer	1213	2360.G.7.i
Aggregate Specific Gravity	As directed by the Engineer	1204, 1205, and 181	2360.G.7.j
Mixture Moisture Content	Daily unless otherwise required by the Engineer	1805	2360.G.7.k
Asphalt Binder	As directed by the Engineer]	Mn/DOT Bituminous Manual 5-693.920	2360.G.7.l

2. For projects with more than 2000 tons of a particular mix type, testing shall be performed at the rates specified in Tables 2360-10 and 2360-11 of the referenced specification.:
3. Contractor shall send a copy of the testing results to the Engineer.
4. Should any of the specified tests fail, the Contractor shall notify the Engineer immediately and shall arrange and pay for additional test as may be necessary to satisfy the Engineer that the requirements have been met.

******END OF SECTION******

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SECTION 02741 - BITUMINOUS PATCH

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the construction of plant-mixed bituminous surfacing as indicated on the plans or as specified herein.

1.2 SPECIFICATION REFERENCE

A. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

B. Removing Existing Bituminous Pavements

1. See Section 02220 of these Specifications.

C. Common Excavation

1. See Section 02330 of these Specifications

D. Subgrade Preparation

1. See section 02335 of these Specifications.

E. Aggregate Base Course

1. See section 02720 of these Specifications.

F. Bituminous Tack Coat

1. Mn/DOT Specification Section 2357 shall apply to the construction of bituminous tack coat, except as modified herein.

G. Bituminous Paving Materials

1. See Section 02740 of these Specifications.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Subgrade Preparation

1. No exception to the referenced specification is made.

B. Aggregate Base Course

1. The material to be used shall conform to the Specifications for Aggregate Base, Class 5.

C. Bituminous Tack Coat

1. The bituminous material for tack coat shall be CSS-1H.

D. Bituminous Paving Materials

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1. Bituminous material for the mixture shall be PG 58-28 asphaltic cement.
2. The bituminous wear and non-wear mixtures shall be as noted in the details.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The depth and class of aggregate base and bituminous surface shall be:

1. Bituminous Patch – Driveway
   (a) 3" Type SP 12.5 Bituminous Wearing Course
   (b) 6" 2211 Aggregate Base, Class 5
2. Bituminous Patch – Parking Area
   (a) 1.5" Type SP 12.5 Bituminous Wearing Course
   (b) 1.5" Type SP 12.5 Bituminous Non-Wearing Course
   (c) 8" 2211 Aggregate Base, Class 5
3. Bituminous Patch - Street
   (a) 2" Type SP 12.5 Bituminous Wearing Course
   (b) 2" Type SP 12.5 Bituminous Non-Wearing Course
   (c) 8" 2211 Aggregate Base, Class 5
4. Bituminous Patch - 9 Ton Street
   (a) 2" Type SP 12.5 Bituminous Wearing Course
   (b) 3" Type SP 12.5 Bituminous Non-Wearing Course
   (c) 12" 2211 Aggregate Base, Class 5

   unless otherwise shown on the plans.

B. The subgrade, aggregate and bituminous base courses of patches whose smallest dimension is less than the width of the compaction equipment shall be hand tamped.

C. The subgrade shall be compacted using Quality Compaction Method.

D. When the Contractor believes subgrade preparation is complete, he shall notify the City Engineer for a final examination. If the City Engineer requests it, the subgrade shall be test rolled with a fully loaded tandem truck to verify subgrade stability.

E. Aggregate base construction shall take place only after the street subgrade condition and grade has been examined by the City Engineer.

F. Cut the adjacent asphalt surface prior to the Construction of the bituminous surface course to obtain a clean, vertical, solid edge.

G. Compaction of the aggregate base courses shall be by the Quality Compaction Method.

H. The bituminous tack coat shall be applied at the rate of 0.05 gallons per square yard.

I. 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

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or Emulsified Asphalt before placing the adjoining mixture. The bituminous material shall be applied by methods that will ensure uniform coating and in no case shall the application be excessive.

J. The bituminous surfacing shall be constructed with maximum deviation of plus or minus 1/4-inch from the planned compacted thickness.

K. Compaction of all bituminous mixtures shall be by the Ordinary Compaction Method. A nuclear density meter and operator shall be provided by the Contractor, if requested by the City Engineer.

3.2 FIELD QUALITY CONTROL

A. The bituminous mix shall be designed using Contractor Trial Mix Designs. A current Mn/DOT mix design may be accepted provided it represents the aggregate source and bituminous plant being used for the project, and is approved by the City Engineer. No bituminous mixture shall be placed without an approved mix design.

B. Final line and grade of the wearing surface shall not exceed the following tolerances from the adjacent pavement surfaces:

	Distance Below Adjacent Bituminous Pavement
City Streets	1/8"
County Highways	1/8"
State Highways	1/8"
Sidewalks	1/8"
Parking Areas	1/8” - 1/4" (max)

******END OF SECTION******

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SECTION 02749 - PAVEMENT MARKINGS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performance of all work and services necessary or incidental to the application of pavement markings as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2581 shall apply to temporary, removable pavement markings, except as modified herein.

B. Mn/DOT Specification Sections 2582, 3354,3590, 3591, and 3592 shall apply to permanent and painted pavement markings, except as modified herein.

C. Mn/DOT Pavement and Marking Specifications shall apply. These specifications may be found at http://www.dot.state.mn.us/traffic/products/markings-specs.html. Exceptions are as modified herein:

1. Specifications – High Durability Preformed Pavement Markings – (including stop lines and crosswalks)
2. Specifications – No. 1 Patterned Preformed Polymer Pavement Marking Tape with improved retention of reflectivity for lines and selected symbols and legends

D. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Interim Pavement Markings for application on bituminous base course prior to the construction of the bituminous wearing course shall be :

1. High Solids Water Based Traffic Paints, in accordance with the referenced specification.
2. Drop-On Glass Beads, in accordance with the referenced specification.

B. Permanent Pavement Markings for application on the final bituminous wearing course shall be:

1. Epoxy Resin Pavement Markings, in accordance with the referenced specification.
2. Drop-On Glass Beads, in accordance with the referenced specification.

C. Preformed Pavement Markings

1. All preformed pavement markings shall be listed on the MnDOT Approved products list.

2.2 EQUIPMENT

A. Application equipment for latex and epoxy resin systems shall consist of a machine of the spray type capable of applying the material under pressure at a controlled temperature through nozzles equipped with remotely controlled cutoff mechanisms and suitable line guides that will produce clean cut lines and prevent excessive material drift.

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B. For highway and street applications, the marking material shall be applied with truck mounted traveling units properly equipped to apply the stripes as required. Where two or more lines are to be applied closely spaced, the machine shall be equipped to apply those stripes simultaneously. For application of broken lines, the applying unit shall include an automatic feed to control device capable of being set to produce the specified stripe gap ratio.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. A minimum of twenty four (24) hours notice shall be provided to the Engineer to allow adequate time to review the layout of the proposed markings.

B. At the time of applying the marking material, the application area shall be free of contamination. The contractor shall clean the surface prior to the line application in a manner and to the extent required by the Engineer.

C. Pavement markings shall not be applied when the wind or other conditions cause a film of dust to be deposited on the pavement surface after cleaning and before the marking material can be applied.

D. The filling of tanks, pouring of materials or cleaning of equipment shall not be performed on unprotected pavement surfaces unless adequate provisions are made to prevent spillage of the material.

E. No striping operations will be permitted between sundown and sunrise without written permission from the Engineer.

F. All material shall be placed in a workmanlike manner, which shall result in a clearly defined line.

G. All pavement striping shall be 4-inches wide, unless noted otherwise on the plans.

H. Application for the marking material shall be such as to provide uniform film thickness throughout the coverage area. Stripe ends shall be clean cut and square, with a minimum of material beyond the cutoff.

I. All pavement markings not conforming to the requirements of the Contract shall be removed and replaced or otherwise repaired to the satisfaction of the Engineer. Removal of unacceptable work shall be accomplished with suitable blasting or grinding equipment unless other means are approved by the Engineer.

3.2 EPOXY RESIN PAVEMENT MARKINGS

A. Epoxy Resin Pavement Markings shall be applied in accordance with the referenced Mn/DOT Specification - Epoxy Resin Pavement Markings - (Free Of Toxic Heavy Metals).

3.3 PREFORMED PAVEMENT MARKINGS

1. Preformed Pavement Markings shall be applied in accordance with the appropriate referenced Mn/DOT Specification for High Durability Preformed Pavement Markings or Patterned Preformed Polymer Pavement Marking Tape.

3.4 ACCEPTANCE

A. The attached “Construction Striper Operations Daily Log” shall be completed as specified.

Construction Striper Operations Daily Log

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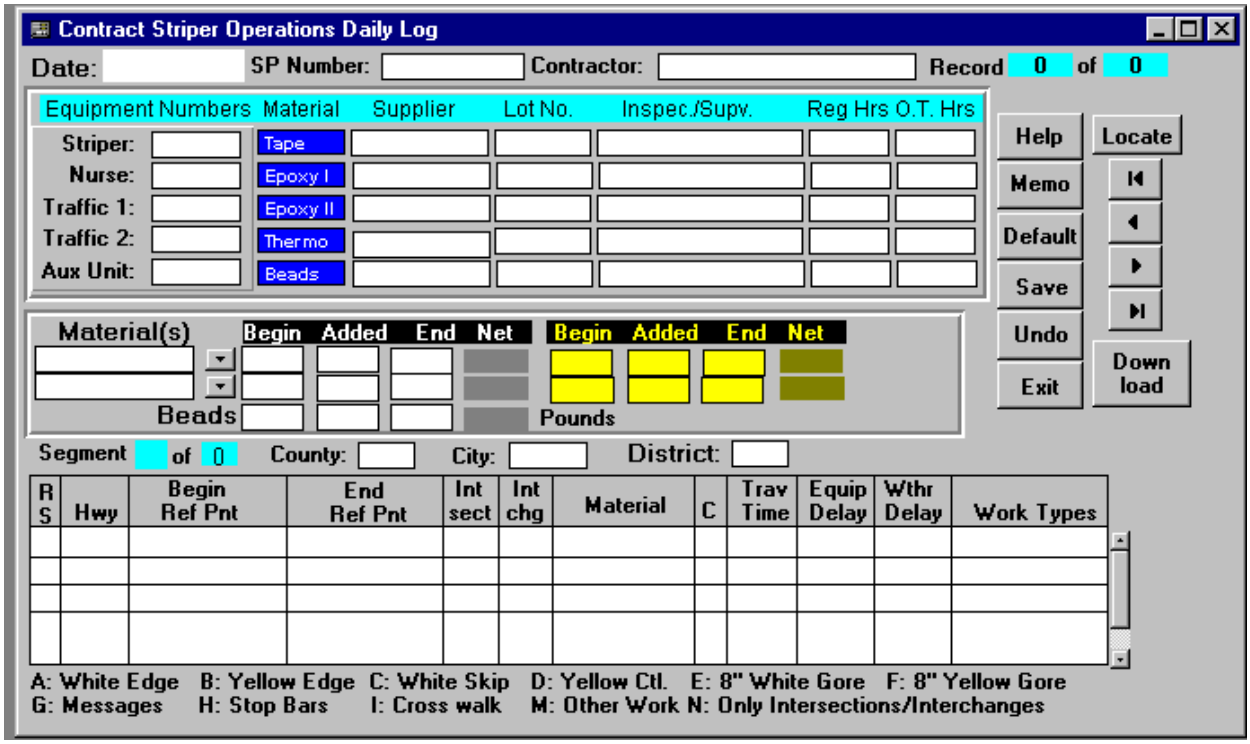

******END OF SECTION******

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SECTION 02750 - CONCRETE FLATWORK

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the construction of concrete flatwork including pavements, curb and gutter, sidewalks, driveways, and aprons.

1.2 SPECIFICATION REFERENCES

A. Minnesota Concrete Flatwork Specifications for Local Government Agencies incorporated by reference.

B. For construction of ADA and PROWAG compliant pedestrian ramps, refer to the most recent version of the following documents:

1. "MnDOT Curb Ramp Guidelines" available at: http://www.dot.state.mn.us/ada/resources.html
2. Public Rights of Way Accessibility Guidance (PROWAG)
3. Standard Pedestrian Ramp Plan Sheets included in this Manual.

1.3 SUBMITTALS

A. No modification to the referenced specification

PART 2 -- PRODUCTS

A. Coarse Aggregate for Concrete – Utilize Table 4, Enhanced Coarse Aggregate Quality Specification, of the referenced specification.

B. Liquid Membrane Curing Compound shall comply with MnDOT 3754 AMS except that the material shall be non-pigmented or provided with dissipating pigment.

C. TRUNCATED DOME SYSTEMS

1. The approved products are those listed on the Mn/DOT web site – No Stainless Steel ramps are allowed.

   http://www.mrr.dot.state.mn.us/materials/ApprovedProducts/appchart.asp#trdomes

2. All domes shall be unpainted.

D. Reinforcing steel is NOT required to be epoxy coated.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Adjacent building surfaces/facades, windows, and doors shall be protected from curing compound overspray and drift due to wind. Removal of any material to the satisfaction of the Engineer will be required for which no additional compensation will be paid.

B. Concrete Sampling and Testing Requirements – Utilize Table 6, Minimum Testing Rates for Curb and Gutter, Sidewalks, and Pavements, of the referenced specification.

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C. Maturity Testing for Compressive Strength will not be required on this project.

D. All unsuitable or organic material shall be removed from below the concrete walk or pavement prior to constructing surface improvements.

E. The Contractor shall furnish and install rebar at locations as indicated within the design details.

F. Form or saw the contraction joints in the concrete sidewalk per the referenced specification.

G. Concrete joints in driveway approaches and apron, walks, and curb and gutter are NOT required to be sealed.

******END OF SECTION******

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SECTION 02776 - BITUMINOUS WALKS AND TRAILS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the construction of bituminous walks and trails as indicated on the plans and/or as specified herein.

1.2 DEFINITIONS

A. Compacted Volume (CV) – The volume of material actually placed as determined by computing the difference between original and final cross-sections by the average end area method.

B. Excavated Volume (EV) – The volume of material actually excavated as determined by computing the difference between original and final cross-sections by the average end area method.

C. Excess Material - Material that is not needed to complete the earthwork balance.

D. Structural Improvements - For the purposes of this specification, structural improvements shall refer sidewalk, trail, or other improvements requiring suitable soil to support the anticipated loadings.

E. Subcut - Excavation performed below the proposed subgrade elevation shown on the plans for the purposes of removing unsuitable material.

F. Subgrade - The top surface of a trail bed upon which the pavement structure (including aggregate base and/or granular subbase) is to be constructed. This is also a general term denoting the soil foundation upon which a proposed improvement is to be placed.

G. Suitable Material - Sand, silty sand or low plasticity clay soils with no organic content. The Engineer shall make the final determination as to what material will be considered suitable.

H. Topsoil - Any soil, generally black in color, containing organic material.

I. Unsuitable Material - Soil with organic content including topsoil, swamp deposits, peat, muck, or other material deemed by the Engineer to be unsuitable for fill or embankment construction.

1.3 SPECIFICATION REFERENCE

A. Section 02310 “Excavation & Embankment – Site Grading” of this Manual, except as modified herein.

B. Section 02330 “Excavation & Embankment – Roadway & Pavement” of this Manual, except as modified herein.

C. Section 02335 “Subgrade Preparation” of this Manual , except as modified herein.

D. Section 02720 “Aggregate Base” of this Manual, except as modified herein.

E. Section 2740 “Plant Mixed Bituminous Surfacing” of this Manual, except as modified herein.

F. Mn/DOT Specification 2105 “Excavation and Embankment” except as modified herein.

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G. For construction of ADA and PROWAG compliant pedestrian ramps and pedestrian facilities, refer to the most recent version of the following documents:

1. "MnDOT Curb Ramp Guidelines" available at: http://www.dot.state.mn.us/ada/resources.html
2. Public Rights of Way Accessibility Guidance (PROWAG)
3. Standard Pedestrian Ramp Plan Sheets included in this Manual.

H. Unless noted otherwise, the provisions in this Section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. See referenced specification sections and details.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Common Excavation

1. The Contractor shall grade the trail in the locations and to the elevations shown on the plans and typical sections and as directed, in accordance with Section 2310 and 02330 of these specifications.
2. Excavated topsoil and suitable material for reuse in the project shall be segregated and stockpiled at a site selected by the Contractor.
3. All excavations shall be kept free of water during the placement of fill.
4. At the end of each day the Contractor shall eliminate surface indentations, including those caused by sheepsfoot rollers and tractor cletes, and roll the surface with a steel wheel or rubber tired roller.
5. Sufficient excavation shall be utilized by the Contractor to replace the soil shrinkage from excavation that occurs through the course of construction handling and compaction. The Contractor shall make his own estimate of the amount of shrinkage that will occur.
6. Topsoil
   (a) Topsoil shall be separated, stockpiled and respread.
   (b) The Contractor shall salvage and stockpile all topsoil removed during the course of the construction. This topsoil shall be used where required for turf establishment as directed by the Engineer.
7. Material suitable for trail backfill shall be segregated and stockpiled at a site selected by the Contractor. Following trail construction, the material shall be placed adjacent to the trail, allowing for a minimum of 4-inches of topsoil.
8. In areas where filling above the existing grade is necessary to establish the final designed elevation, the Contractor shall fully remove the topsoil and organic material to the level of stable underlying sand or clay prior to backfilling with suitable embankment material.
9. All vegetation, topsoil, organic, or other unsuitable materials shall be excavated from the area below the structural improvement. Due to the variability of soils, the depth of the excavation in these areas is expected to vary significantly throughout the site. The excavated area shall be inspected by the geotechnical engineer to verify that all organic material has been removed.
10. All embankment material shall be spread in 6 to 8 inch loose lifts.

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11. The Contractor shall perform a roll test on the subgrade prior to placing any portion of the pavement structure. The roll test shall be performed with a fully-loaded tandem truck. Soils which rut or deflect 1-inch or more shall be corrected by scarifying, drying, and recompacting the soils.

12. Once the subgrade has been test rolled and accepted by the Engineer, no traffic or construction equipment shall be permitted to operate directly on the subgrade without the prior approval of the Engineer. All equipment shall be restricted to operating only in areas where the aggregate base has been installed to its full design depth.

13. Subgrade excavation shall be performed, as directed by the Engineer, for the removal of any unstable soils which may be encountered. Such excavation shall be backfilled with suitable excess common excavation material or granular borrow as directed by the Engineer. If the Contractor proceeds without approval from the Engineer or Owner, all work and material to restore the trail bed to the proper grade shall be at the Contractor's expense.

B. Subgrade Preparation

1. Trail subgrade preparation shall be completed in accordance with Section 02335 of this specification, and as directed.

C. Aggregate Base

1. Aggregate base for trail construction shall be furnished and installed in accordance with Section 02720 of this specification, and as directed.

D. Bituminous Surfacing

1. The Contractor is required to use the self-propelled pneumatic tire roller as an intermediate roller on the wearing courses.

2. The bituminous surfacing shall be constructed with maximum deviation of plus or minus 1/4-inch from the planned compacted thickness.

3. The contact surfaces of all fixed structures, the edge of all in-place bituminous shall be given a uniform coating of Liquid Asphalt or Emulsified Asphalt before placing the adjoining mixture. The bituminous material shall be applied by methods that will ensure uniform coating and in no case shall the application be excessive.

4. Cut the adjacent asphalt surface prior to construction of the bituminous surface course to obtain a clean, vertical, solid edge.

5. Compaction of all bituminous mixtures shall be by the Ordinary Compaction Method.

3.2 SOURCE QUALITY CONTROL

A. The bituminous mix shall be designed using Contractor Trial Mix Designs. A current Mn/DOT mix design may be accepted provided it represents the aggregate source and bituminous plant being used for the project, and is approved by the Engineer. No bituminous mixture shall be placed without an approved mix design.

B. Source quality control for aggregate base shall be in accordance with Section 02720 of this specification.

3.3 FIELD QUALITY CONTROL

A. Field quality control for subgrade preparation shall be in accordance with Section 02335 of this specification.

B. Field quality control for aggregate base shall be in accordance with Section 02720 of this specification.

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C. Field quality control for bituminous surfacing shall be in accordance with Section 02740 of this specification.

D. Testing:

1. Refer to Section 02740 – Plant Mixed Bituminous Surfacing

******END OF SECTION******

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SECTION 02777 – BOARDWALKS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the construction of boardwalks as indicated on the drawings or as specified herein.

1.2 SPECIFICATIONS REFERENCES

A. Mn/DOT Specification Section 2403 shall apply to the construction of boardwalks except as modified herein.

B. Current City Requirements for Building Code.

C. American Wood Preservers Association.

D. ASTM.

1.3 SUBMITTALS

A. Three copies of all drawings and specifications prepared by a licensed engineer registered in the State of Minnesota shall be submitted for review and approval of the City Engineer and Public Works Director.

B. Geotechnical Soils Investigation Report, two (2) copies.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Structural Lumber

1. All structural lumber shall be Southern Yellow Pine and shall be graded under the Southern Pine Inspection Bureau (SPIB) rules.

   (a) All bents, stringers, curbing, curb block, guide rail cap, and rails shall be S4S (surfaced four sides) and shall have the appropriate grade stamp.

2. All lumber, piles, and timbers shall be pressure treated with chromium copper arsenate (CCA) type C in accordance with the American Wood Preservers Association (AWPA) Standard PS-90 and A2-88. All timers and lumber shall be pressure impregnated under AWPA Standards C1-90, C2-90, C14-90, and C18-90.

When possible, lumber and timbers shall be kiln dried after treatment to 19% or less moisture control.

B. Wood Decking

1. Wood decking shall be nominal 2” x (minimal) timber decking. Wood type shall be pressure treated Southern Pine with a minimum allowable fiber stress in binding and minimum modules of elasticity as specified.

C. Abutments

1. Abutment material, size, and dimensions shall be as specified by the design engineer.

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D. Guiderail

1. All guiderail material is to be nominal 2" material or greater, kiln dried after treatment to 19% or less moisture control, No. 1 grade dense.
2. All decks exceeding 42 inches in elevation shall have a guiderail installed.

E. Structural Steel and Miscellaneous Metals

1. All structural bolts and all associated washers and nuts shall be the size and diameter as specified by the design engineer and shall be hot dipped galvanized per A.A.S.H.T.O. specification #M-232, or stainless steel.

F. Construction Matting

1. Temporary construction matting must be used over bridge decking to protect the bridge deck and any wetlands during construction.

PART 3 -- STRUCTURAL REQUIREMENTS

G. Heavy duty boardwalk

1. All heavy duty boardwalk shall be designed for a minimum uniform load of 5 tons GVW.
2. All heavy duty boardwalk decking shall be a minimum of ten (10) feet in width between any deck curbing.

H. Pedestrian boardwalk

1. All pedestrian boardwalk shall be designed for a superimposed load of one (1) ton.
2. All pedestrian boardwalk decking shall be a minimum of eight (8) feet in width between any deck curbing.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. All boardwalks shall be constructed to satisfy all American Disability Association (ADA) requirements. Such requirements include but are not limited to line, grade, and elevation.

B. All disturbed areas due to boardwalk construction shall be restored to their original condition or better after construction.

C. All boardwalk construction shall be subject to the review and approval of the City Engineer and Public Works Director.

****** END OF SECTION ******

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SECTION 02782 - CONCRETE PAVERS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the proper installation of concrete pavers in a crosswalk configuration and as insets in the sidewalks as shown on the drawings, as specified herein.

1.2 SPECIFICATION REFERENCES

A. All work shall be done according to practices set forth in the Concrete Masonry Handbook

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.3 SUBMITTALS

A. The Contractor shall submit 3 sample pavers to the City Engineer for approval prior to actually placing the order together with the name of the manufacturer, the model or style of the particular paver, and the technical specification for the paver.

B. Once the order is placed, the Contractor shall submit to the Owner the lot number(s) of the pavers to be shipped so the Owner can order a quantity for repair and replacement.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Concrete paver units shall comply with the following:

1. Size: Approximately 4 x 8" with 1/16" tolerance in all directions. Pavers in sidewalk areas shall be 2-5/8” (6cm) nominal thickness.
2. Style: Holland Style/ Holland Stone
3. Color/ Color Scheme:
   (a) To be Approved by City Engineer and Owner
4. Technical Performance:
   (a) Compressive Strength: 8,000 p.s.i.
   (b) Density: 2,500 KG/cubic meter
   (c) Absorption: Less than five percent (5%)
   (d) Finish: Manufacturer's standard, close knit and void free.
5. Manufacturers:
   (a) Borgert Products, Inc.
      1. 8646 Ridgewood Road
         St. Joseph, MN 56374
         800.622.4952
   (b) Approved Equal
6. The setting bed shall consist of three-quarter inches (3/4”) clean washed sand per plans.

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PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The paver installer shall examine areas and conditions under which concrete pavers are to be installed. The Contractor shall notify the Engineer, in writing, of conditions detrimental to proper and timely completion of the work. The Contractor shall not proceed with the work until unsatisfactory conditions have been corrected in an acceptable manner, unless otherwise directed by the Engineer.

B. The Contractor shall protect materials during storage and construction against wetting by rain, snow or ground water and against spoilage or intermixture with earth or other types of materials.

C. The Contractor shall pre-compact the setting bed with a roller or vibrating plate. Then rescreed to loosen the top 1/2 inch to aid the bedding of the concrete bricks during the compaction of the final laid surface. Keep the setting bed approximately 1/4 inch higher to allow for final consolidation under the paver units.

D. The pavers shall be laid tight in the indicated pattern on the screeded sand. Units are brought forward to the working edge of the pavement over the already laid bricks, so that the layers are always working on a hard surface. Screeded sand should never be walked upon. Tight joints shall be maintained with all sides in firm contact. The pattern shall be checked with line every several feet and corrected if necessary.

E. Surface shall be swept with clean dry sand. Vibrate bricks into bedding with plate vibrator. Sweep surface again and repeat vibration.

F. Cut paver units with motor-driven saw designed to cut masonry with clean, sharp, unchipped edges. Cut units are required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible.

G. The Contractor shall protect all paved areas from damage until work is turned over to Owner. Remove and replace pavers which are loose, chipped, broken, stained or otherwise damaged, or if units do not match adjoining units as intended. Provide new units to match adjoining units and install so that there is no evidence of replacement.

******END OF SECTION******

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SECTION 02810 - IRRIGATION SYSTEM

PART 1 -- GENERAL

1.1 DESCRIPTION

A. Design, obtain proper approvals, furnish and install an underground irrigation system as shown on Project Drawings and as specified herein.

B. Design, furnish, install (including trenching & backfilling) and service a complete, automatic underground irrigation system and downstream of the backflow preventer, providing 100% watering coverage of lawns and planted areas within the property limits shown on the Project Drawings. The system design shall be capable of watering the entire property designated within an 8-hour period. The system shall be capable of expansion. Instruct the City, in person and in written forms to the proper operation and maintenance of the total system. Winterize the system the first fall.

1.2 SUBMITTALS

A. Following acceptance of proposal, provide the following information to the City Engineer for review and approval.

1. Submit complete design drawings showing 100% head to head coverage of the designated area with pipe layout and sizes, sprinkler head locations and effective watering radii, drip lines, controller location, controller panel size, and quick coupler valves.

2. Design calculations showing source size in GPM, PSI and pressure losses to the farthest zone. All calculations and design shall be based on a maximum flow rate of 4’ per second.

3. Manufacturer’s product data shall be included as part of the design submittal.

(a) Project Submittals: All valves, sprinkler heads, system piping, controller equipment, and other system components shall be submitted to the City Engineer for approval.

B. Record Drawings

1. Record Drawings of the completed system clearly marking pipe sizes, conduits, zones, valves, sprinkler head locations, drip lines, and all other components of the system shall be submitted. The “as-built” drawings shall include the name, address and phone number of the installer. Two (2) copies of large scale (22”X34” or 24”x36”) prints, three (3) copies of reduced size (11”x17”), and electronic CAD files shall be submitted of the completed system.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and have at least five continuous years experienced in the work of this section.

1.4 PERMITS

A. The Contractor shall procure all permits, bonds, and licenses, except as otherwise indicated, pay all charges and fees and give all notices necessary and incident to the proper and lawful prosecution of the work. He shall also obtain and supply the Owner all certificates required to show that the work has been performed in accordance with the building, plumbing, other authorities, the Board of Fire Underwriter’s, or such other like bodies, as the specifications may require directly or by implication.

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B. When the work performed affects the property of facilities of public utility or other corporations or of private persons, he shall obtain and supply from such corporations or person if required, statements that the work has been performed satisfactorily so far as their interests are affected and that all claims therefore have been settled by the Contractor.

C. The entire installation shall comply with all local and state laws and ordinances, and with all the established codes applicable thereto. The Contractor shall take out all required permits, arrange all necessary inspections and shall pay any fees or expenses in conjunction with the work under this contract.

PART 2 -- PRODUCTS

2.1 MANUFACTURERS

A. Equipment manufactured by Toro, Rainbird, Nelson, Hunter, or other established irrigation equipment manufacturers may be used except where specifically indicated. Alternate products may be allowed. Obtain approval of the City Engineer for alternate products.

2.2 MATERIALS

A. All materials shall be new, of first class quality and designed for the intended use.

B. The pressurized irrigation water supply main shall be 160 PSI, SDR 26 PVC piping with a minimum diameter of 1½".

C. Zone valves shall be properly sized, 24 volt, and electrically operated with a manual operation feature. Zone valves shall be housed valve boxes that provide adequate space for valve servicing without excavation with the zone number marked on the cover. Valve box lids must be bolted down with stainless steel bolts.

D. Lateral zone irrigation piping shall be 100 PSI, NSF rated polyethylene piping, assembled with barbed nylon fittings and two stainless steel clamps ½" per side spaced ½ ", screw type. No crimped or compression allowed. Locating wire #12 shall be installed along all pipes.

E. The controller (clock) shall be a dual program controller and shall fully incorporate irrigation system. Controller shall be equipped with a rain sensor and a remote controller.

F. The Controller box shall be sufficiently sized to accommodate a half sized set of "as-builts".

G. Brass quick coupler valves shall be ¾", each with a coupler key, each in a valve box with lockable cover.

H. Piping under pavement shall be installed in 3" Schedule 40 PVC sleeves.

I. Control wire shall be sheathed, 13 #14 wire minimum, meeting Underwriters Laboratory approval for direct burial with waterproof connections.

J. Sprinkler heads shall be pop-up, gear driven, full or part circle rotary heads or pop-up spray heads. Six (6) extra heads of each type shall be provided to the owner.

K. Backflow Preventer: All systems shall include a backflow preventer.

L. Lockable cabinets for controller and supply the owner with 10 sets of keys for controller's lock.

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PART 3 -- EXECUTION

3.1 SYSTEM DESIGN

A. Design system and prepare drawing and specifications for review and installation. Drawings shall show locations and types of all sprinkler heads and equipment along with information as to watering area of each component, pipe locations and sizing, precipitation rates and flow rates. Specifications shall indicate detailed information for all products and maintenance procedures. Submit system design for review and approval. See Submittals for required information.

3.2 SYSTEM INSTALLATION

A. A copy of the approved drawing shall be on-site during any work.

B. All equipment shall be located flagged prior to any work.

C. Gopher State One Call (GSOC) shall have been notified 48 hours prior to work and the GSOC ticket number shall be on-site and available to all workers during all work. Contractor is responsible for all utility locating costs.

D. Locations of equipment and/or any changes shall be approved by the Owner prior to work.

E. All materials shall be installed in a workman-like manner in accordance with the approved drawings and specifications.

F. Piping shall be securely capped at all times prior to final assembly of fittings and equipment.

G. Control wire shall be installed with the pressure main with loops at each valve location. Advise electrician on what type of wiring that will be needed. Wiring installation shall comply with all state and local codes.

H. PVC pressure main piping shall be assembled and allowed to cure in dry conditions when the air temperature is above 40 degrees F, in strict accordance with the manufacturer's recommendations prior to testing.

I. Install the pressure main in an open trench, 18" deep, free of rock, stones or rubble.

J. Air test PVC main piping according to manufacturer's recommendations. If leaks are detected, they shall be repaired and the line re-tested until satisfactory. The Owner must verify a successful air test.

K. Following a successful air-test, backfill the main pipe trench in 6" lifts with suitable clean fill and compact to the point of no subsidence. Pulling PVC pipe will not be permitted.

L. Install the proper size zone piping to a minimum depth 10" according to the drawing. Pulling pipe will be permitted.

M. Install valves and valve boxes. Provide waterproof connections where control wires attach to valve. Center valve in an upright position within the valve box. Valve boxes shall be free of debris and provide free drainage of water. Install two blocks under valve boxes to prevent settling.

N. Prior to installing sprinkler heads, flush lateral lines with a full head of water.

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O. Install the sprinkler heads and equipment. Heads shall be set plumb to within 1/16th of an inch and level to the finish grade and be readjusted and changed as directed after lawn areas are completed to assure proper operation. Location the heads, piping, and valves shall be marked to avoid damage by others during completion of the landscaping work.

P. Securely mount the controller at the approved location. The Controller box shall be sufficiently sized to accommodate a half sized set of "as-builts".

3.3 SYSTEM OPERATION

A. Demonstrate to the City Engineer and the City that the system meets 100% coverage requirements and that the automatic controls function properly. Any equipment which does not meet this coverage shall be promptly relocated at the direction of the Owner at the irrigation contractor's expense.

B. Furnish "as-built" drawings with the name, address and phone number of this installer which identifies and locates all sizing, piping and equipment. See Submittals for required information.

C. A plastic covered, mounted copy of the "as-built" drawing shall be installed near the controller. The Controller box shall be sufficiently sized to accommodate a half sized set of "as-builts".

D. Upon completion of the job, the contractor shall clean up all debris caused by his work and leave the job in a neat and clean condition. All debris from the job shall be taken away from the premises.

E. After completion and testing of the system, instruct the Owner's Public Works Personnel as to the proper operation and maintenance of the system. The contractor shall also provide the owner with two copies of the construction and maintenance manuals on all equipment installed and a manufacturer's parts catalogue.

F. This system shall be fully guaranteed for a period of one year after acceptance by the Owner. This installer shall promptly repair or replace any part of this system, including all materials and/or workmanship, which fail to perform and function correctly without cost to Owner. Guarantee shall include a five (5) year warranty against manufacturing defects of all sprinklers, automatic valves, and controllers.

G. Prior to the first winter after acceptance and no later than October 15, the installer shall winterize the system using compressed air.

******END OF SECTION******

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SECTION 02830 - MODULAR BLOCK RETAINING WALL

PART 1 -- GENERAL

1.1 SUMMARY

A. The work under this section of these specifications includes, or is incidental to, the design, furnishing, and constructing a modular block retaining wall as indicated on the drawings or as specified herein. The work shall include the footings, drainage, the modular block, anchoring devices, railings, specified accessories and related items of construction.

B. Geosynthetic wall reinforcement (if required) shall be designed as part of the modular block retaining wall system and shall be certified by the designer of the retaining wall system that it meets the necessary strength and durability criteria for the application.

1.2 SPECIFICATION REFERENCE

A. Mn/DOT Standard Plans 5-297.640, 5-297.641, 5-297.643, 5-297.644, and 5-297.645 as applicable.

B. Unless otherwise noted, the provisions in this Section are in addition to the referenced specifications.

C. In addition, all work and equipment shall conform to the most current applicable OSHA standards.

1.3 SUBMITTALS

A. Product Data: Material description and installation instructions for each manufactured product specified.

B. Shop Drawings: Retaining wall system design, including wall elevation views, geosynthetic reinforcement layout, pertinent details, and drainage provisions. The shop drawings shall be signed by a professional engineer licensed in the State of Minnesota.

C. Design:

1. The successful bidder shall submit detailed design drawings and computations for the construction of the modular block retaining wall. The drawings and computations shall include, but not be limited to, footing / foundation drawings, wall details, anchoring requirements, compaction requirements, subdrainage details, railing details, re-bar schedules and other drawings and details that are appropriate for the successful completion of the project.
2. Included shall be a typical section detailing excavation limits, geotextile locations, block embedments, leveling pad dimensions, backfill, etc. Include as many sections and other views necessary for the construction and inspection of the wall. The information on embedment, geotextile locations, and geotextile lengths as they relate to wall heights may be shown in tabular form. Also included shall be pertinent information on the individual blocks, the geotextile material and compaction requirements.
3. All drawings submitted by the Contractor shall be certified and signed by a Professional Engineer licensed in the State of Minnesota. Each plan sheet shall clearly identify the name of the responsible engineering firm and the name of the person certifying the plan.
4. Mn/DOT Standards Plans 5-297.640, 5-297.641, 5-297.643, 5-297.644 and 5-297.645 as applicable.
5. Analysis of global stability must be addressed and incorporated into the design for installations involving multiple retaining walls.

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D. Samples

1. Furnish samples showing standard color selections for the block type being supplied.
2. Furnish one unit in the color and face pattern specified, if requested.
3. Furnish 12-inch square or larger piece of the geosynthetic reinforcement specified.

E. Test Reports: Independent laboratory reports stating moisture absorption and compressive strength properties of the concrete retaining wall units meet the Project Specifications when tested in accordance with ASTM C140, Sections 6, 8 and 9.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. CONCRETE RETAINING WALL UNITS:

1. Physical Requirements:

(a) The units shall conform to ASTM C1372, except that:

1. The minimum compressive strength requirements shall be 38 Mpa (5500 psi) for any individual unit and 40 Mpa (5800 psi) for the average of 3 units.
2. The freeze/thaw durability of wall units tested in accordance with ASTM C 1262 in a 3% saline solution shall be the minimum of the following:
    i. The weight loss of each of five test specimens at the conclusion of 90 cycles shall not exceed 1% of its initial weight; or
    ii. The weight loss of 4 out of 5 test specimens at the conclusion of 100 cycles shall not exceed 1.5% of its initial weight, with the maximum allowable weight loss for the 5th specimen to not exceed 10%.
3. The freeze/thaw durability of cap units test tested in accordance with ASTM C 1262 in a 3% saline solution shall be the minimum of the following:
    i. The weight loss of each of five test specimens at the conclusion of 40 cycles shall not exceed 1% of its initial weight; or
    ii. The weight loss of 4 out of 5 test specimens at the conclusion of 50 cycles shall not exceed 1.5% of its initial weight, with the maximum allowable weight loss for the 5th specimen not to exceed 10%.
4. Cap units must meet the requirements of (a) and (c) and have a top surface sloped at minimum of 1 mm fall per 10 mm run (1 inch fall per 10 inches run) front to back or be crowned at the center.
5. ASTM C 1262 test results shall be recorded and reported in 10 cycle intervals
6. It is the intention of this testing that 100% of the wall units and cap units meet the weight loss requirements for (b1) and (c1) respectively, or that a minimum of 80% of the wall units and cap units tested meet the weight loss requirements for (b2) and (c2) respectively. If a manufacturer chooses to increase the sample size tested beyond the 5 units required for each block type, these percentages will still apply to the sample size chosen (i.e. if a sample size of 7 blocks is tested a minimum of 6 must meet the weight loss requirement of (b2) or (c2), if a sample size of 10 blocks is tested a minimum of 8 must meet the weight loss requirement).
7. The minimum required sampling rate for laboratory testing is one sample set per 10,000 units or fraction thereof, with a minimum of one sample per product type per contract. Sample size = 5 whole units per block type. Wall units and cap units are considered separate block types.

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8. Sampling and testing shall conform to ASTM C 140, except that: Section 6.2.4 shall be deleted and replaced with:

"The specimens shall be coupons cut from a finished side or back shell of each unit and sawn to remove any face shell projections. The coupon size shall have a height to thickness ratio of 2 to 1 before capping and a length to thickness ratio of 4 to 1. The coupon shall be cut from the unit such that the coupon height dimension is in the same direction as the unit height dimension. Compressive testing of full size units will not be permitted. The compressive strength of the coupon shall be assumed to represent the net area compressive strength of the whole unit."

9. Cap units and wall units shall be sampled and tested as separate block types.

2. Unit Face Area: 1.0 square feet.
3. Color: Selected by the Owner/City from manufacturer's full range of standard colors.
4. Face Pattern Geometry: Beveled.
5. Texture: Split Rock Face.
6. Batter: 1V:8H
7. Acceptable Products: (All products shall be listed on MnDOT's Approved Products list)
   (a) Diamond Pro as manufactured by Anchor Block Company.
   (b) Classic 8 as manufactured by Rockwood Retaining Walls.
   (c) Square Foot as manufactured by Versa-Lock Retaining Walls.
   (d) Standard Unit as manufactured by Keystone Retaining Walls

B. SURFACE SEALER

1. Surface sealers shall meet the requirements on file in the Mn/DOT Concrete Engineering Unit. The list may also be viewed on the Mn/DOT website at:

   www.mrr.dot.state.mn.us/pavement/concrete/products.asp

C. GEOSYNTHETIC WALL REINFORCEMENT

1. Polyester fiber geogrid or geotextile, or polypropylene woven geotextile, as shown on the plan or as recommended by the retaining wall block manufacturer.

D. SUB-SURFACE DRAINS

1. Perforated PVC drain pipe, SDR35 (ASTM D3034)
2. Perforated PVC drain pipe, A-2000 (ASTM D2412).
3. Perforated corrugated polyethylene drainage tubing, PE (ASTM D3350)

E. GRANULAR MATERIALS

1. The drainage aggregate shall conform to the requirements of Mn/DOT 3149-2H for coarse filter aggregate.
2. The granular backfill shall be select granular borrow conforming to Mn/DOT Spec 3149 modified as follows:
   (a) Pit-run or crusher-run material that is graded from coarse to fine such that 100% of the material must pass the 2" sieve and that the ratio of the proportion passing the #200 sieve divided by the portion passing the 1" sieve (#200/1" ratio) may not exceed 10% by mass.

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F. CONSTRUCTION ADHESIVE

1. Exterior grade adhesive as recommended by the retaining wall unit manufacturer or where shown on the plans.

2.2 SOURCE QUALITY CONTROL

A. Sampling and testing shall be performed by the modular block supplier in accordance with ASTM C1372.

PART 3 -- EXECUTION

3.1 RETAINING WALL ERECTION

A. General: Erect units in accordance with manufacturer's instructions and recommendations, and as specified herein.

B. Place first course of concrete wall units on the prepared base material. Check units for level and alignment. Maintain the same elevation at the top of each unit within each section of the base course.

C. Ensure that foundation units are in full contact with natural or compacted soil base.

D. Place concrete wall units side-by-side for full length of wall alignment. Alignment may be done by using a string line measured from the back of the block. Gaps are not allowed between the foundation concrete wall units.

E. Place drainage aggregate (12 inches, minimum unless otherwise shown on the drawings) between, and directly behind the concrete wall units. Fill voids in retaining wall units with drainage aggregate. Provide a drainage zone behind the wall units to within 9 inches of the final grade. Cap the backfill and drainage aggregate zone with 9 inches of impervious material.

F. Install drainage pipe at the lowest elevation possible, to maintain gravity flow of water to outside of the reinforced zone. Slope the main collection drainage pipe, located just behind the concrete retaining wall units, 2 percent (minimum) to provide gravity flow to the daylighted areas. Daylight the main collection drainage pipe through the face of the wall, and/or to an appropriate location away from the wall system at each low point or at 50 foot (maximum) intervals along the wall. Alternately, the drainage pipe can be connected to a storm sewer system at 50 foot (maximum) intervals.

G. Remove excess fill from top of units and install next course. Ensure drainage aggregate and backfill are compacted before installation of next course.

H. Check each course for level and alignment. Adjust units as necessary to maintain level and alignment prior to proceeding with each additional course.

I. Install each succeeding course. Backfill as each course is completed. Pull the units forward until the locating surface of the unit contacts the locating surface of the units in the preceding course. Interlock wall segments that meet at corners by overlapping successive courses. Attach concrete retaining wall units at exterior corners with adhesive specified.

J. Install geosynthetic reinforcement in accordance with geosynthetic manufacturer's recommendations and the shop drawings.

1. Orient geosynthetic reinforcement with the highest strength axis perpendicular to the wall face.
2. Prior to geosynthetic reinforcement placement, place the backfill and compact to the elevation of the top of the wall units at the elevation of the geosynthetic reinforcement.
3. Place geosynthetic reinforcement at the elevations and to the lengths shown on the drawings.

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4. Lay geosynthetic reinforcement horizontally on top of the concrete retaining wall units and the compacted backfill soils. Place the geosynthetic reinforcement within one inch of the face of the concrete retaining wall units. Place the next course of concrete retaining wall units on top of the geosynthetic reinforcement.

5. The geosynthetic reinforcement shall be in tension and free from wrinkles prior to placement of the backfill soils. Pull geosynthetic reinforcement hand-taut and secure in place with staples, stakes, or by hand-tensioning until the geosynthetic reinforcement is covered by 6 inches of loose fill.

6. The geosynthetic reinforcements shall be continuous throughout their embedment lengths. Splices in the geosynthetic reinforcement strength direction are not allowed.

7. Do not operate tracked construction equipment directly on the geosynthetic reinforcement.

8. At least 6 inches of compacted backfill soil is required prior to operation of tracked vehicles over the geosynthetic reinforcement. Keep turning of tracked construction equipment to a minimum.

9. Rubber-tired equipment may pass over the geosynthetic reinforcement at speeds of less than 5 miles per hour. Turning of rubber-tired equipment is not allowed on the geosynthetic reinforcement.

3.2 BACKFILL PLACEMENT

A. Unless otherwise shown on the plans, backfill beyond the drainage aggregate within reinforcement zone shall be granular backfill as specified herein.

B. Place reinforced backfill, spread and compact in a manner that will minimize slack in the reinforcement.

C. Place fill within the reinforced zone and compact in lifts not exceeding 6 to 8 inches (loose thickness) where hand-operated compaction equipment is used, and not exceeding 12 inches (loose thickness) where heavy, self-propelled compaction equipment is used.

D. Only lightweight hand-operated compaction equipment is allowed within 4 feet of the back of the retaining wall units. If the specified compaction cannot be achieved within 4 feet of the back of the retaining wall units, replace the reinforced soil in this zone with drainage aggregate material.

E. Compaction testing shall be done in accordance with ASTM D1556 or ASTM D2922.

F. Minimum Compaction Requirements for Fill Placed in the Reinforced Zone :

1. The minimum compaction requirement shall be determined by the project geotechnical engineer testing the compaction. At no time shall the soil compaction requirements be less than 95 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)] for the entire wall height

2. Moisture Content: Within 2 percentage points of the optimum moisture content for all wall heights.

3. These specifications may be changed based on recommendations by the Project geotechnical engineer.

G. At the end of each day's operation, slope the last level of compacted backfill away from the interior (concealed) face of the wall to direct surface water runoff away from the wall face.

H. The Contractor is responsible for ensuring that the finished site drainage is directed away from the retaining wall system.

I. In addition, the Contractor is responsible for ensuring that surface water runoff from adjacent construction areas is not allowed to enter the retaining wall area of the construction site.

3.3 CAP UNIT INSTALLATION

A. Apply adhesive to the top surface of the unit below and place the cap unit into desired position.

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B. Cut cap units as necessary to obtain the proper fit.

C. Backfill and compact to top of cap unit.

3.4 SITE CONSTRUCTION TOLERANCES

A. Vertical Alignment: Plus or minus 1 inch over any 10-foot distance, with a maximum differential of 2 inches over the length of the wall.

B. Horizontal Location Control From Plan

1. Straight Lines: Plus or minus 1 inch over any 10-foot distance.
2. Corner and Radius Locations: Plus or minus 12 inches from theoretical location shown on plan.
3. Curves and Serpentine Radii: Plus or minus 12 inches from theoretical location shown on plan.

C. Immediate Post Construction Wall Batter: Within 2 degrees of the design batter, negative batter unacceptable.

D. Bulging: Plus or minus 1-1/4 inches over any 10-foot distance.

E. Maximum horizontal gap between erected blocks: ½ inch

3.5 ADJUSTING AND CLEANING

A. Replace damaged units with new units as the work progresses.

B. Remove debris caused by wall construction and leave adjacent paved areas broom clean.

C. All work shall be done in accordance with the approved drawings.

3.6 SEALER

A. Segmental masonry retaining wall surface sealing shall consist of preparation, furnishing and applying the surface sealer to the top, exposed front face, and backside of the upper three courses of all walls.

B. Due to the potentially hazardous ingredients contained in sealer formulations extreme care must be exercised in their handling and use, and the manufacturer's recommendations shall be closely followed.

C. The Contractor shall comply with the manufacturer's written instructions for preparing, handling and applying the surface sealer.

D. The surface to be treated shall receive a light water-blast to the extent that the surface is clean and free of oils.

E. Before the surface sealer is applied the surface to be sealed shall be dry and free of all dust, debris, and frost.

F. Surface sealers shall be applied at the heaviest application rate specified by the manufacturer.

G. **Two coats of surface sealer shall be applied.**

****** END OF SECTION ******

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SECTION 02890 - TRAFFIC SIGNS

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools equipment and performances of all work and services necessary or incidental to project signing as indicated on the drawings or as specified herein.

1.2 SUBMITTALS

A. Contractor shall submit literature regarding signing materials to be used for the project which includes the type of sheeting to be used and life expectancy of the signage sheeting.

1.3 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2564 shall apply to the construction of project signing, except as modified herein.

B. Mn/DOT Specification Section 3401 shall apply to the construction of project signing, except as modified herein.

C. The current "Minnesota Manual for Uniform Traffic Control Devices" shall apply unless modified herein. http://www.dot.state.mn.us/trafficeng/publ/mutcd/index.html

D. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Sign Panels

1. All signing materials shall conform to the requirements of Mn/DOT Specification 3352 and all Supplemental Specifications thereto.
2. Sign sheeting shall be type IX, 3M Diamond Grade VIP or approved equal.
3. Plates shall be 0.080 aluminum. (Plates larger than 30 inches shall be 0.100 aluminum)
4. All signs shall include Nylon washers as shown on the detail in the plan.
5. All signs shall be as specified in the details.

B. Posts – Traffic Signs & Street Signs

1. Posts for traffic signs shall be 2"x2", 12 gauge Telespar posts as shown in the details. All posts shall be listed on MnDOT's Approved Products list.
2. Base posts shall be 2-1/4" x 2-1/4", 48 inches in length, 12 gauge Telespar posts as shown in the detail.
3. Posts shall have 7/16 inch diameter mounting holes, 1' on center running the entire length of the post.

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C. Street Name Signs

1. Plates shall be single faced, 9" flat .080 aluminum with Type IX, 3M Diamond Grade VIP reflective sheeting. Plates shall be a minimum of 24" and a maximum of 48" in length. Plate border shall be white.

2. Letters shall be 6" series B, uppercased, white on green background.

3. The "SF" portion of the 'City of St. Francis' logo shall be installed on all street sign panels to the left of the street name.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The lower portion of the post shall be air-driven into the ground. Where posts must be placed in concrete or bituminous, the Contractor shall core the area without damaging the remainder of the surface. At core location, a PVC tube at least four inches in diameter shall be inserted and the post air driven from that point. The area shall then be patched.

B. The Contractor shall construct the posts and signs at the locations indicated on the drawings and shall verify all sign locations with the City Engineer prior to installation.

C. Contractor shall date all signs with installation month and year on the side opposite the sheeting for retroreflectivity purposes. The sign shall be stamped on the opposite side of the sheeting with the manufacturer's retroreflectivity warranty.

******END OF SECTION******

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SECTION 02920 - TURF RESTORATION

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to turf restoration as indicated on the drawings or as specified herein.

B. A variety of different seeding mixtures may be utilized on this project. The Contractor shall refer to the plan for the locations of the different turf establishment areas.

C. Temporary seeding may be necessary during construction in erosion sensitive areas. The Contractor shall do temporary seeding work as specified herein or as directed by the City Engineer.

D. Rapid Stabilization - This stabilization process is directed at areas of a critical or unique characteristic to prevent the separation of soil particles from the soil surface. This work may be required at anytime during the contract on small areas that may or may not be accessible with normal equipment.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2575 - Controlling Erosion and Establishing Vegetation

B. Mn/DOT Specification Section 3876 – Seed

C. Mn/DOT Specification Section 3878 - Sod

D. Mn/DOT Technical Memorandum No. 02-23-ENV-05 shall apply to additional seed mixtures.

E. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Seeding Items

1. The seed mixtures to be used shall be shown on the plans. In general, all application rates for mixes, except oats, are 150% the rate in Mn/DOT 2575.3 Table 2575-2 and 3876.2 Table 3876-5.
2. Seeding with the various seed mixture designations shall utilize the following combinations of seed, fertilizer and mulch:
   (a) Type 1 mulch shall consist of clean straw with no pasture hay.
   (b) Temporary seeding, if required, shall use Seed Mixture – 110B Oats.
   (c) Fertilizer shall be 22-5-10. (Phosphorous use in fertilizer for first establishment and the first year is allowed unless limited or prohibited by local ordinances.)

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APPLICATION RATES						
		FERTILIZER		MULCH (**)		
Seed Mix *	Rate	Type	Rate	Type	Rate	Typical Use
	lb/AC		lb/AC		ton/AC	
240SR (Sandy Roadside)	112.5	22-5-10	200	1	2	Sand, loamy sand, sandy loam, sandy clay loam.
250GR (General Roadside)	105	22-5-10	200	1	2	All.
260CT (Commercial Turf)	150	22-5-10	200	1	2	Good topsoils, loams.
270RT (Residential Turf)	180	22-5-10	200	1	2	Good topsoils, loams.
280AG (Agricultural Areas)	75	22-5-10	200	1	2	Clay, clay loam, loam, silty clay, silty clay loam.
310NWT (Native Wet Tall)	123	22-5-10	200	1	2	Clay, clay loam, loam, silty clay, silty clay loam, silty loam, silt.
325 (Prairie Sedge Meadow)	126	22-5-10	400	1	2	Native sedge/prairie meadow mix. Reaches a height of 36 to 48 inches. Developed for use on hydric soils and for wetland restoration. Sedges, meadow grasses, and meadow forbs are best installed by broadcast method, separate from main grass mix, in early spring or fall if possible. Many of these species require pre-germination treatments.
110B (Oats)	100	22-5-10	200	1	2	All, temporary seeding

* Seed Mixtures used for projects shall be site specific. All areas maintained by the City of St. Francis shall include seed mixture 250, 260 or 270 as approved by the City Engineer.

** Erosion Control Blanket or Hydromulch may be required in areas to satisfy SWPPP requirements.

3. Seed Mixtures:

   (a) The application rates for Mn/DOT seed mixes shall be at 1.5 times that specified in the referenced specification.

   (b) The application rates for BWSR seed mixes shall be at 1.5 times that specified in the referenced specification.

B. Seed Standards

1. Seed must be obtained from as close to the project site as possible with an emphasis on obtaining seed from the local ecotype region.
2. Source identified (Yellow tag) seed through the Minnesota Crop Improvement Association (MCIA) unless otherwise approved by the Engineer.
3. All seed shall be supplied as pure-live seed (PLS)
4. All seed and seed mixes shall conform to State seed requirements for noxious weed content.
5. All seed and seed mixes shall conform to State labeling requirements. For all species in the mix, the label and or invoice shall include the county of origin, and if from Canada, the province.

C. Sodding Items

1. The sod to be used shall be Type A - Lawn Sod.

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D. Erosion Control Blanket

1. A variety of erosion blanket materials are called out in the details. Critical areas may include erosion blanket or turf reinforcement to provide adequate erosion control. Category of Erosion Control Blanket may vary due to site conditions.
2. All areas where maintenance is required, including residential areas, park areas, outlots, pond slopes, and City property shall typically include Category 00, Category 0 or Category 1 blankets.

E. Hydraulic Soil Stabilizer- Type 8 Bonded Fiber Matrix

1. Type 8 Hydraulic Soil Stabilizer may be used as an alternative to Erosion Control Blanket for areas as approved by the City Engineer.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. GENERAL

1. The subgrade shall be shaped to approximate the contour of the finished surface. All construction debris shall be removed from the area prior to the placement of the topsoil. The subgrade shall be loosened with a disc or harrow to a depth of six-inches prior to application of the topsoil.
2. The topsoil shall be shaped to the approximate the contour of the finished surface, with a minimum depth of 4-inches, unless otherwise shown on the plan. All construction debris shall be removed from the area prior to seeding or sodding. The topsoil shall be loosened with a disc or harrow to its full depth prior to seeding.
3. If, in the opinion of the City and/or City Engineer, that such maintenance is required, the City Engineer will notify the Contractor of the situation. **Failure to perform the work required within the 24 hours of the notification, will result in a contract deduction of $ 100 for each 24 hour period that the work is incomplete, as observed by the City Engineer.**
4. **If, in the opinion of the City and/or City Engineer, the Contractor fails to perform such maintenance, including watering, during the 30 day period, a contract deduction of $ 500 per acre may be assessed.**
5. The Contractor shall remove all rocks and debris from the surface prior to seeding and mulching.

B. SEEDING REQUIREMENTS

1. Turf establishment by seeding shall be done utilizing the various combinations of seed mixtures (including aquatic plants), fertilizing and mulching at disturbed areas as shown on the plans. Erosion control blanket installation or hydromulch shall be completed in areas as noted in the plans.
2. Areas prepared for seeding shall be free of rocks, debris and clumps of soil. The areas shall be graded uniformly and lawned areas shall be raked free of chunks exceeding ¾ inches diameter. Seed shall be applied with a drill seeder, unless otherwise approved in writing by the City Engineer.
3. Dormant seeding may be utilized in accordance with the referenced specification and technical memorandum, provided the final acceptance standards are met.
4. Final acceptance of seeding shall be based on an established growth of 6-inches with a uniform density to cover 70% of the designated area, free of weeds and bare spots. Any re-seeding necessary shall be performed at the Contractor's expense.
5. SEASON OF PLANTING

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Seed Mix Designation	Seed Mix Name	Spring	Fall	Dormant Seeding	Dormant Seeding Temperature [1]
240SR	Sandy Roadside	April 1 – June 1	July 20 – September 20	October 20 – November 15	40
250GR	General Roadside				
260CT	Commercial Turf				
270RT	Residential Turf				
280AG	Agricultural uses	April 1 – Sept. 1		Oct. 20 – Nov. 15.	40
310NWT	Native Wet Tall	April 15 – July 20	September 20 – October 20	October 20 – November 15	50
110B	Oats	May 1 – August 1	-	-	-

C. SODDING REQUIREMENTS

1. Sod shall be placed by the Contractor adjacent to sidewalks and trails and in disturbed boulevard areas as noted on the plan.
2. When placing sod in irregularly shaped locations, the Contractor shall produce sharp, straight joints between sod rolls.
3. Sod shall be placed to create a firm, smooth, uniform surface without ruts, knobs or wrinkles.
4. Topsoil preparation next to walk, driveways, curb and gutter, and similar improvements must be 1" below the surface.
5. Sod placed on slopes greater than 1:4 (v:h), in ditch bottoms, and around storm sewer inlets or outlets shall be anchored with staples. Staples shall be U shaped 3 mm (0.12 inch) diameter or heavier steel wire having a span width of 25 mm (1 inch) and a length of 200 mm (8 inches) from top to bottom, after bending.
6. The Contractor shall be responsible for providing water and maintenance for a period of 30 growing days to firmly establish the sod. The term maintenance shall include mowing and weed control, as necessary.
7. All re-work necessary to repair imperfections in sod placement shall be performed at the Contractor's expense.

******END OF SECTION******

[1] Maximum soil temperature at a depth of 1-inch.

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SECTION 02930 - PLANT INSTALLATION

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performance of all work and services necessary or incidental to plant installation as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2571 shall apply to plant installation, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Nursery Stock

1. Plant materials shall conform to the requirements of Mn/DOT Specification 3861.
2. No substitutions will be accepted without written approval from the Owner or Engineer.
3. Treated burlap will be allowed on soil balls, as an exception to Mn/DOT Specification 2571.3F, and 3861.2G, if vertical slits are cut through the burlap. The vertical slits shall be made at six (6) inch intervals horizontally around the circumference of the root ball and shall be made from the top of the root ball extending downward and shall be done in a manner which does not damage the root system.

B. Root guard shall be Typar Bio Barrier, or approved equal.

C. Landscaping rock shall be 1 -1/2" washed river gravel, or other rock approved by the Owner.

D. Weed control landscape fabric shall be non-biodegradable, non-woven, chemically inert and resistant to fertilizers and soil chemicals. Fabric shall be a rot-proof synthetic material and shall contain inhibitors to make the fabric resistant to heat and ultraviolet exposure. It shall be dimensionally stable so that fibers maintain their positions with respect to each other. It shall be water permeable and shall be free from any chemical treatment or coating that might significantly affect its physical properties. Suitable fabrics include Mirascape, Weed-check or Supac 5NP.

E. Shredded hardwood mulch shall be provided free of dirt, ashes, sawdust, rocks, leaves, roots, black bark mold or any other debris.

F. Poly Edging shall be 5" in width and similar to Valley View Black Diamond Brand with interconnects which will allow edging to be installed in a continuous line.

G. Imported Topsoil: Imported topsoil will be pliable loam, typical of cultivated topsoils of the locality. Secure from naturally well-drained areas. Use satisfactory soil materials with highly organic content capable of sustaining turf grass and landscape plants. Stockpiled topsoil shall be free of admixture of subsoil, and free from weed seeds, harmful insects, and clay lumps, stone, or other debris greater than 1" in diameter. Topsoil to have pH value of minimum 5.4 and maximum 7.0.

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H. Organic matter: Grade 2 compost conforming to Mn/DOT Specification 3890.2B.

I. Sand: Gradation FA-1 conforming to Mn/DOT 3127.2B.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Planting operations shall not be started, nor shall any planting stock be delivered to the Project site, until all other work has been completed in the area of the proposed planting site as determined by the Engineer.

B. The Contractor shall notify the Engineer orally or in writing, as designated by the Engineer, at least twenty four (24) hours prior to the start of any planting operations during this Contract, including layout staking, clearing, weed spraying, soil preparation, watering, mulching, plant protection, weeding and clean-up.

C. All planting operations shall be performed during normal working hours and under conditions suitable for such work, as determined by the Engineer, unless otherwise authorized by the Engineer.

D. Before cultivating isolated plant locations and plant beds, the Contractor shall kill turf and weed growth within the areas that will receive mulch in accordance with the following steps.

1. Step 1. Mow existing vegetation to no less than 75 mm (**3 inches**) at least one week prior to any herbicide spraying. Remove the cuttings. The vegetation shall be allowed to re-grow to a height of at least 100 mm (**4 inches**) and no more than 200 mm (**8 inches**) prior to applying the herbicide.
2. Step 2. At least 3 days prior to the proposed application date, submit labels of all intended herbicides and a copy of a valid pesticide applicator license to the City Engineer for review and approval.
3. Step 3. Spray any regrowth and kill all vegetation (top growth and roots) using a non-selective, non-residual post emergence herbicide containing 41% glyphosate as the active ingredient. Crews licensed by the Minnesota Department of Agriculture and experienced in the use of chemical pesticides shall perform the work in accordance with the manufacturer's recommendations. The herbicide shall be applied to dry foliage on actively growing vegetation. The application shall be made in August or September preceding fall or spring planting or in May if August or September application is not possible. If precipitation occurs within 6 hours after spraying, the Contractor shall respray. Additional herbicides may be applied on a prescriptive basis if approved by the Engineer.
4. Step 4. Prior to placing any specified soil additives, deep cultivate the planting holes and beds by thoroughly loosening the soil to a minimum depth of 200 mm (**8 inches**), as measured from the existing grade elevation of the soil. Operations (in this step and the following step) shall not result in soil compaction due to excessively wet soil conditions (field capacity or wetter) or improper methods. The Contractor shall demonstrate proper methods and equipment in a competence test for this operation as specified in Mn/DOT Specification 2571.3B3.
5. Step 5. Unless otherwise specified, add soil additives and thoroughly incorporate them into the previously deep-cultivated soil to a minimum depth of 200 mm (**8 inches**), as measured from the finished grade elevation of the soil. The equipment and methods shall be in conformance with Mn/DOT Specification 2571.3B3 (Competence Test).
6. Step 6. Use a compaction tester to verify that planting areas have been loosened to less than 1400 kPa (**200 psi**) at the initial minimum cultivation depth of 200 mm (**8 inches**) plus the depth of added soil additives as measured from the finished grade elevation of the soil.

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E. Select salvaged topsoil shall be used for preparation of planting soil. Grade 2 compost conforming to Mn/DOT Specification 2890.2B shall be mixed with the topsoil at a rate of three (3) parts topsoil to one (1) part compost.

F. In all landscape planting beds, two (2) inches of Grade 2 compost conforming to Mn/DOT Specification 3890.2B shall be applied over the soil surface and shall be roto-tilled uniformly into the top twelve (12) inches of in place soil.

G. The Plant Establishment Period will be one (1) calendar year from the date of final acceptance of the project. Replacement of dead, defective or missing plants or incidental materials shall be required immediately or as soon as is practicable within an appropriate period of time as ordered by the Owner or Engineer. It is anticipated that the plant establishment will be included in the specified warrantee period and that no retainage will be held throughout the plant establishment period unless the Owner or Engineer determine that the materials or procedures warrant such a retainage.

H. Watering during the Plant Establishment Period shall consist of maintaining adequate (but not excessive) soil moisture at all times. It is recommended that after the initial thorough "watering in", every plant should receive a thorough watering, as necessary, at weekly intervals, on the average, throughout the growing season (approximately May 1 thru October 1). General water guidelines for the average condition are as follows:

Plant Type	**Average Amount of Water Per Application**
Machine Transplanted Trees (3" caliper plus)	50 to 100 Gallons
Balled & Burlapped Trees	20 Gallons ±
Bare Root Trees	15 Gallons ±
Balled & Burlapped Shrubs	10 Gallons ±
Bare Root or Container Shrubs	7 Gallons ±

I. The Contractor is expected to carry insurance to cover responsibility for plants lost to acts of vandalism, theft and rodent damage. In the case of repeated and excessive vandalism, theft, and rodent damage, the Owner will make a determination as to whether the plants will be deleted or replaced again subsequent to initial replacement with additional compensation in accordance with the Contract prices.

J. The Contractor shall install root guards as specified at all tree grate locations as shown on the plans. The Contractor shall protect tree grate castings from breakage due to vehicular traffic prior to the planting of the trees. If the tree grates are not protected, and breakage occurs due to traffic loading during the construction period, the Contractor will replace the tree grate casting at their expense.

3.2 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Remove excess and waste materials, including unacceptable excavated material, trash, and debris from the job site.

******END OF SECTION******

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SECTION 02960 - PAVEMENT MILLING

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the milling of concrete or bituminous pavement as shown on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2232 shall apply to the milling of all pavements, except as modified herein.

B. Mn/DOT Specification Section 2211 shall apply to the installation of milled materials as an aggregate base, except as modified herein.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. All milled materials shall remain the property of the Contractor/Developer and shall be removed from the site by the Contractor/Developer.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Milling shall be required to remove bituminous ramps provided at catch basins prior to paving the final wearing course.

******END OF SECTION******

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SECTION 02975 -BITUMINOUS SURFACE CRACK AND JOINT REPAIR

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the repairing of the existing bituminous surface improvements shall including routing, cleaning and sealing the existing surface prior to placement of the overlay.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 3723 shall apply to the sealing of all cracks for roadways, except as modified herein.

B. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. Crack Sealant

1. The crack sealant compound 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.
2. Mixing of different manufacturer's brands or different types of sealant shall be prohibited

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. A copy of the manufacturer's recommendations pertaining to the heating and application of the joint sealant material shall be submitted to the City Engineer prior to the commencement of work. These recommendations shall be adhered to and 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. Sealing shall not proceed if the temperature of the material has not reached or has fallen below the manufacturer's recommended minimum application temperature.

B. Sealant materials may be placed during a period of rising temperature after the air temperature in the shade and away from artificial heat has reach 40 degrees F and indications are for a continued rise in temperature. During a period of falling temperature, the placement of sealant material shall be suspended when the air temperature, in the shade and away from artificial heat, reaches 40 degrees F. Sealant shall not be placed when in the opinion of the City Engineer, the weather or roadbed conditions are unfavorable.

C. Routing and sealing will be permitted only during daylight hours between May 1 and October 15.

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D. The City Engineer shall determine the actual areas which will be repaired by marking the existing cracks to be routed, cleaned and sealed. The routing, cleaning and sealing shall extend the full width of the surface on transverse cracks.

E. The Contractor shall conduct the bituminous crack sealing operations so that routing, cleaning and sealing is a continuous operation. Traffic shall not be allowed to kneed together or damage the reservoir once it has been created. Routed cracks not sealed before traffic is allowed on the surface shall be re-routed.

1. ROUTING. The routing equipment shall be mechanical and power driven and shall be capable of following the existing cracks. All cracks shall be routed 1 inch wide x 1 inch deep. If wider cracks are encountered route to width and depth called out on the details. The cracks shall be routed with sharp router blades to the specified dimensions without deviation from the existing crack or creating excessive spalling. Equipment designed to "plow" the cracks to dimension will not be permitted. Wet sawing will not be allowed.

2. CLEANING. Immediately prior to cleaning and sealing the cracks, the entire bituminous surface shall be cleaned to remove all loosened bituminous particles and foreign material and the cracks shall be blown clean with oil-free compressed air. Compressed air shall be 100 psi and 75 cfm minimum at the nozzle. The crack and surface area six (6) inches on both sides will then be cleaned and dried with a hot compressed air heat lance. The heat lance shall meet the following requirements: temperature of heated air at exit or orifice minimum of 2,800 degrees F. Velocity of exiting heated air minimum of 2,800 fps. The application time and final results of the cleaning are subject to the City Engineers approval.

3. SEALING. After the cracks have been properly cleaned, the Contractor shall install a foam backer rod in those cracks wider than 1/4 inch which extend below the bottom to the routed joint. The backer rod shall be compressed to fill the entire width of the crack and shall not protrude up above the bottom of the routed reservoir. The Contractor shall install a bond breaker tape at the bottom of the routed reservoir for those cracks less than 1/4 inch in width which extended below the bottom of the routed joint.

F. The sealant shall be placed evenly in two separate applications. The first application shall fill the reservoir to approximately three-fourths the depth of the routed joint. After the first application has sufficiently cooled, the second application shall be placed to provide an "over bond" seal with the bituminous pavement. The over band shall be of the width and thickness to assure a tight seal with the pavement surface. The sealant shall be pressure applied with a wand type applicator; pour pots or similar devices shall not be used to apply the crack sealant. The applicator wand shall be returned to the machine and the crack sealant materials recirculated immediately upon completion of each crack.

******END OF SECTION******

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SECTION 03315 - MISCELLANEOUS CONCRETE STRUCTURES

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to the construction of miscellaneous concrete structures as indicated on the drawings or as specified herein.

1.2 SPECIFICATION REFERENCES

A. Mn/DOT Specification Section 2411 shall apply to the construction of reinforced concrete utility vaults, except as modified herein.

B. Mn/DOT Specification Section 2451 shall apply to the structure excavation and backfill construction for reinforced concrete utility vaults, except as modified herein.

C. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.3 SUBMITTALS

A. The concrete mix to be used shall conform to Mn/DOT Mix. No. 3Y43. The mix proportions shall be determined by an independent certified testing laboratory secured by the Contractor. A current mix design may be submitted and accepted, provided the aggregate source is the same as that being used for this project. Two copies of the certified mix design shall be submitted to the City Engineer for review 2 weeks prior to construction of structures for the project.

B. The Contractor shall submit design of the utility vault reinforced concrete top slab for approval by the City Engineer.

PART 2 -- PRODUCTS

2.1 MATERIALS

A. The casting assembly for utility vaults shall be Neenah R1733 with gasketed cover and concealed pickholes, or approved equal, and stamped with the appropriate utility marking.

B. Concrete shall conform to Mn/DOT Mix. No. 3Y43. All concrete shall be supplied by a MnDOT approved source.

C. Steel reinforcement shall be deformed Billet Steel bars, grade 60 conforming to AASHTO M 31.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. The utility vaults shall be constructed to the following dimensions:

1. Wall Thickness: 8"
2. Base Thickness: 8"
3. Top Slab Thickness: 8" (or more for traffic loading)

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4. Interior Dimensions: As needed
5. Manhole Location: As needed
6. Top of Top Slab to Top of Casting: 16"
7. Utility Line Openings: Where Required
8. The Contractor shall construct a 2" keyway around the base aligned with the center of structure walls.

B. Steel reinforcement for utility vaults shall be placed as follows:

1. Base Slab: #5 bars - 12" c. to c. Bars placed 1 -1/2" from bottom of slab. Bars shall be bent at the edges of the slab and extended a minimum of 18" above the top of base.
2. Walls: #5 bars - 12" c. to c. (x 2) Bars placed 1 -1/2" from interior and exterior wall face. Stagger interior and exterior horizontal bar spacing. Exterior vertical bars shall be tied to the extended base slab steel providing for an overlap of 18".
3. Top Slab: Design submitted by Developer/Contractor. (#5 bars minimum).
   (a) The utility vaults walls are to be constructed around existing underground electric utility lines. The Contractor will be required to construct the vault walls and base with cast-in-place concrete. The Contractor may use pre-cast concrete for the vault top slab. The Contractor shall seal the joint between the cast-in-place walls and the pre-cast top slab (if used) with non-shrink grout.

C. All concrete shall be consolidated by means of mechanical vibration. Consolidation by hammering forms alone will not be allowed.

D. CONTRACTOR SHALL take one (1) set of concrete cylinders for each day's pour of 25 cubic yards or less, plus one set for each additional 50 cubic yards poured on that day. Cylinders shall be of representative concrete, taken from mixer discharge at actual time of pouring. Contractor will pay all costs of preparing, transporting to laboratory, and making of tests. All such tests shall be made at an independent testing laboratory approved by the CITY ENGINEER.

E. Each set shall consist of three cylinders. One Cylinder shall be tested at five (5) days, the second at seven (7) days and the third at twenty-eight (28) days. The cylinders shall be numbered consecutively and labeled with date of pour, slump when poured, location in building at which representative concrete is placed and name of CONTRACTOR and project. Copies of tests shall be sent to the CITY ENGINEER and CONTRACTOR. Compression tests shall be performed in accordance with ASTM C39.

F. If the average strength of any set of 7-day and 28-day job-cured cylinders falls below the required strength, the cost of any additional cement found necessary to correct subsequent mixes shall be borne by the CONTRACTOR. Also, if the strength is found deficient, the cost of hardened concrete or load tests shall be borne by the CONTRACTOR. The CITY ENGINEER reserves the right to reject any portions of such questionable areas, if in his opinion, the tests indicate that such areas will not safely carry the design loads.

G. All concrete which fails to meet these specifications is subject to removal and replacement at the cost of the CONTRACTOR.

H. Backfilling of the cast-in-place structures may commence if the five-day compression test shows a minimum compression strength of 3000 p.s.i. Imported granular backfill or suitable on site materials shall be used for backfill material. The top two (2') feet of backfill material shall be representative of adjacent in-place materials. Compaction of the structure backfill shall be by the "Ordinary Compaction Method". The Contractor shall be responsible for replacement of all work damaged by any subsequent settlement that occurs adjacent to structures due to insufficient compaction effort.

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******END OF SECTION******

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SECTION 11309 - LIFT STATION STRUCTURE

PART 1 -- GENERAL

1.1 SUMMARY

A. This section covers the furnishing of all labor, materials, tools, equipment and performances of all work and services necessary or incidental to lift station construction as indicated on the drawings or as specified herein.

B. The minimum lift station structure shall be sized to accommodate the volume of storage required and the space required for the particular make and model pump specified, including all appurtenances necessary for a complete operational system. Should another make and model pump be submitted as an equal, any change necessary in the design of the pump station to accommodate the substitution must be approved by the City Engineer.

C. Pump Design and selection shall be approved by the City Engineer.

1.2 SPECIFICATION REFERENCES

A. Unless noted otherwise, the provisions in this section are in addition to the referenced specification.

1.3 SUBMITTALS

A. Shop drawings of the wet well and valve vault construction shall be submitted prior to their fabrication. The submittal shall indicate the pipe penetration locations in the wet well and the valve vault and the access hatch location on the top slab.

B. Shop drawings of the wet well and valve vault components shall be submitted prior to their installation.

PART 2 -- PRODUCTS

2.1 PIPE AND FITTINGS

A. Ductile Iron Pipe (DIP)

1. Ductile iron pipe shall conform to the requirements of ANSI A221.51 (AWWA C151) standard specification for centrifugally cast ductile iron pipe for water or other liquids.
2. Ductile iron pipe in exterior locations shall be provided with flanged, or mechanical joint type ends as shown on the plans and all interior ductile iron piping shall be ANSI/AWWA thickness Class 53 (minimum).
3. Ductile iron flanges shall conform to ANSI/AWWA C115 standard 125# template and shall be rated for 250 psi. Mechanical joints and push-on joints shall conform to ANSI/AWWA C111 standard for rubber gasket joints for ductile iron and gray iron pressure pipe and fittings.
4. Unless otherwise shown on the plans, ANSI/AWWA short-body ductile iron fittings shall be furnished. Short body fittings shall conform to ANSI/AWWA C110. Flanged long radius elbows, reducing on-the-run tees, side outlet fittings eccentric reducers and laterals shall conform to ANSI B16.1 standard specification for flanged fittings and flanges. All fittings shall be ductile iron. Compact fittings conforming to ANSI/AWWA C15./A21-53 may be supplied for mechanical and push-on joints.

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5. Ductile iron pipe and fittings used for interior and exposed locations shall be furnished with a shop primed coating of Tnemec Primer, or equal, to facilitate painting as specified.

2.2 BOLTS AND ANCHOR BOLTS

A. Pump anchor bolts shall 18-8 stainless steel. All nuts and bolts on the piping inside the wet well shall be 304 stainless steel. All bolts and nuts in the valve vault shall be ASTM 307 Zinc plated hex bolts. All below grade fittings, and valves shall be secured with Cor-Blue T-Bolts as manufactured by NSS Industries or equal.

2.3 GATE VALVES

A. All valves furnished and installed on the force main shall be as specified in section 02535.

2.4 CHECK VALVES

A. Swing Check Type

1. Check valves shall be of either the standard or increasing swing check type as noted on the plans. Check valves shall be provided with an extended hinge pin and outside weight and lever allowing field adjustment.
2. Valve bodies shall be cast iron of minimum 175 psi pressure rating and shall be provided with ANSI standard 125# flanges. Valve gates shall be ductile or cast iron. Renewable gate ring shall be Buna-N Rubber. Body seat shall be 304 stainless steel.
3. Each check valve shall be provided with a stainless steel hinge pin extending through bronze bushings. Valves shall have outside packed glands made of graphite and Kevlar.
4. Each valve shall be provided with a cushion chamber. The cushion chamber shall be of bronze construction and the shock absorption shall be by air. The cushion chamber shall be so arranged that the closing speed is adjustable to meet the service requirements.
5. Manufacturers or Equal:
   (a) Golden Anderson Fig. No. 250-D
   (b) APCO (Valve and Primer Corp.)

2.5 AIR AND VACUUM RELEASE VALVES

A. The Combination Air Valve shall be designed to exhaust large amounts of air during filling, to release small amounts of accumulated air during operation and to admit large amounts of air upon impending vacuum during draining.

B. The valve shall be float operated and both the Air & Vacuum and Air Release functions shall be housed in a single body. Body and cover shall be housed in a single body. Body and cover shall be of cast iron confirming to ASTM A126, Class B. All leverage mechanism parts and the float shall be stainless steel, no plastic or bronze parts shall be permitted. The large and small orifice seats shall be Buna-N and shall be renewable.

C. The Combination Air Valve shall be supplied with "Flushing Attachments" to allow periodic flushing of sediment, grease and solids. Attachments consist of inlet isolating valve, bronze blow-off and flushing valves.

D. Manufactures or Equal

1. APCO (Valve and Primer Corp.)

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2.6 FLANGED COUPLING ADAPTERS (FCA)

A. Flanged coupling adapters shall be provided where indicated. CONTRACTOR may install additional FCA at no additional cost as he desires for ease of piping installation. FCA and piping shall be secured against movement with fixed supports or tie rods. FCA shall be Dresser Style 127, Rockwell/Smith-Blair Type 912 with anchor studs for 12 inches and under; Type 913 for 14 inches and over. Coupling Adapters shall be of cast iron construction with shop coating.

2.7 WET WELL / VALVE VAULT

A. Precast Concrete Structure

1. The pump station structure shall be constructed of Class I precast reinforced concrete with R4 joints and having an inside diameter as shown on the plans. The structure base shall be integrally cast with the bottom barrel section. The base, as shown on the plans, shall be fabricated to accommodate the loading condition. The pump station structure shall be constructed as shown on the detail drawings and in accordance with the approved shop drawings. The concrete mix shall be Type II cement (Sulfate resistant) with entrained air content of not less than 4 percent and not more than 7 percent, Grade A concrete with a cement-water ratio of 0.50 and a minimum compressive strength of 4,000 psi at 28 days. Precast structure shall have attained the specified design strength when delivered to the project site.
2. The top slab of the structures shall be Type II precast reinforced concrete having the dimensions shown on the detail drawings. Frames for access hatches and vent pipe shall be cast in the slab when fabricated. Cut-outs to accommodate all piping entering the wetwell shall be preformed or pre-cut and provided with a seal or water stop to ensure a watertight connection between pipe and wetwell. The type of seal proposed shall be submitted to the Project Engineer for approval before installation of the wetwell is undertaken.
3. Joints between barrel riser sections and top slab shall be sealed with two strips of flexible bitumastic preformed joint compound.
4. The interior of the wetwell shall be painted as specified below.
5. A hole, which is compatible with the furnished winch/hoist shall be prefabricated into the lift station top slab.
6. Aluminum or steel reinforced plastic manhole steps similar to Neenah R-1981-J shall be provided in the lift station.

2.8 ACCESS HATCHES.

A. Pump manufacturer to verify hatch size and location in top slab for clearance of pumps positioned as shown on the Drawings. Minimum clearance of 3-inches required. Size shown on the Drawings is the minimum acceptable size. Each hatch shall be provided with safety grating.

B. Door leaves a minimum 1/4-inch aluminum, diamond pattern, to withstand a live load of 300 pounds per square foot.

C. Angle frame of minimum 3-inch welded aluminum with anchor flange around the perimeter.

D. Each door leaf equipped with heavy duty recessed hinges, totally enclosed spring or torsion bar operators as necessary for easy operation, drop handle, and automatic hold open arm with release handle. Locate hold open arm release handle such that it can be easily operated without endangering personnel.

E. Maximum hatch opening force is not to exceed 15 pounds when applied perpendicularly to the hatch edge through any part of the hatch-operating arc.

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F. Each door leaf secured with snap lock with removable handle and padlock hasp welded to each leaf and frame.

G. Aluminum surfaces mill finished. Apply bituminous paint to the exterior of the frame in contact with concrete.

H. Mechanical Fasteners and Hardware:Series 304 stainless steel.

I. Approved Manufacturers: Halliday, Bilco, Nystrom, or equal.

2.9 SAFETY GRATING

A. The protective grating panel as manufactured by Halliday Products, of Orlando, Florida or equal shall be 1-1/2 in. "I" bar aluminum grating with Safety Orange powder-coated finish. Grating shall be hinged, and shall be supplied with a positive latch to maintain unit in an upright position. Grating shall have a 6-in. viewing area on each lateral unhinged side for visual observation and limited maintenance. Grating support ledges on 300 lbs. psf loaded access covers only shall incorporate nut rail with a minimum of four (4) stainless steel spring nuts. A padlock hasp for owner-supplied padlock shall be provided.

2.10 SAND BACKFILL AND ENGINEERED FILL

A. Water from areas to receive sand backfill shall be removed before commencing work, and areas shall be kept free of water during filling and compaction. All topsoil and organic materials in any area to receive Engineered Fill shall be removed to a minimum depth of 12 inches.

B. Where concrete floor slabs are to be supported on Engineered Fill, the entire surface of the fill area shall be smoothed, leveled, and compacted using heavy vibratory equipment until there is no loss of elevation. The sand fill material shall be placed in 6" deep lifts and compacted to at least 100% of the maximum density given by ASTM D698 (Standard Proctor Density). The fill shall extend beyond the edges of the footings one foot for each one foot of fill placed below the footings. The compacted lift shall be relatively smooth and level.

C. Frozen material or material containing ice or snow shall not be used for fill. Sand fill shall not be placed on soil that is frozen or covered with ice or snow. Necessary precautions shall be taken during freezing weather to prevent freezing of the sand fill during placing and compaction

D. All debris shall be removed from the excavated areas before backfilling.

E. Excavations shall be promptly backfilled as work permits.

F. The excavated area outside of the lift station structure and valve manhole shall be filled with sand fill. Unless otherwise noted, the fill area shall be defined by a line 30Evertical plane, starting at a point at the base of the foundation. Sand fill shall be placed in 6 inch deep lifts, and each lift shall be compacted by approved methods to not less than 95% of the maximum density given by ASTM D698 (Standard Proctor Density). Compacted lifts shall be relatively smooth and level.

G. The sand fill to be used for backfill shall be a SW clean well graded sand (Unified Soil Classification System), free of organic impurities. The well graded sand shall have less than 40% passing the No. 40 sieve and less than 10% passing the #200 sieve with the maximum aggregate size of 1 1/2".

H. The Contractor shall furnish tests for all fill material prior to use from an independent testing laboratory. The testing laboratory reports shall be reviewed and approved before the material is placed. The tests are to include optimum density ASTM D698-70 and gradation.

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2.11 PAINTING

A. This section shall include the furnishing of all labor and materials for the painting and finishing of pumping station as well as described hereinafter.

B. All paints and materials furnished shall be the standard product of a reputable manufacturer. The standard products of manufacturers other than that specified hereinafter as a descriptive standard will be accepted if they are equal in composition, durability, utility and in all other respects are equal for the purpose intended to those specified.

C. All paint shall be delivered to the site of the work in unbroken containers. Each container shall show the name of the manufacturer, date of manufacture, the designated name of the paint or formula, the color, and any special instructions for mixing or application. All mixing and tinting will be done on the premises, and no material shall be reduced or changed, except as specified by the manufacturer. All paints shall be stored in a manner to prevent contamination of painting materials after containers are opened.

D. Lift Station Structure. A coal-tar epoxy shall be applied to all internal surfaces, concrete or metallic, including all piping and valves. Using a protective coating system of Carboline Bitumastic No. 300-M, Tnemec's 46H-413 Tneme-Tar, Sherwin Williams' HI-MIL SHER-Tar Epoxy, or equal. The total coating thickness shall be not less than 16 mils DFT.

2.12 SIGNAGE

A. Provide a caution sign at the top of the entrance to wetwell.

B. Sign shall be yellow and black and shall have a minimum size of 10" x 14" and shall read:

1. "Dangerous/hazardous gases"
2. "Level 2 Confined Space"
3. "Do Not Enter Without Proper Equipment"

C. Letter shall be a minimum one inch in height.

D. Caution sign shall be Lab Safety reference #6113761, or equal.

PART 3 -- EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. Temporary Service

1. If needed, the Contractor shall furnish, install and maintain equipment to bypass and control the storm and/or sanitary sewer flow around the construction zone. Failure to operate and maintain the bypass equipment could result in direct damage claims as well as consequential damage claims to the Contractor.

B. Internal and External Pipe Restraint

1. Piping shall be secured against movement with fixed supports or approved joint restraints.
2. If the structures are located on disturbed soils or where differential subsidence is a potential, provision to allow for differential settlement shall be made at the time of construction. The Contractor shall notify the Engineer of the methods to be employed before construction.

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C. Connection to Sanitary Sewer

1. When connection to a sanitary sewer is made at the lift station, the Contractor shall expose and verify the elevation of any existing sewers prior to laying any sanitary sewer to, or from, the connection point. If the elevation of the existing sewer does not match the elevation shown on the plans, the Contractor shall notify the Engineer, at which time the Engineer may adjust the proposed grades.

3.2 EXCAVATION

A. Interference of Underground Structures

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

B. Excavation Limits and Requirements

1. The Contractor shall dewater the excavations as necessary to construct the station. Excavation may require shoring and sheeting to maintain stable slopes or facilitate dewatering.

2. The Contractor shall excavate to the limits required by safety and to adequately install the lift station structures. Oversize excavation one foot horizontally beyond the footing slab for each foot vertically that the excavation is below the footing. The area shall be protected from surface runoff. Pumps and related appurtenances shall be readily available to remove excess water.

3. Existing inverts shall be protected during construction. If debris enters the sewer, it shall be the responsibility of the Contractor to clean the sewer.

C. Preparation and Maintenance of Foundation.

1. The Contractor shall undercut the foundation one foot, smooth and compact the existing subgrade. Any areas below the base of the structure shall be backfilled with ¾-inch crushed rock.

2. If the subgrade material becomes soft or unstable during the Contractor's operations, undesirable material shall be excavated, refilled with ¾-inch crushed rock.

3.3 BACKFILL

A. Placement of backfill adjacent to the structure shall be delayed until any field constructed concrete has attained its design compressive strength. Any backfill placement prior to attaining this strength shall be considered the responsibility of the Contractor, who shall be liable for any resultant damage to the structure.

3.4 PUMP STATION COMPONENTS

A. General: Install pump station components in accordance with manufacturer's recommendations and these specifications.

B. Operation of System:

1. When sump level rises to pump on level, controller shall start lead pump. With lead pump operating, sump level shall lower pump to off level and lead pump shall stop. Alternating relay shall index on stopping of pump so lag pump will start first on next operation and become lead pump. If sump level continues to rise when lead pump is operating, on reaching lag pump start level, and start lag pump. Both lead and lag pump shall operate together until pump stop float switch turns off both pumps. If level continues to rise when both pumps are operating, then alarm switch shall energize when high level alarm level is reached and signal alarm. If one pump should fail for any reason, then second pump shall operate on override control, and if level rises above

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override control, then alarm switch shall energize and signal alarm. All float switches shall be adjustable from the surface for level setting. If loss of utility power or loss of one or more phases of 3 phase system is sensed, then all pump motors shall shut down until condition is corrected to prevent damage to motors and equipment. Restoration of all phases of power shall automatically allow normal operation of system.

C. Discharge Base Elbow:

1. Shall be attached to flat steel fabricated base plate which rests squarely on wet-well floor.
2. Flat base plate shall assure pump has smooth surface on which to rest when lowered into position.
3. Pump discharge flange shall align with base elbow of base plate assembly.

D. Electrical Cords: Cords shall be continuous with no splices made in wiring and are to run from pump and level controls to control panel.

E. Float Cords: Attach weight to cord above float to hold switch in place in sump and efficiently prevent sharp bends in cord when float operates.

F. Electrical and Telephone Service Entrance:

1. Developer/Contractor is responsible for costs of getting electric service and telephone service to the pump station site.
2. Contractor is responsible for installation of necessary conduit for and coordination of electrical service from the utility pole to the service entrance equipment in the control panel and telephone service installation with the respective utility companies.
3. Electrical work shall be completed in accordance with NEC and any applicable local ordinances.
4. Grounding of electrical and telephone service for lift station shall be in accordance with Article 250 of NEC.

G. Automatic Dialer:

1. Upon answer from programmed number, shall play message describing location and fault condition. Dialer shall then request confirmation of receipt of message by asking person contracted to press particular key on telephone. If no confirmation is made, dialer shall call next number and repeat above process.
2. Connect following to inputs of dialer and provide auxiliary control relays as necessary to accomplish this connection:
   (a) Wet well high level alarm.
   (b) Wet well low level alarm.
   (c) Phase loss or imbalance .
   (d) Spare Owner Specified alarm.

****** END OF SECTION ******

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STANDARD DETAIL INDEX

Typical Sections

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Detail # 3-700	Construction Site Erosion Control

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Detail # 4-001	RC Pipe Class "B" Bedding
Detail # 4-002	PVC Storm Sewer Trench Detail
Detail # 4-003	Perforated Pipe Bedding Detail (Infiltration System)
Detail # 4-100	Catch Basin – "Design G"
Detail # 4-101	Catch Basin – "Design H"
Detail # 4-102	Storm Sewer Manhole – "Design F"
Detail # 4-103	Storm Sewer Structure – "Design J"
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Detail # 4-105	Storm Sewer Structure – "Design 4020"
Detail # 4-107	Precast Shallow Depth MH/CB – "Design SD"
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Detail # 4-111	Drainage Ditch Structure County
Detail # 4-200	Precast Concrete Pond Skimmer Structure
Detail # 4-201	Precast Concrete Pond Skimmer Structure w/Rate Cont. Baffle
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Watermain

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Detail # 6-000A	Clow Medallion Hydrant
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Miscellaneous

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Mn/DOT Standard Plan Sheets

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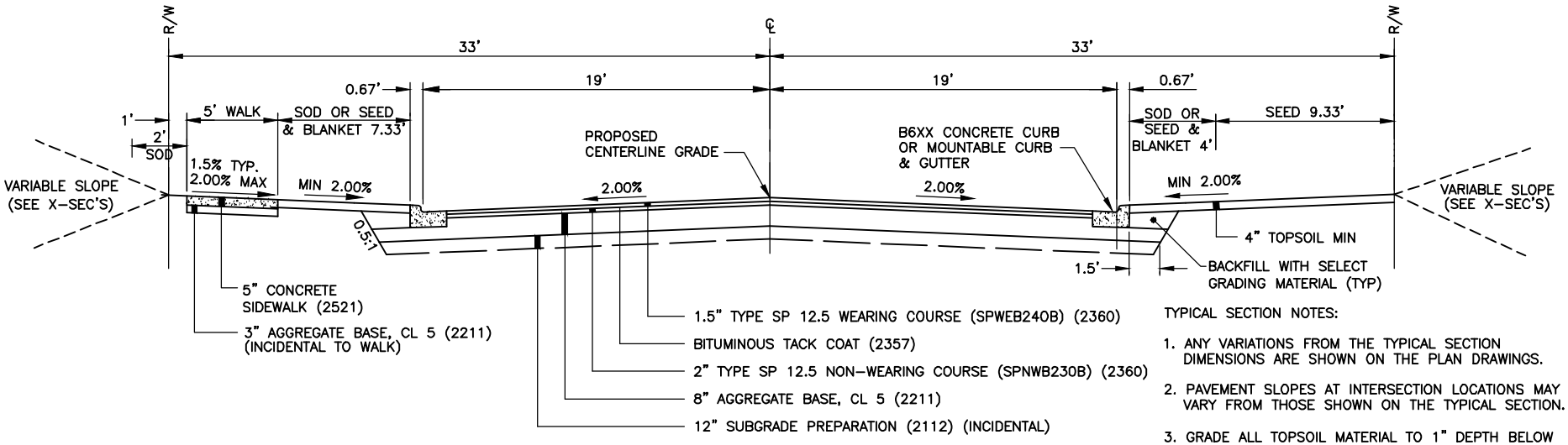
PEDESTRIAN CURB RAMP DETAILS
MnDOT STANDARD PLANS

TYPICAL SECTION

STA X+XX TO STA XX+XX



TYPICAL SECTION NOTES:

1. ANY VARIATIONS FROM THE TYPICAL SECTION DIMENSIONS ARE SHOWN ON THE PLAN DRAWINGS.
2. PAVEMENT SLOPES AT INTERSECTION LOCATIONS MAY VARY FROM THOSE SHOWN ON THE TYPICAL SECTION.
3. GRADE ALL TOPSOIL MATERIAL TO 1" DEPTH BELOW CONCRETE SURFACES PRIOR TO PLACING SOD.
4. SEE STANDARD DETAIL 1-300 FOR STREET CLASSIFICATION MINIMUM ROADWAY SECTIONS.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

TYPICAL SECTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-000

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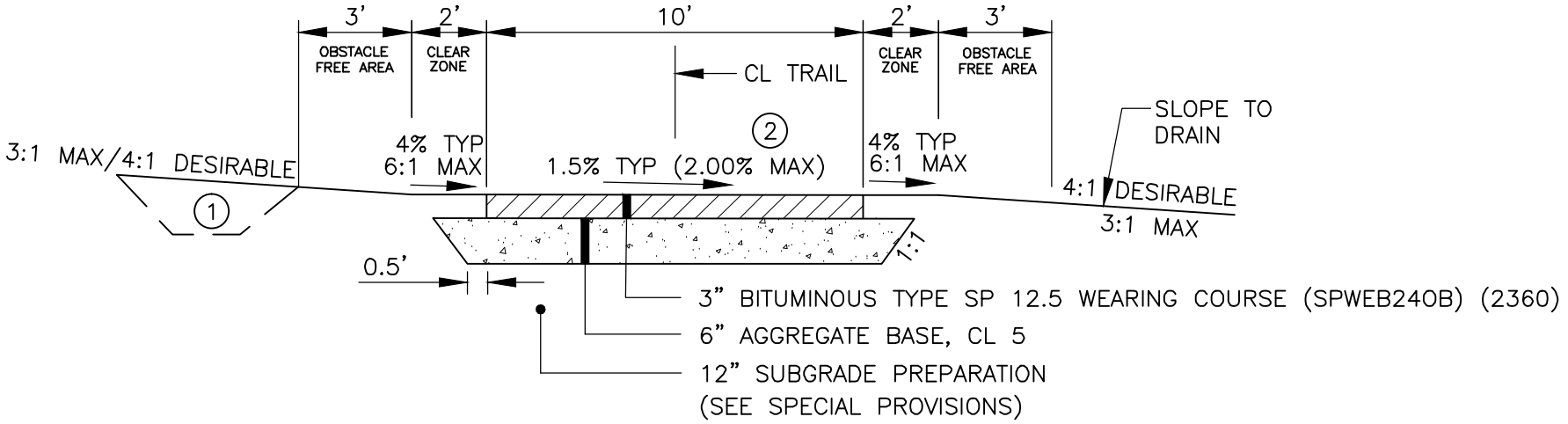

(1) DITCH IF REQUIRED FOR DRAINAGE

(2) SLOPE TOWARDS INSIDE OF CURVE

BITUMINOUS TRAIL (SHARED USE PATH)

NOT TO SCALE

NOTE:

RESTORE ADJACENT AREA AND SEED.
PROVIDE 10' MINIMUM RADIUS AT ALL TRAIL INTERSECTIONS.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

BITUMINOUS TRAIL DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 1–004

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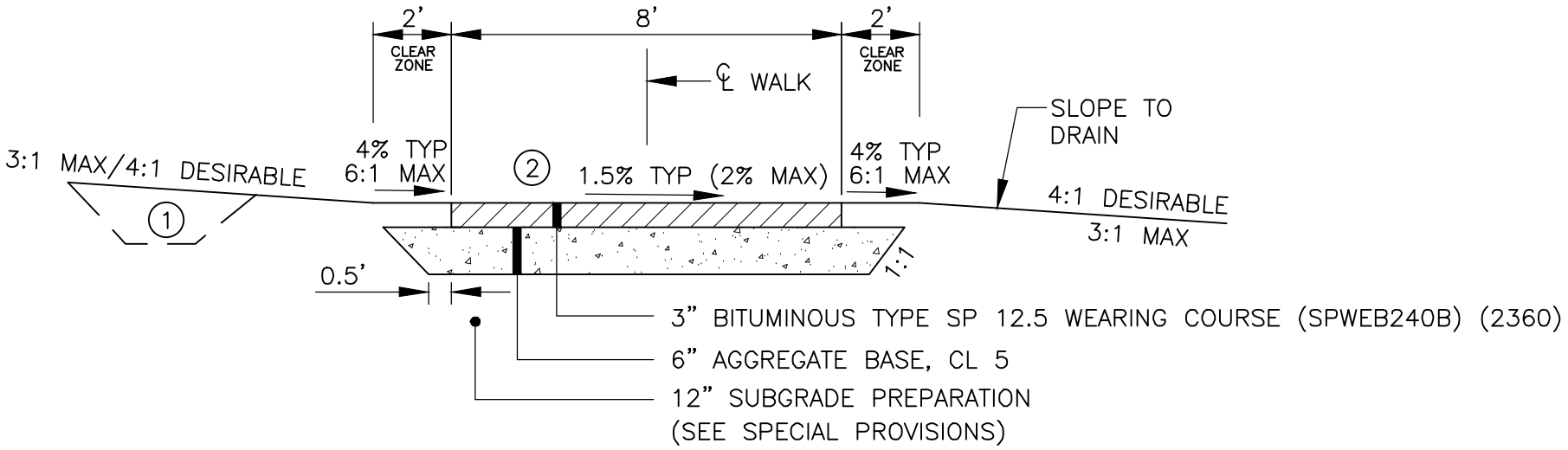

(1) DITCH IF REQUIRED FOR DRAINAGE

(2) SLOPE TOWARDS INSIDE OF CURVE

BITUMINOUS SIDEWALK

NOT TO SCALE

NOTE:

RESTORE ADJACENT AREA AND SEED.
PROVIDE 10' MINIMUM RADIUS AT ALL WALK INTERSECTIONS.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

BITUMINOUS SIDEWALK DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 1–005

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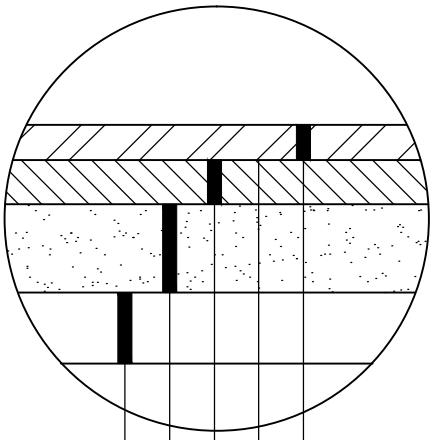

2" TYPE SP 12.5 WEARING COURSE (SPWEB240B) (2360)

BITUMINOUS TACK COAT (2357)

2" TYPE SP 12.5 NON-WEARING COURSE (SPNWB230B) (2360)

8" AGGREGATE BASE, CL 5 (2211)

12" SUBGRADE PREPARATION (2112) (INCIDENTAL)

BITUMINOUS PATCH SECTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

BITUMINOUS STREET REPAIR

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-100

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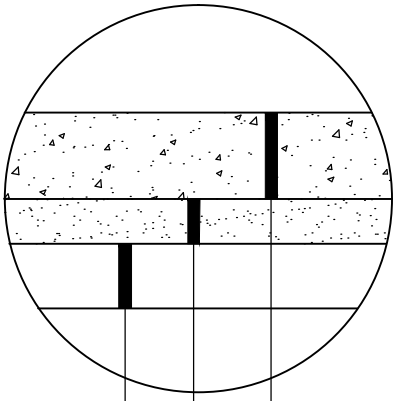

7" CONCRETE DRIVEWAY PAVEMENT (2531)

3" AGGREGATE BASE, CL 5 (2211) (INCIDENTAL)

6" SUBGRADE PREPARATION (2112) (INCIDENTAL)

CONCRETE DRIVEWAY PAVEMENT

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CONCRETE DRIVEWAY PAVEMENT

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-101

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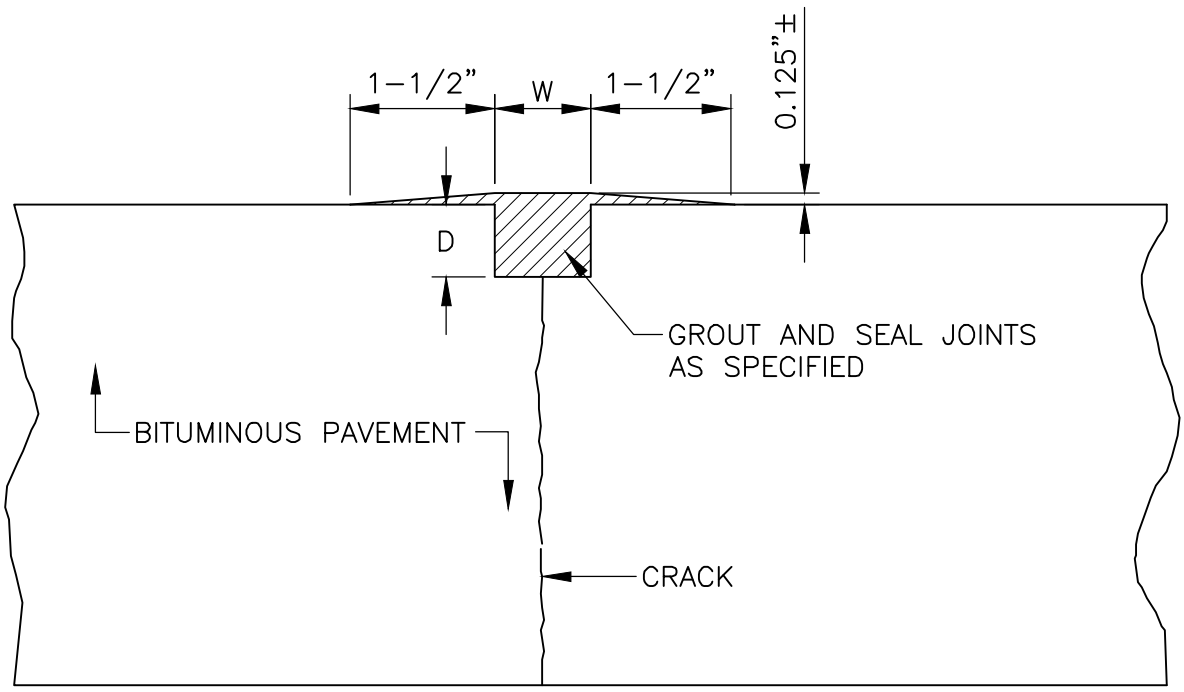

W	D
1"	1"
2"	1.25"

CRACK SEALING TYPICAL SECTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CRACK SEALING TYPICAL SECTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-102

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FUNCTIONAL CLASSIFICATION	F-F WIDTH (FT)	ROW WIDTH	PARKING LANES	MINIMUM ROADWAY SECTION
MINIMUM RESIDENTIAL	28'	50'	0	1.5" SPWEB240B 2.0" SPNWB230B 8.0" CLASS 5 AGGREGATE BASE 12.0" COMPACTION SUBCUT
RESIDENTIAL STREET	32'	60'	1	1.5" SPWEB240B 2.0" SPNWB230B 8.0" CLASS 5 AGGREGATE BASE 12.0" COMPACTION SUBCUT
THROUGH RESIDENTIAL STREET	38'	66'	2	1.5" SPWEB240B 2.0" SPNWB230B 8.0"/10.0" CLASS 5 AGG. BASE 12.0" COMPACTION SUBCUT
MINOR COLLECTOR	40'-44'+	80'+	2	1.5" SPWEB240C 3.5" SPNWB230B 8.0"/10.0" CLASS 5 AGG. BASE 12.0" COMPACTION SUBCUT
MAJOR COLLECTOR	VARIES	100'+	2	4.0" SPWEB240C / SPWEB340C 2.0" SPNWB230F / SPNWB330B 10.0" CLASS 5 AGGREGATE BASE 12.0" COMPACTION SUBCUT
HIGH DENSITY ARTERIAL	VARIES	100'+	-	4.0" SPWEB340F 2.0" SPNWB330B 12.0" CLASS 5 AGGREGATE BASE 12.0" COMPACTION SUBCUT

BOLTON & MENK, INC.
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BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

MINIMUM STREET STANDARDS

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-300

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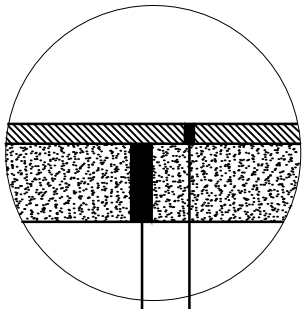
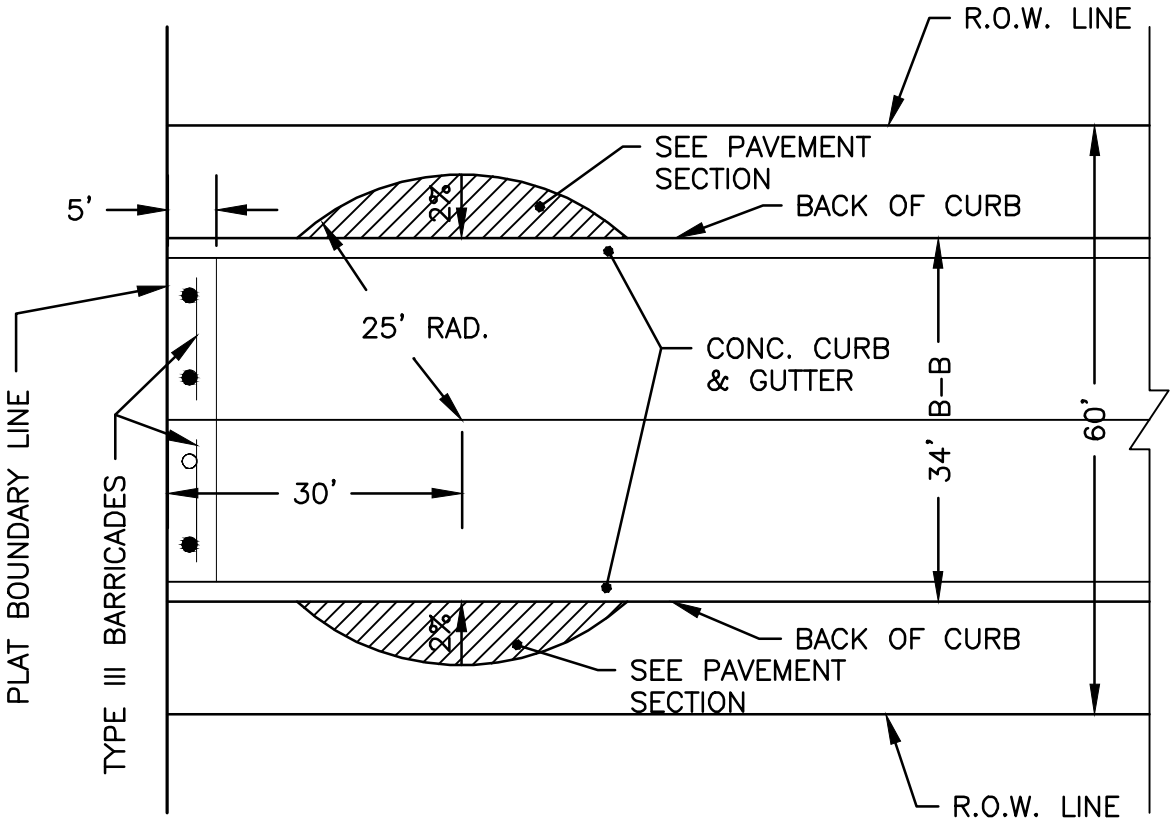


1.5" TYPE SP 12.5 NON-WEARING COURSE (SPNWB230B) (2360)

8" CL. 5 AGGREGATE BASE

TEMPORARY BITUMINOUS CUL-DE-SAC PAVEMENT SECTION



TEMPORARY BITUMINOUS CUL-DE-SAC PLAN VIEW

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN
BURNSVILLE, MN WILLMAR, MN CHASKA, MN
RAMSEY, MN MAPLEWOOD, MN BAXTER, MN AMES, IA

TEMPORARY BITUMINOUS CUL-DE-SAC

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-400

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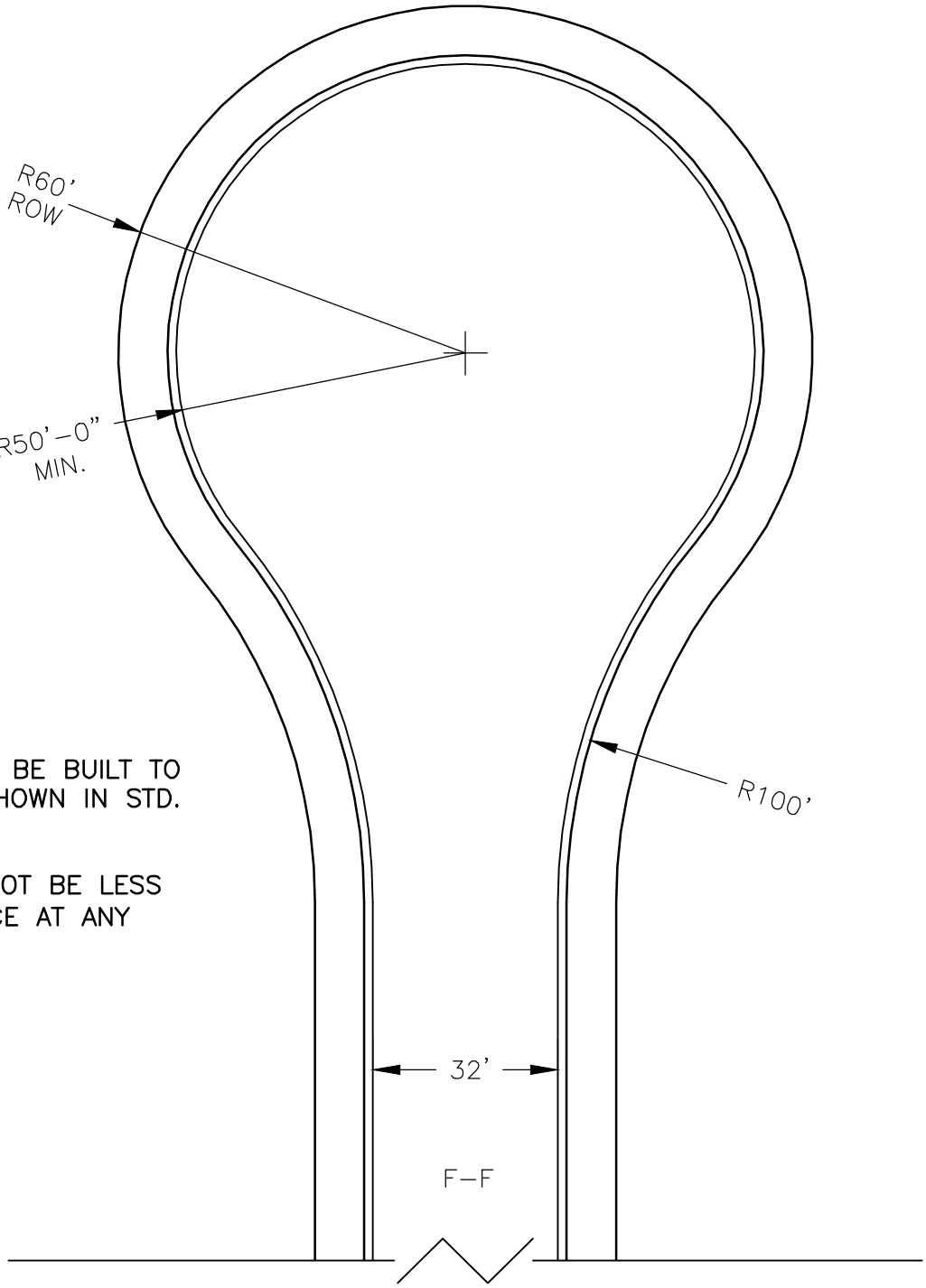

NOTE:

STREET SECTION SHALL BE BUILT TO CITY STANDARDS, AS SHOWN IN STD. DETAIL 1-300.

STREET WIDTH SHALL NOT BE LESS THAN 32' FACE TO FACE AT ANY LOCATION.

ALL CURB SHALL BE SURMOUNTABLE.

CUL-DE-SAC PLAN VIEW

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN
BURNSVILLE, MN WILLMAR, MN CHASKA, MN
RAMSEY, MN MAPLEWOOD, MN BAXTER, MN AMES, IA

CUL-DE-SAC

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-400A

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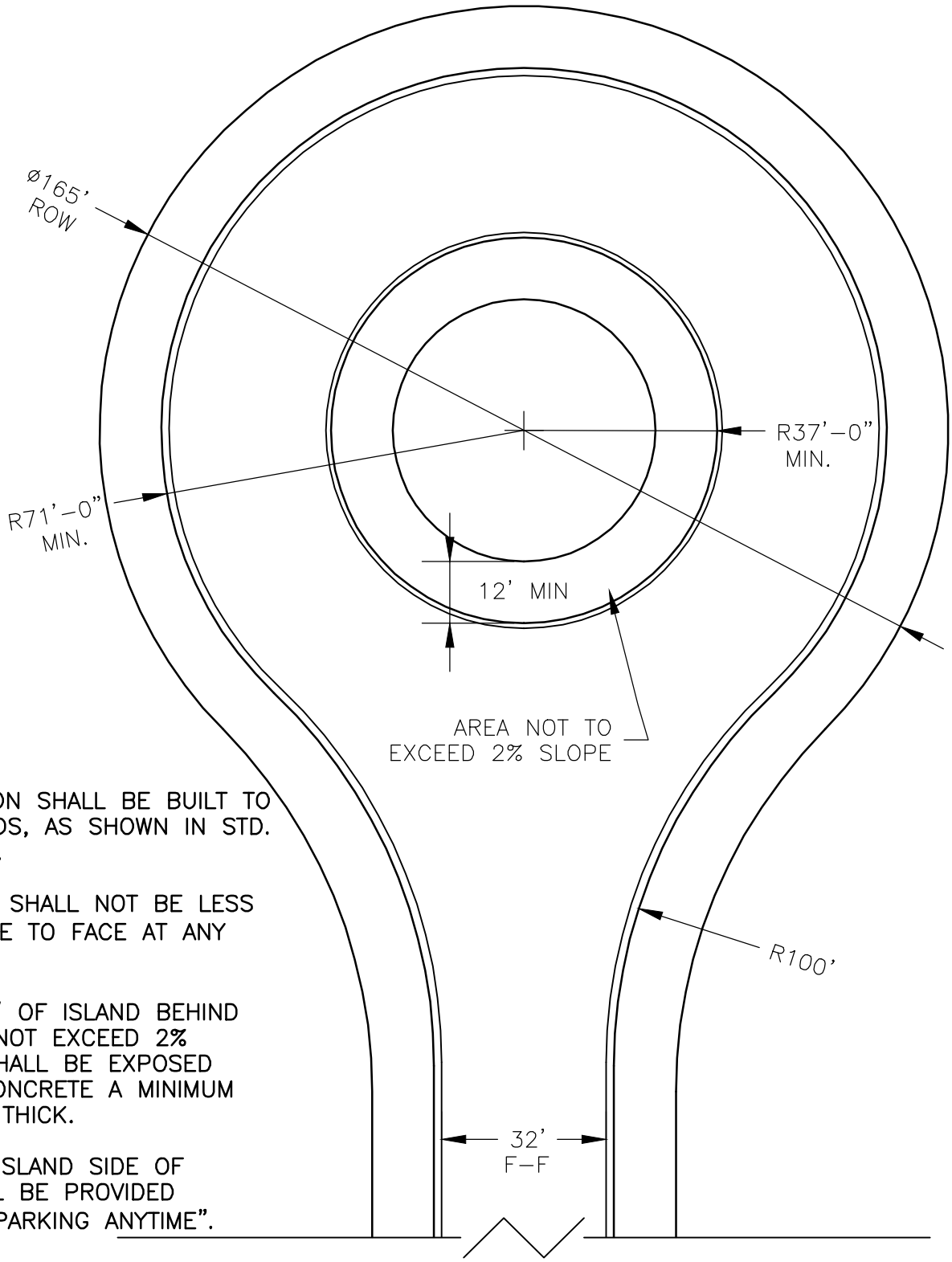

NOTE:

STREET SECTION SHALL BE BUILT TO CITY STANDARDS, AS SHOWN IN STD. DETAIL 1-300.

STREET WIDTH SHALL NOT BE LESS THAN 32' FACE TO FACE AT ANY LOCATION.

THE FIRST 12' OF ISLAND BEHIND CURB SHALL NOT EXCEED 2% SLOPE AND SHALL BE EXPOSED AGGREGATE CONCRETE A MINIMUM OF 5 INCHES THICK.

SIGNAGE, ON ISLAND SIDE OF STREET, SHALL BE PROVIDED STATING "NO PARKING ANYTIME".

ALL CURB SHALL BE SURMOUNTABLE.

CUL-DE-SAC WITH INTERNAL ISLAND PLAN VIEW

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CUL-DE-SAC WITH INTERNAL ISLAND

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-400B

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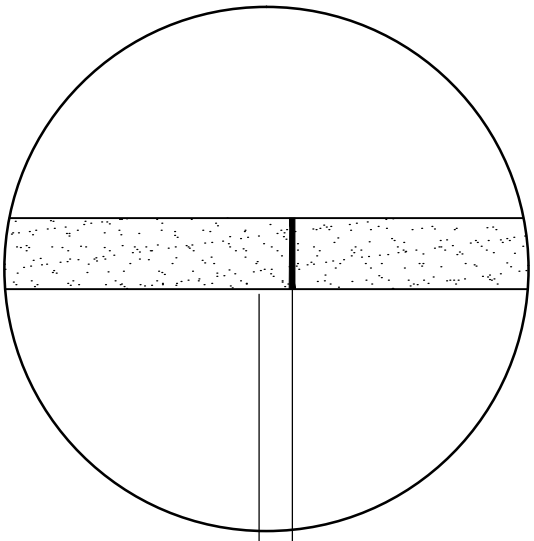

TYPICAL SECTION – GRAVEL DRIVEWAY RESTORATION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

GRAVEL DRIVEWAY REPLACEMENT

City of St. Francis

DATE: 07/2013

STD. DETAIL 1–500

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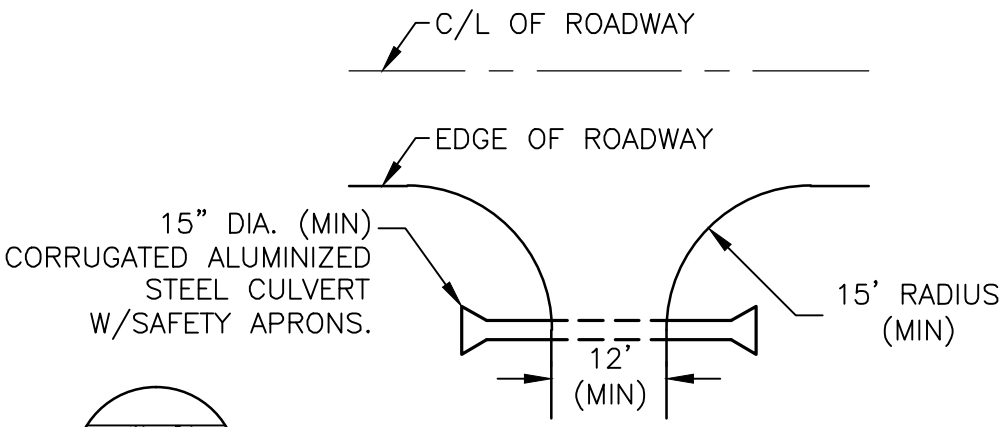
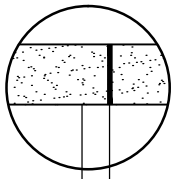


RURAL DRIVEWAY UNDER 600' IN LENGTH

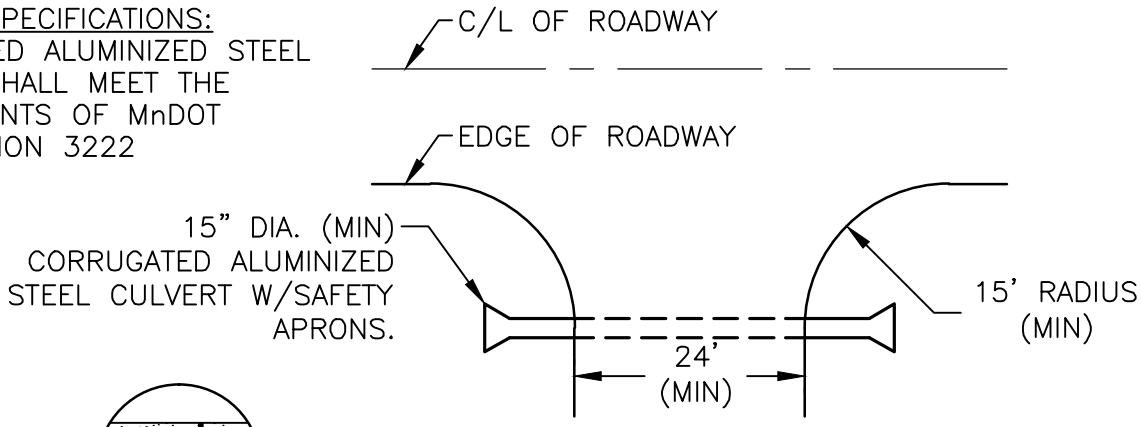
NOT TO SCALE



TYPICAL SECTION – RURAL GRAVEL DRIVEWAY

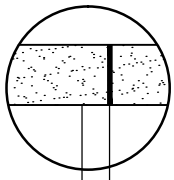
NOT TO SCALE

CULVERT SPECIFICATIONS:
CORRUGATED ALUMINIZED STEEL CULVERT SHALL MEET THE REQUIREMENTS OF MnDOT SPECIFICATION 3222



RURAL DRIVEWAY OVER 600' IN LENGTH

NOT TO SCALE



TYPICAL SECTION – RURAL GRAVEL DRIVEWAY

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

RURAL GRAVEL DRIVEWAY REPLACEMENT

City of St. Francis

DATE: 07/2013

STD. DETAIL 1–501

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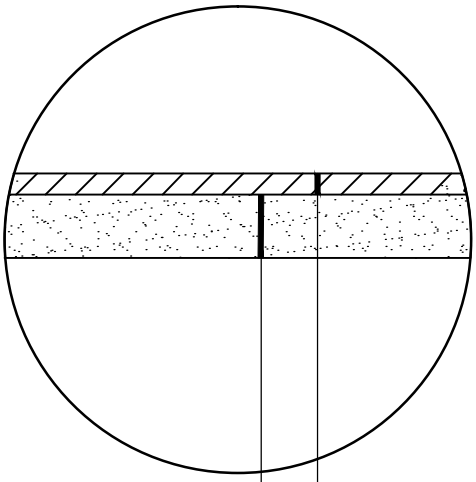

3" TYPE SP 12.5 WEARING COURSE, (SPWEB240B) (2360)

6" AGGREGATE BASE, CLASS 5 (SPEC 2221)

TYPICAL SECTION – BITUMINOUS DRIVEWAY RESTORATION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

BITUMINOUS DRIVEWAY REPLACEMENT

City of St. Francis

DATE: 07/2013

STD. DETAIL 1–600

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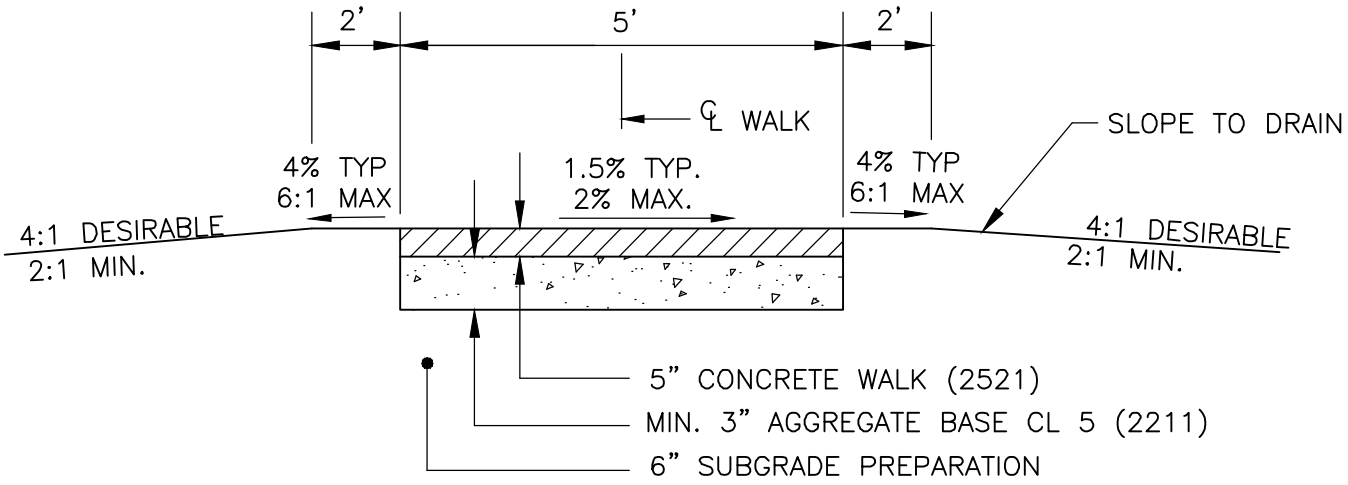

NOTE:

EXPANSION JOINTS SHALL BE REQUIRED ON BOTH SIDES OF DRIVEWAY.

CONCRETE SIDEWALK DETAIL

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CONCRETE SIDEWALK DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-700

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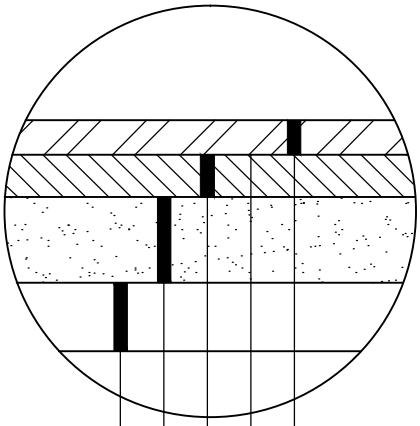

1.5" TYPE SP 12.5 BITUMINOUS WEAR COURSE (SPWEB240B) (2360)

BITUMINOUS TACK COAT (2357)

1.5" TYPE SP 12.5 BITUMINOUS BASE COURSE (SPNWB230B) (2360)

8" AGGREGATE BASE, CL 5 (2211)

12" SUBGRADE PREPARATION (2112)

PARKING AREA BITUMINOUS SECTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PARKING AREA BITUMINOUS SECTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 1-800

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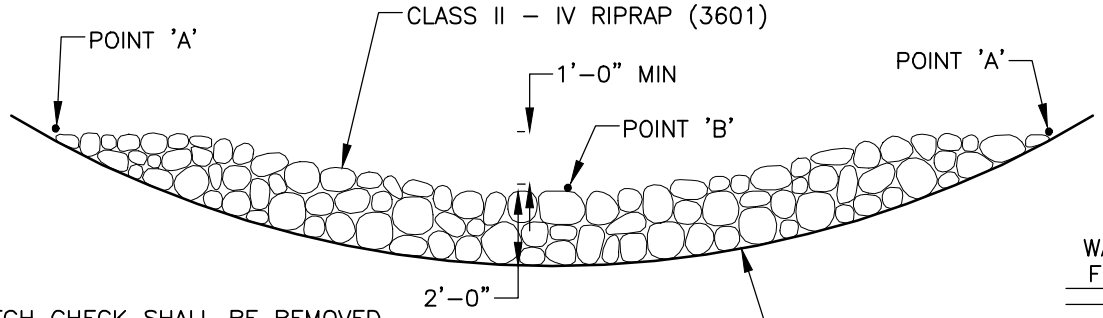
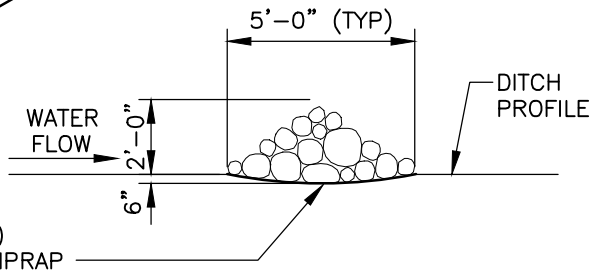


CROSS SECTION



PROFILE VIEW

NOTE:
ROCK DITCH CHECK SHALL BE REMOVED FROM THE CLEAR ZONE AFTER SEEDING OR TURF IS ESTABLISHED AND PRIOR TO FINAL ACCEPTANCE

POINT 'A' MUST BE 1'–0" MINIMUM HIGHER THAN POINT 'B' TO ENSURE THAT WATER FLOWS OVER THE DIKE AND NOT AROUND THE ENDS.

DITCH CHECK – RIPRAP

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

DITCH CHECK – RIPRAP

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–001

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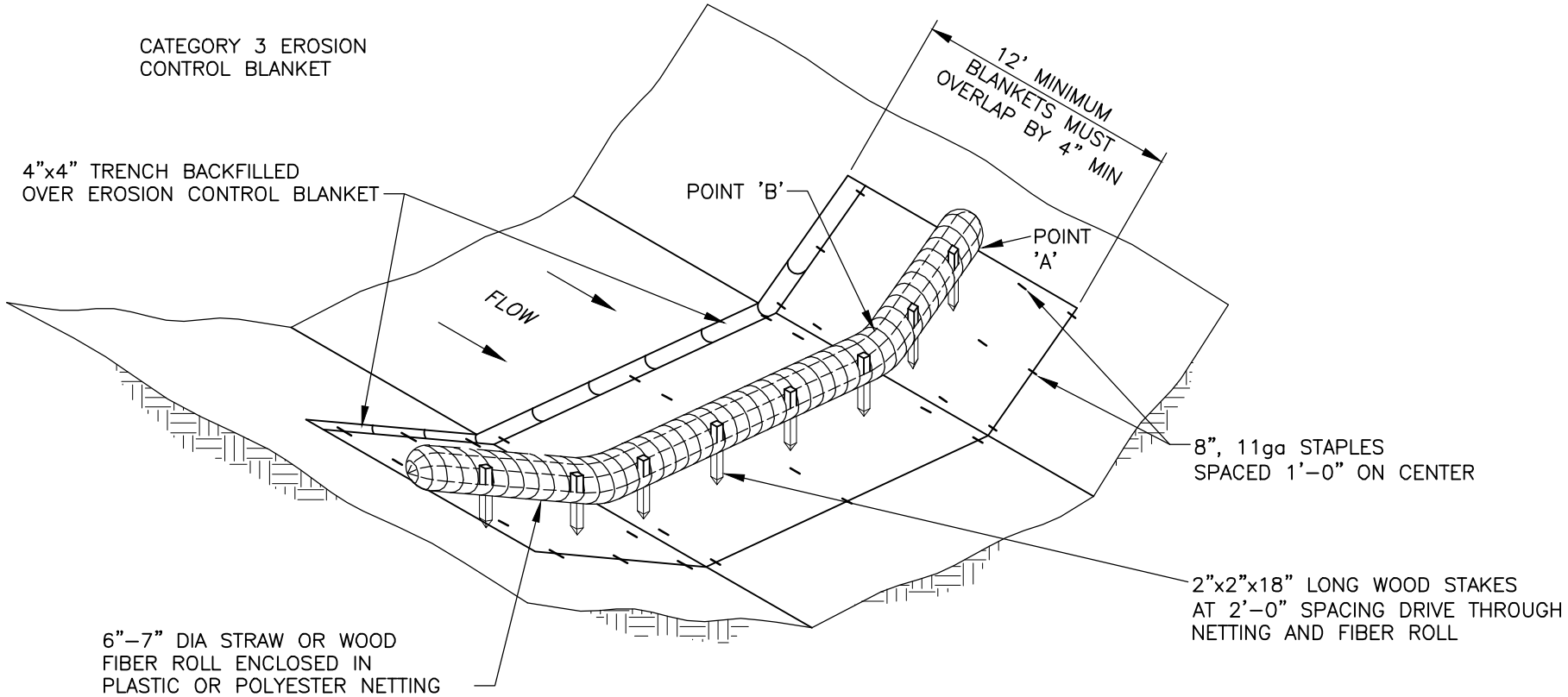

DITCH CHECK – BIOROLL

NOT TO SCALE

NOTE:
POINT 'A' MUST BE 1'-0" MINIMUM HIGHER THAN POINT 'B' TO ENSURE THAT WATER FLOWS OVER THE DIKE AND NOT AROUND THE ENDS.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

DITCH CHECK – BIOROLL

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-002

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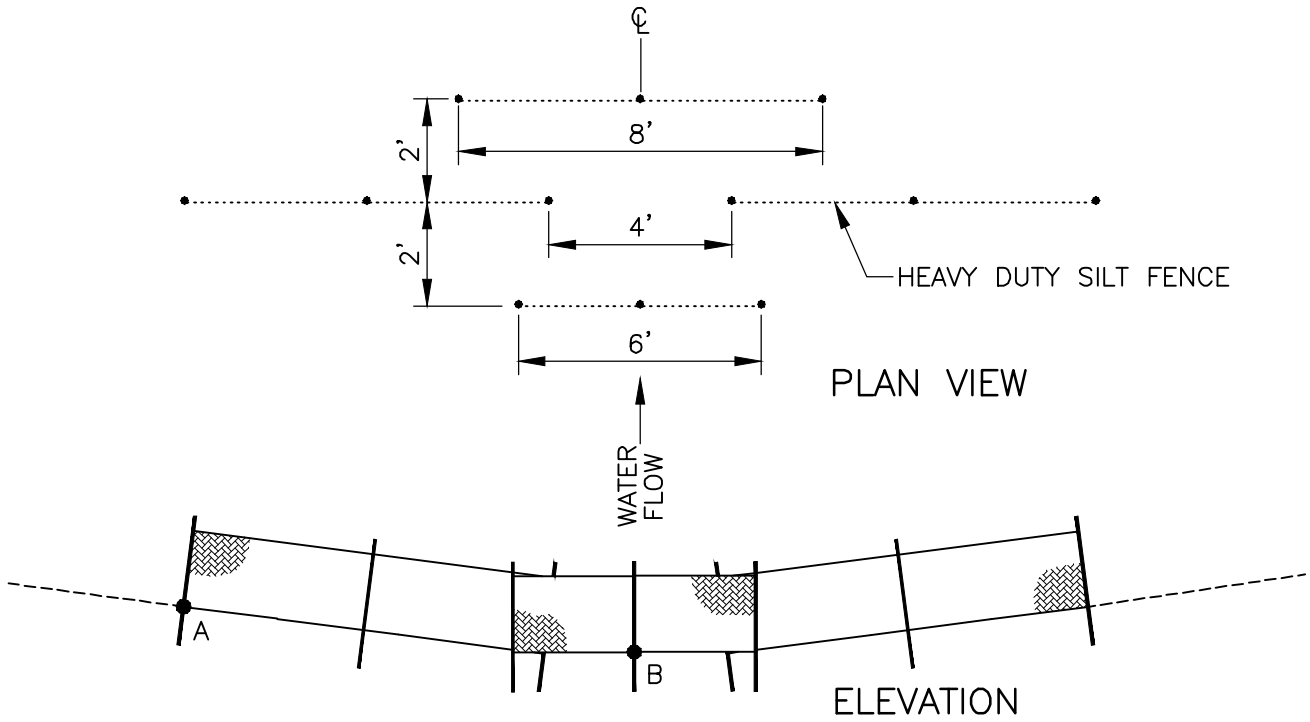

NOTES:

1. POINT A MUST BE A MINIMUM OF 12 INCHES HIGHER THAN POINT B.
2. HEAVY DUTY SILT FENCE SHALL CONFORM TO THE REQUIREMENTS OF MnDOT SPECIFICATION 3886.
3. DIMENSIONS SHOWN ARE FOR TYPICAL 8' DITCH BOTTOM. MODIFICATIONS MAY BE NECESSARY FOR VARYING SLOPES AND DITCH WIDTHS.
4. REFER TO PLAN OR MnDOT EROSION CONTROL MANUAL FOR SPACING INTERVALS OF CHECKS.

VELOCITY CHECK
HEAVY DUTY SILT FENCE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

VELOCITY CHECK
HEAVY DUTY SILT FENCE

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–004

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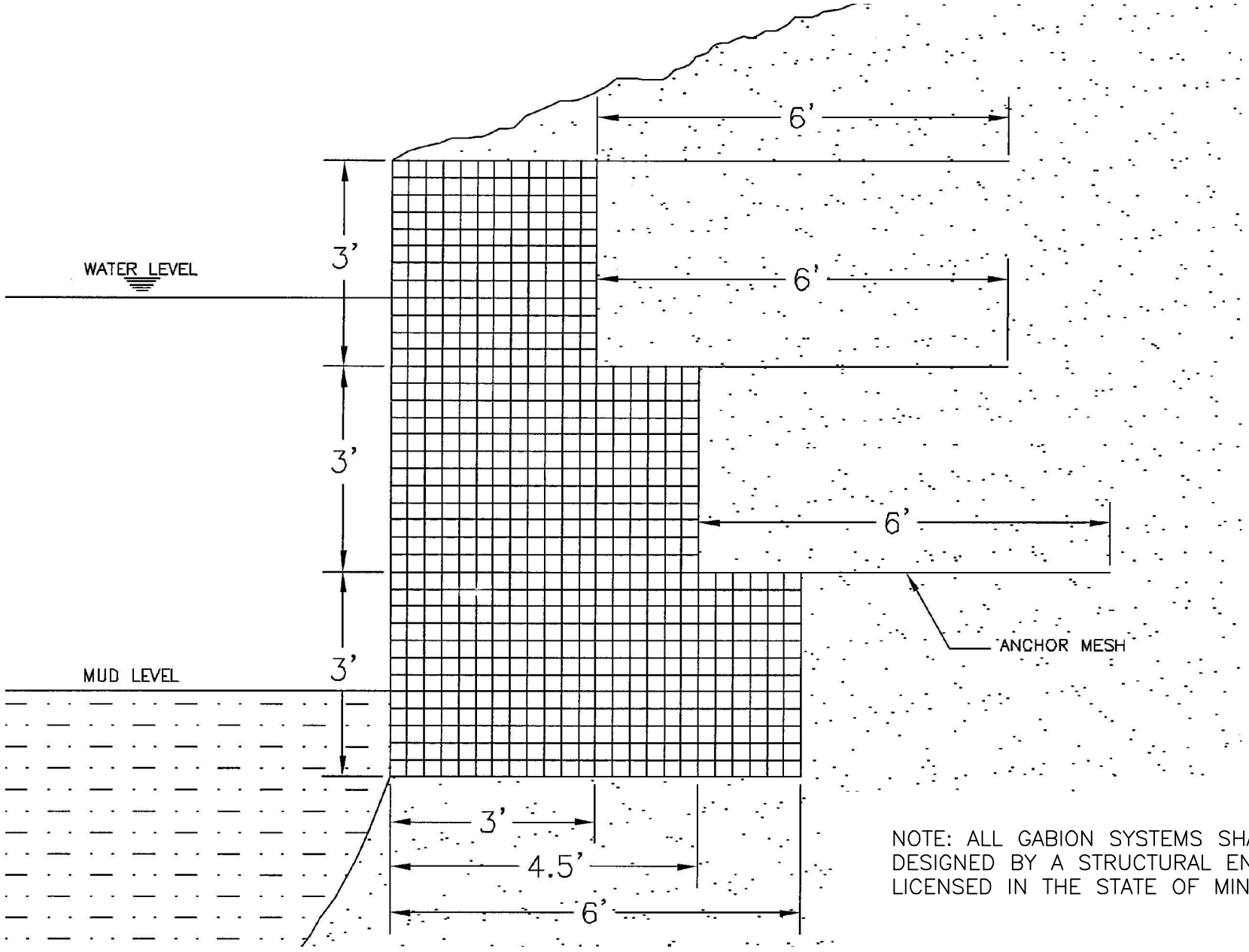

NOTE: ALL GABION SYSTEMS SHALL BE DESIGNED BY A STRUCTURAL ENGINEER LICENSED IN THE STATE OF MINNESOTA.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

GABION SYSTEM (PART A)

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–005A

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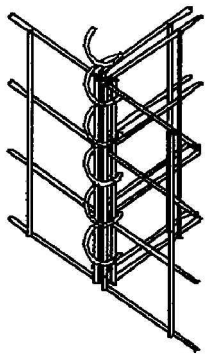
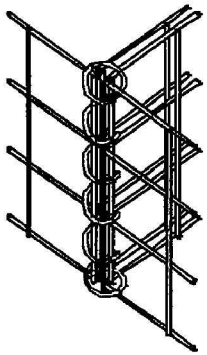
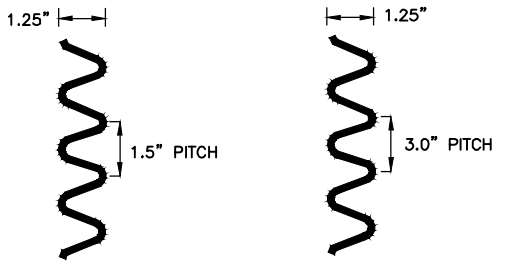


SPIRAL INSTALLATION



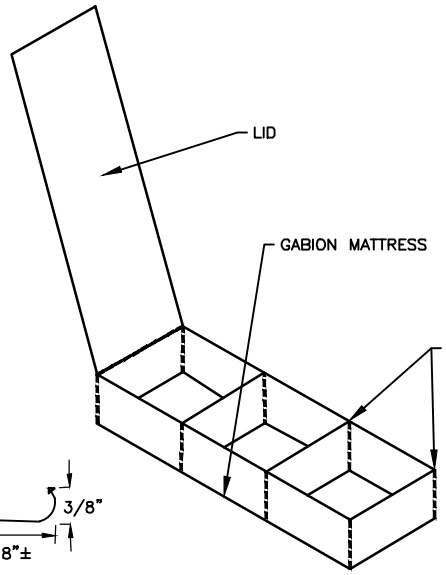
SPIRAL CLOSURE

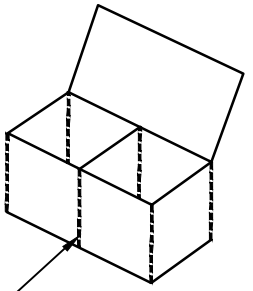
WELDED WIRE GABIONS
SPIRAL BINDERS



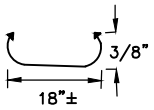
LESS THAN 1 FT HEIGHT — GABION MATTRESS

1 FT OR OVER BASKET HEIGHT — GABION BASKET

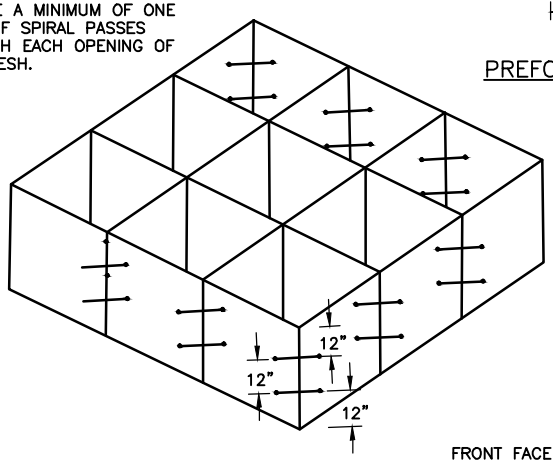


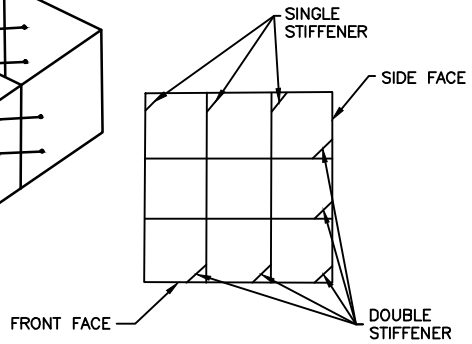


NOTE:
1. FOR SPIRAL BINDERS WITH WELDED WIRE MESH ONLY.
2. ENSURE A MINIMUM OF ONE LOOP OF SPIRAL PASSES THROUGH EACH OPENING OF WIRE MESH.

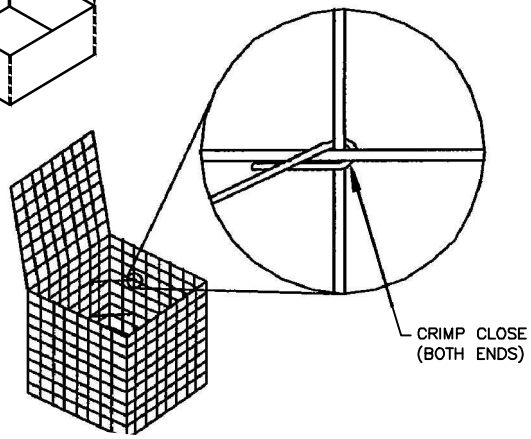


PREFORMED STIFFENERS





LOCATION OF STIFFENERS, TOP VIEW



HOOK STIFFENERS AT CROSSING WIRE

GENERAL NOTES:

1. ON ANY GIVEN LEVEL BASKETS WITH EXPOSED FACES MUST BE FILLED PRIOR TO FILLING BASKETS WITH NO EXPOSED FACE.
2. BASE OF GABION TO BE CONSTRUCTED BELOW SCOUR DEPTH NEXT TO STREAMS.
3. EXTERIOR GABIONS SHALL CONSIST OF WIRE-MESH BASKETS FILLED BY HAND PLACEMENT OF COARSE AGGREGATE, AT LEAST ALONG EXPOSED FACES FOR A UNIFORM APPEARANCE.
4. INTERIOR GABIONS SHALL CONSIST OF WIRE-MESH BASKETS FILLED BY HAND PLACEMENT OR SMALL POWER EQUIPMENT PLACEMENT OF COARSE AGGREGATE.
5. FOR 3 FT GABION, INSTALL PREFORMED STIFFENERS ACROSS THE CORNERS OF THE GABION BEFORE FILLING. TWO ROWS OF STIFFENERS (2 PER CELL) ARE REQUIRED FOR THE FRONT FACE AND SIDE FACES. INSTALL A SINGLE ROW (1 PER CELL) ON THE BACK FACE. NO STIFFENERS ARE REQUIRED IN THE INTERIOR CELLS
6. FOR 15 FT GABION INSTALL A SINGLE ROW (ONE PER CELL) OF STIFFENERS IN THE SAME LOCATIONS AS BEFORE. FOR 1 FT GABION AND MATTRESSES, NO STIFFENERS ARE REQUIRED.
7. STIFFENERS SHALL BE PLACED ACROSS THE CORNERS, AT 12" FROM THE CORNER PROVIDING A DIAGONAL BRACE.

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GABION SYSTEM (PART B)

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-005B

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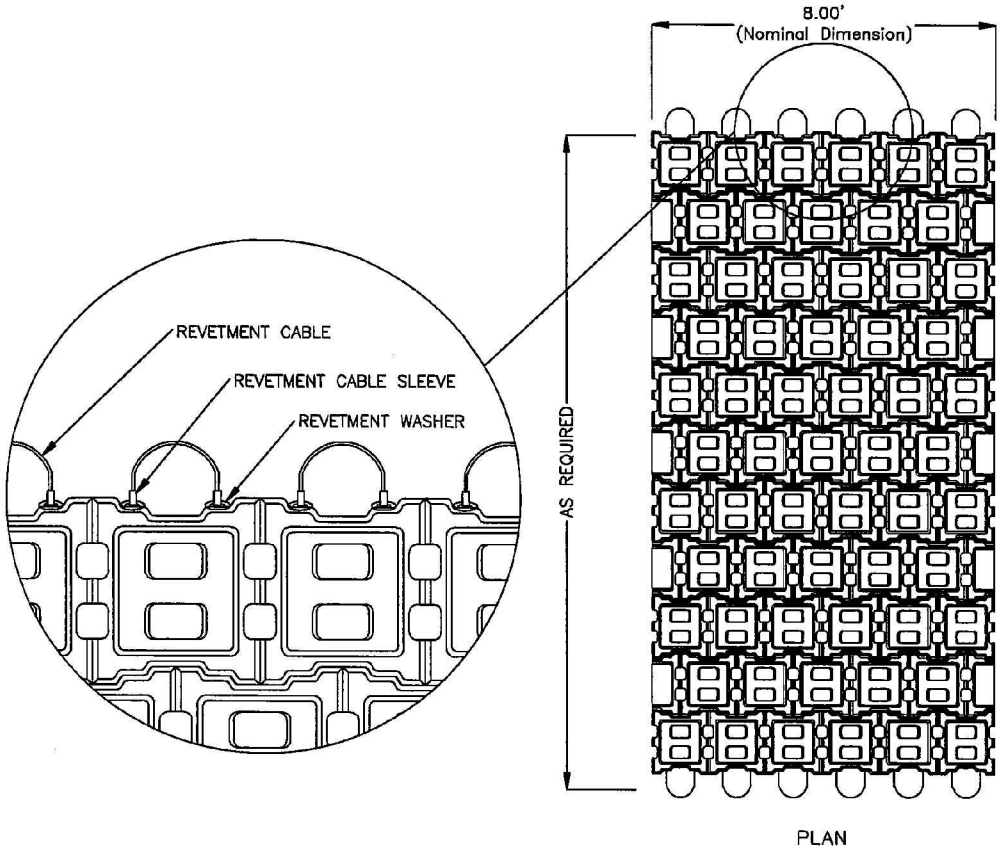
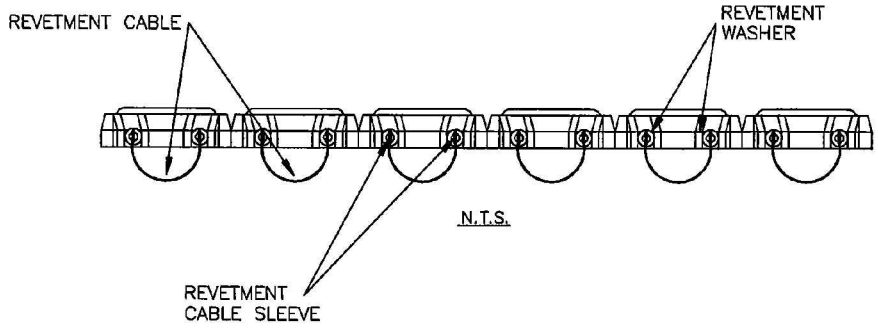


TYPICAL ARMORFLEX MAT

NOT TO SCALE



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CABLE CONCRETE

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–006

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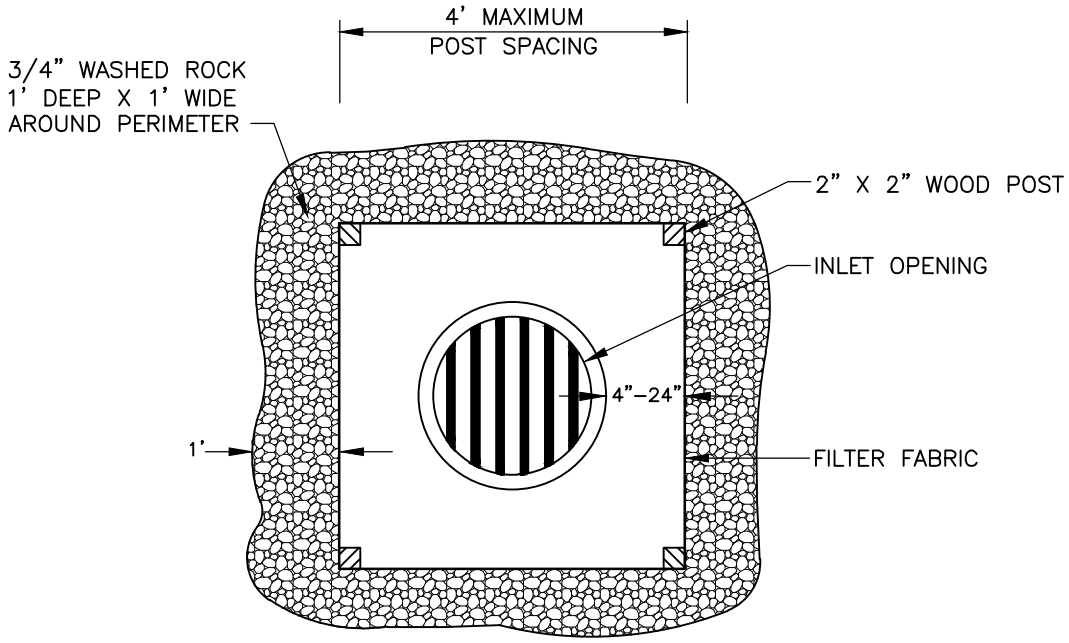
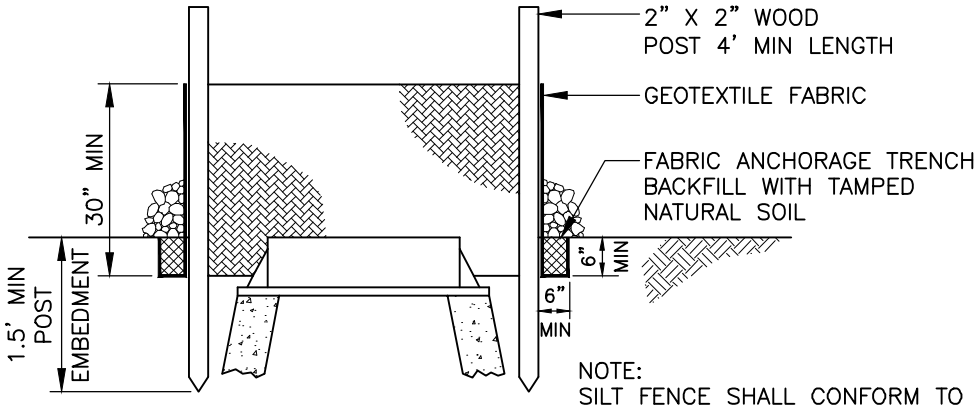


PLAN VIEW



SECTIONAL VIEW

NOTE:
SILT FENCE SHALL CONFORM TO THE REQUIREMENTS OF MnDOT SPECIFICATION 3886

INLET PROTECTION PREASSEMBLED SILT FENCE

NOT TO SCALE

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INLET PROTECTION PREASSEMBLED SILT FENCE

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-101

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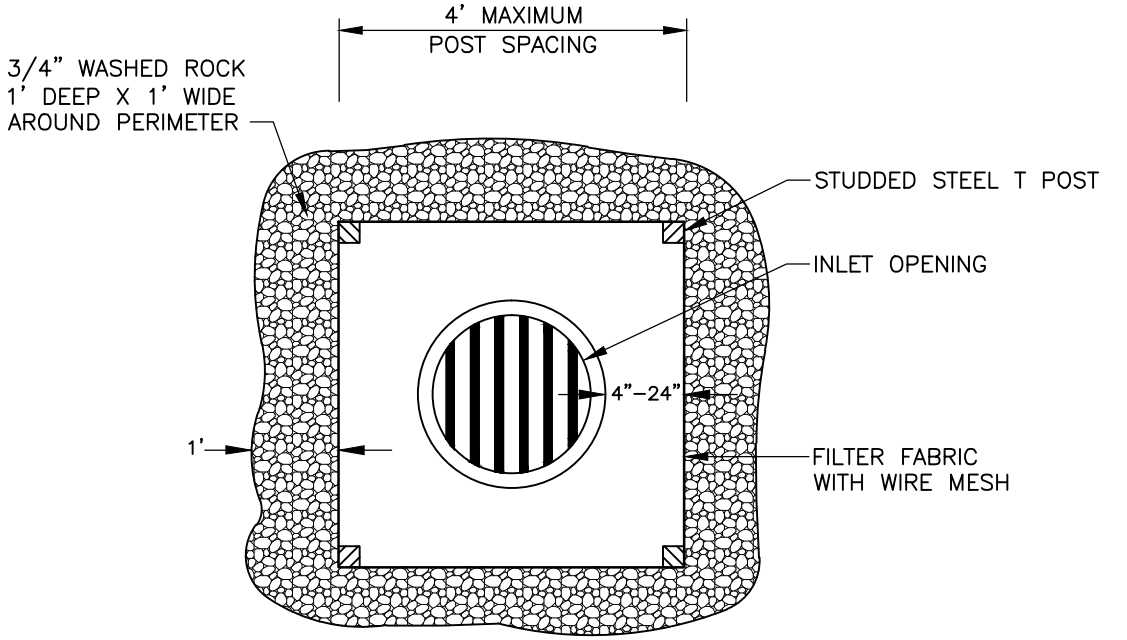
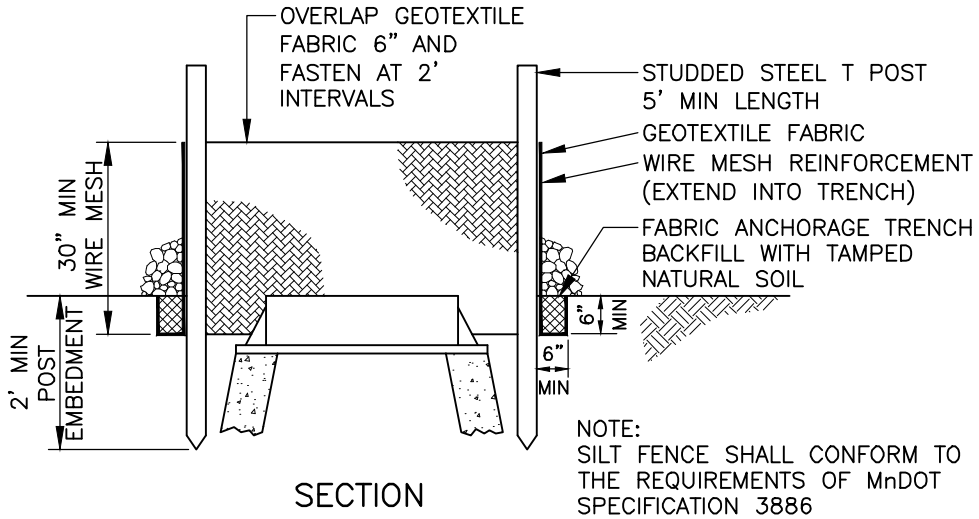


PLAN VIEW



SECTION

NOTE:
SILT FENCE SHALL CONFORM TO THE REQUIREMENTS OF MnDOT SPECIFICATION 3886

INLET PROTECTION
HEAVY DUTY SILT FENCE

NOT TO SCALE

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INLET PROTECTION
HEAVY DUTY
SILT FENCE

City of St. Francis

DATE:
07/2013

STD. DETAIL
3-102

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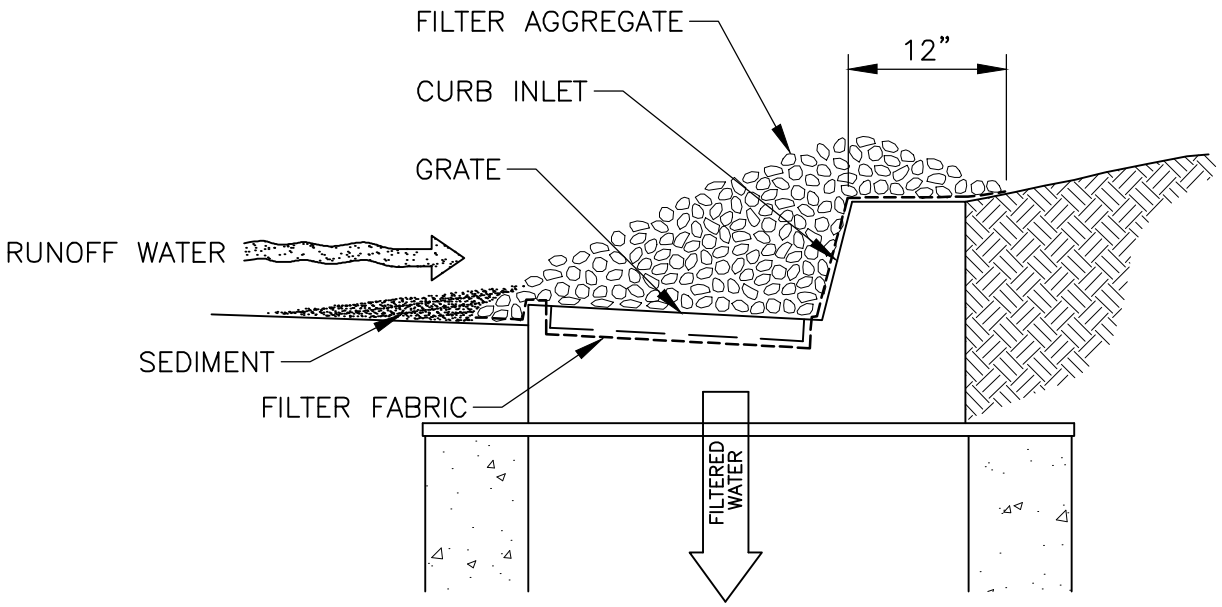
NOTES:

1. FILTER AGGREGATE TO BE 1 TO 2 INCH CLEAN ROCK.

2. FILTER FABRIC SHALL MEET MnDOT SPECIFICATION 3733 GEOTEXTILE FABRIC TYPE II.



INLET PROTECTION FILTER AGGREGATE

NOT TO SCALE

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Consulting Engineers & Surveyors
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INLET PROTECTION FILTER AGGREGATE

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-103

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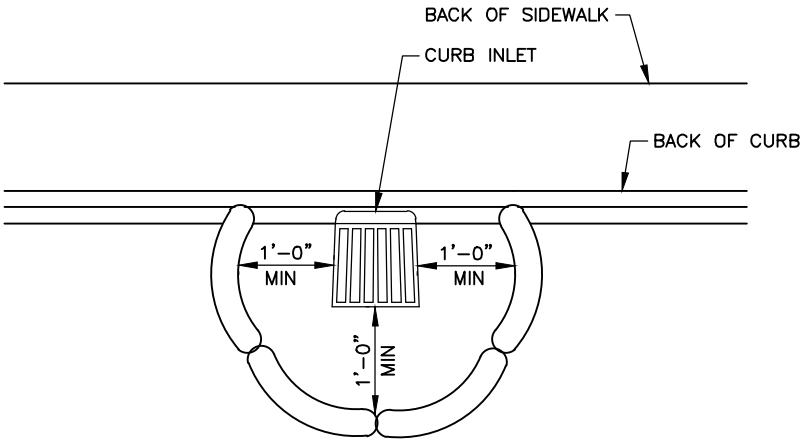
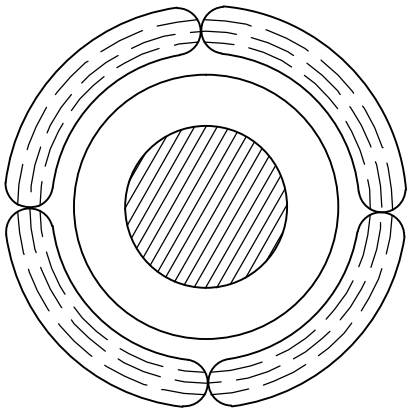


NOTE:
THIS INLET PROTECTION IS USED DURING ROUGH GRADING ONLY. USE BEFORE ROAD IS OPEN TO TRAFFIC OR IS PAVED.

PAYMENT SHALL INCLUDE ALL MATERIALS, FILLING OF LOG, PLACEMENT, MAINTENANCE & REMOVAL. 80% OF BID PRICE SHALL BE PAID UPON PROPER PLACEMENT WITH THE FINAL 20% PAID UPON REMOVAL.

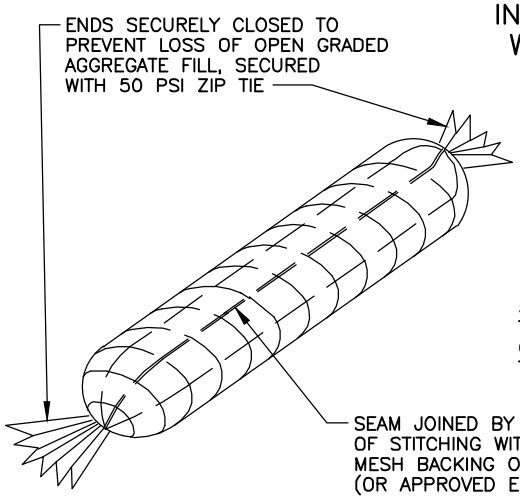


INLET PROTECTION WITH ROCK LOG

FILL ROCK LOG WITH 45 LBS. OF OPEN GRADED AGGREGATE CONSISTING OF SOUND, DURABLE PARTICLES OF CRUSHED QUARRY ROCK OR GRAVEL CONFORMING TO THE FOLLOWING GRADATION.

GRADATION	
SIEVE SIZE	PERCENT PASSING
1 1/2"	100
1"	95–100
3/4"	65–95
3/8"	30–65
NO 4	10–35
NO 10	3–20
NO 40	0–8
NO 200	0–3

NOTE:
CRUSHED CONCRETE OR BITUMINOUS SHALL NOT BE USED FOR OPEN GRADED AGGREGATE.



INLET PROTECTION ROCK BAG

NOT TO SCALE

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Consulting Engineers & Surveyors
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INLET PROTECTION ROCK BAG

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-105

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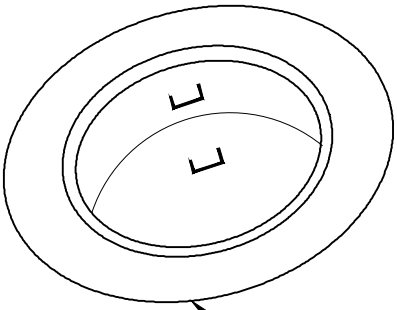
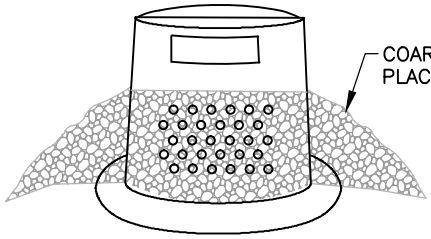
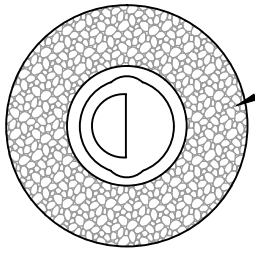
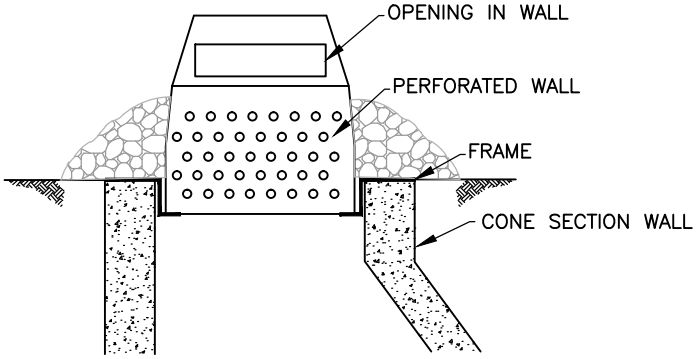






TOP VIEW



INLET PROTECTION PERFORATED WALL

NOT TO SCALE

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INLET PROTECTION PERFORATED WALL

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-107

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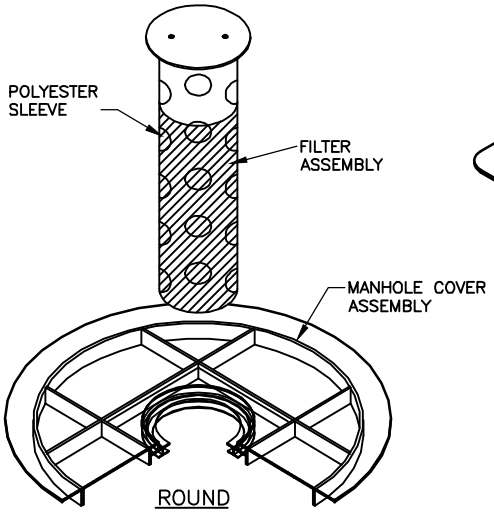
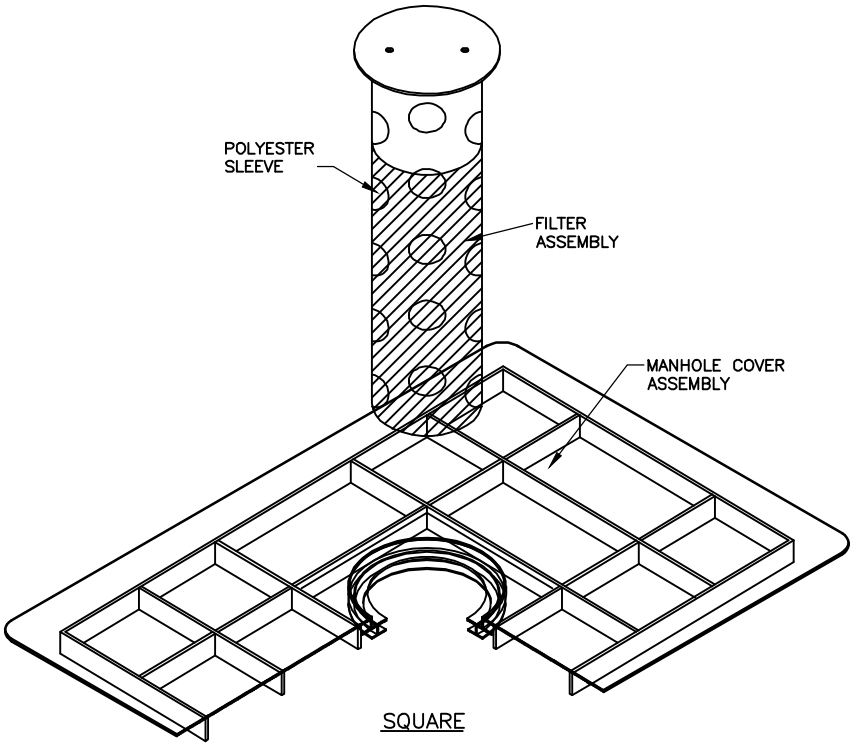


ROUND



SQUARE

NOTES:
1. PLACE THE ROAD DRAIN–TOP SLAB MODEL DIRECTLY ON THE TOP OF STRUCTURE OR ON ENGINEER APPROVED ADJUSTING RINGS.
2. INSTALL GASKET AND COVER CENTER OF GASKET WITH PIPE GREASE OR OTHER APPROVED LUBRICATION.
3. PLACE THE FILTER MEDIA ONTO THE RISER PIPE.
4. ADJUST FILTER MEDIA PROPER HEIGHT FOR OVERFLOW.
5. CHECK RISER TUBE TO MAKE SURE IT IS FULLY EXTENDED AND ALL FILTER HOLES ARE EXPOSED.
6. CHECK FILTER MEDIA AFTER EACH RAIN EVENT. CLEAN OR REPLACE IF SEDIMENT CLOGS FILTER.
7. REMOVE SEDIMENT AND DEBRIS FROM THE BASE OF THE RISER PIPE TO THE WIDTH EQUAL TO THE SIZE OF THE TOP SLAB MODEL.

INLET PROTECTION
ROAD DRAIN

NOT TO SCALE

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INLET PROTECTION
ROAD DRAIN

City of St. Francis

DATE:
07/2013

STD. DETAIL
3–108

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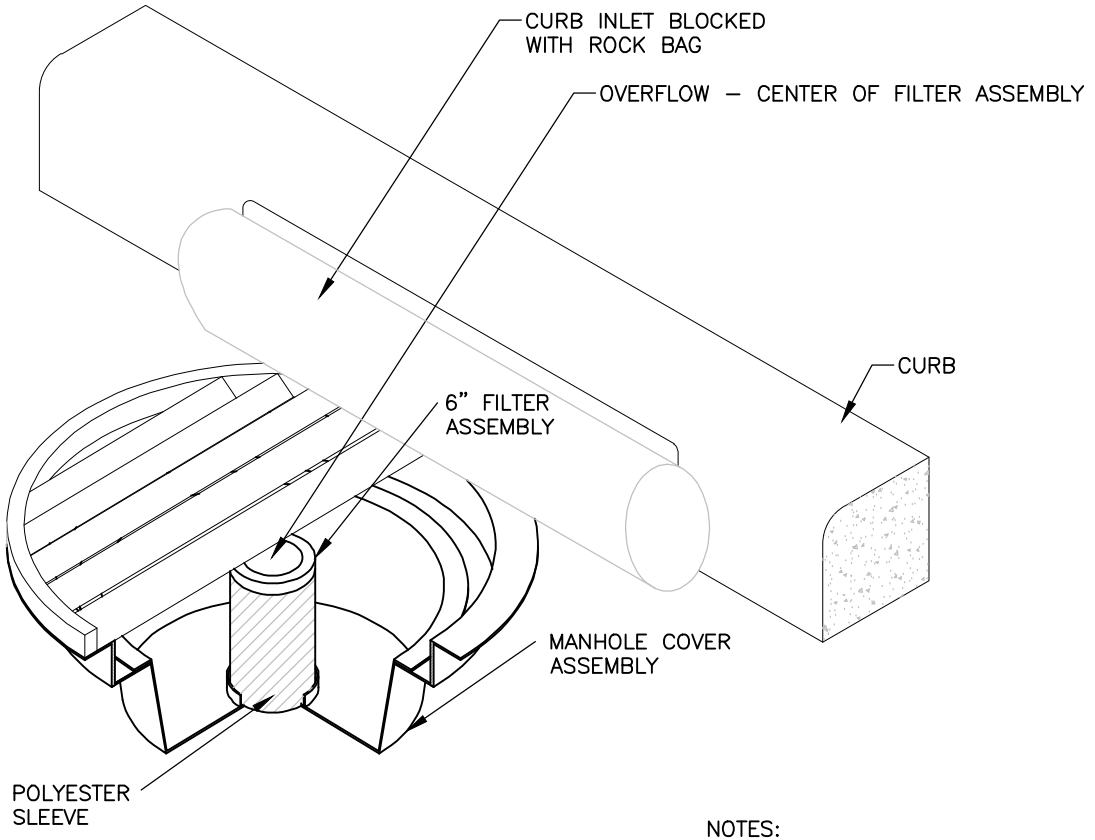

INLET PROTECTION
ROAD DRAIN
CURB AND GUTTER

NOT TO SCALE

NOTES:
1. ROAD DRAIN DEVICE FITS NEENAH R–3250–1 CASTINGS.
2. PLACE THE ROAD DRAIN–TOP SLAB MODEL DIRECTLY INTO THE CASTING.
3. INSTALL GASKET AND COVER CENTER OF GASKET WITH PIPE GREASE OR OTHER APPROVED LUBRICATION.
4. PLACE THE FILTER MEDIA ONTO THE RISER PIPE.
5. ADJUST FILTER MEDIA PROPER HEIGHT FOR OVERFLOW.
6. CHECK RISER TUBE TO MAKE SURE IT IS FULLY EXTENDED AND ALL FILTER HOLES ARE EXPOSED.
7. CHECK FILTER MEDIA AFTER EACH RAIN EVENT. CLEAN OR REPLACE IF SEDIMENT CLOGS FILTER.
8. REMOVE SEDIMENT AND DEBRIS FROM THE BASE OF THE RISER PIPE TO THE WIDTH EQUAL TO THE SIZE OF THE TOP SLAB MODEL.

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INLET PROTECTION
ROAD DRAIN
CURB AND GUTTER

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–108A

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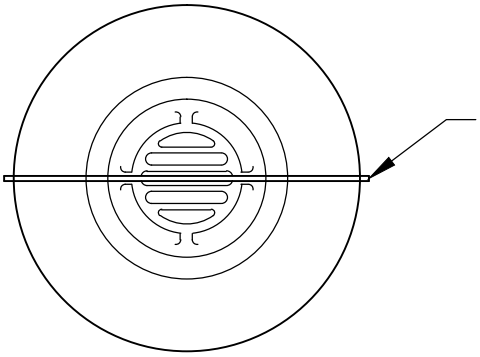
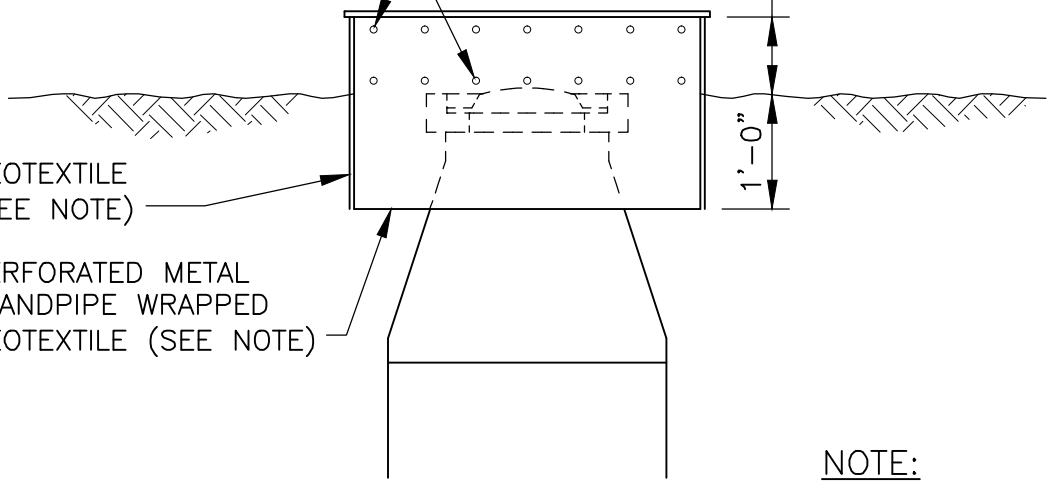


ANTIVORTEX ROD, 5/8"ø MINIMUM, TACK WELD TO STANDPIPE AND SET PARALLEL TO FLOW

PLAN VIEW

1" HOLES SPACED 8"–10" ON CENTER

1'–0" UNLESS ADJUSTMENT IS REQUIRED BECAUSE OF POTENTIAL FOR FLOODING



GEOTEXTILE (SEE NOTE)

PERFORATED METAL STANDPIPE WRAPPED GEOTEXTILE (SEE NOTE)

ELEVATION

NOTE:
ALL GEOTEXTILE USED FOR INLET PROTECTION SHALL BE MONOFILAMENT IN BOTH DIRECTIONS

INLET PROTECTION RISER STANDPIPE

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INLET PROTECTION RISER STANDPIPE

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–109

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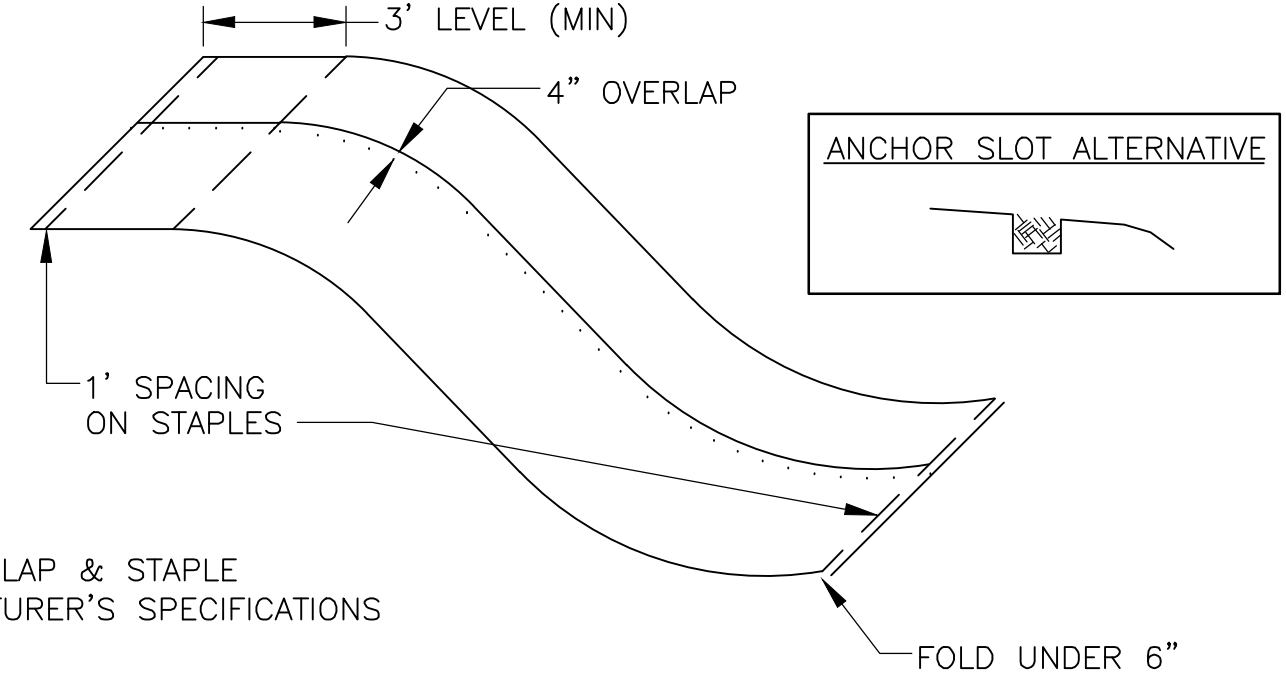

NOTE:
ANCHOR, OVERLAP & STAPLE
PER MANUFACTURER'S SPECIFICATIONS

EROSION CONTROL BLANKET INSTALLATION

NOT TO SCALE

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EROSION CONTROL BLANKET INSTALLATION

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–200

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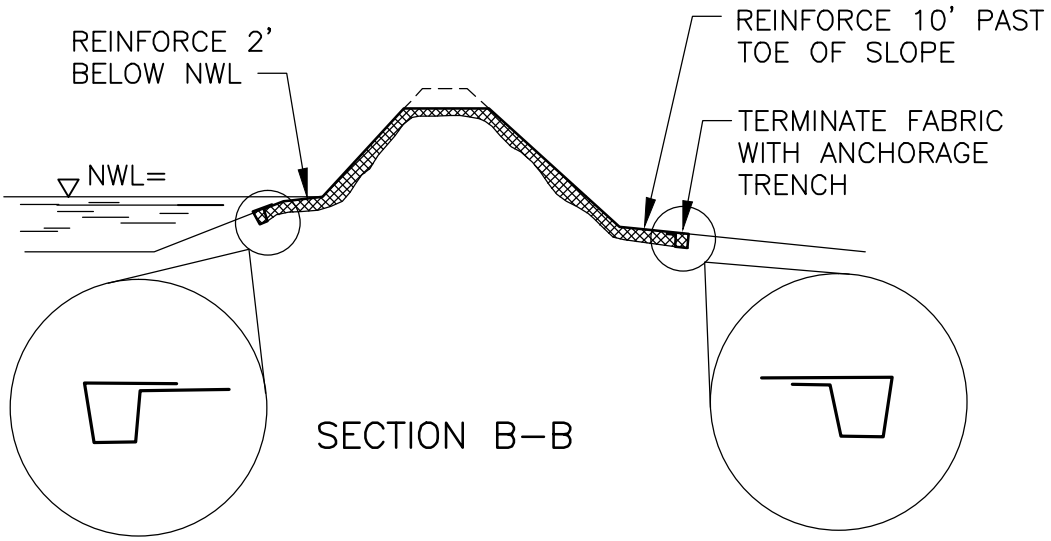

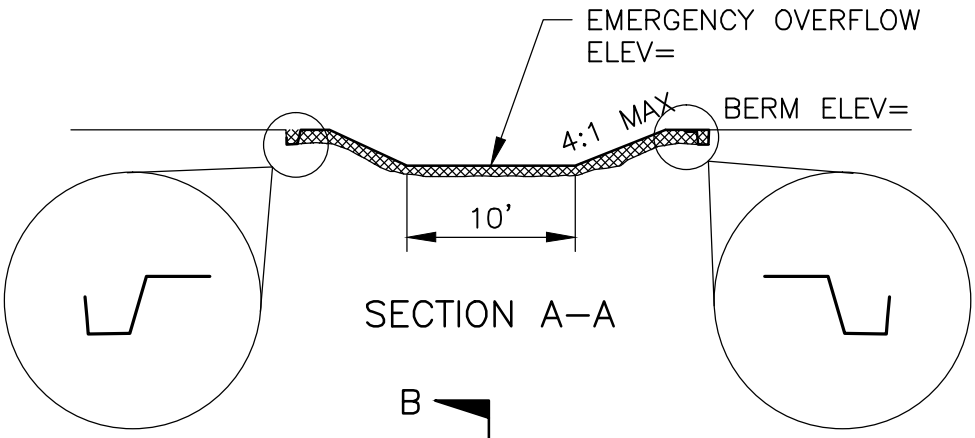

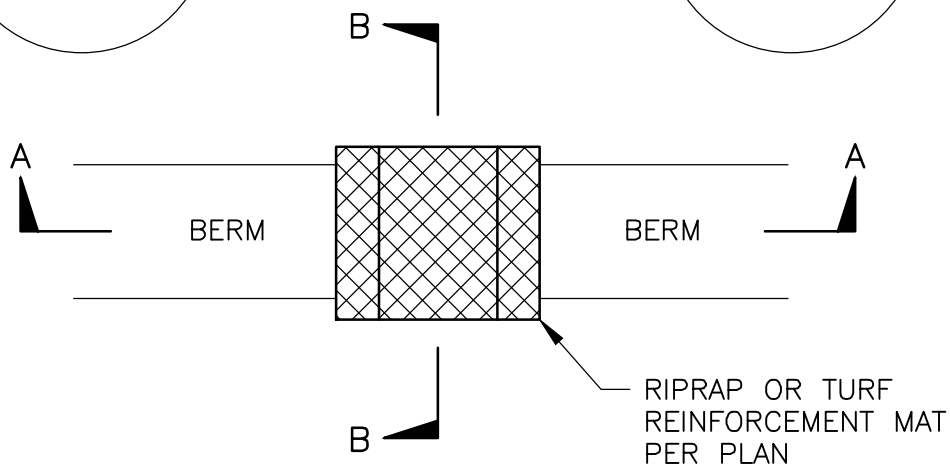

EROSION CONTROL BLANKET OR RIP RAP AT POND EOF

NOT TO SCALE

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EROSION CONTROL BLANKET OR RIPRAP AT POND EOF

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–201

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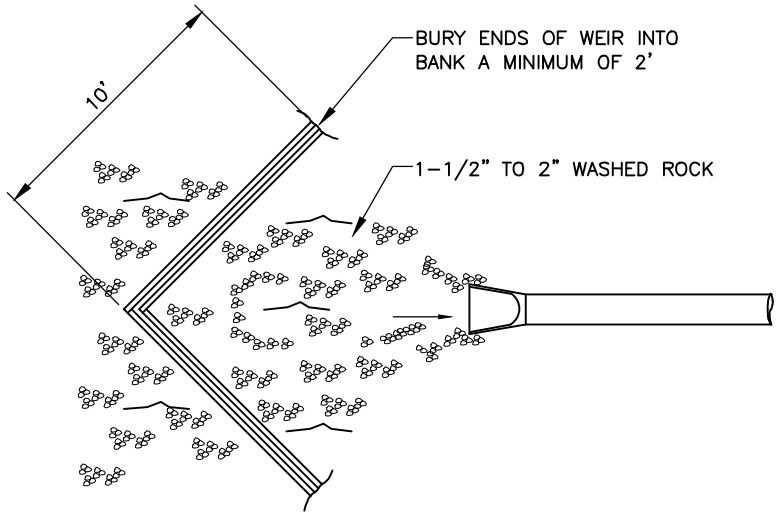
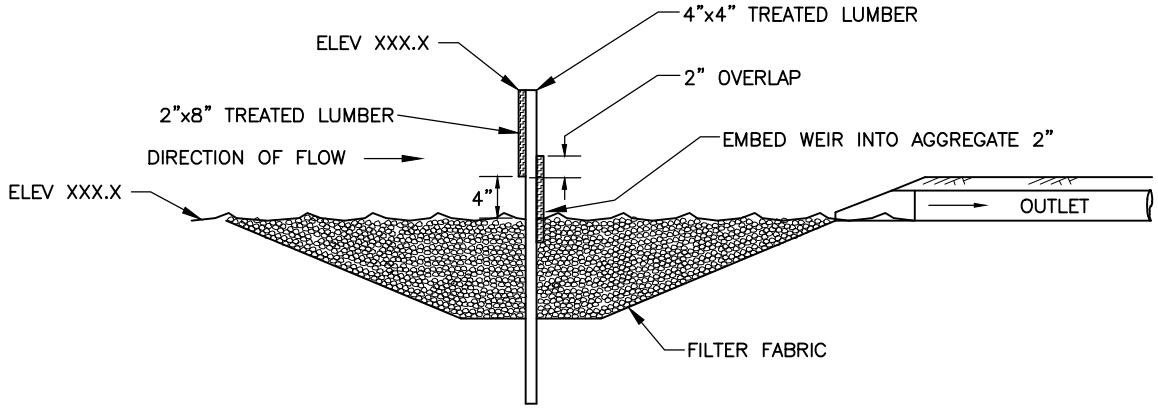


PLAN



SKIMMER WEIR (POND OR WIDE CHANNEL)

NOT TO SCALE

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SKIMMER WEIR
(POND OR WIDE CHANNEL)

City of St. Francis

DATE:
07/2013

STD. DETAIL
3-300

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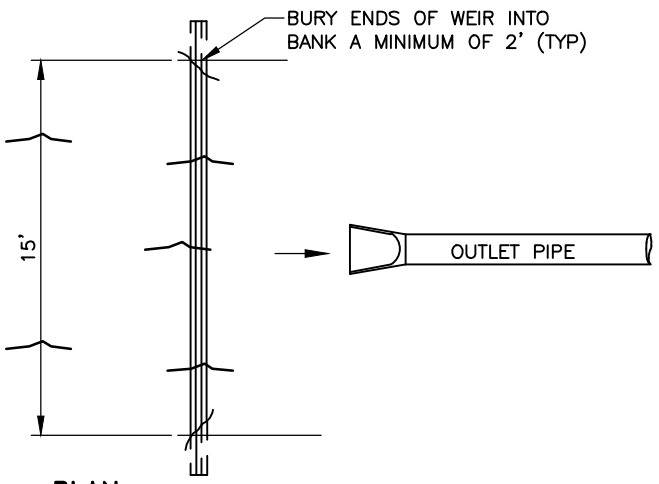
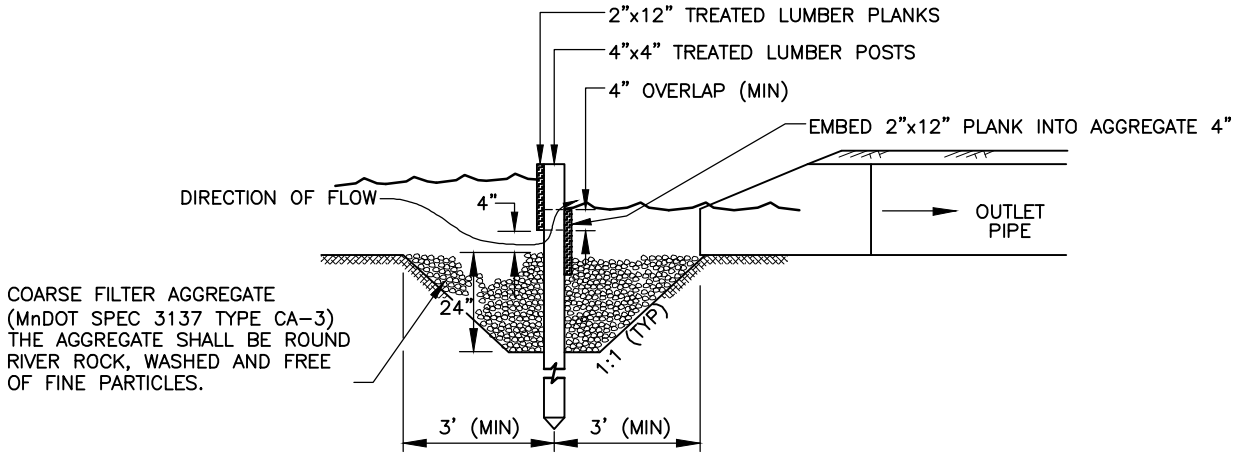


PLAN



SKIMMER WEIR (NARROW CHANNEL)

NOT TO SCALE

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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

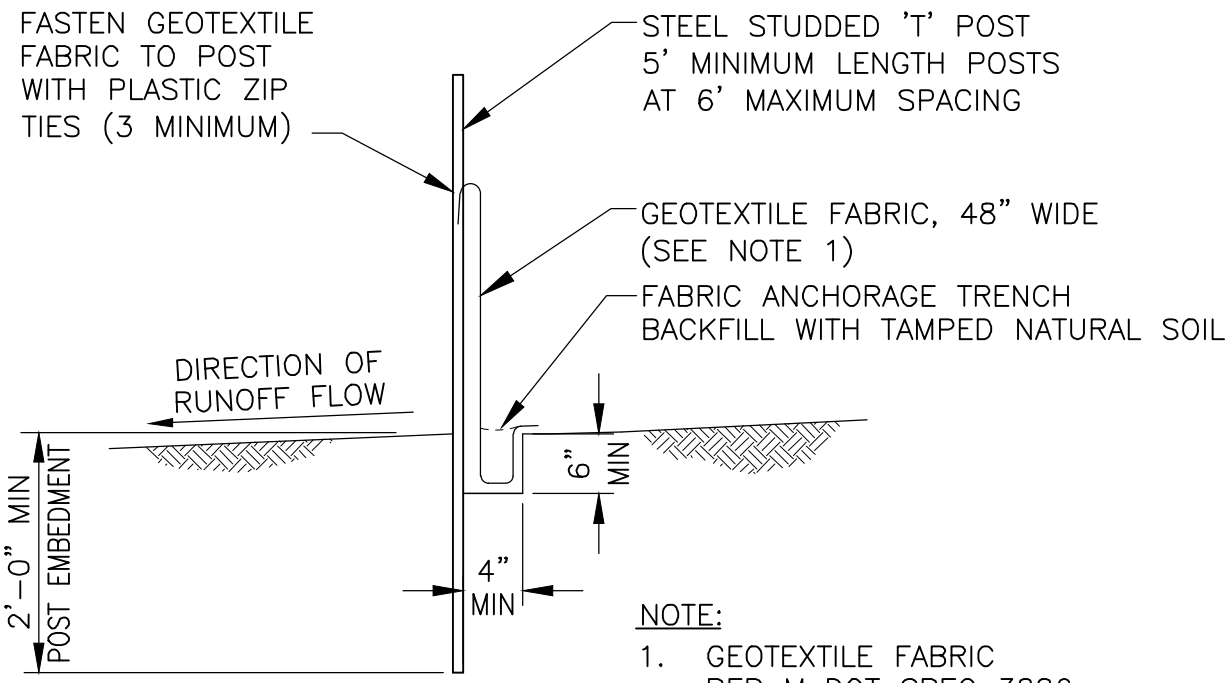
SKIMMER WEIR
(NARROW CHANNEL)

City of St. Francis

DATE:
07/2013

STD. DETAIL
3-301

Y:\STFR\2013 Details\STFR_3-301.dwg



SILT FENCE – HEAVY DUTY

NOT TO SCALE

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Consulting Engineers & Surveyors
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SILT FENCE
HEAVY DUTY

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-400

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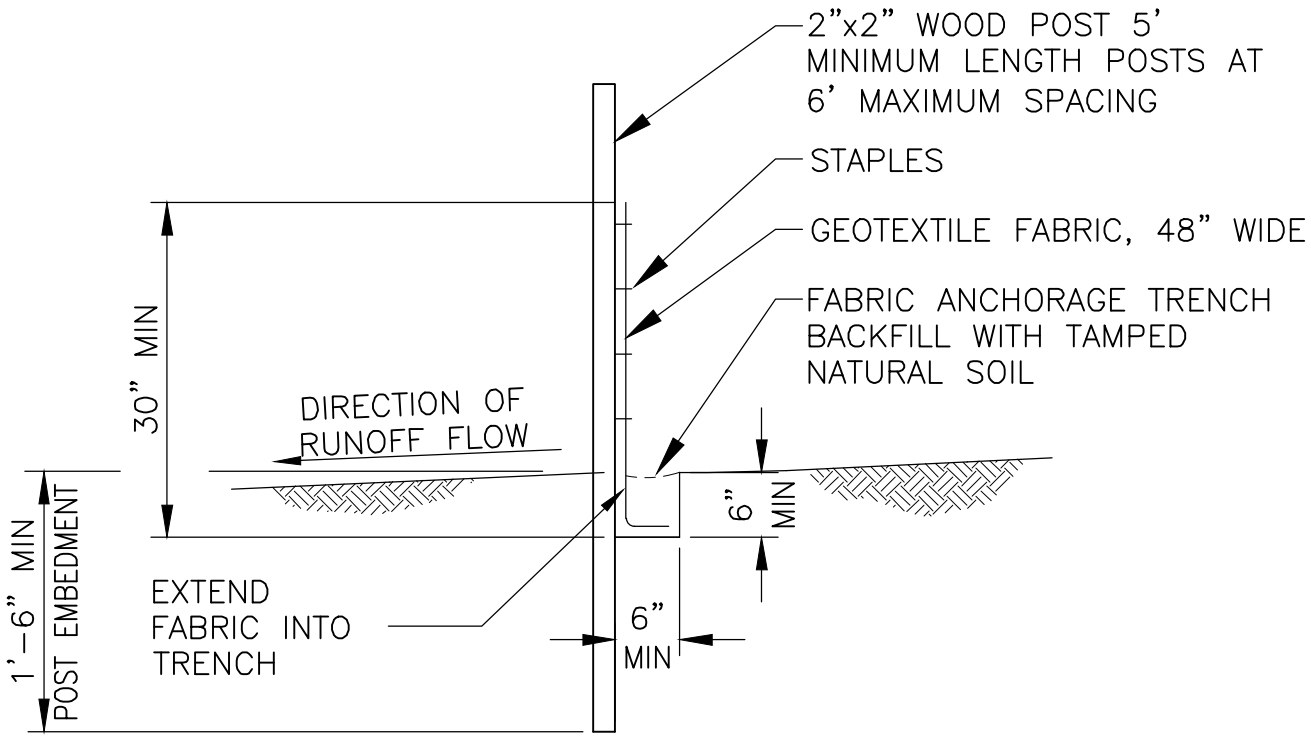

SILT FENCE – PREASSEMBLED

NOT TO SCALE

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BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SILT FENCE PREASSEMBLED

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-401

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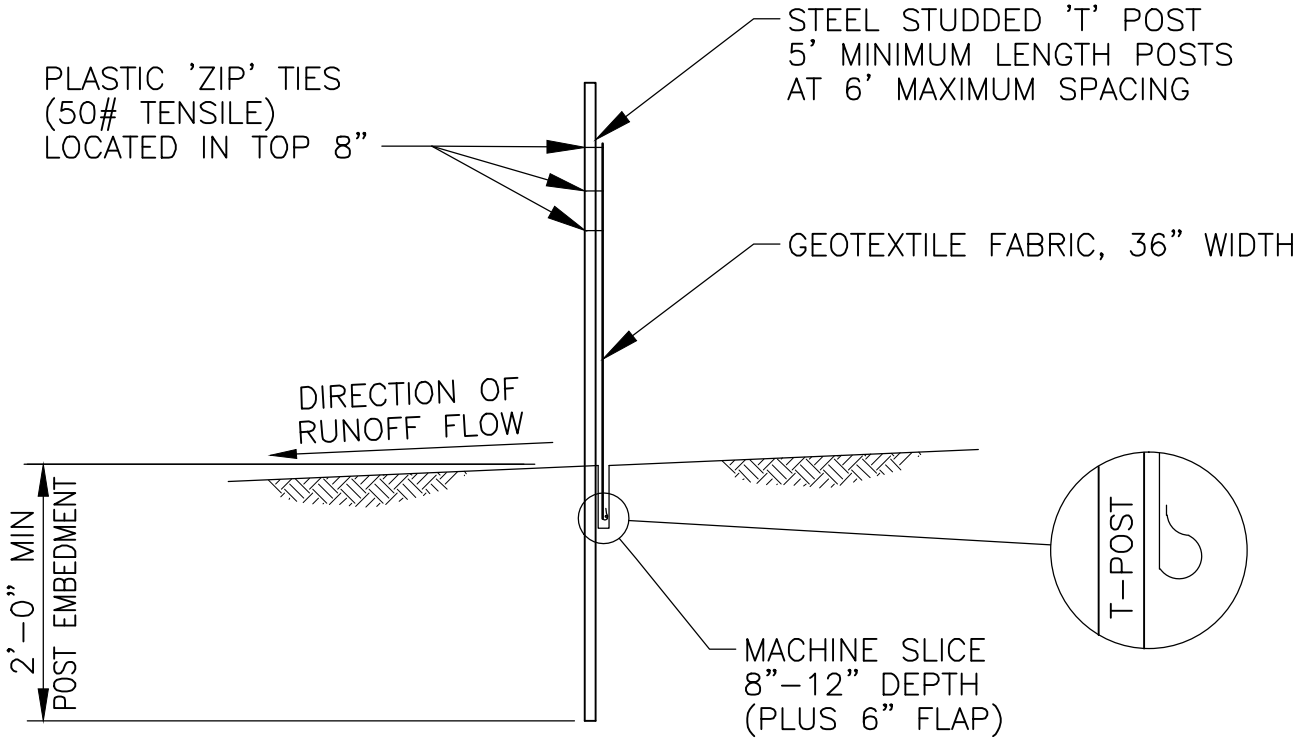

SILT FENCE – MACHINE SLICED

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

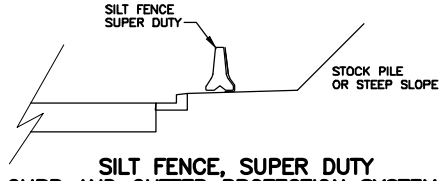
SILT FENCE
MACHINE SLICED

City of St. Francis

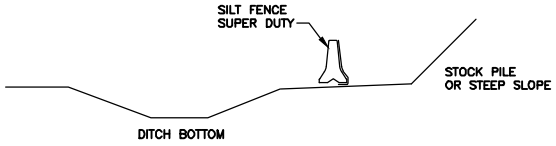
DATE:
07/2013

STD. DETAIL
3-402

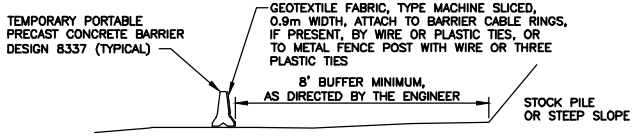
Y:\STFR\2013 Details\STFR_3-402.dwg



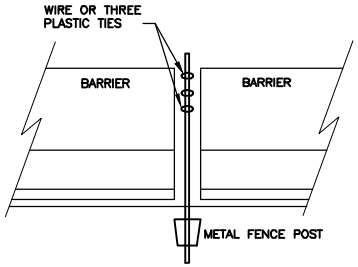
SILT FENCE, SUPER DUTY
CURB AND GUTTER PROTECTION SYSTEM



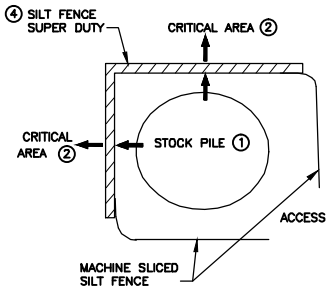
SILT FENCE, SUPER DUTY
DITCH PROTECTION SYSTEM

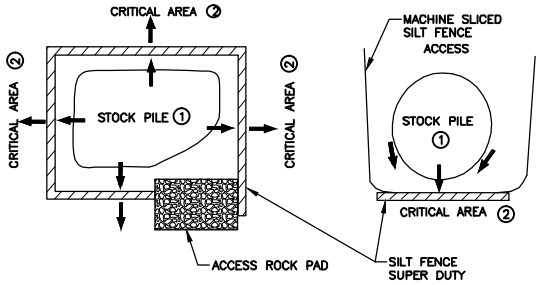


SILT FENCE, SUPER DUTY
STOCKPILE SEDIMENT CONTROL

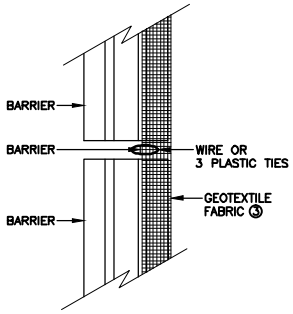


BARRIER WITHOUT CABLE RINGS
SIDE VIEW

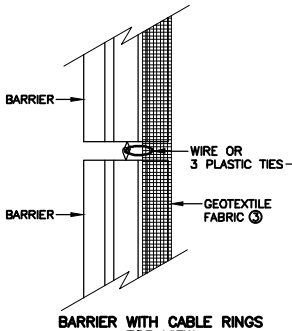




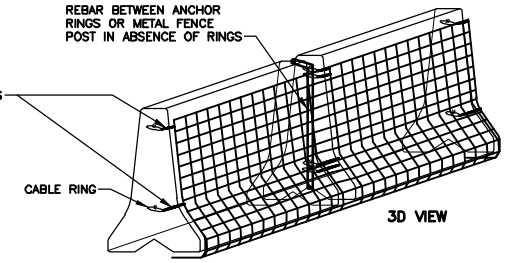
SILT FENCE, SUPER DUTY
STOCK PILE CONTAINMENT



BARRIER WITHOUT CABLE RINGS
TOP VIEW



BARRIER WITH CABLE RINGS
TOP VIEW



3D VIEW

NOTES:

1. PLACING STOCK PILES NEXT TO AN ENVIRONMENTALLY SENSITIVE AREA IS NOT RECOMMENDED. WHEN THERE ARE NO FEASIBLE ALTERNATIVES, THE SUPER DUTY SILT FENCE IS TO BE USED AS SHOWN OR AS DIRECTED BY THE ENGINEER.
2. CRITICAL AREAS INCLUDE WETLANDS, JUDICIAL DITCHES, STREAMS, WATER BODIES, AND OTHER AREAS REQUIRING PROTECTION.
3. GEOTEXTILE FABRIC, TYPE WOVEN MONOFILAMENT CONFORMING TO SPEC 3886, TABLE 3886-1.
4. INSTALL TO FIT LAND FORM AND ITEM TO PROTECT.

SILT FENCE
TEMPORARY SEDIMENT CONTROL

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SILT FENCE
SUPER HEAVY DUTY

City of St. Francis

DATE:
07/2013

STD. DETAIL
3-403

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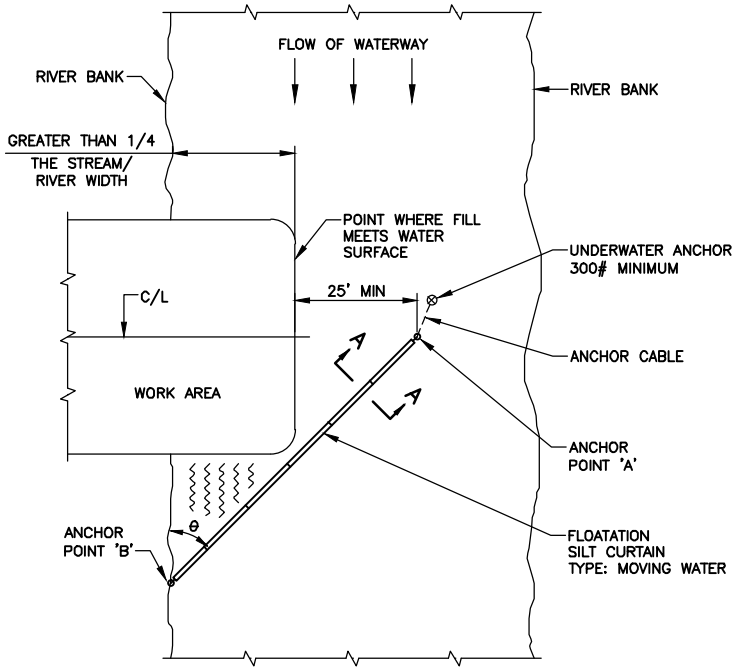
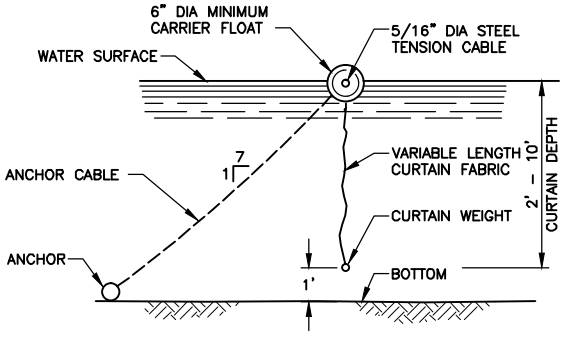


∠ θ	RIVER VELOCITY
45°	SLOW, LESS THAN 3 FT/SEC
35°	MODERATE, 3 – 5 FT/SEC

PLAN VIEW

DESIGN GUIDELINES:
WHEN TEMPORARY FILL ENCROACHES MORE THAN 1/4 BUT LESS THAN 1/3 THE WIDTH OF THE STREAM

MAXIMUM WATER DEPTH: 11 FT
MINIMUM WATER DEPTH: 3 FT
MAXIMUM WATER VELOCITY: 5 FT/SEC



SECTION A–A

SILT FENCE – FLOTATION SILT CURTAIN

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

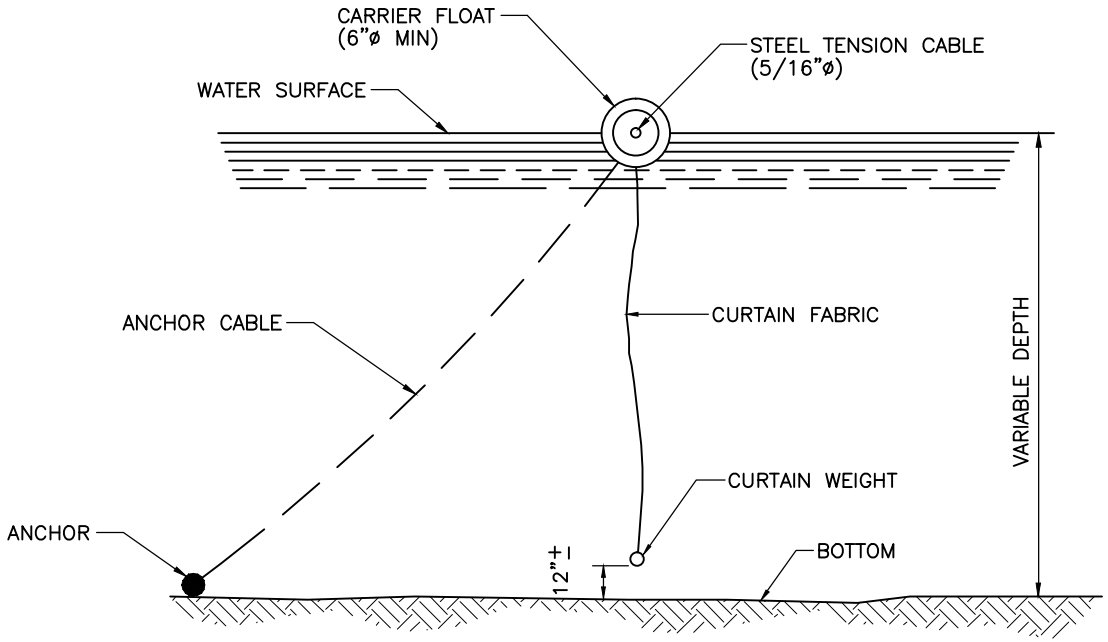
SILT FENCE
FLOTATION
SILT CURTAIN

City of St. Francis

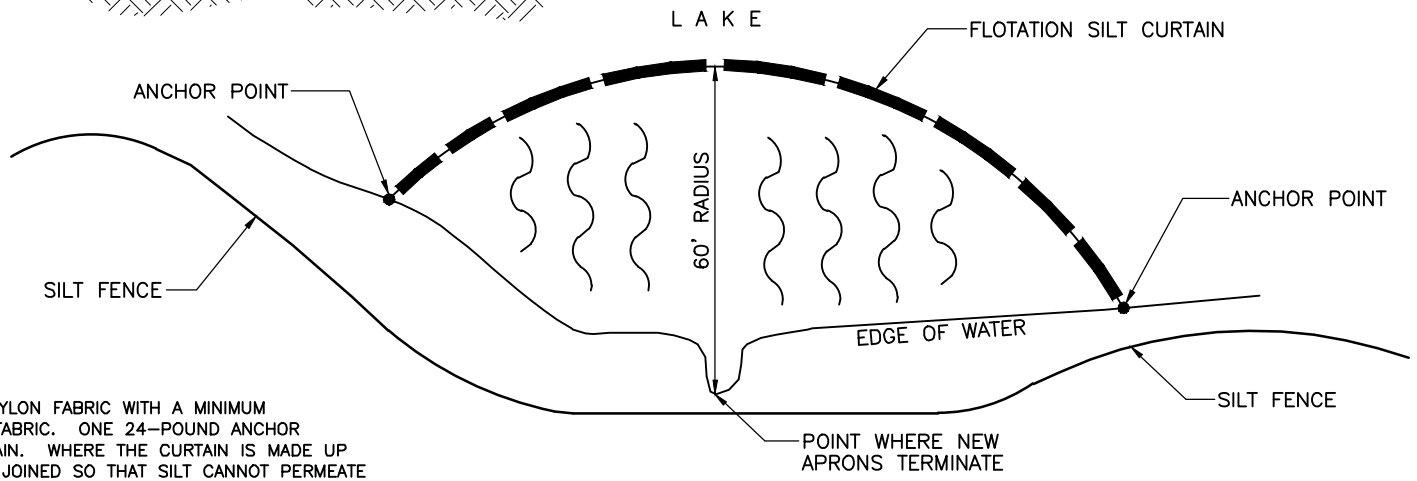
DATE:
07/2013

STD. DETAIL
3–404

Y:\STFR\2013 Details\STFR_3-404.dwg



PROFILE VIEW



PLAN VIEW

NOTE: CURTAIN SHALL BE CONSTRUCTED OF A NYLON FABRIC WITH A MINIMUM TENSILE STRENGTH OF 300 LBS./IN. OF FABRIC. ONE 24–POUND ANCHOR SHALL BE USED PER 100 FEET OF CURTAIN. WHERE THE CURTAIN IS MADE UP OF SECTIONS, THE SECTIONS SHOULD BE JOINED SO THAT SILT CANNOT PERMEATE THROUGH THE CONNECTION.

FLOTATION SILT CURTAIN – STILL WATER

N.T.S.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SILT FENCE
FLOTATION SILT CURTAIN
(STILL WATER)

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–405

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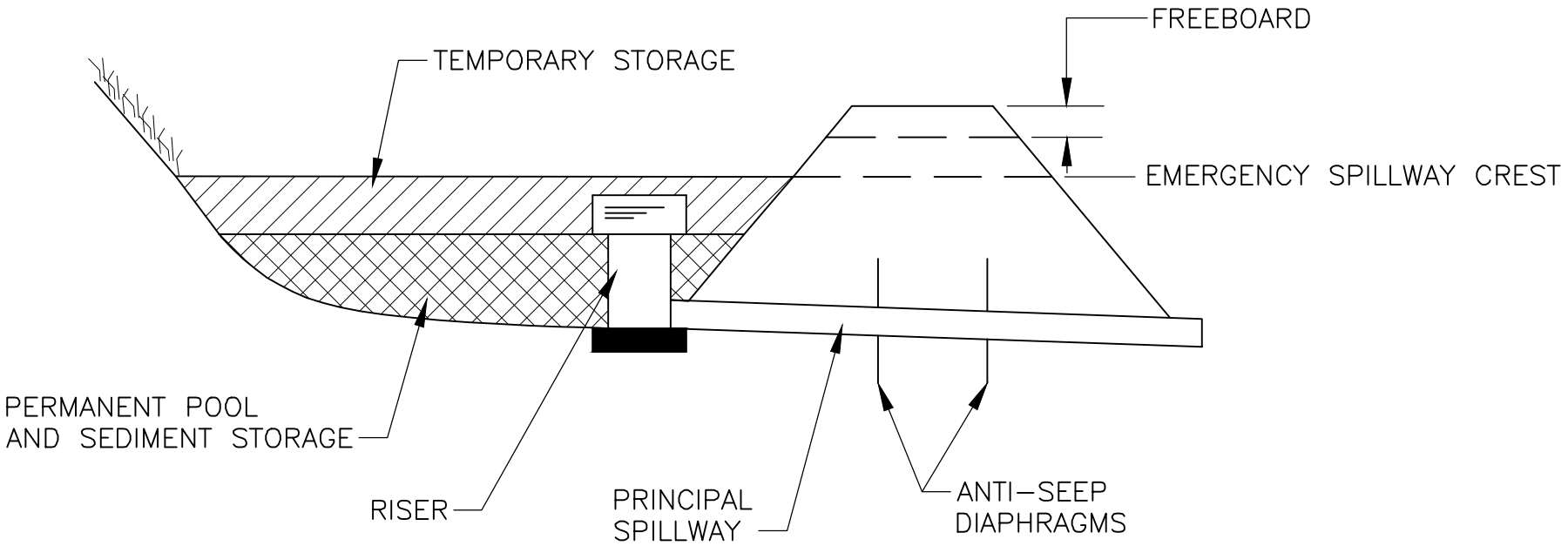

TYPICAL SEDIMENT BASIN CROSS SECTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

TYPICAL SEDIMENT BASIN CROSS SECTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-500

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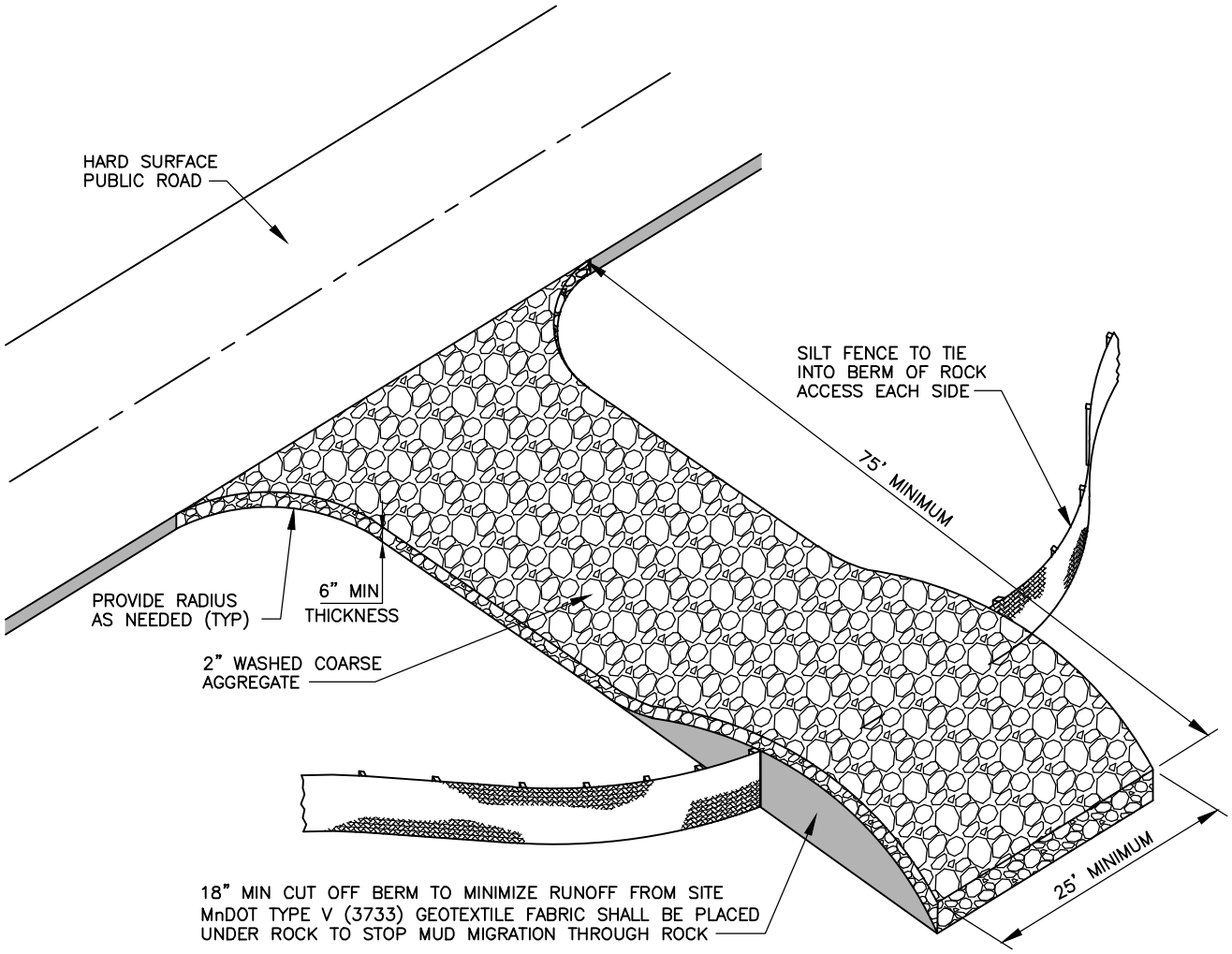

ROCK CONSTRUCTION ENTRANCE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

ROCK CONSTRUCTION ENTRANCE

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–502

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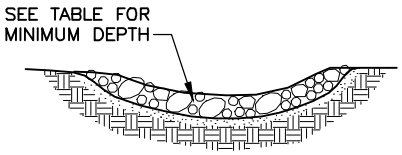
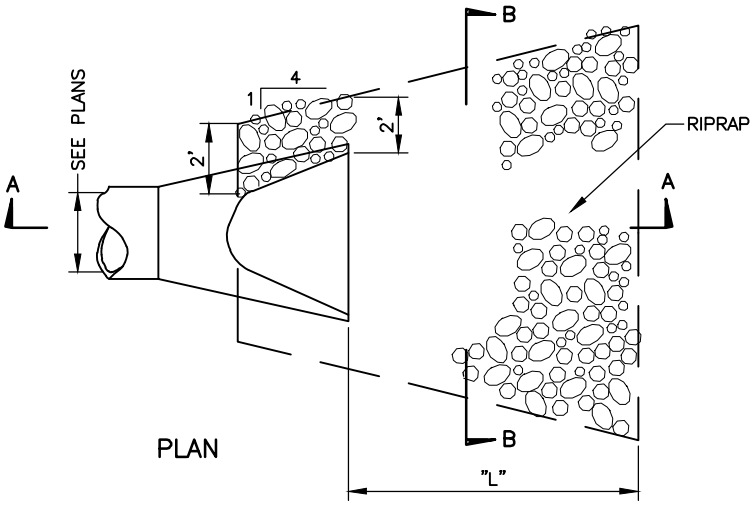


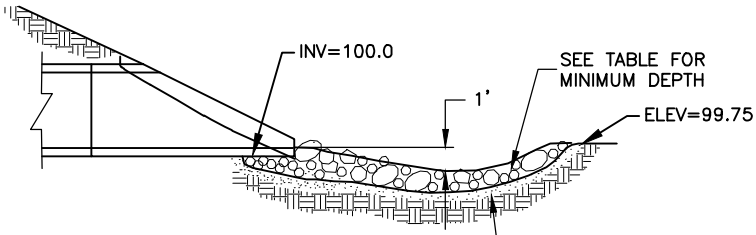
SECTION B–B



PLAN

DIA OF ROUND PIPE (IN)	L (FT)*	CLASS III d50=9" 18" DEPTH RIPRAP (CU YD)	CLASS IV d50=12" 24" DEPTH RIPRAP (CU YD)
12	8	8	10
15	8	8	10
18	10	10	15
21	10	15	15
24	12	15	20
27	12	15	20
30	14	20	25
36	16	25	30
42	18	30	40
48	20	40	50

*"L" DIMENSION IS MINIMUM REQUIRED.
RIP RAP SHALL EXTEND TO POND BOTTOM



SECTION A–A

RIPRAP AT RCP CULVERT END

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

RIPRAP AT RCP CULVERT END

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–600

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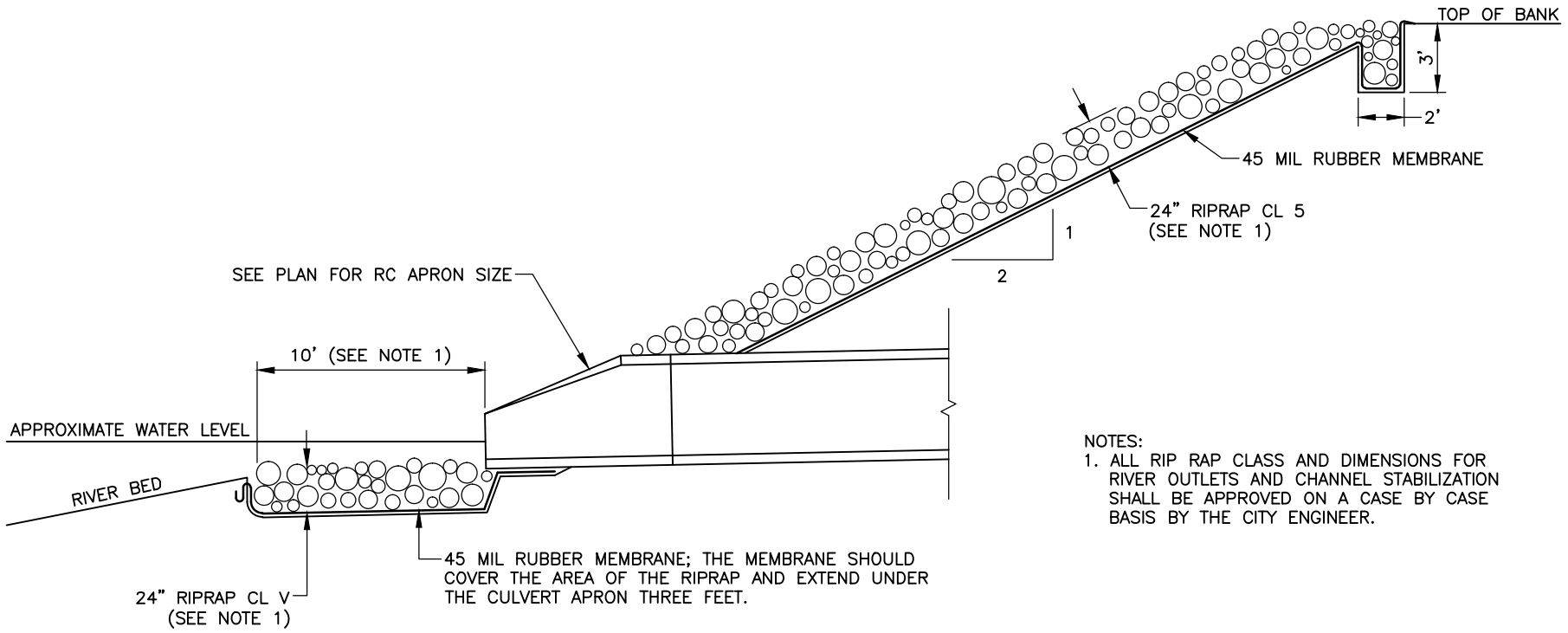

NOTES:
1. ALL RIP RAP CLASS AND DIMENSIONS FOR RIVER OUTLETS AND CHANNEL STABILIZATION SHALL BE APPROVED ON A CASE BY CASE BASIS BY THE CITY ENGINEER.

RIPRAP AT RIVER OUTFALL

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

RIPRAP AT RIVER OUTFALL

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-601

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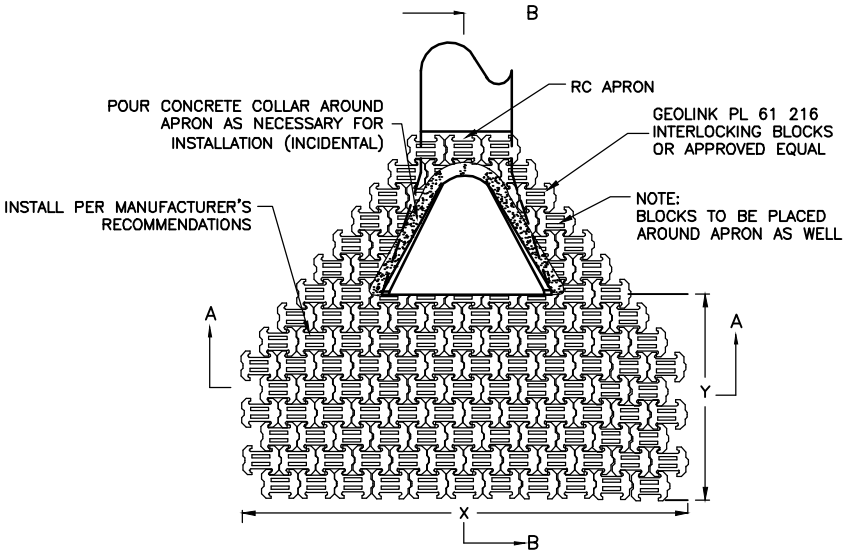
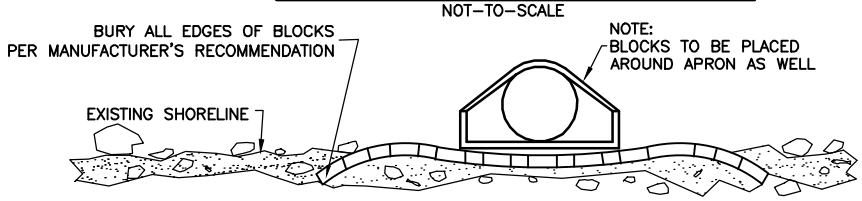
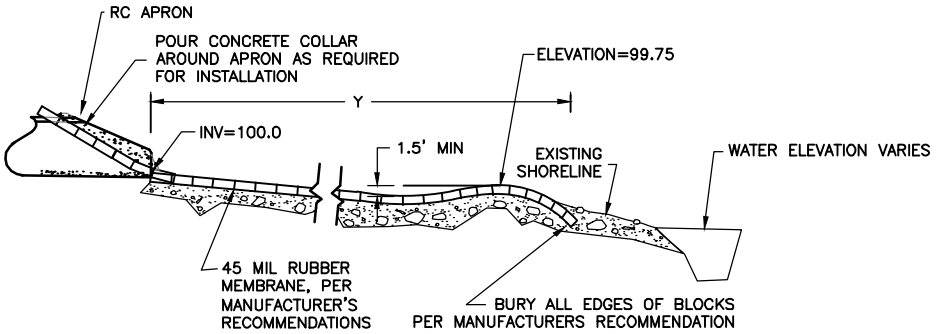


PLAN VIEW
STORM APRON EROSION CONTROL
NOT-TO-SCALE



STORM APRON EROSION CONTROL
SECTION A-A
NOT-TO-SCALE



STORM APRON EROSION CONTROL
SECTION B-B
NOT-TO-SCALE

EROSION CONTROL SIZES			
PIPE SIZE	X	Y	AREA (SF)
12"	10'	12'	200
15"	11'	15'	225
18"	12'	20'	300
24"	13'	25'	385
30"	14'	25'	415

BOLTON & MENK, INC.
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

GEOLINK AT RCP CULVERT END

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-602

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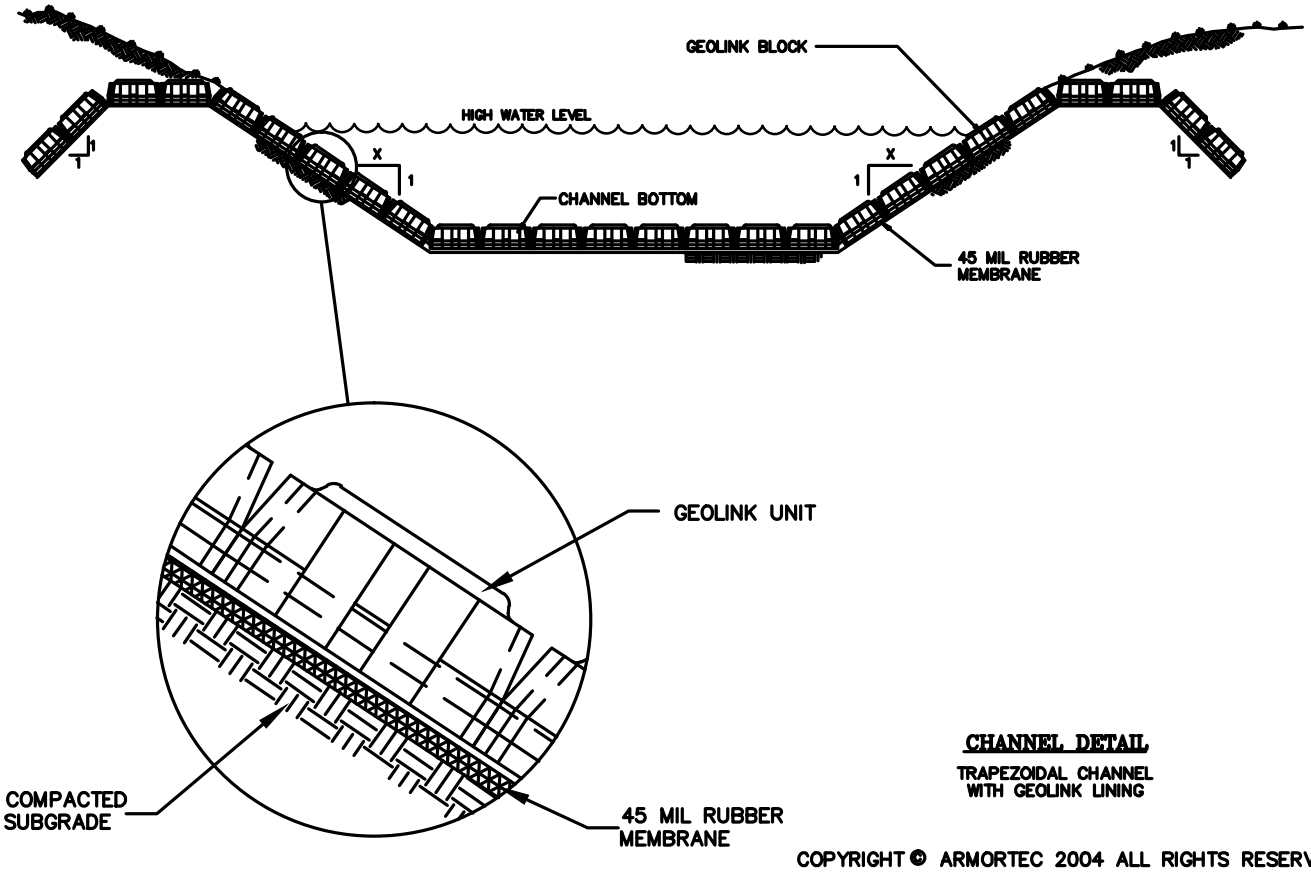

CHANNEL DETAIL

TRAPEZOIDAL CHANNEL WITH GEOLINK LINING

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BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

GEOLINK CHANNEL DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-603

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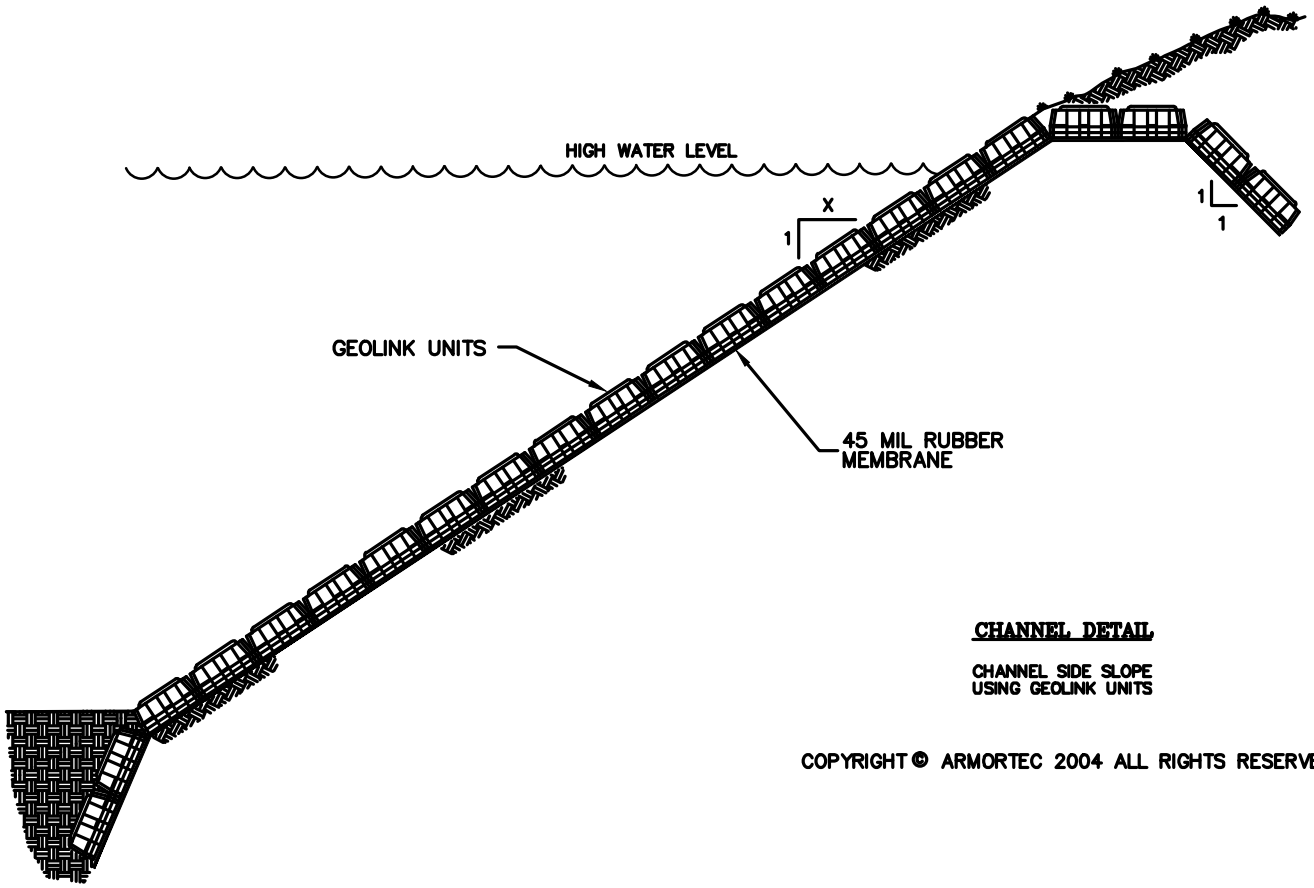

CHANNEL DETAIL

CHANNEL SIDE SLOPE
USING GEOLINK UNITS

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BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

GEOLINK–CHANNEL SIDE SLOPE

City of St. Francis

DATE: 07/2013

STD. DETAIL 3–604

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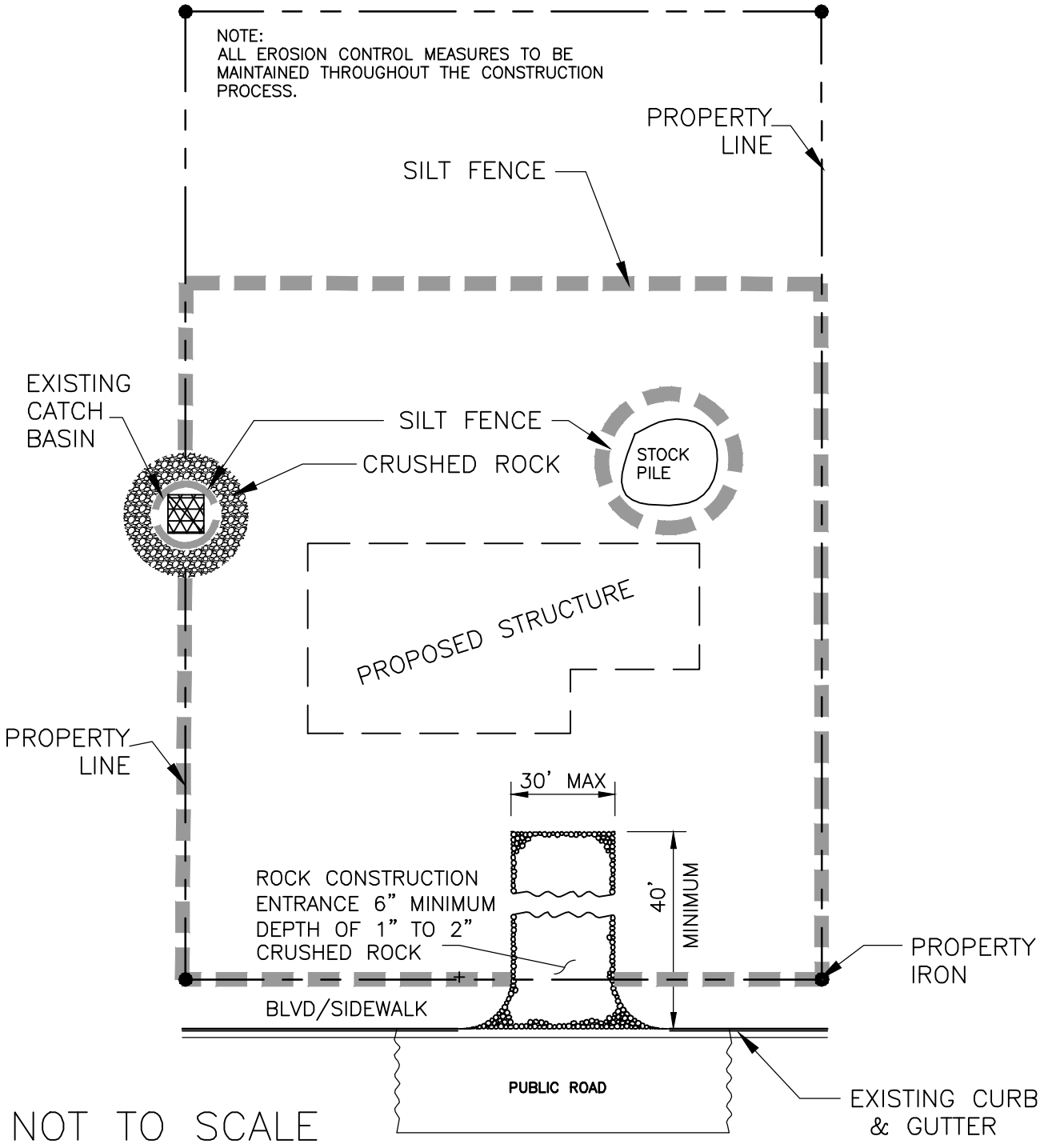

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CONSTRUCTION SITE EROSION CONTROL

City of St. Francis

DATE: 07/2013

STD. DETAIL 3-700

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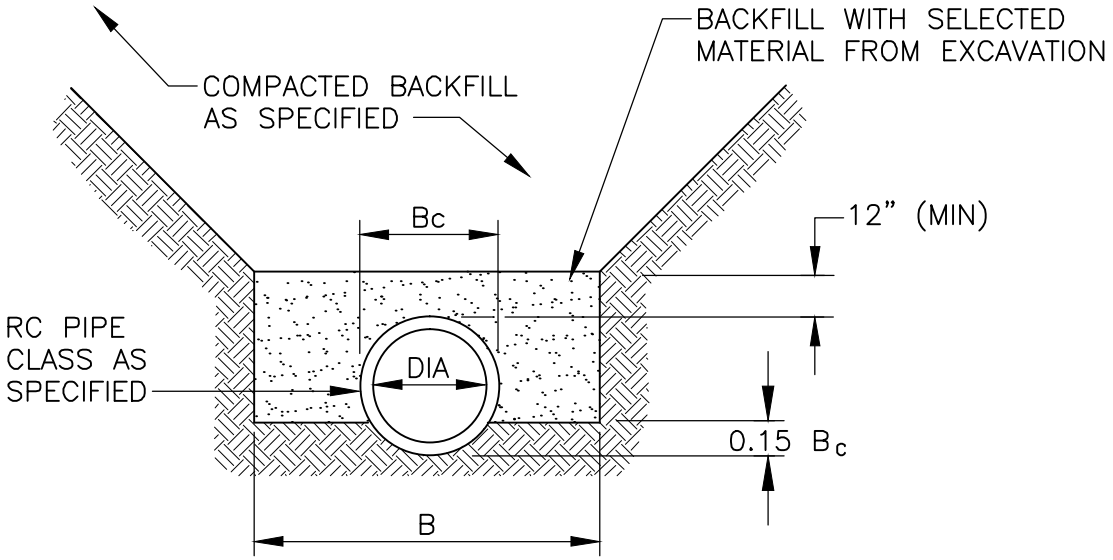

PIPE DIA	B
36" OR LESS	B_c + 24"
42" TO 54"	1.5 x B_c
60" OR OVER	B_c + 36"

RC PIPE
CLASS "C" BEDDING

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

RC PIPE
CLASS "C" BEDDING

City of St. Francis

DATE:
07/2013

STD. DETAIL
4-000

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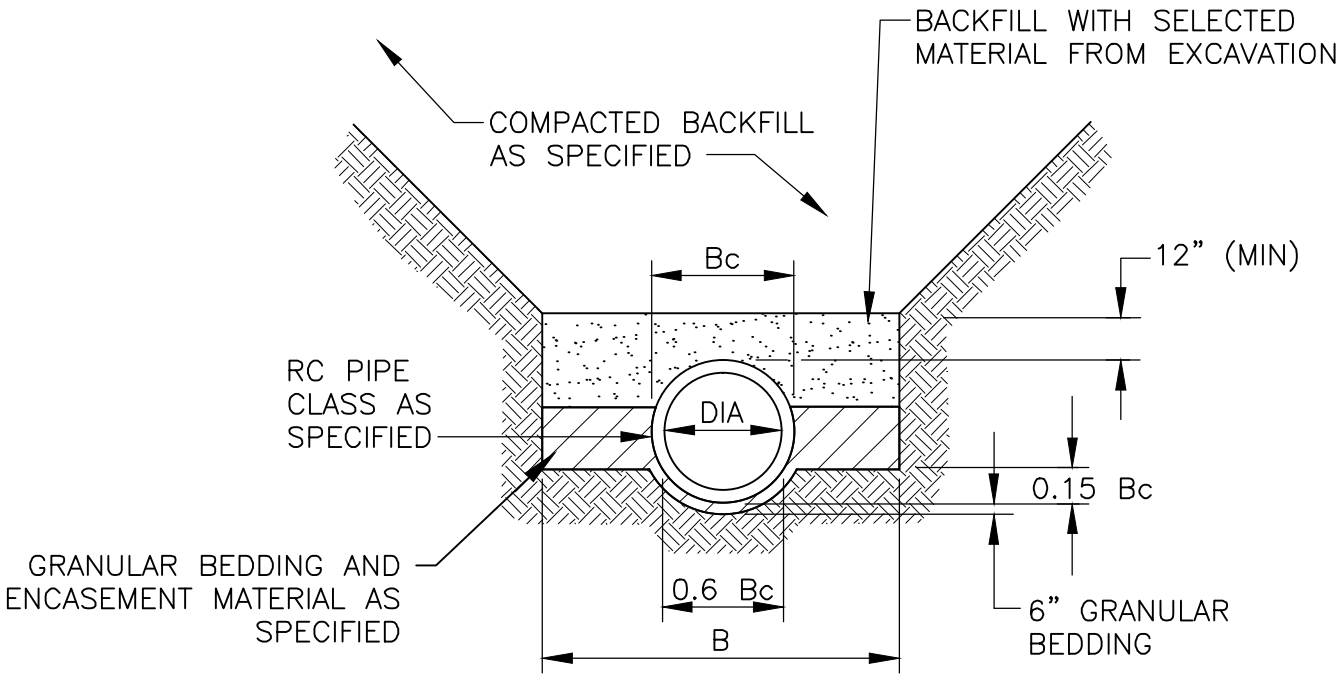

NOTES:

1. SELECT NATIVE MATERIAL MAY BE USED AS TRENCH BACKFILL ABOVE THE GRANULAR BEDDING UP TO THE BOTTOM OF THE SUBGRADE EXCEPT IN THOSE CONDITIONS WHERE THE TOP OF THE PIPE IS LESS THAN 12-INCHES FROM THE BOTTOM OF THE SUBGRADE IN WHICH CASE GRANULAR MATERIAL COMPACTED TO 100% STANDARD PROCTOR DENSITY SHALL BE USED AS TRENCH BACKFILL THE FULL WIDTH OF THE TRENCH TO THE BOTTOM OF THE SUBGRADE EXCAVATION ZONE.

PIPE DIA	B
36" OR LESS	B_c + 24"
42" TO 54"	1.5 x Bc
60" OR OVER	B_c + 36"

RC PIPE
CLASS "B" BEDDING

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

RC PIPE
CLASS "B" BEDDING

City of St. Francis

DATE: 07/2013

STD. DETAIL 4-001

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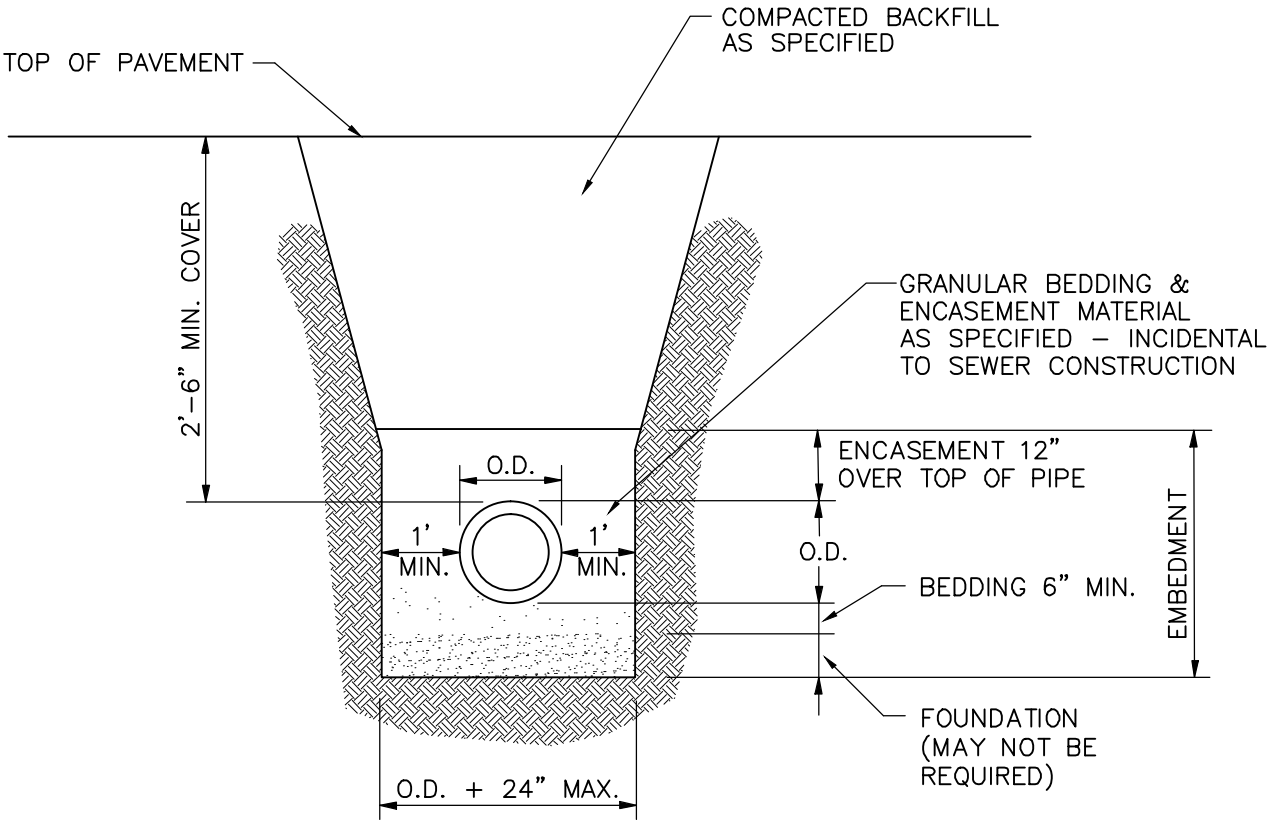

NOTES:

1. THIS NON–RIGID PIPE INSTALLATION DETAIL APPLIES ONLY TO STORM SEWER.
2. MAXIMUM PIPE DIAMETER IS 24".
3. PIPE MATERIAL REQUIREMENTS PER SPECIFICATIONS.
4. EMBEDMENT MATERIAL PER SPECIFICATIONS.
5. CONSTRUCTION REQUIREMENTS PER SPEC. 2451 MODIFIED SO THAT EMBEDMENT MATERIAL IS COMPACTED IN UNIFORM LIFTS, 8" OR LESS IN DEPTH, LOOSE MEASURE, TO 95% STANDARD PROCTOR DENSITY FROM THE BEDDING TO A MIN. DEPTH OF AT LEAST 12" ABOVE THE CROWN OF THE PIPE.
6. TRENCH WIDTH PER ASTM D2321 EXCEPT AS MODIFIED TO PROVIDE A MINIMUM OF 1–FOOT ON EACH SIDE OF THE PIPE TO ALLOW FOR COMPACTION.

PVC STORM SEWER TRENCH DETAIL

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PVC STORM SEWER TRENCH DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 4–002

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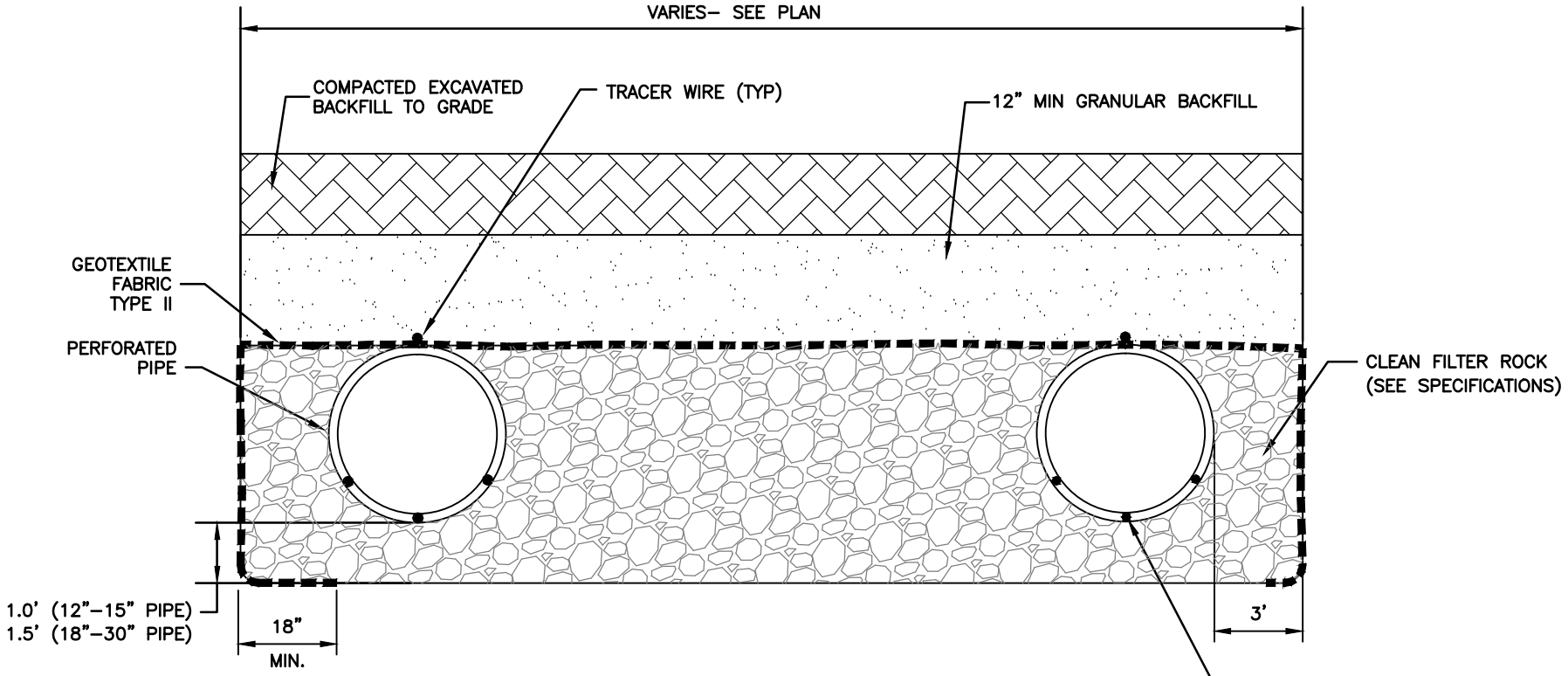

PERFORATED PIPE BEDDING DETAIL (INFILTRATION SYSTEM)

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PERFORATED PIPE BEDDING DETAIL (INFILTRATION SYSTEM)

City of St. Francis

DATE: 07/2013

STD. DETAIL 4–003

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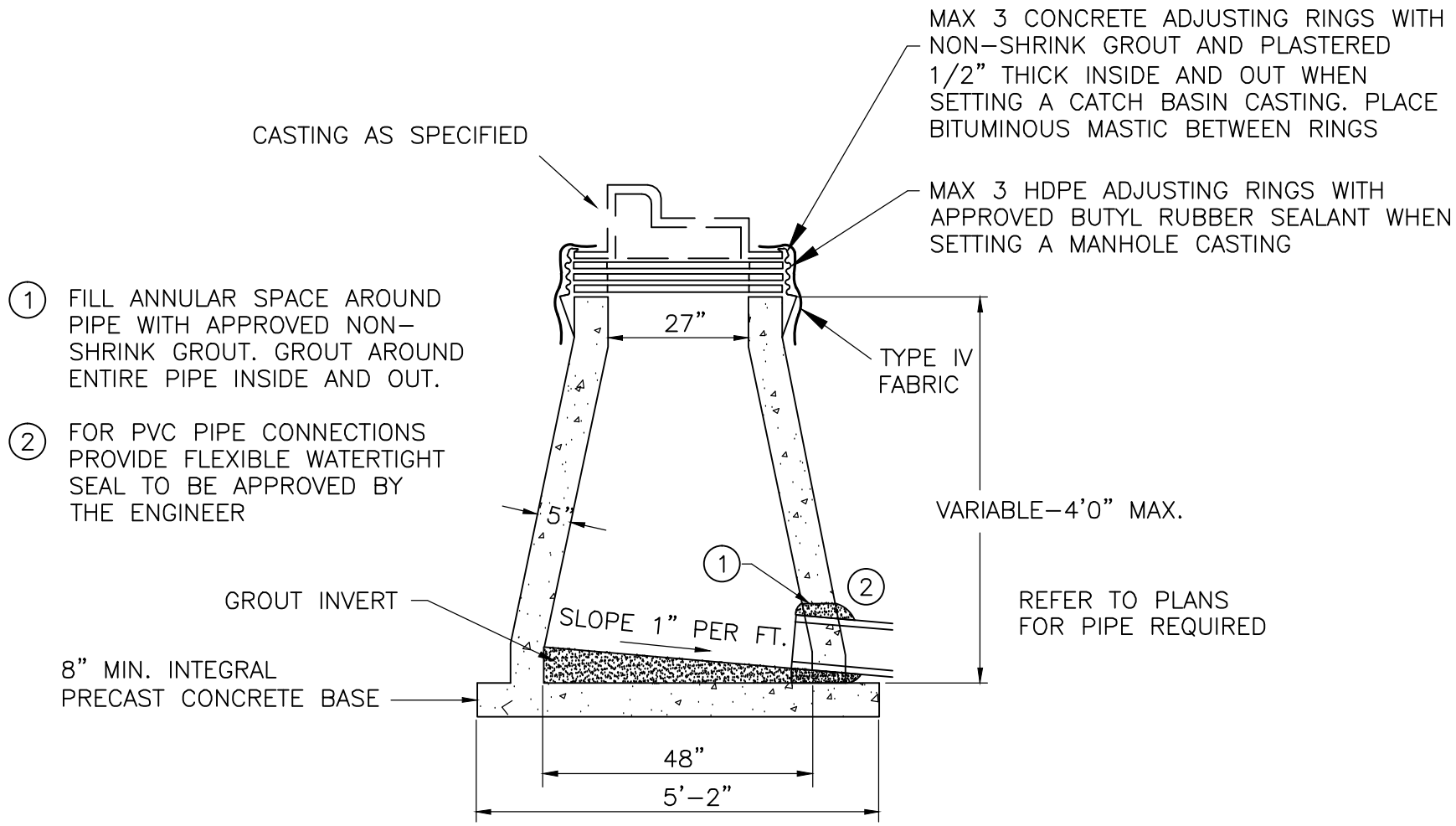

CATCH BASIN, DESIGN G

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CATCH BASIN
DESIGN G

City of St. Francis

DATE: 07/2013

STD. DETAIL 4–100

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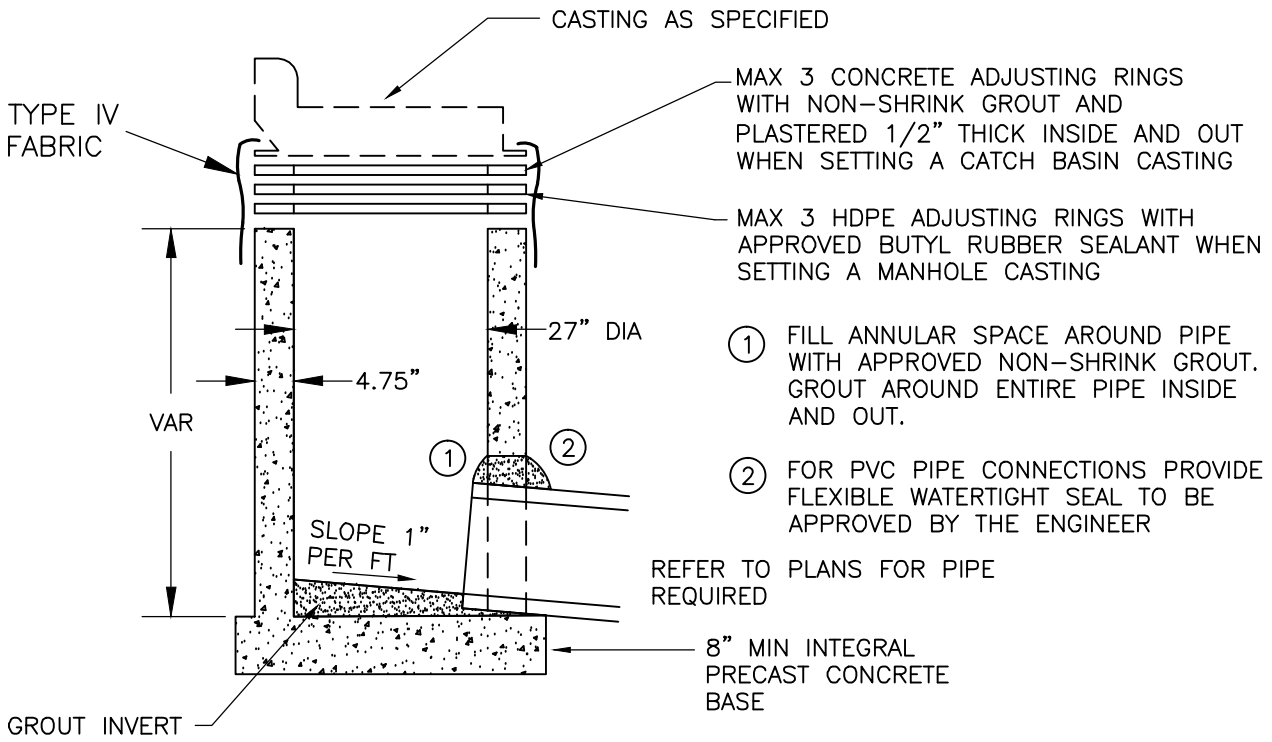


CATCH BASIN
DESIGN H
NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

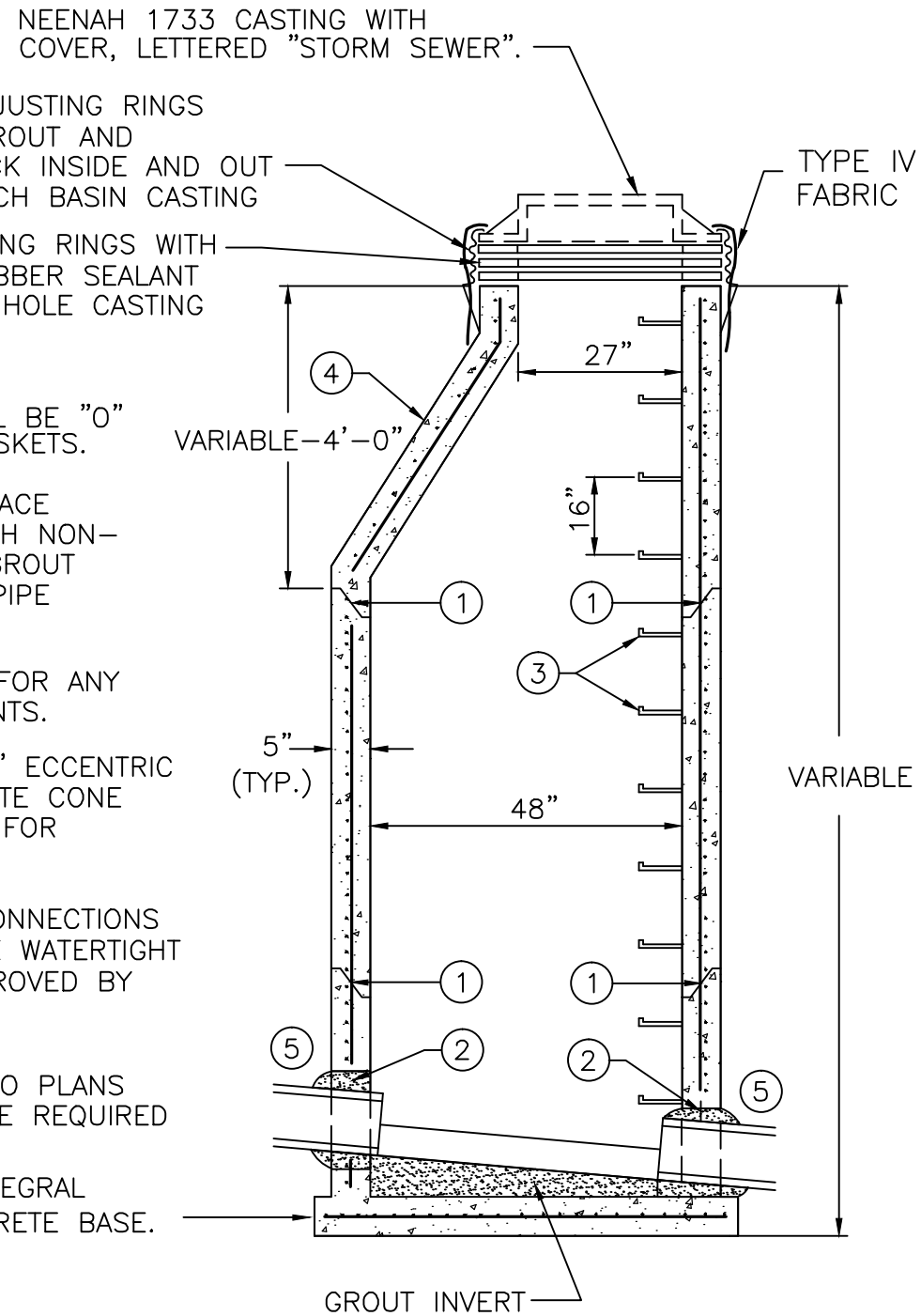
CATCH BASIN
DESIGN H

City of St. Francis

DATE: 07/2013

STD. DETAIL 4-101

Y:\STFR\2013 Details\STFR_4-101.dwg



1. ALL JOINTS SHALL BE "O" RING RUBBER GASKETS.
2. FILL ANNULAR SPACE AROUND PIPE WITH NON-SHRINK GROUT. GROUT AROUND ENTIRE PIPE INSIDE AND OUT.
3. REFER TO SPEC FOR ANY STEP REQUIREMENTS.
4. MN/DOT TYPE "B" ECCENTRIC PRECAST CONCRETE CONE SECTION TYPICAL FOR ALL MANHOLES.
5. FOR PVC PIPE CONNECTIONS PROVIDE FLEXIBLE WATERTIGHT SEAL TO BE APPROVED BY THE ENGINEER

REFER TO PLANS FOR PIPE REQUIRED

8" MINIMUM INTEGRAL PRECAST CONCRETE BASE.

STORM SEWER MANHOLE, DESIGN F

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

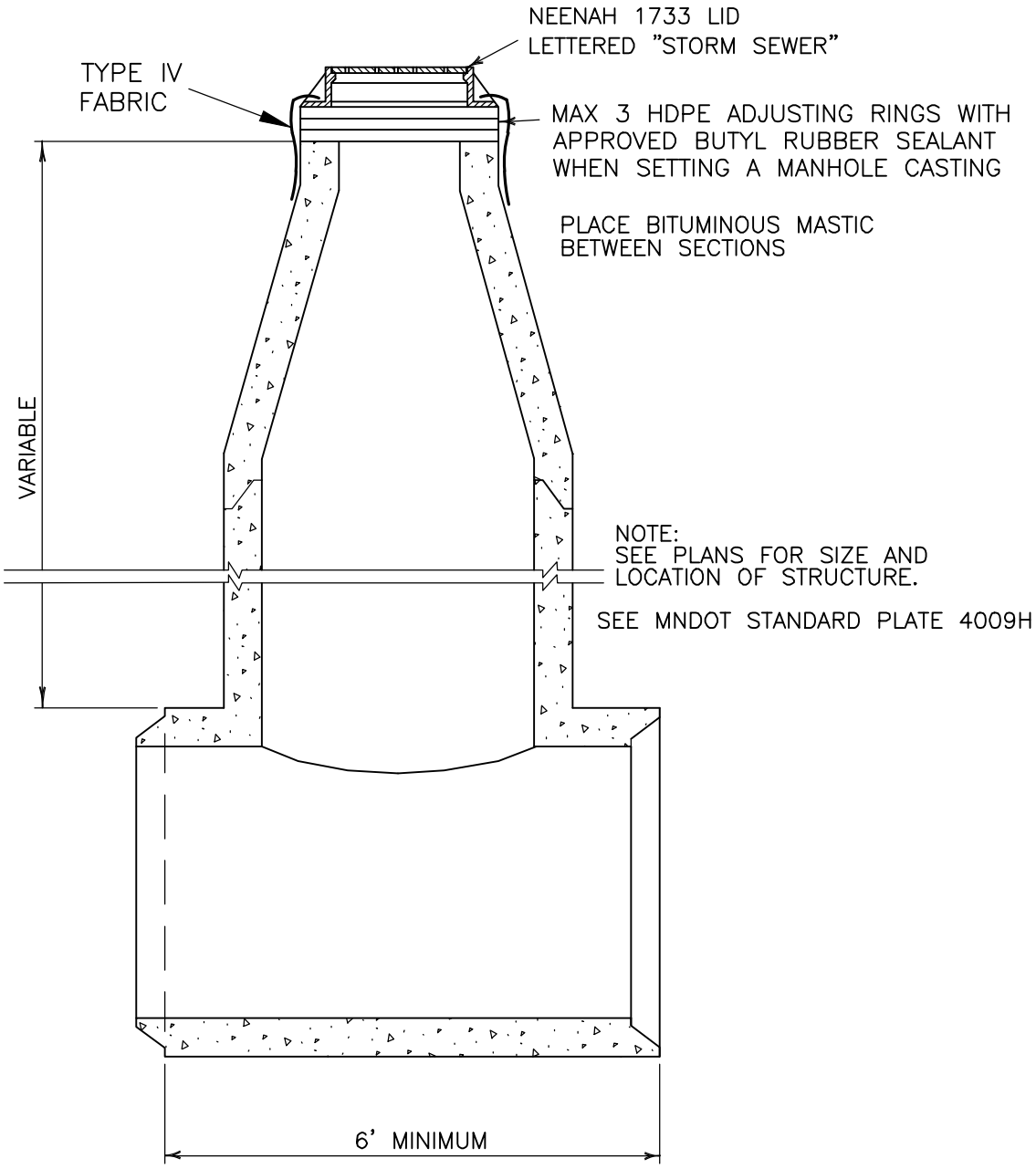
STORM SEWER MANHOLE DESIGN F

City of St. Francis

DATE: 07/2013

STD. DETAIL 4-102

Y:\STFR\2013 Details\STFR_4-102.dwg



STORM SEWER STRUCTURE
DESIGN J
NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

STORM SEWER STRUCTURE DESIGN J

City of St. Francis

DATE: 07/2013

STD. DETAIL 4–103

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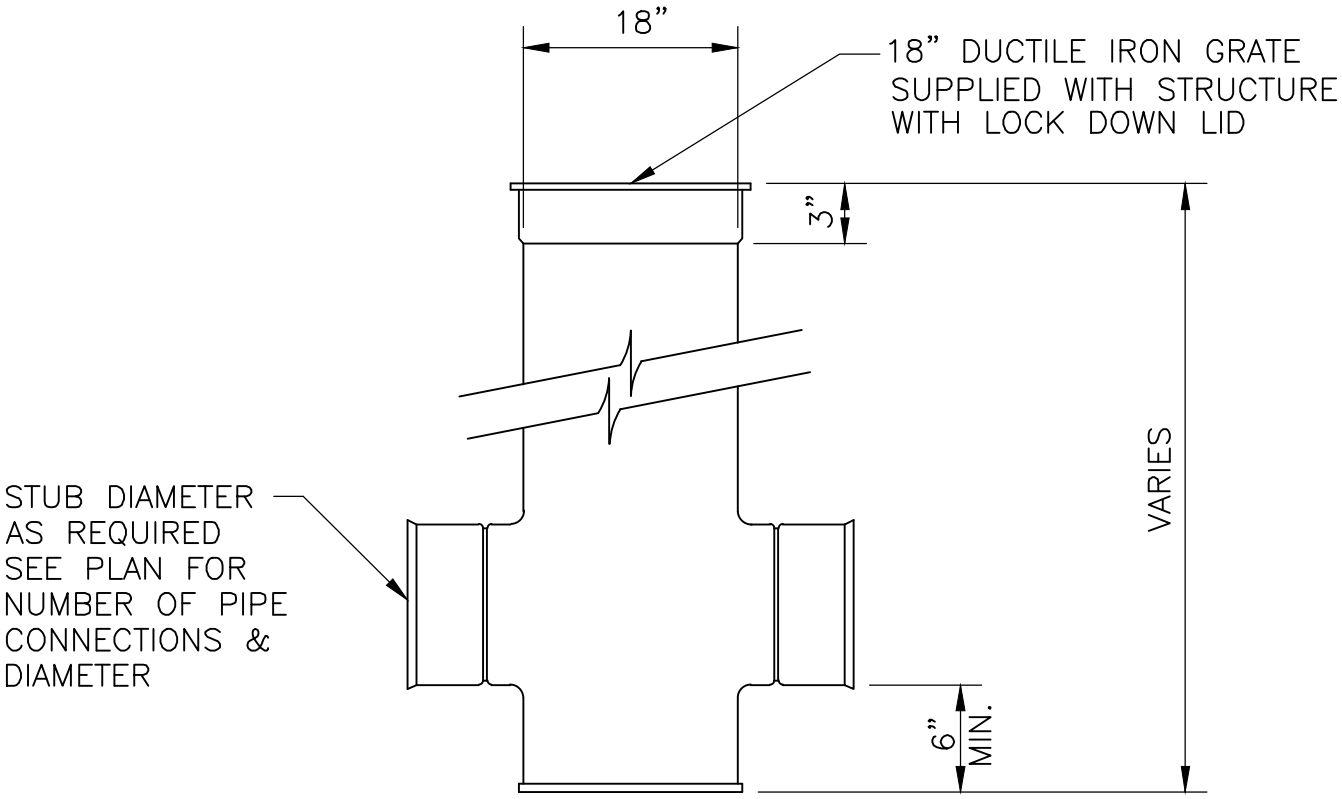

NOTE: REFER TO PLANS FOR REQUIRED PIPE SIZE

18" PVC DRAIN BASIN (DESIGN SPEC 1)

EQUAL TO NYLOPLAST PVC BASIN, OR APPROVED EQUAL

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PVC DRAIN BASIN
DESIGN SPEC 1

City of St. Francis

DATE:
07/2013

STD. DETAIL
4–104

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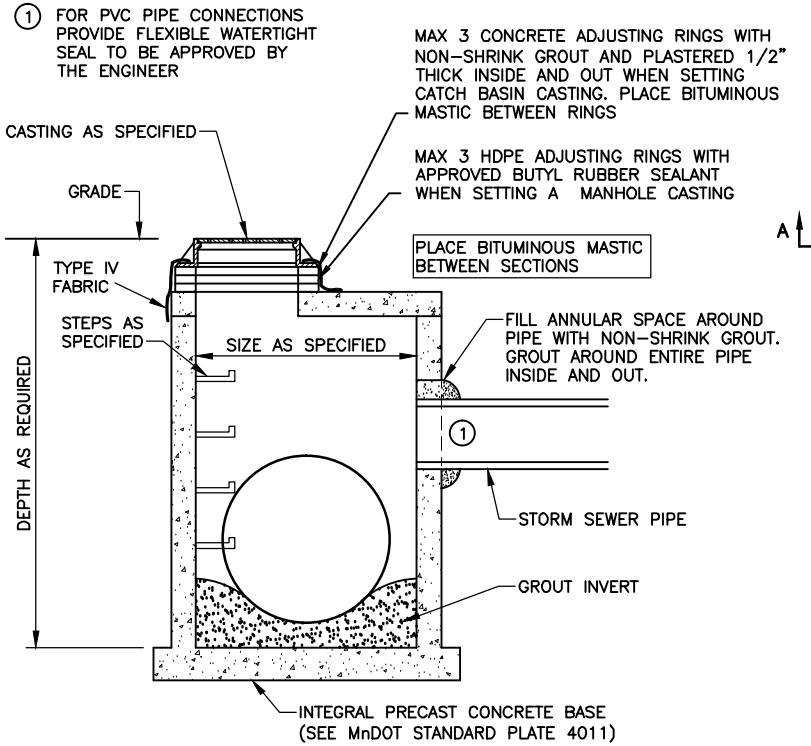
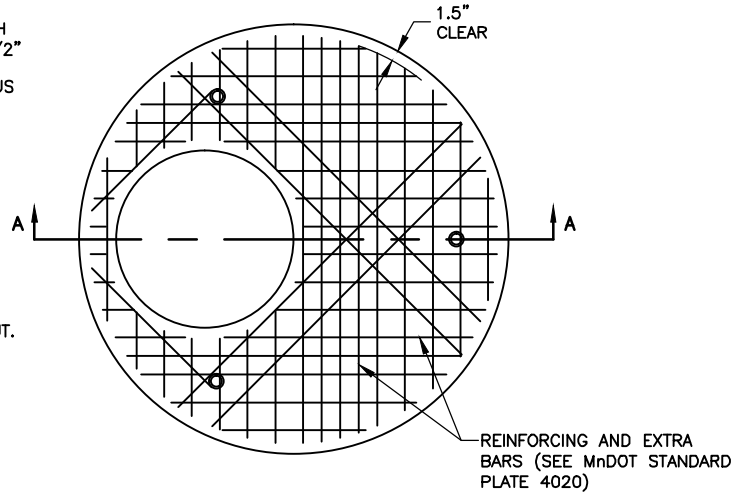
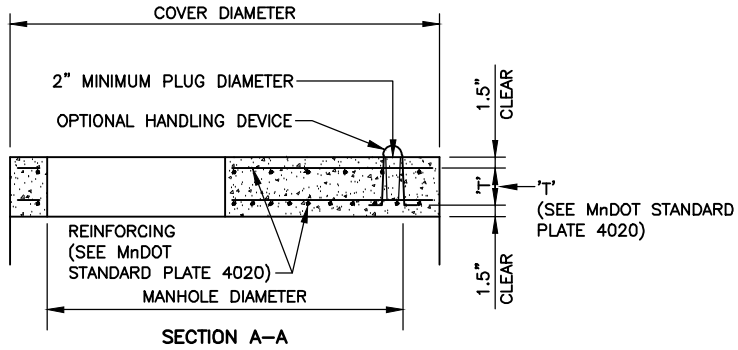


TYPICAL DESIGN 4020 MANHOLE/CATCH BASIN



PLAN OF COVER
TOP BARS NOT SHOWN



SECTION A–A

NOTES:

AASHTO HS 25 LOADING MAXIMUM FILL HEIGHT 15'. THE No 4020 SHALL BE PERMANENTLY MARKED ON THE TOP COVER. EQUIVALENT STEEL AREAS IN WIRE MESH MAY BE USED. REINFORCEMENT PER SPEC 3301, GRADE 60 A SINGLE HOOP OF 8ga STEEL WIRE.

DESIGNATION:
DESIGN: STANDARD PLATE #–DESIGN DESIGN 4020–48

STORM SEWER STRUCTURE DESIGN 4020

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

STORM SEWER STRUCTURE DESIGN 4020

City of St. Francis

DATE: 07/2013

STD. DETAIL 4–105

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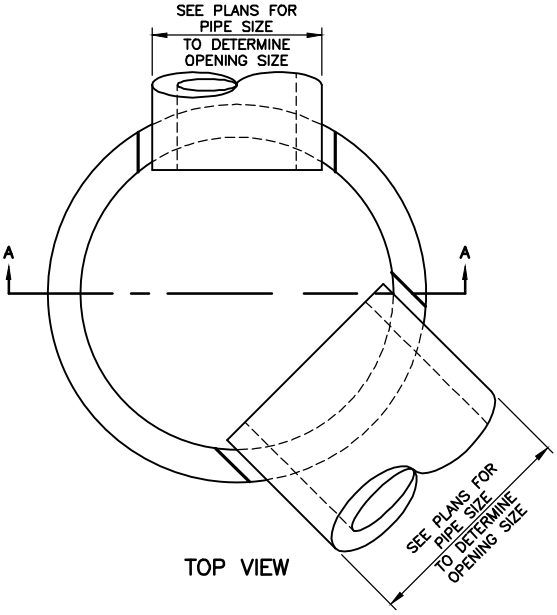
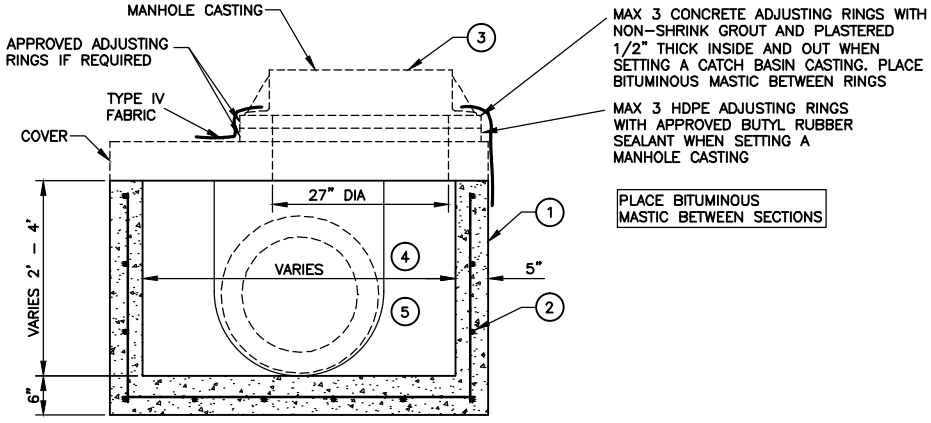


TOP VIEW



SECTION A-A

STANDARD OPENINGS	
PIPE DIA (INCHES)	OPENING SIZE (INCHES)
12	20
15	24
18	26
21	30
24	34

NOTES:

1. BRICK OR CONCRETE BLOCK MASONRY MAY BE USED. AS APPROVED BY THE ENGINEER. FOR MATERIALS AND CONSTRUCTION METHODS, SEE STANDARD PLATE NO 4-001. CONE SECTION DETAILS OF 4-001 DO NOT APPLY.
2. REINFORCING: SINGLE LINE STEEL WIRE FABRIC HAVING AN AREA OF NOT LESS THAN 0.12 SQ IN PER FOOT.
3. COVER AND CASTING AS SPECIFIED.
4. FILL ANNULAR SPACE AROUND PIPE WITH NON-SHRINK GROUT. GROUT AROUND ENTIRE PIPE INSIDE AND OUT
5. FOR PVC PIPE CONNECTIONS PROVIDE FLEXIBLE WATERTIGHT SEAL TO BE APPROVED BY THE ENGINEER

PRECAST SHALLOW DEPTH MANHOLE/CATCH BASIN, DESIGN SD

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PRECAST SHALLOW DEPTH MH/CB DESIGN SD

City of St. Francis

DATE: 07/2013

STD. DETAIL 4-107

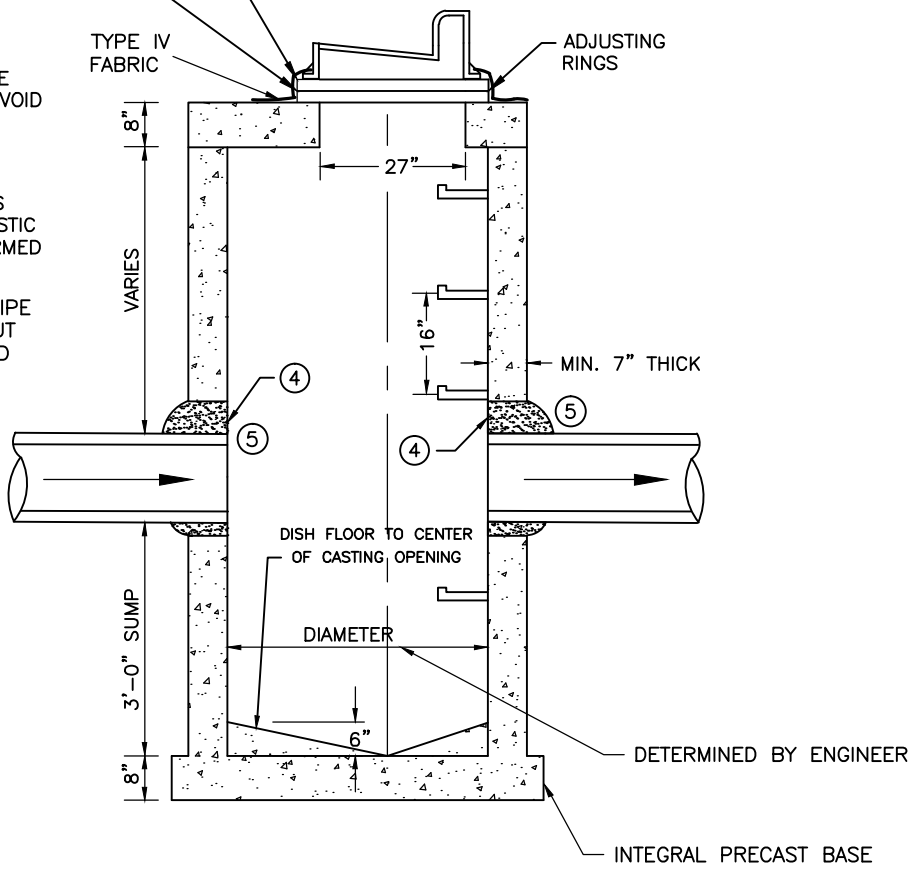
Y:\STFR\2013 Details\STFR_4-107.dwg

MAX 3 CONCRETE ADJUSTING RINGS WITH NON-SHRINK GROUT AND PLASTERED 1/2" THICK INSIDE AND OUT WHEN SETTING A CATCH BASIN CASTING. PLACE BITUMINOUS MASTIC BETWEEN RINGS

MAX 3 HDPE ADJUSTING RINGS WITH APPROVED BUTYL RUBBER SEALANT WHEN SETTING A MANHOLE CASTING

NOTES:

1. ECCENTRIC CONE SECTION MAY BE USED IN DEEP STRUCTURES TO AVOID MORE THAN 3 ADJUSTING RINGS.
2. PIPE CUT-OUTS TO BE LOCATED AS SPECIFIED.
3. STEEL REINFORCED PLASTIC STEPS SHALL BE A POLYPROPYLENE PLASTIC REINFORCED WITH A NO. 2 DEFORMED STEEL ROD GRADE 60.
4. FILL ANNULAR SPACE AROUND PIPE WITH NON-SHRINK GROUT. GROUT AROUND ENTIRE PIPE INSIDE AND OUT.
5. FOR PVC PIPE CONNECTIONS PROVIDE FLEXIBLE WATERTIGHT SEAL TO BE APPROVED BY THE ENGINEER



SECTIONAL VIEW

DRAINAGE STRUCTURE WITH SUMP

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

DRAINAGE STRUCTURE WITH SUMP

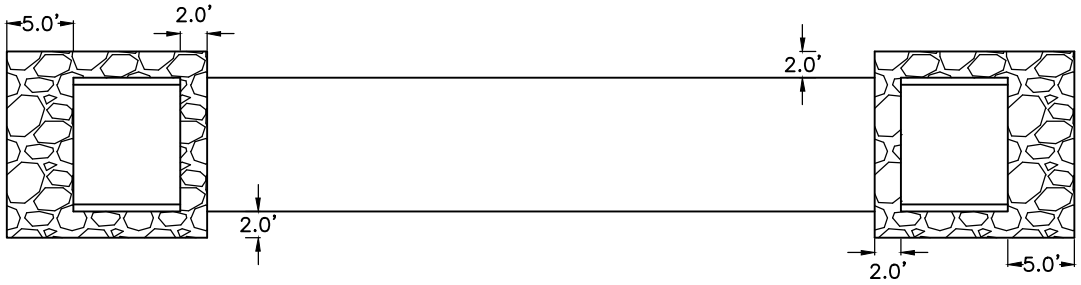
City of St. Francis

DATE: 07/2013

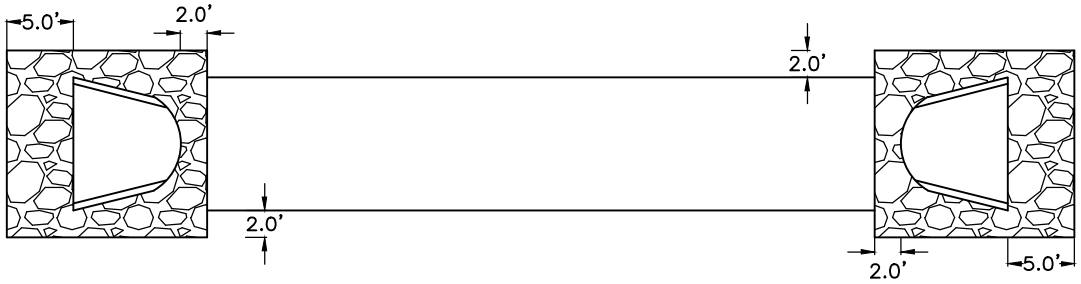
STD. DETAIL 4-108

Y:\STFR\2013 Details\STFR_4-108.dwg

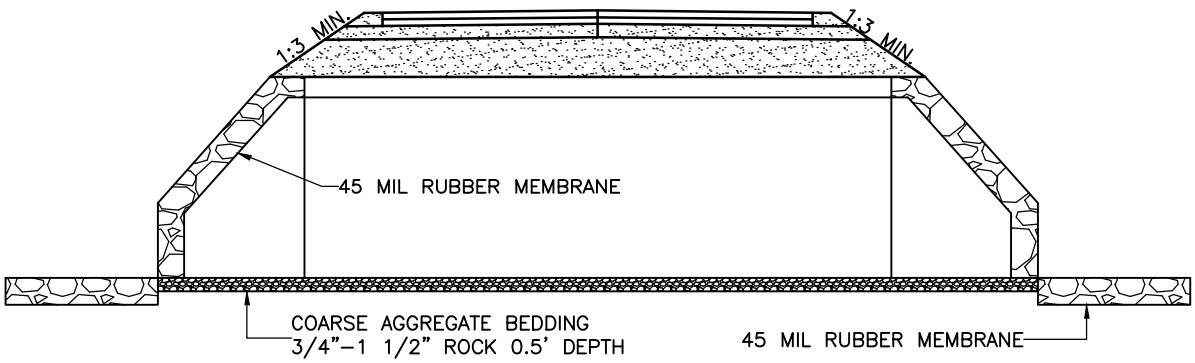
RIP RAP FOR BOX CULVERTS



RIP RAP FOR ROUND PIPE



SIDE VIEW FOR BOTH TYPES OF CULVERTS



NOTES: RUBBER MEMBRANE SHALL BE PLACED UNDER ALL RIP RAP. SIZE OF RIP RAP AREAS ARE MINIMUMS AND ARE DETERMINED ON A CASE BY CASE BASIS. CULVERT SIZE TO BE DETERMINED BY THE COUNTY DRAINAGE DITCH INSPECTOR.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

DRAINAGE DITCH STRUCTURE COUNTY

City of St. Francis

DATE: 07/2013

STD. DETAIL 4-111

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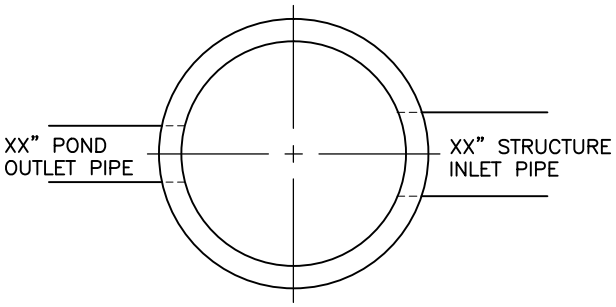
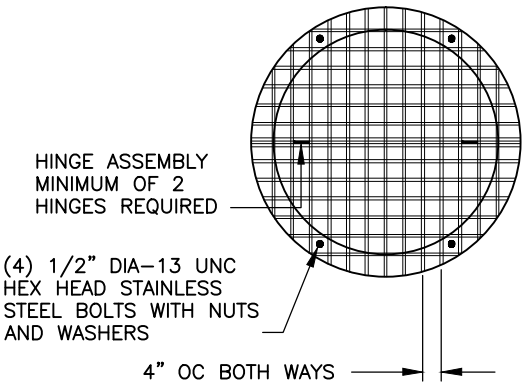
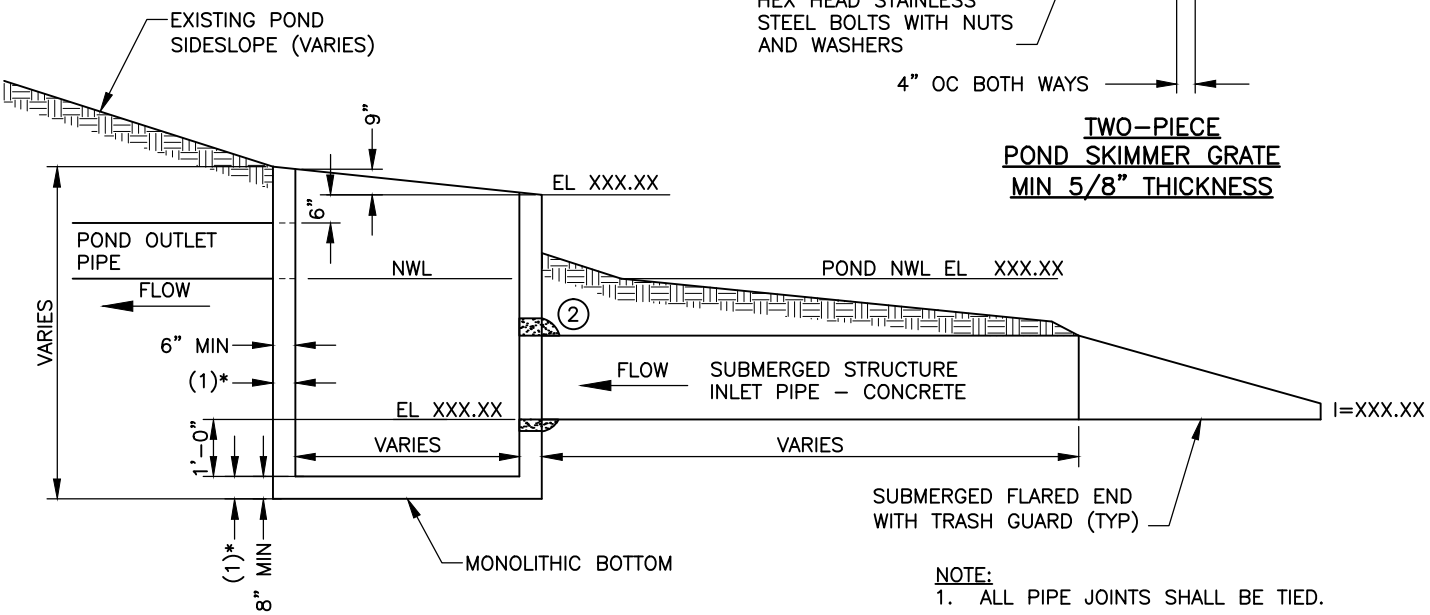
GRATE NOTES:
1. GRATE TO BE MADE IN TWO (2) PIECES
2. ALL METAL SHALL BE HOT–DIPPED GALVANIZED
3. SKIMMER SHALL BE A STEEL PLATE.





TWO–PIECE
POND SKIMMER GRATE
MIN 5/8" THICKNESS



SECTION VIEW

NOTE:
1. ALL PIPE JOINTS SHALL BE TIED.
2. FILL ANNULAR SPACE AROUND PIPE WITH NON–SHRINK GROUT. GROUT AROUND ENTIRE PIPE INSIDE AND OUT.

NOTE:
(1)* SEE DETAIL 4–105 FOR DIMENSIONS FOR LARGE SKIMMERS

PRECAST CONCRETE POND SKIMMER STRUCTURE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PRECAST CONCRETE POND SKIMMER STRUCTURE

City of St. Francis

DATE: 07/2013

STD. DETAIL 4–200

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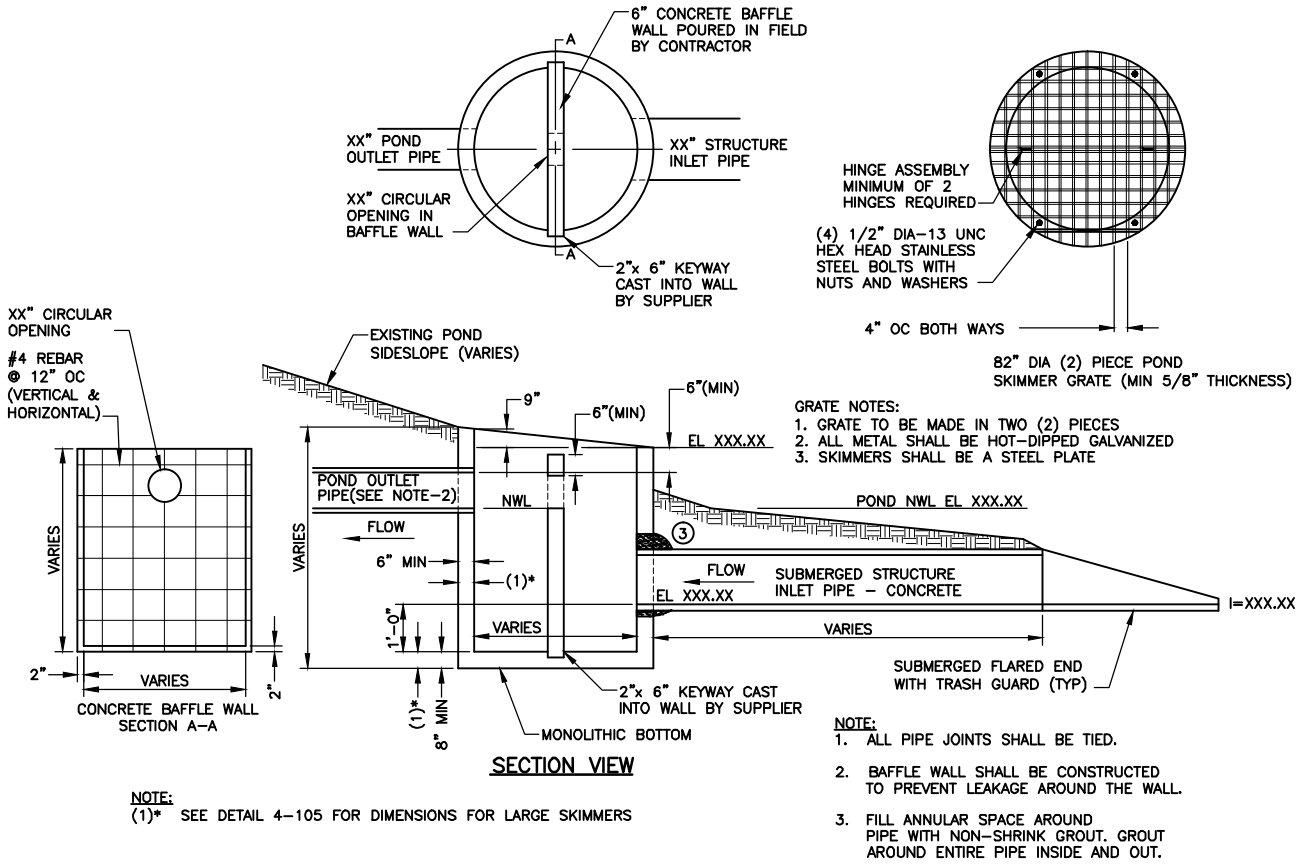

NOTE:
(1)* SEE DETAIL 4-105 FOR DIMENSIONS FOR LARGE SKIMMERS

PRECAST CONCRETE POND SKIMMER STRUCTURE WITH RATE CONTROL BAFFLE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PRECAST CONCRETE POND SKIMMER STRUCTURE W/RATE CONTROL BAFFLE

City of St. Francis

DATE: 07/2013

STD. DETAIL 4-201

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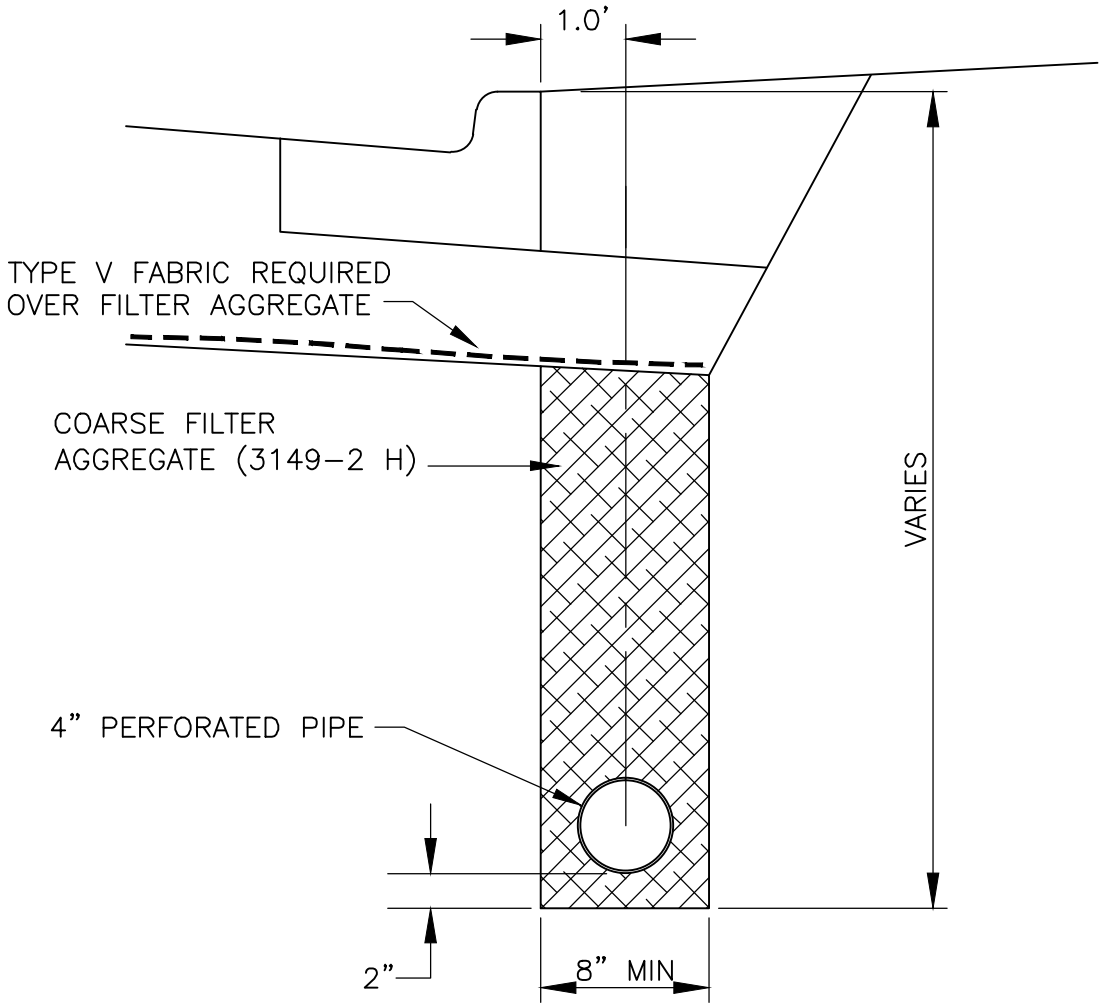

SUBSURFACE EDGE DRAIN PIPE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SUBSURFACE EDGE DRAIN PIPE

City of St. Francis

DATE: 07/2013

STD. DETAIL 4-303

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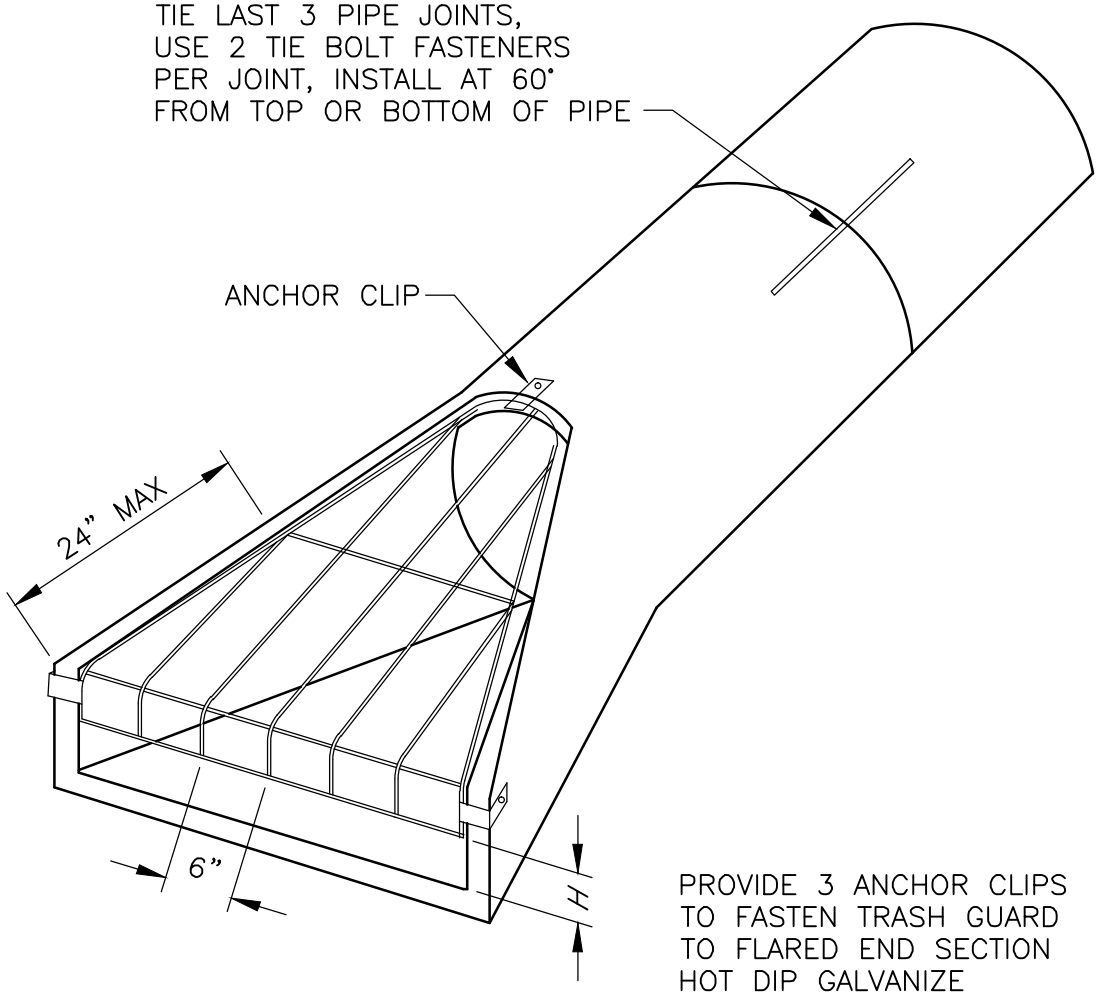

PROVIDE 3 ANCHOR CLIPS
TO FASTEN TRASH GUARD
TO FLARED END SECTION
HOT DIP GALVANIZE
AFTER FABRICATION

ANCHOR BOTH SIDES

TRASH GUARD SIZES			
PIPE SIZE	BARS	"H"	BOLTS
12"–18"	3/4"ø	4"	5/8"
21"–42"	1"ø	6"	3/4"
42"–72"	1 1/4"ø	12"	1"

RC APRON TRASH RACK (STEEL BARS)

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

RC APRON TRASH RACK (STEEL BARS)

City of St. Francis

DATE: 07/2013

STD. DETAIL 4–601

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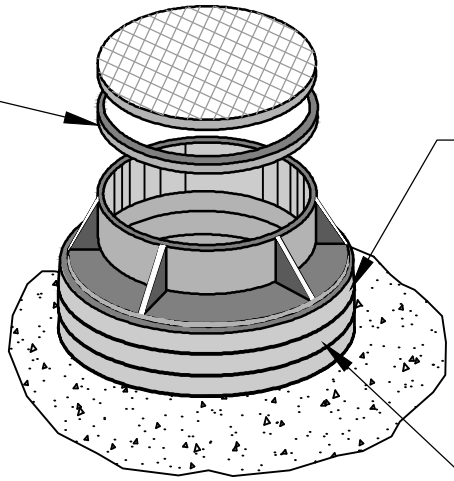
PAVING RING (ONE PIECE) WITH MANUFACTURER'S RECOMMENDED ADHESIVE



MAX 3 HDPE ADJUSTING RINGS WITH APPROVED BUTYL RUBBER SEALANT WHEN SETTING A MANHOLE CASTING

MAX 3 CONCRETE ADJUSTING RINGS WHEN SETTING A CATCH BASIN IN CURB & GUTTER

NOTE: A FIVE HUNDRED DOLLAR ($500) PENALTY WILL BE ENFORCED FOR EACH CASTING NOT PROPERLY ADJUSTED REQUIRING A PATCH IN THE BITUMINOUS WEARING COURSE.

CASTING & GRADE ADJUSTMENTS–STORM SEWER

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CASTING AND GRADE ADJUSTMENT RING DETAIL–STORM

City of St. Francis

DATE: 07/2013

STD. DETAIL 4–700

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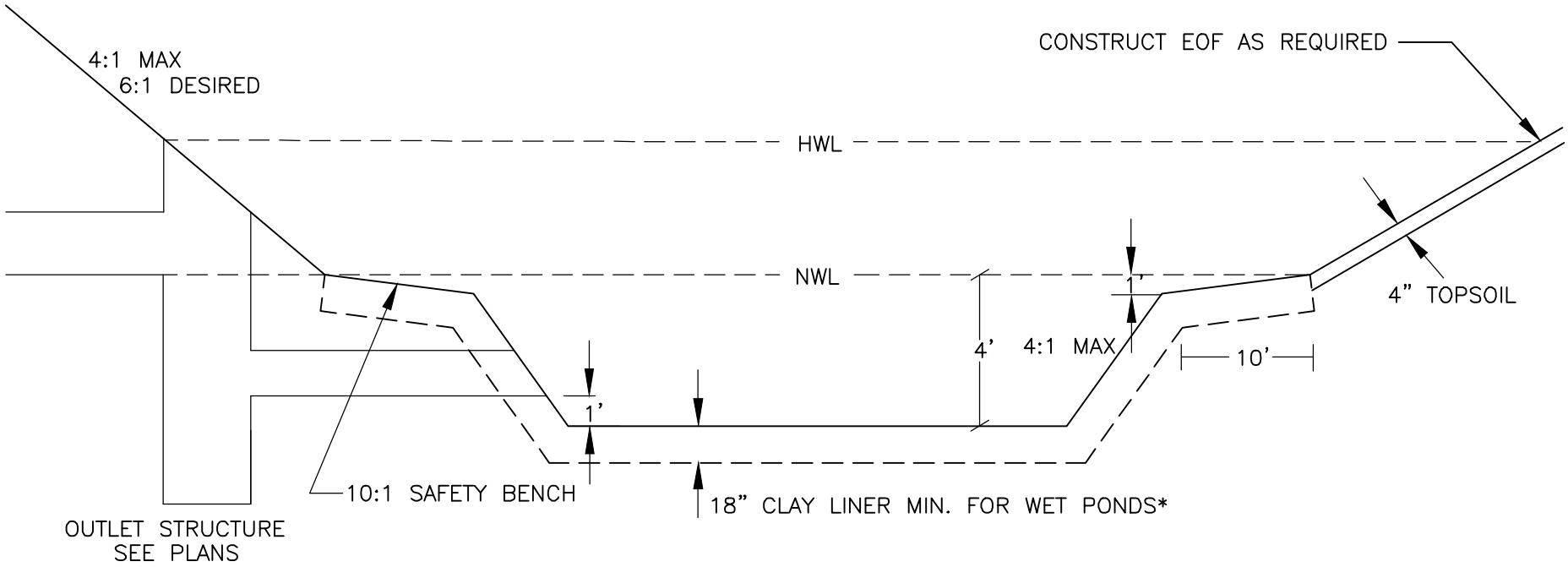

*INFILTRATION SHALL BE UTILIZED TO THE EXTENT FEASIBLE

NOTE: PLANT POND SLOPES WITH NATIVE MIX TO BE APPROVED BY ENGINEER

POND DETAIL

N.T.S.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

POND DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 4–800

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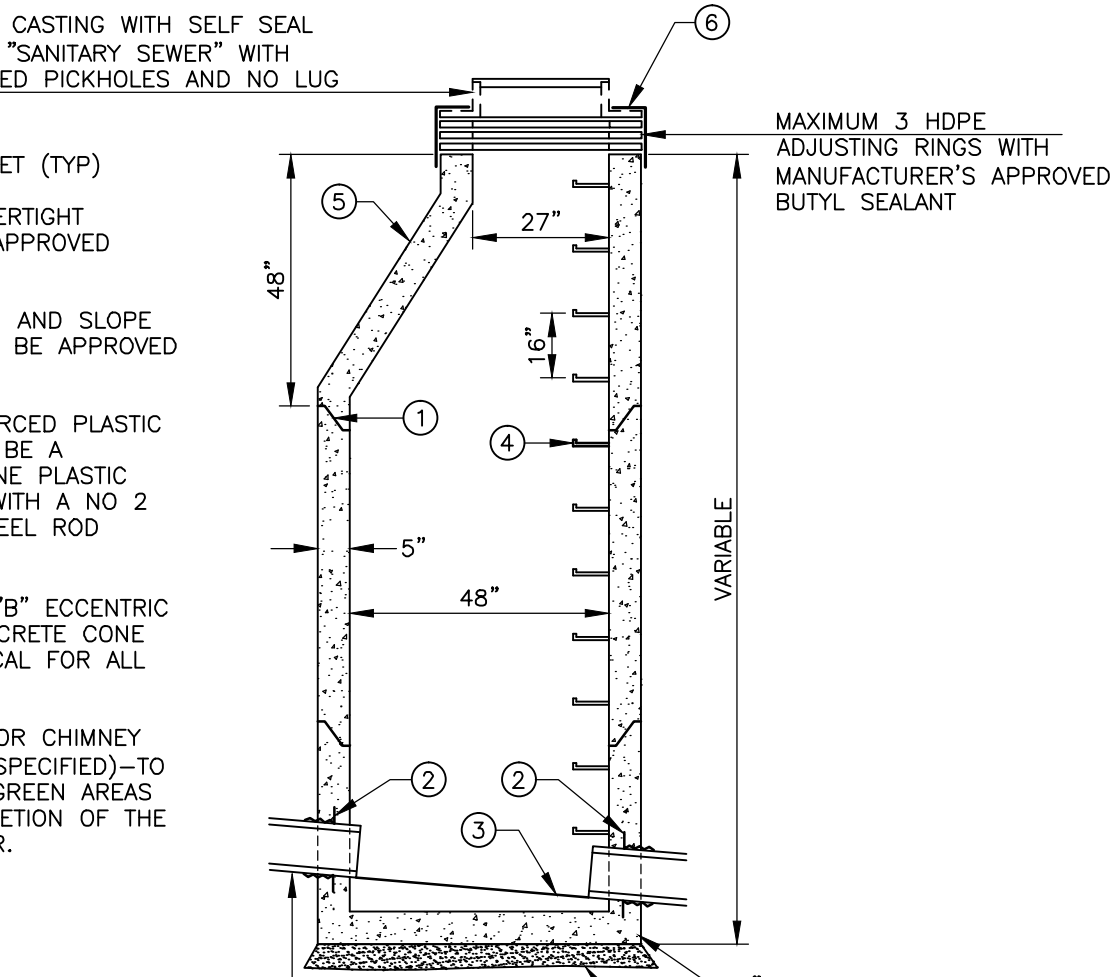
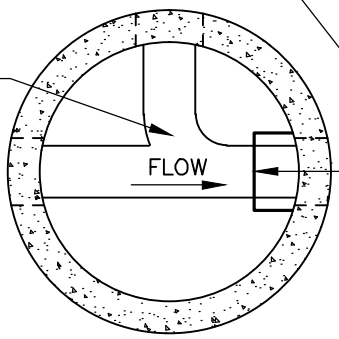
NEENAH 1733 CASTING WITH SELF SEAL LID LETTERED "SANITARY SEWER" WITH TWO CONCEALED PICKHOLES AND NO LUG

1. RUBBER GASKET (TYP)
2. FLEXIBLE WATERTIGHT SEAL TO BE APPROVED BY ENGINEER
3. SHAPE, DEPTH AND SLOPE OF INVERT TO BE APPROVED BY ENGINEER
4. STEEL REINFORCED PLASTIC STEPS SHALL BE A POLYPROPYLENE PLASTIC REINFORCED WITH A NO 2 DEFORMED STEEL ROD GRADE 60
5. MnDOT TYPE "B" ECCENTRIC PRECAST CONCRETE CONE SECTION TYPICAL FOR ALL MANHOLES
6. PLACE EXTERIOR CHIMNEY SEAL (WHEN SPECIFIED)—TO BE USED IN GREEN AREAS AT THE DISCRETION OF THE CITY ENGINEER.





REFER TO PLANS FOR PIPE REQUIRED

PLAN VIEW

SANITARY MANHOLE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SANITARY MANHOLE

City of St. Francis

DATE: 07/2013

STD. DETAIL 5—000

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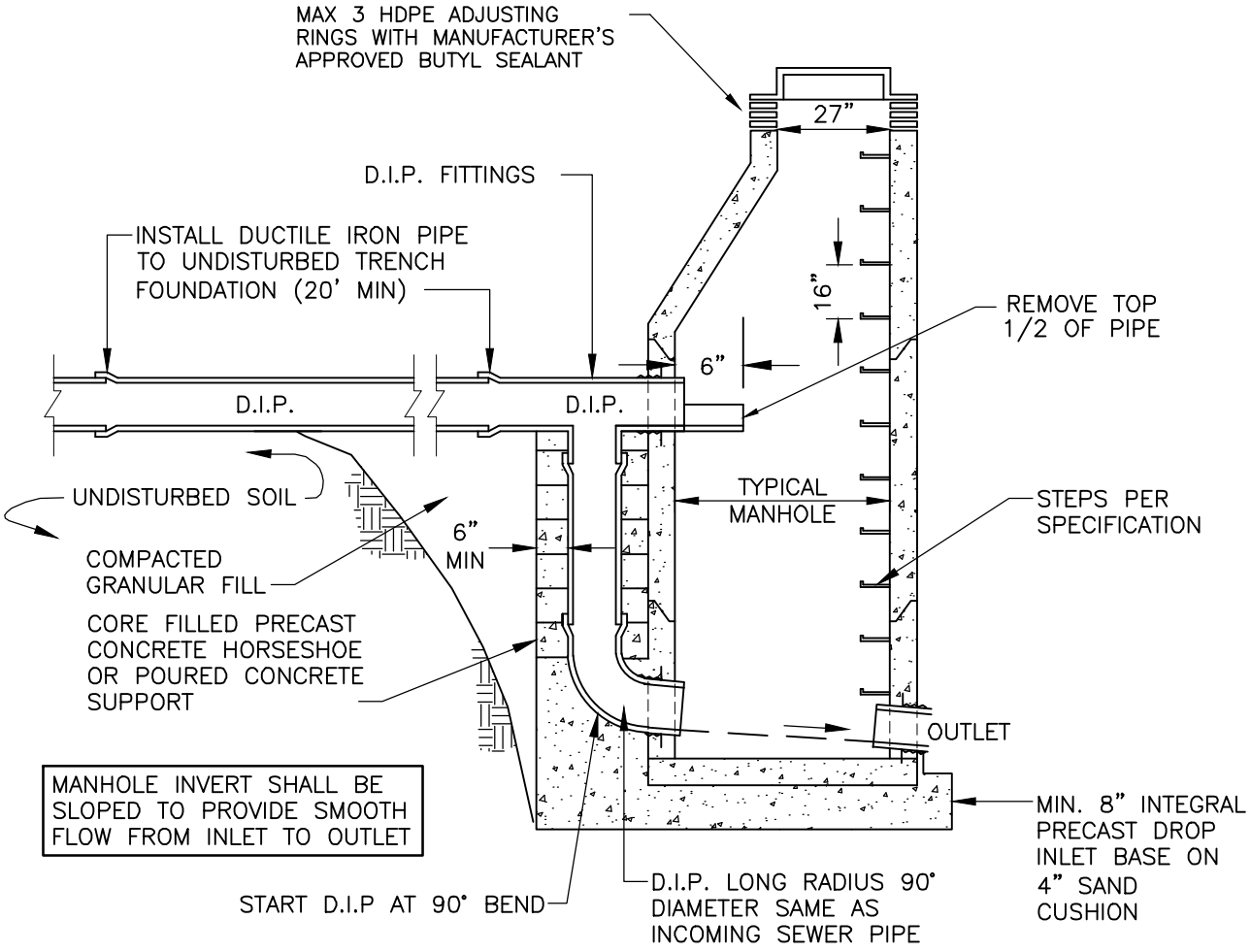

SANITARY MANHOLE WITH OUTSIDE DROP

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN
BURNSVILLE, MN WILLMAR, MN CHASKA, MN
RAMSEY, MN MAPLEWOOD, MN BAXTER, MN AMES, IA

SANITARY MANHOLE WITH OUTSIDE DROP

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-002

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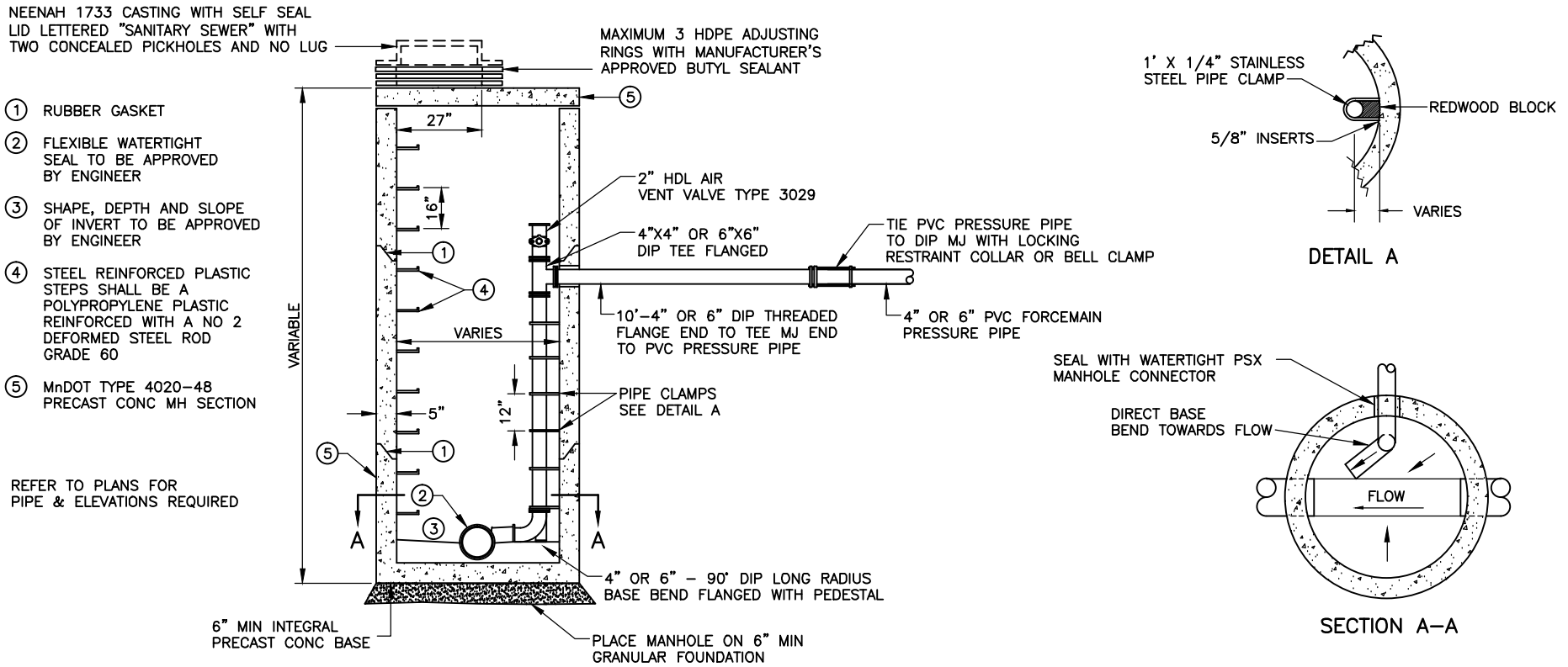


SANITARY MANHOLE WITH INSIDE DROP (FORCEMAIN)

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SANITARY MANHOLE WITH INSIDE DROP (FORCEMAIN)

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-003

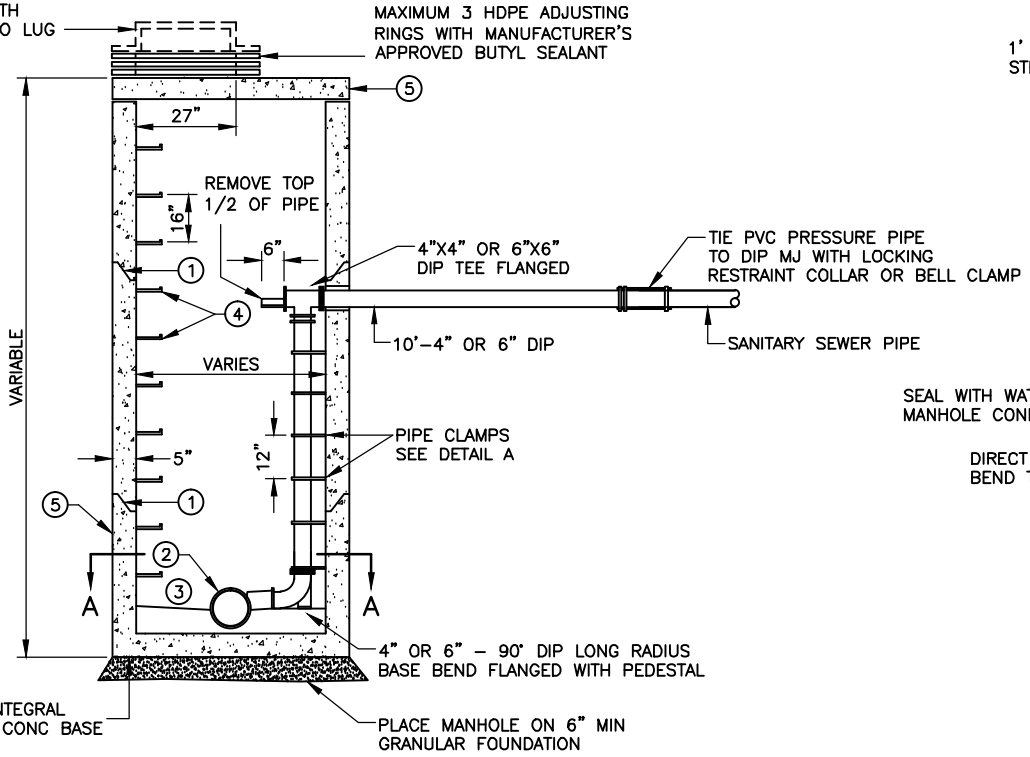
Y:\STFR\2013 Details\STFR_5-003.dwg

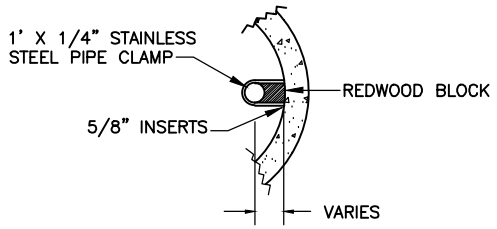
NEENAH 1733 CASTING WITH SELF SEAL LID LETTERED "SANITARY SEWER" WITH TWO CONCEALED PICKHOLES AND NO LUG

MAXIMUM 3 HDPE ADJUSTING RINGS WITH MANUFACTURER'S APPROVED BUTYL SEALANT

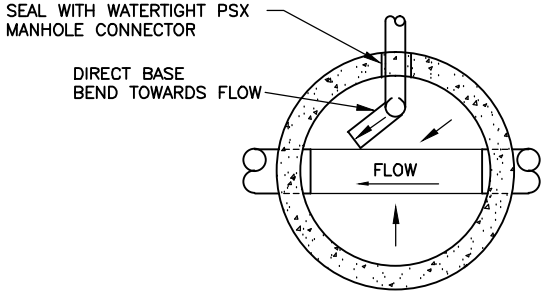
1. RUBBER GASKET
2. FLEXIBLE WATERTIGHT SEAL TO BE APPROVED BY ENGINEER
3. SHAPE, DEPTH AND SLOPE OF INVERT TO BE APPROVED BY ENGINEER
4. STEEL REINFORCED PLASTIC STEPS SHALL BE A POLYPROPYLENE PLASTIC REINFORCED WITH A NO 2 DEFORMED STEEL ROD GRADE 60
5. MnDOT TYPE 4020-48 PRECAST CONC MH SECTION

REFER TO PLANS FOR PIPE & ELEVATIONS REQUIRED





DETAIL A



SECTION A-A

SANITARY MANHOLE WITH INSIDE DROP

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SANITARY MANHOLE WITH INSIDE DROP (GRAVITY)

City of St. Francis

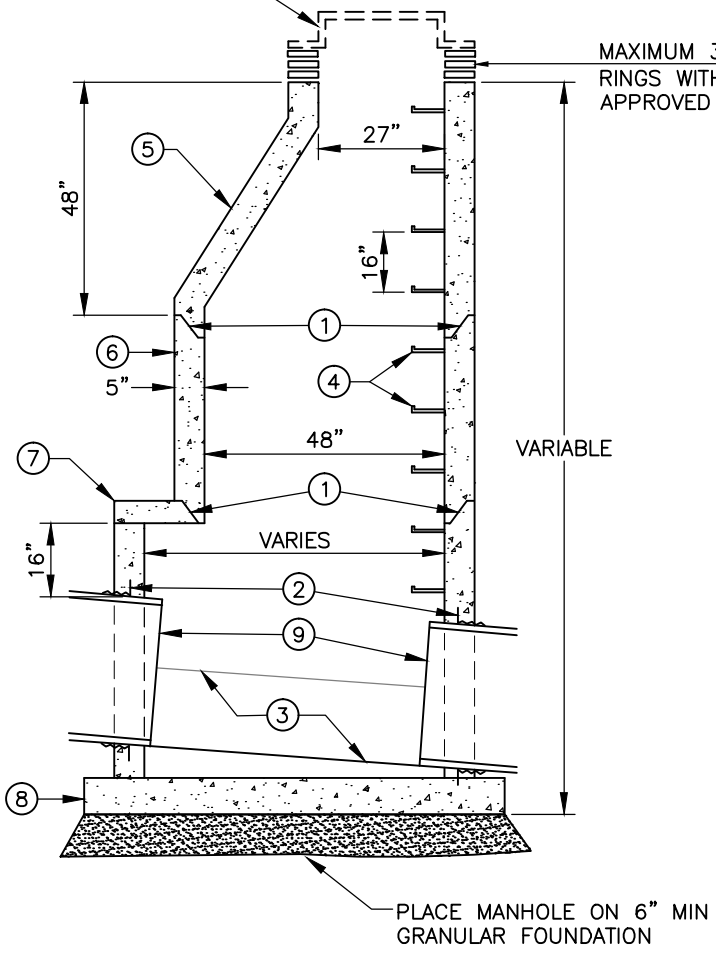
DATE: 07/2013

STD. DETAIL 5-003A

Y:\STFR\2013 Details\STFR_5-003A.dwg

NEENAH 1733 CASTING WITH SELF SEAL LID LETTERED "SANITARY SEWER" WITH TWO CONCEALED PICKHOLES AND NO LUG

1. RUBBER GASKET
2. FLEXIBLE WATERTIGHT SEAL TO BE APPROVED BY ENGINEER
3. SHAPE, DEPTH AND SLOPE OF INVERT TO BE APPROVED BY ENGINEER, GROUT TO BE MIX 3A34
4. STEEL REINFORCED PLASTIC STEPS SHALL BE A POLYPROPYLENE PLASTIC REINFORCED WITH NO 2 DEFORMED STEEL ROD GRADE 60
5. MnDOT TYPE "B" ECCENTRIC PRECAST CONCRETE CONE SECTION TYPICAL FOR ALL MANHOLES
6. 48" DIAMETER PRECAST RISER SECTIONS AS REQUIRED
7. PRECAST SLAB WITH ECCENTRIC 48" OPENING DESIGN –HS20 PLUS EARTH LOAD
8. 80" PRECAST INTEGRAL BASE SECTION
9. REFER TO PLANS FOR PIPE REQUIRED



SANITARY MANHOLE DESIGN SPECIAL

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SANITARY MANHOLE DESIGN SPECIAL

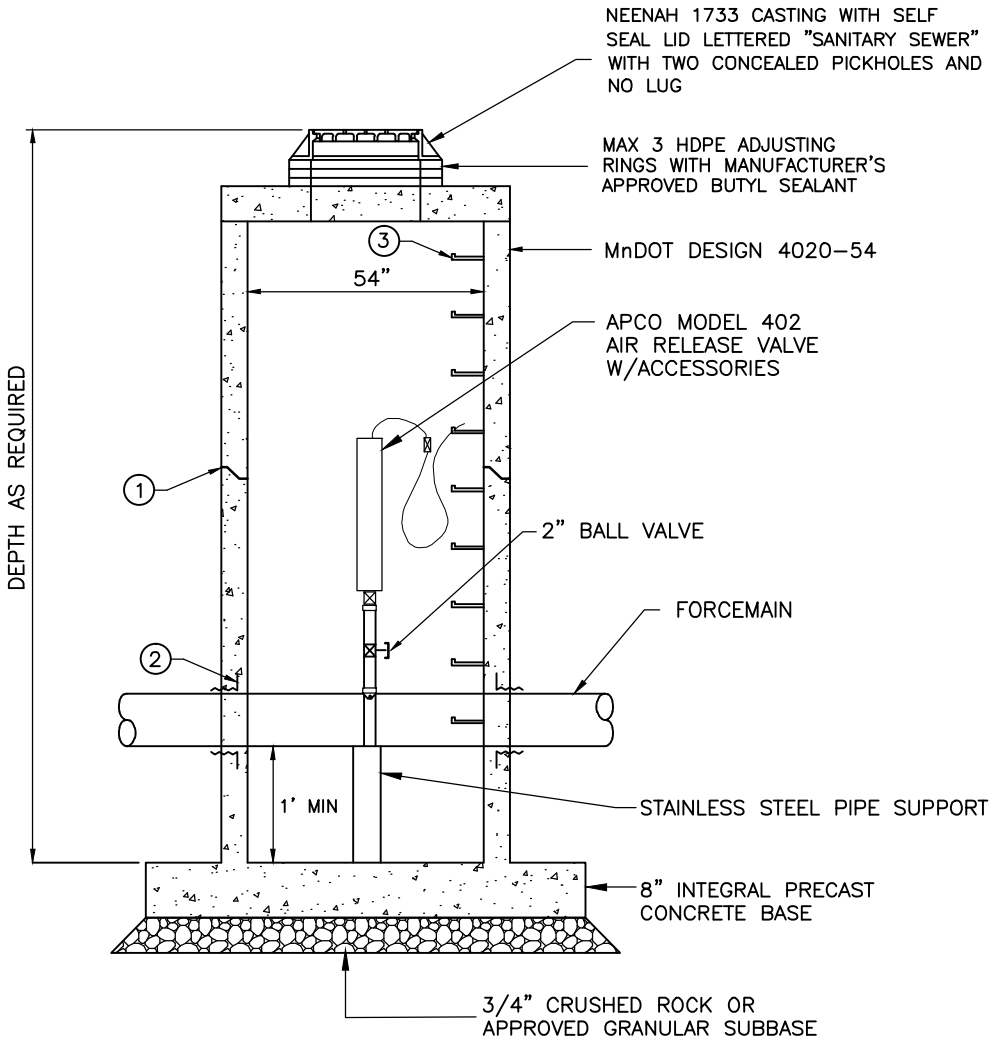
City of St. Francis

DATE: 07/2013

STD. DETAIL 5–004

Y:\STFR\2013 Details\STFR_5–004.dwg

1. RUBBER GASKET
2. FLEXIBLE WATERTIGHT SEAL TO BE APPROVED BY ENGINEER
3. STEEL REINFORCED PLASTIC STEPS SHALL BE A POLYPROPYLENE PLASTIC REINFORCED WITH A NO. 2 DEFORMED STEEL ROD GRADE 60



AIR RELEASE MANHOLE, DESIGN 4020

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

AIR RELEASE MANHOLE DESIGN 4020

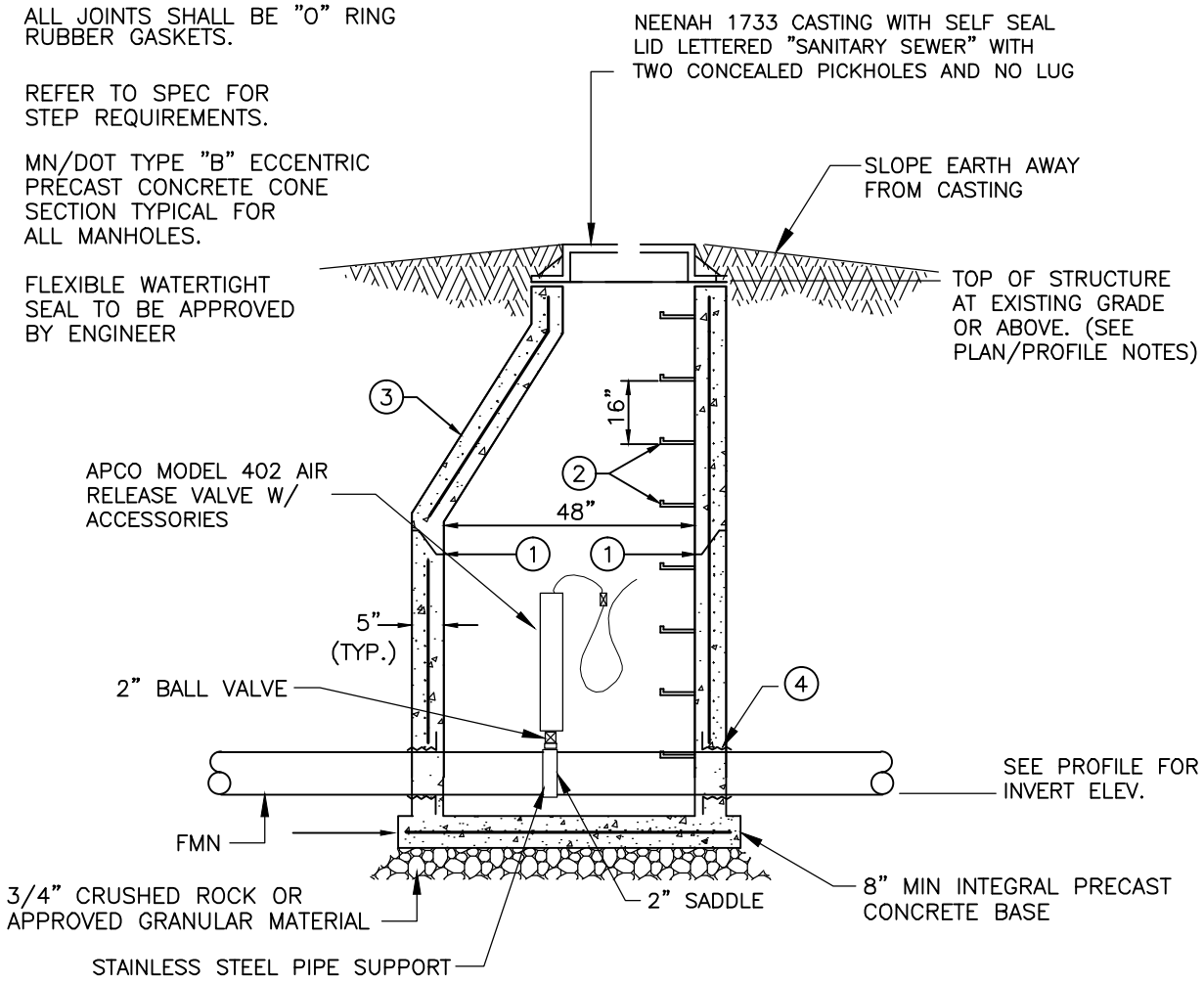
City of St. Francis

DATE: 07/2013

STD. DETAIL 5-005

Y:\STFR\2013 Details\STFR_5-005.dwg

1. ALL JOINTS SHALL BE "O" RING RUBBER GASKETS.
2. REFER TO SPEC FOR STEP REQUIREMENTS.
3. MN/DOT TYPE "B" ECCENTRIC PRECAST CONCRETE CONE SECTION TYPICAL FOR ALL MANHOLES.
4. FLEXIBLE WATERTIGHT SEAL TO BE APPROVED BY ENGINEER



AIR RELEASE MANHOLE, DESIGN F

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

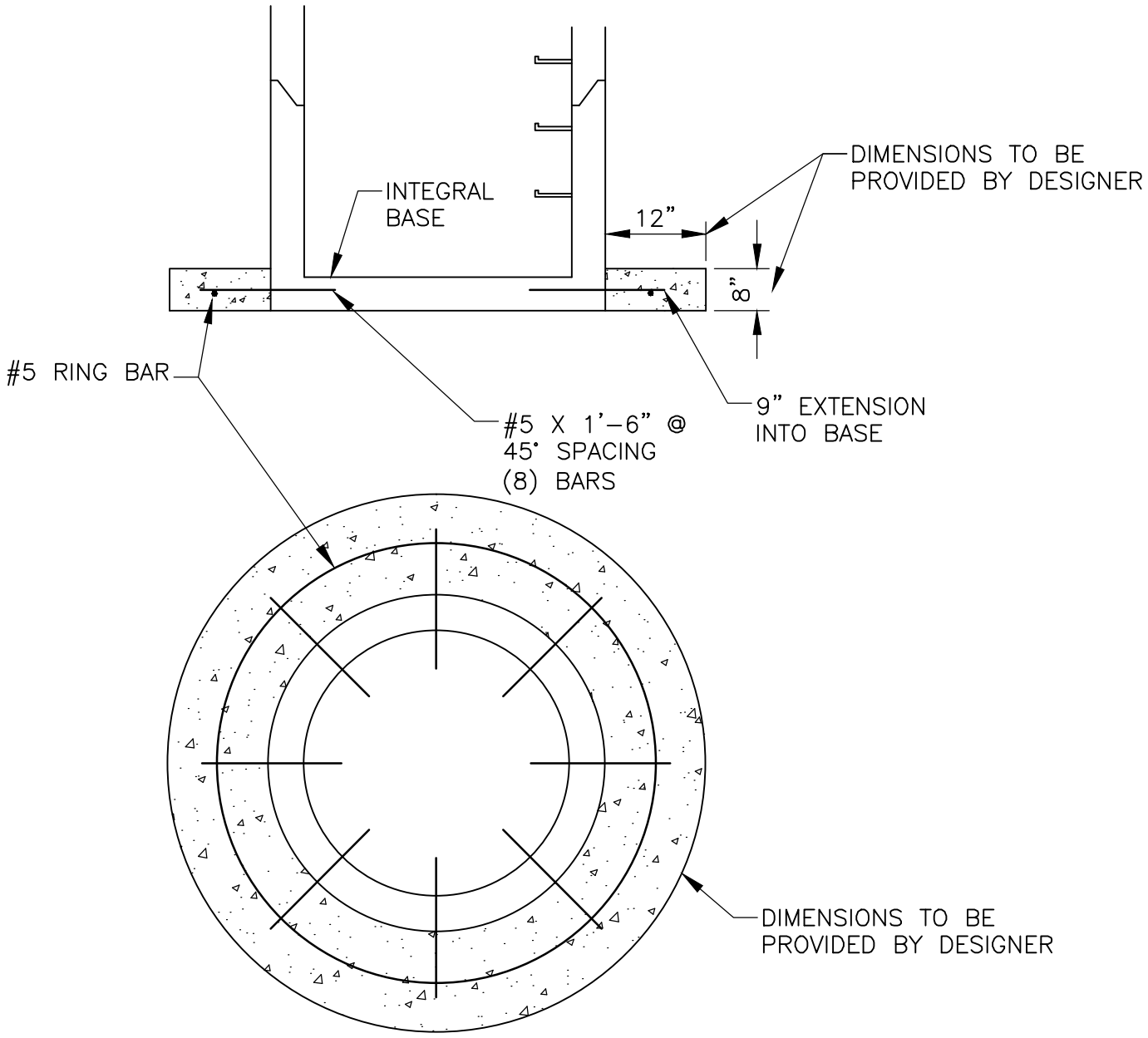
AIR RELEASE MANHOLE DESIGN F

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-006

Y:\STFR\2013 Details\STFR_5-006.dwg



MANHOLE ANTI-BUOYANCY COLLAR

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

MANHOLE ANTI-BUOYANCY COLLAR

City of St. Francis

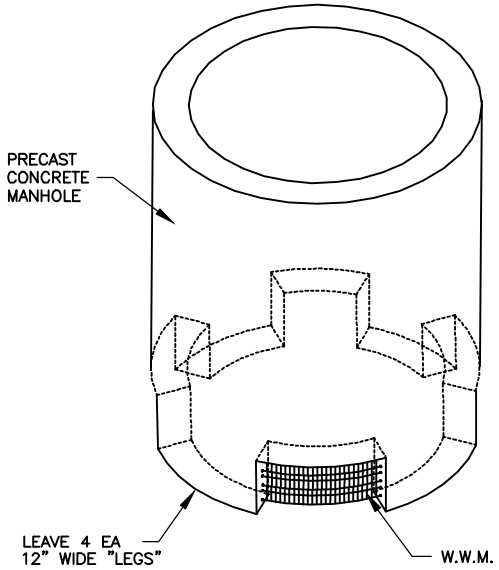
DATE: 07/2013

STD. DETAIL 5-007

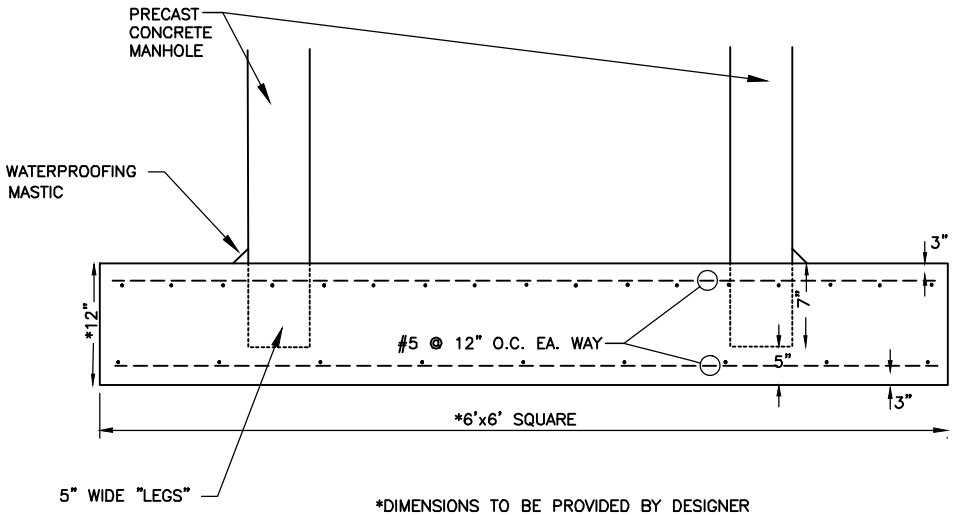
Y:\STFR\2013 Details\STFR_5-007.dwg

CAST INPLACE CONCRETE BASE:

KNOCK OUT BOTTOM OF PRECAST CONCRETE MANHOLE 6" HIGH LEAVING 4 EA. 12" WIDE LEGS AT QUARTER POINTS. LEAVE W.W.M. INTACT – DO NOT CUT – DO NOT REMOVE. SET MANHOLE IN CENTER OF FORM FOR CAST IN PLACE CONCRETE BASE. THREAD REINFORCING BARS THROUGH EXPOSED W.W.M. POUR CONCRETE IN AND AROUND MANHOLE.



CONCRETE BASE REINFORCING SECTION



*DIMENSIONS TO BE PROVIDED BY DESIGNER

MANHOLE ANTI–BUOYANCY COLLAR–OPTION 2

NOT TO SCALE

NOTE:
ALL NON–INTEGRAL ANTI–BOUYANCY COLLARS SHALL BE APPROVED FOR INSTALLATION BY THE CITY ENGINEER.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

MANHOLE ANTI–BUOYANCY COLLAR– OPTION 2

City of St. Francis

DATE: 07/2013

STD. DETAIL 5–007A

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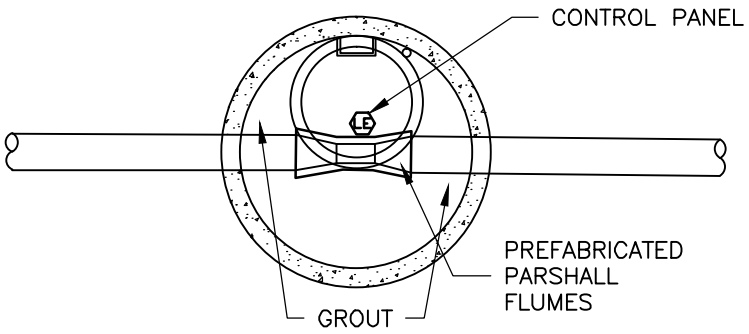
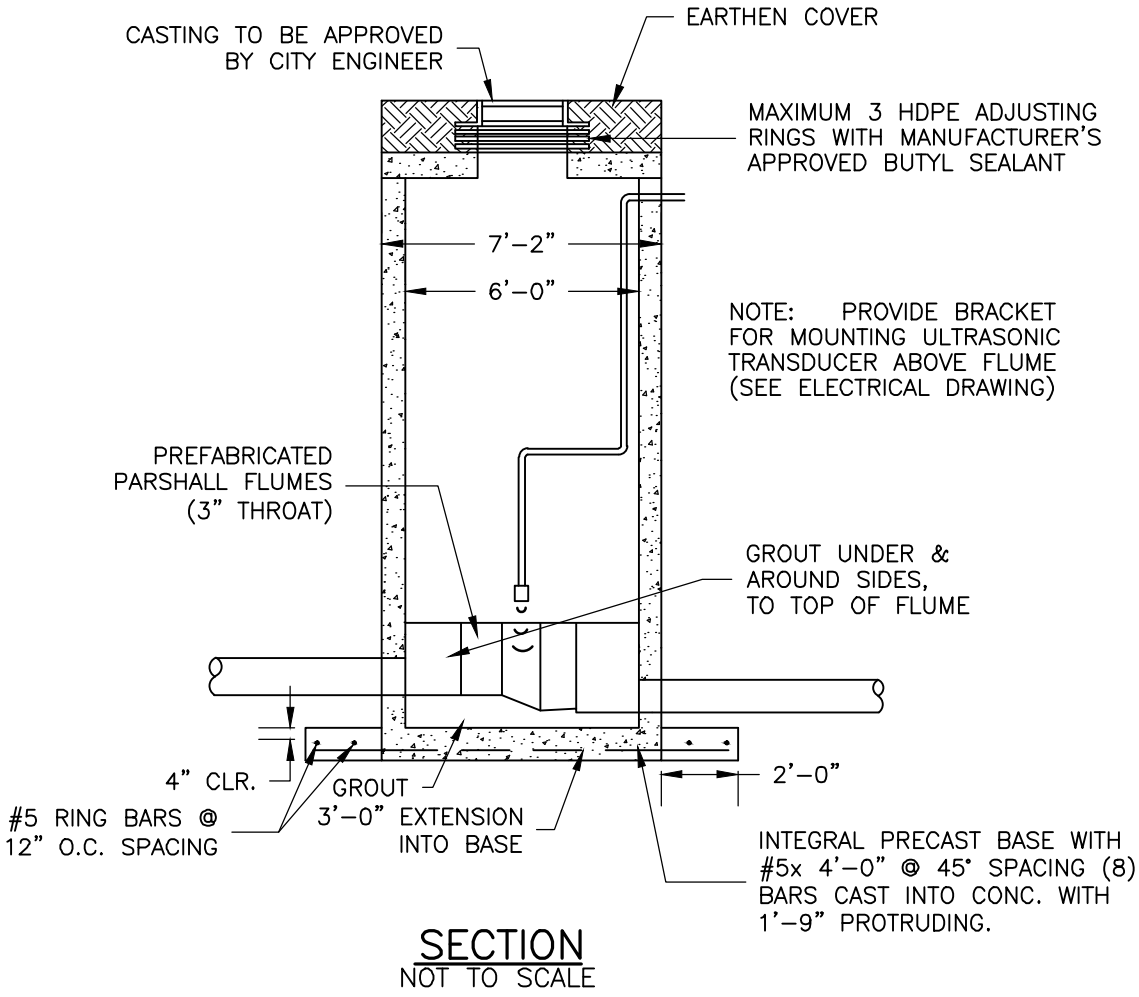


PLAN



SECTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

FLOW METERING MANHOLE

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-010

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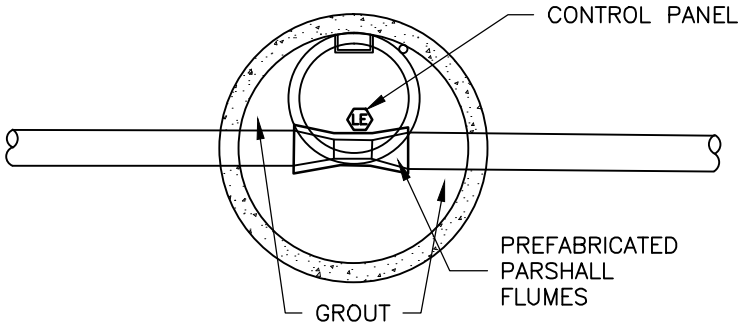
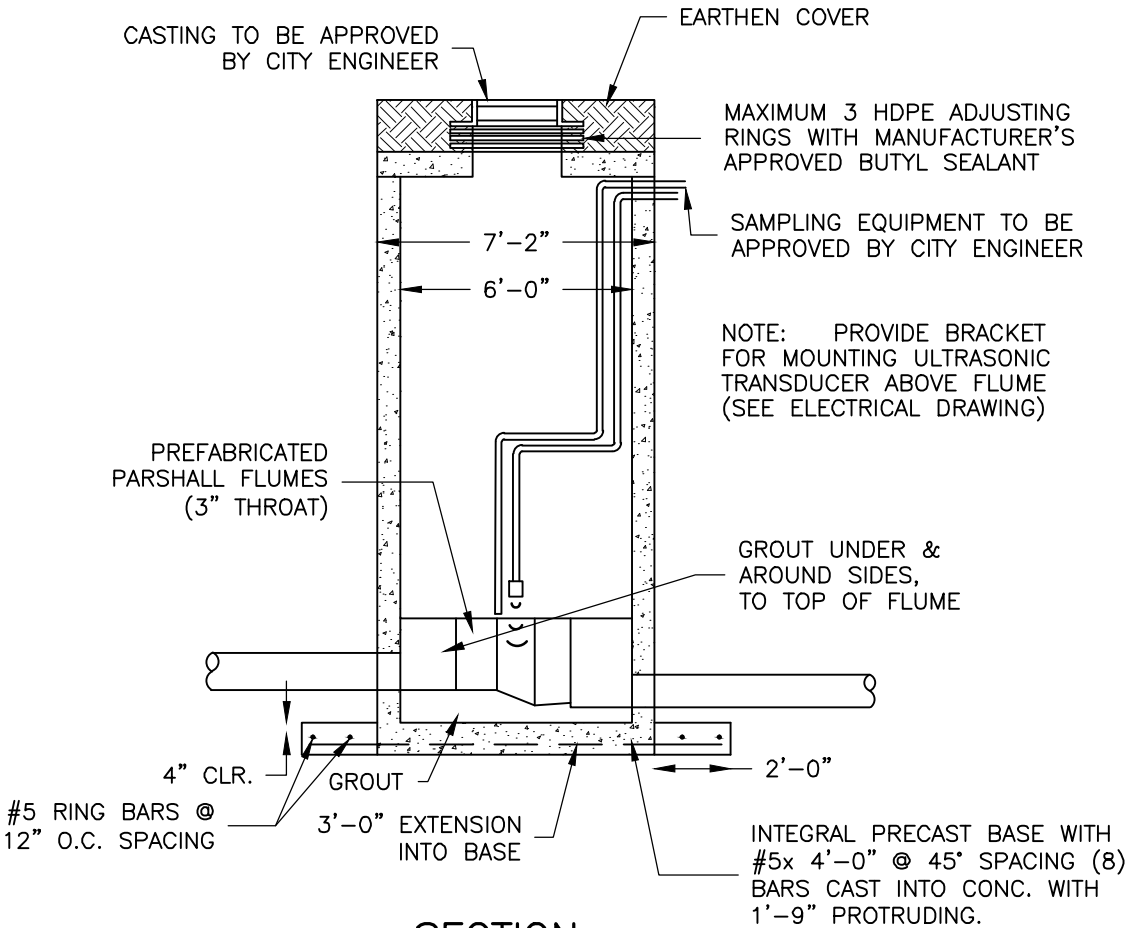


PLAN



SECTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

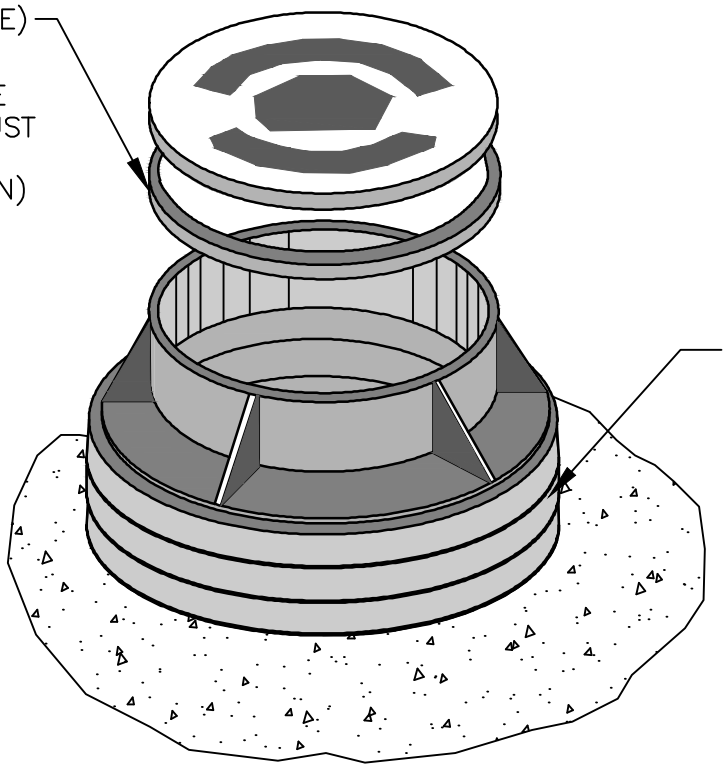
FLOW METERING & SAMPLING MANHOLE

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-011

Y:\STFR\2013 Details\STFR_5-011.dwg



NOTE: A FIVE HUNDRED DOLLAR ($500) PENALTY WILL BE ENFORCED FOR EACH CASTING NOT PROPERLY ADJUSTED REQUIRING A PATCH IN THE BITUMINOUS WEARING COURSE.

CASTING & GRADE ADJUSTMENT – SANITARY SEWER

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CASTING AND GRADE ADJUSTMENT DETAIL–SANITARY

City of St. Francis

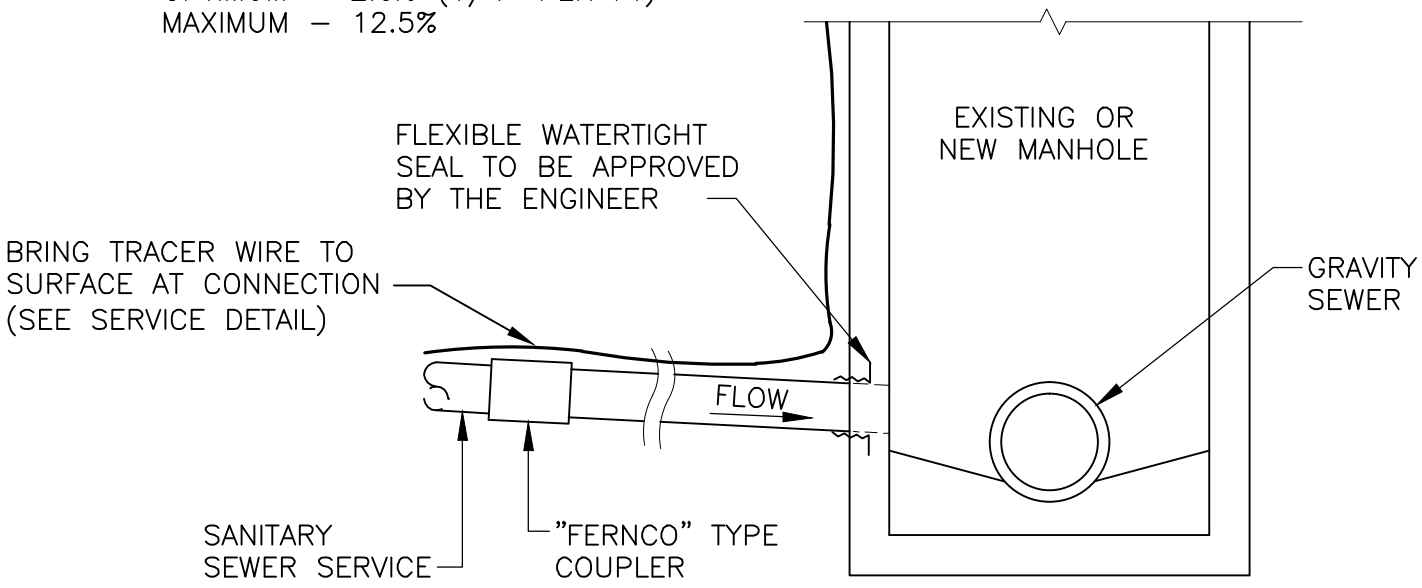
DATE: 07/2013

STD. DETAIL 5–019

Y:\STFR\2013 Details\STFR_5–019.dwg

NOTE:
WYES, BENDS AND PIPE SIZES
AS REQUIRED BY PLANS AND SPECS

SEWER GRADE SERVICE REQUIREMENTS
–GRADES–
MINIMUM – 1.0% (1/8" PER FT)
OPTIMUM – 2.0% (1/4" PER FT)
MAXIMUM – 12.5%



NOTE:
WHERE NO EXISTING SEWER IS IN PLACE, INSTALL PVC CAP AND MARK LOCATION WITH 4"X4"X6' TIMBER & 2" DIAMETER GALVANIZED STEEL PIPE EXTENDING 3' ABOVE GROUND WITH THE TOP 2' PAINTED FLUORESCENT GREEN.

SANITARY SEWER SERVICE CONNECTION TO MANHOLE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SANITARY SEWER SERVICE CONNECTION TO MANHOLE

City of St. Francis

DATE: 07/2013

STD. DETAIL 5–100

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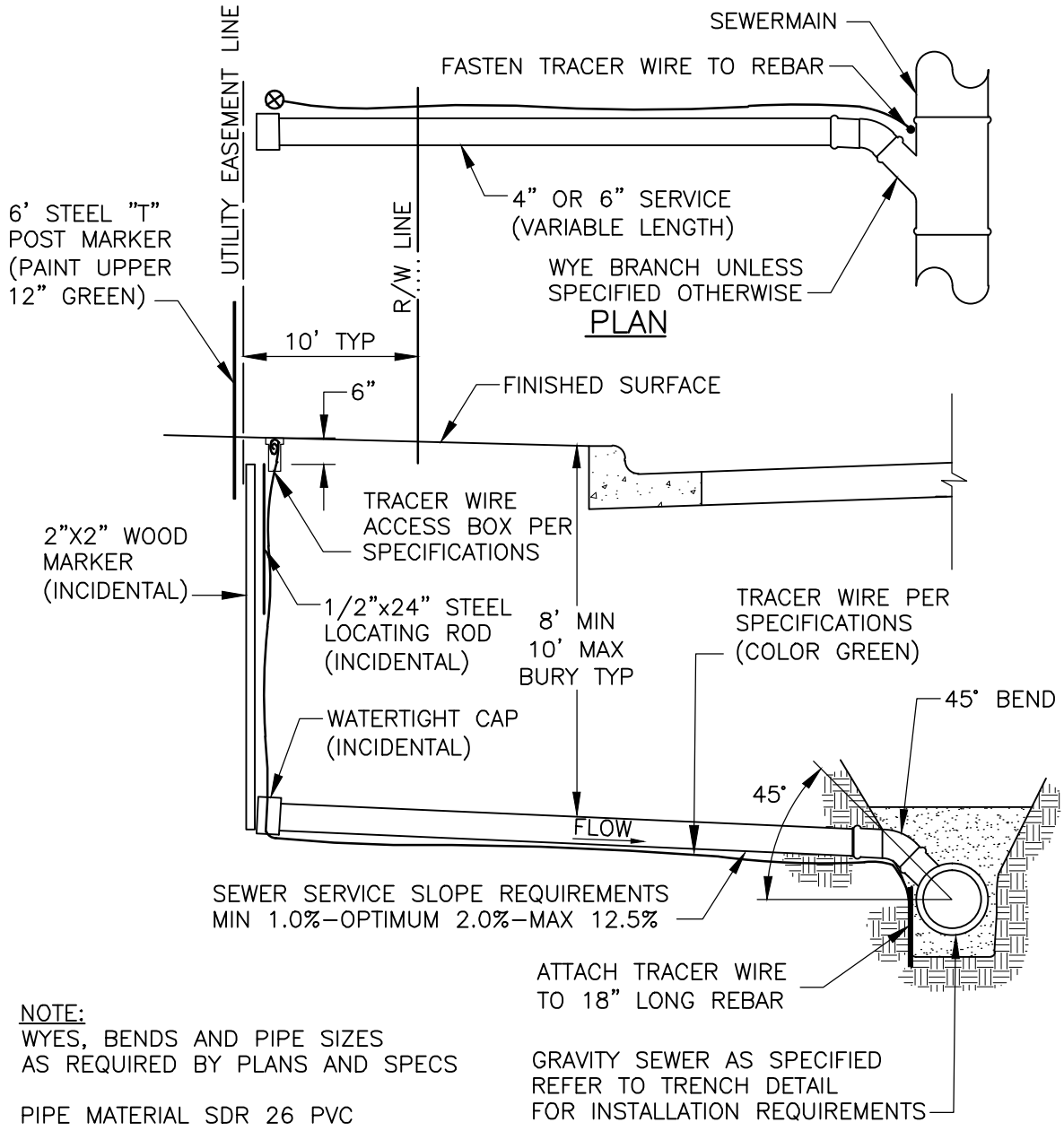


NOTE:
WYES, BENDS AND PIPE SIZES
AS REQUIRED BY PLANS AND SPECS

PIPE MATERIAL SDR 26 PVC

PROFILE

SANITARY SEWER SERVICE, NEW CONSTRUCTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

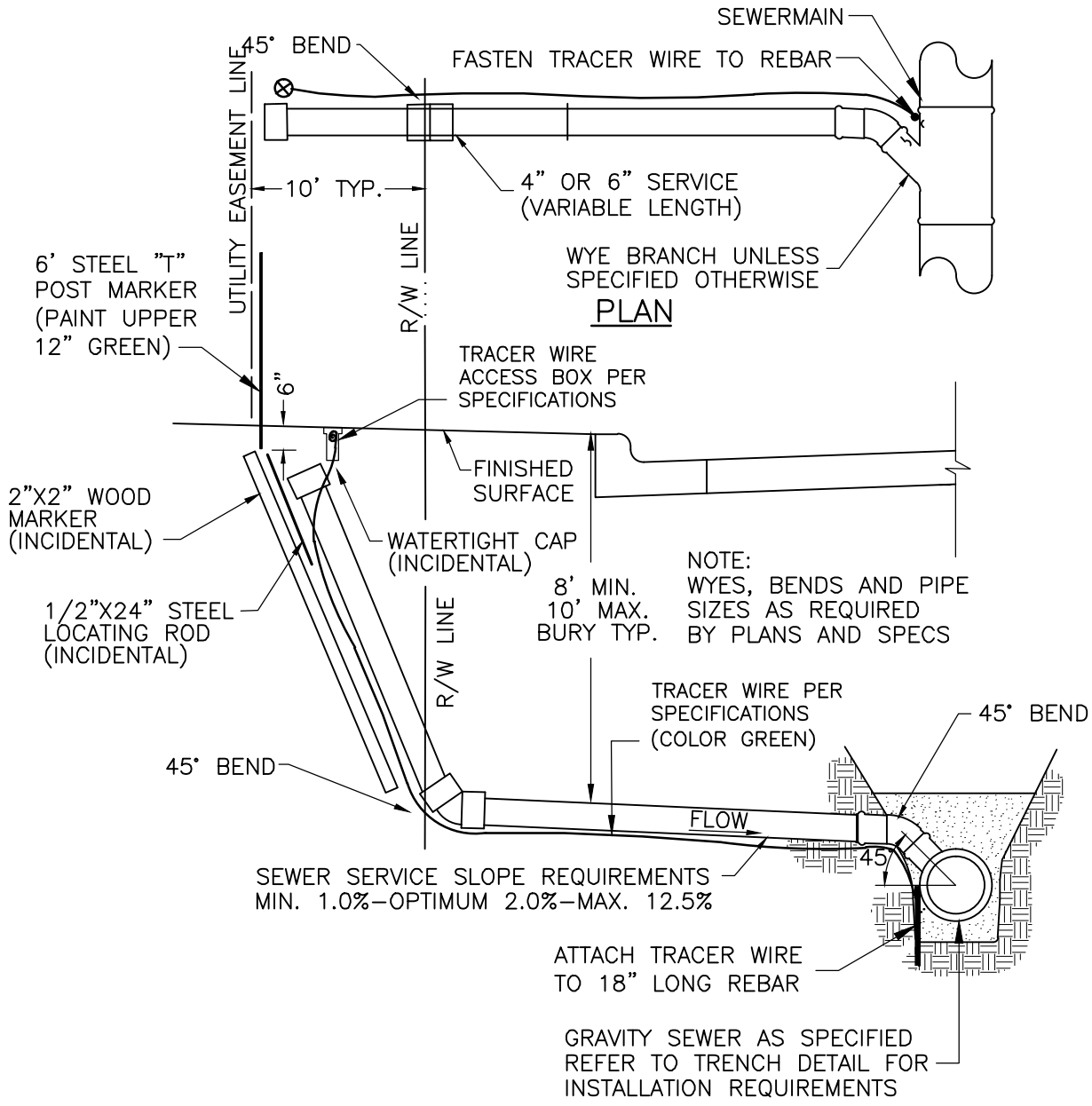
SANITARY SEWER SERVICE NEW CONSTRUCTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 5–101

Y:\STFR\2013 Details\STFR_5–101.dwg



PROFILE

SANITARY SEWER SERVICE, NEW CONSTRUCTION

NOT TO SCALE

(IN AREAS OF POSSIBLE HIGH GROUNDWATER)

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

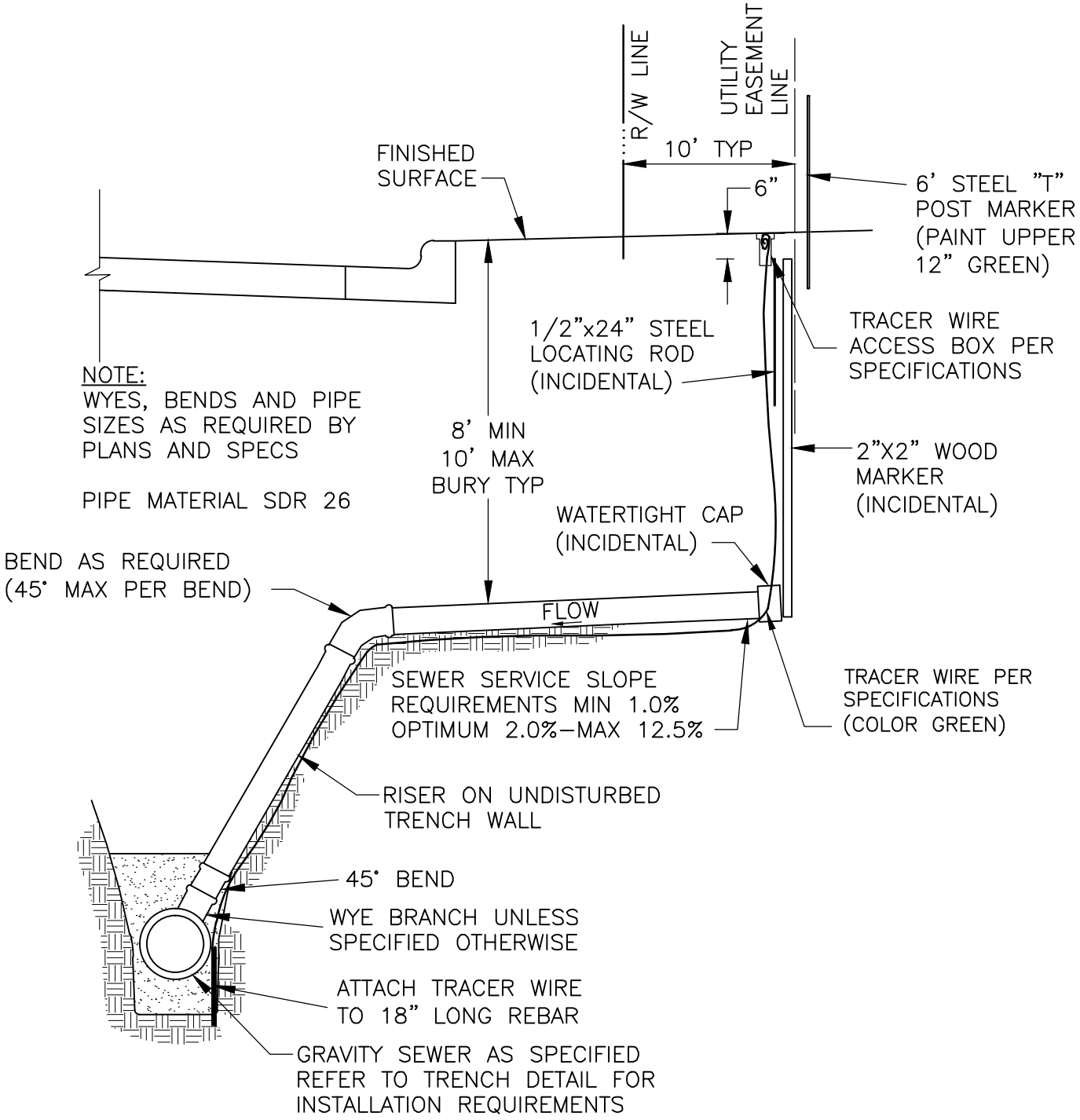
SANITARY SEWER SERVICE NEW CONSTRUCTION (HIGH GROUND WATER)

City of St. Francis

DATE: 07/2013

STD. DETAIL 5–101A

Y:\STFR\2013 Details\STFR_5–101A.dwg



SANITARY SEWER SERVICE RISER, NEW CONSTRUCTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

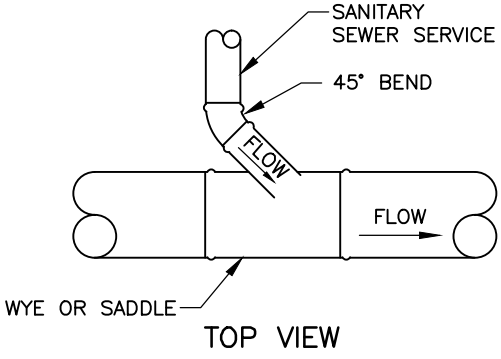
SANITARY SEWER SERVICE RISER NEW CONSTRUCTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 5–104

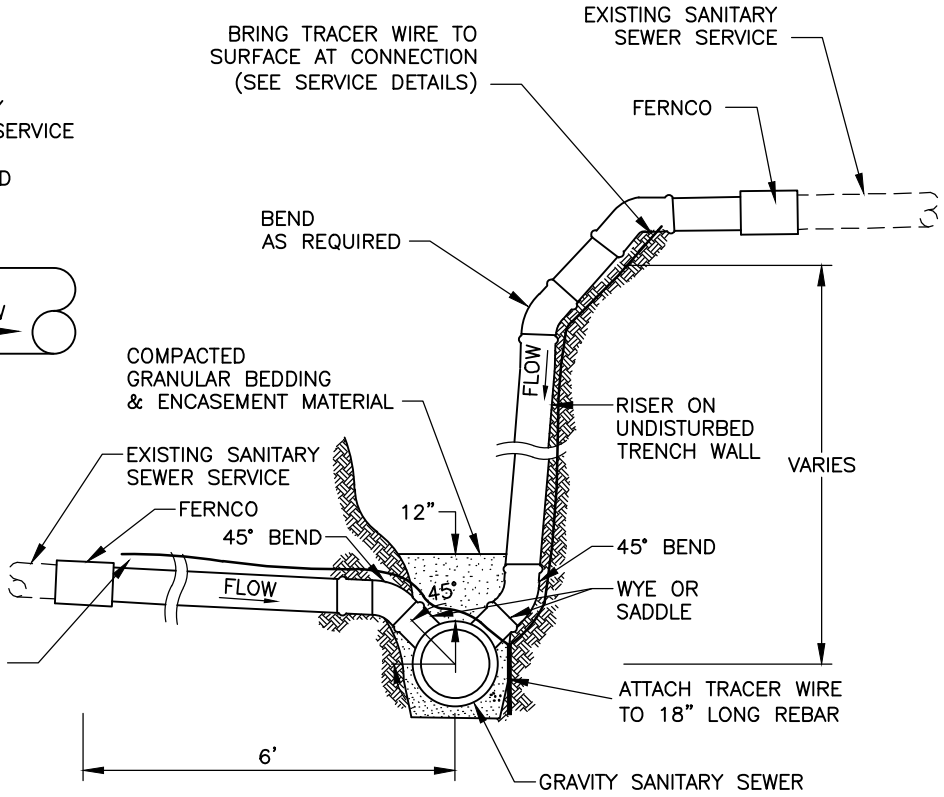
Y:\STFR\2013 Details\STFR_5–104.dwg



TOP VIEW

NOTE:
WYES, BENDS AND PIPE SIZES
AS REQUIRED BY PLANS AND SPECS

PIPE MATERIAL SDR 26



SEWER SERVICE REQUIREMENTS
–GRADES–
MINIMUM – 1.0% (1/8" PER FT)
OPTIMUM – 2.0% (1/4" PER FT)
MAXIMUM – 12.5%

NOTE:
WHERE NO EXISTING SEWER IS IN PLACE, INSTALL PVC CAP AND MARK LOCATION WITH 2"x2" WOOD MARKER WITH 24" LONG REBAR EXTENDED WITHIN 6" OF GROUND SURFACE AND MARK STUB WITH STEEL FENCE POST, 4' ABOVE GRADE WITH TOP 1' PAINTED GREEN.

SANITARY SEWER SERVICE AND SERVICE RISER, RECONSTRUCTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

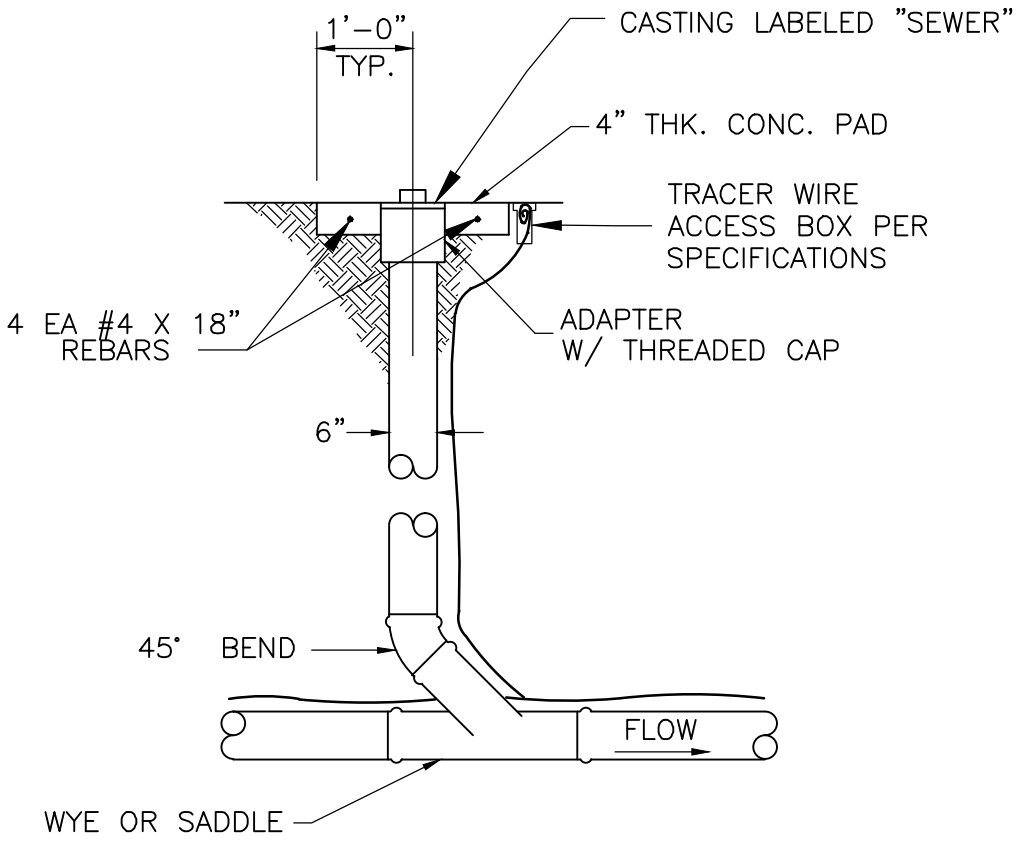
SANITARY SEWER SERVICE AND SERVICE RISER, RECONSTRUCTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 5–107

Y:\STFR\2013 Details\STFR_5–107.dwg



SANITARY SEWER CLEANOUT

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

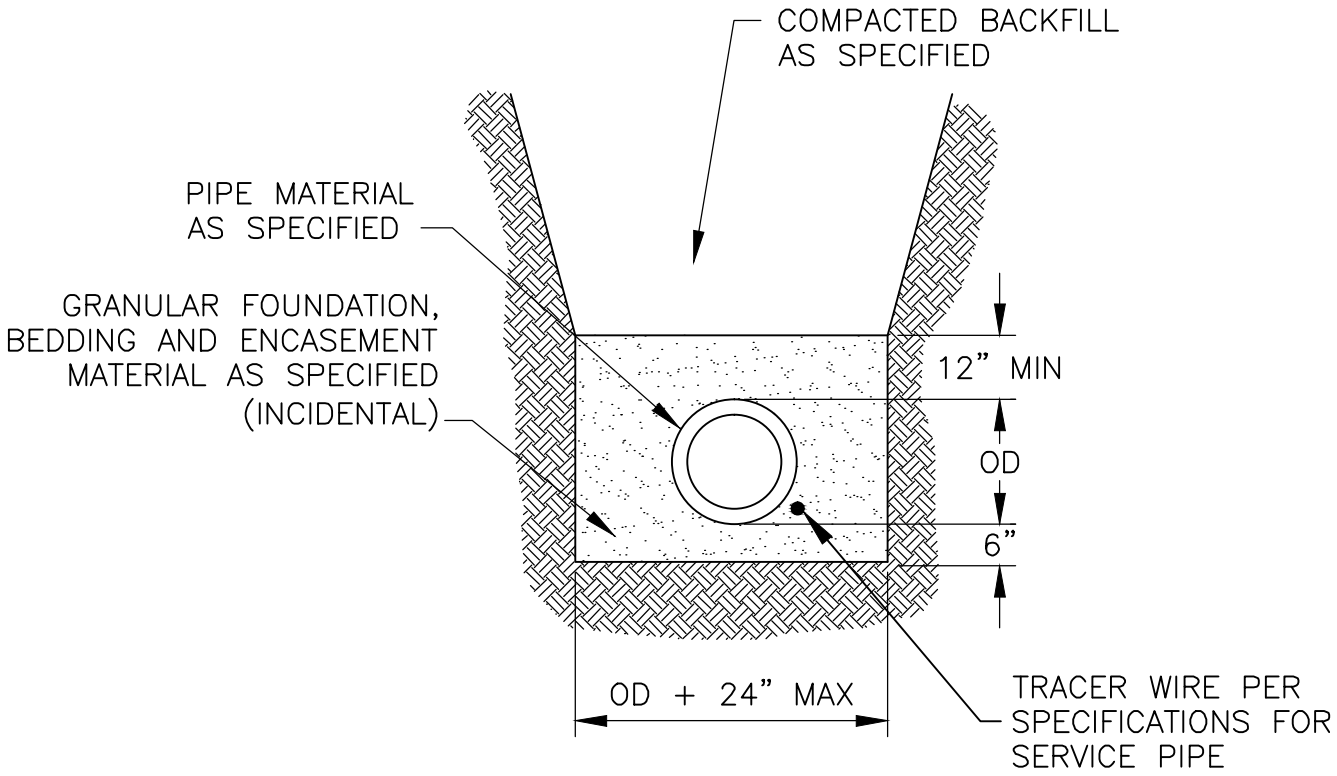
SANITARY SEWER CLEANOUT

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-110

Y:\STFR\2013 Details\STFR_5-110.dwg



PVC SANITARY SEWER TRENCH

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

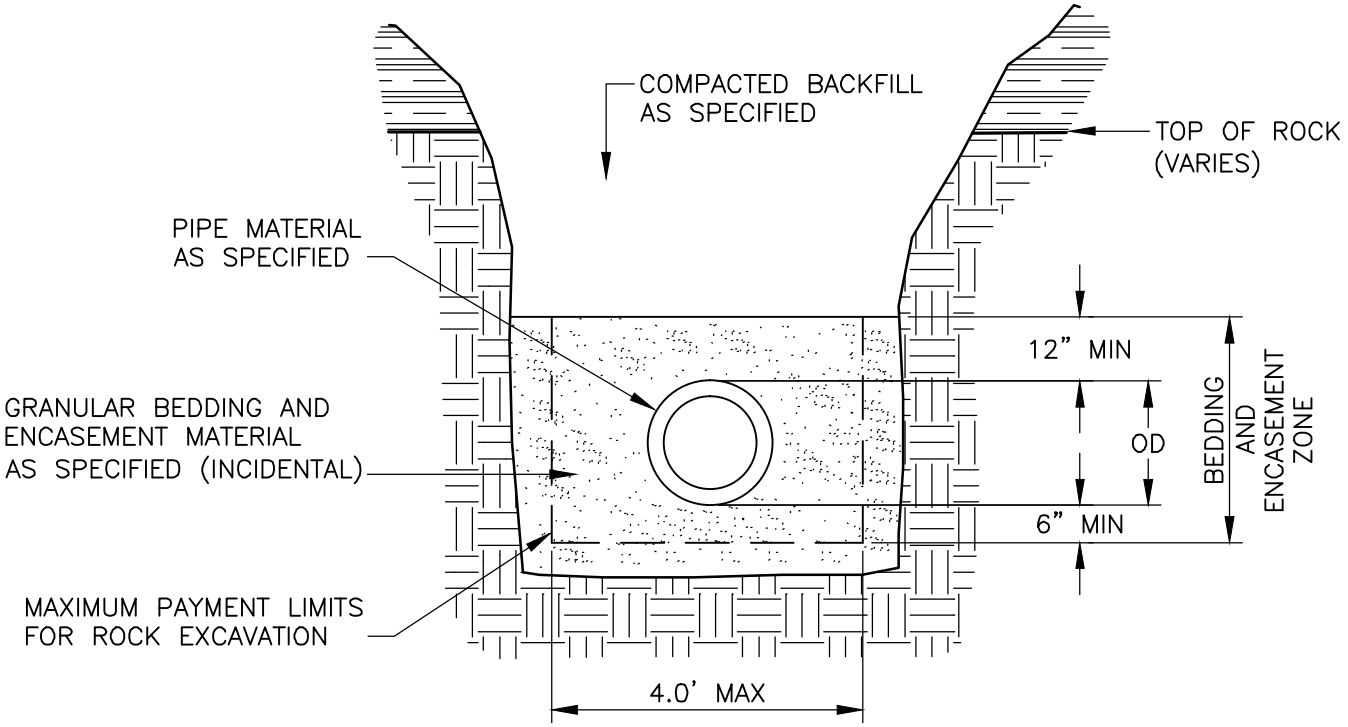
PVC SANITARY SEWER TRENCH

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-200

Y:\STFR\2013 Details\STFR_5-200.dwg



ROCK EXCAVATION FOR WATERMAIN AND SANITARY SEWER

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

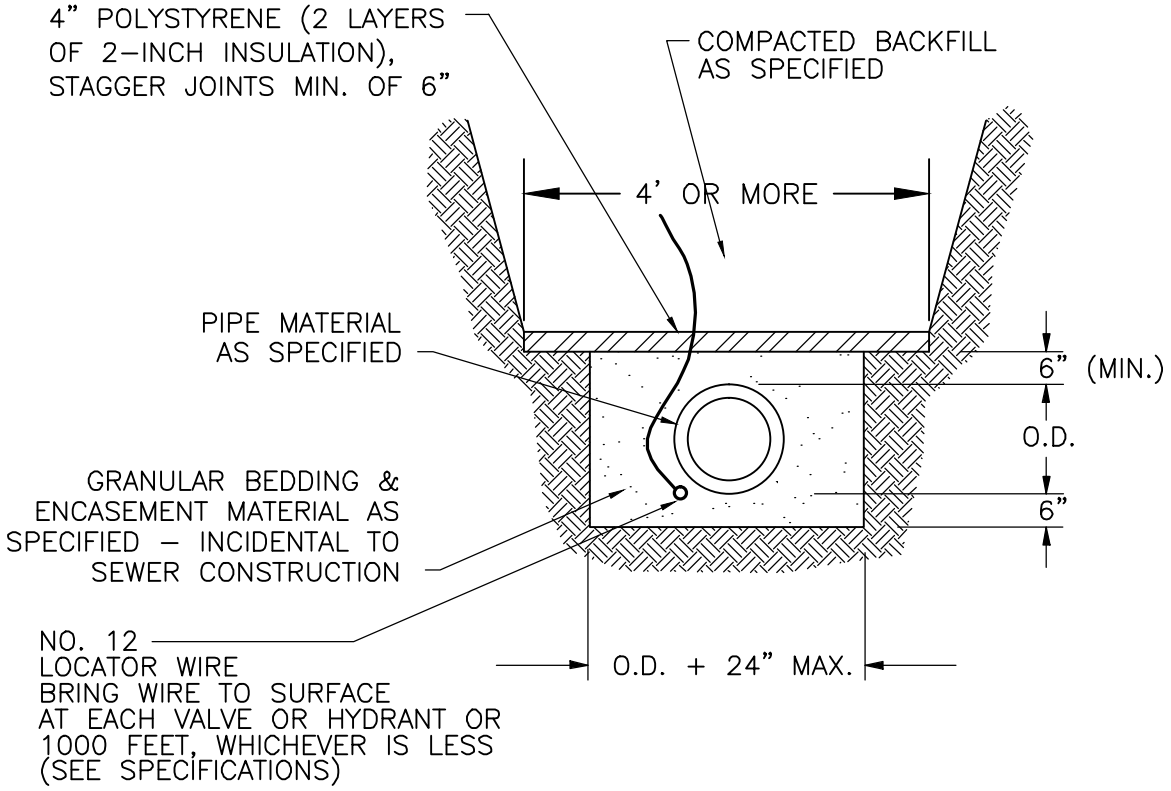
ROCK EXCAVATION FOR WATERMAIN AND SANITARY SEWER

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-201

Y:\STFR\2013 Details\STFR_5-201.dwg



NOTE: IF SERVICE LINE HAS LESS THAN 7' OF COVER INSULATION WIDTH SHALL INCREASE AS FOLLOWS:

DEPTH OF COVER	WIDTH OF INSULATION
6 FT. TO 6.5 FT.	6 FT.
5 FT.	8 FT.
4.5 FT.	10 FT.

INSULATION DETAIL
FORCEMAIN, SANITARY SEWER AND SERVICES

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

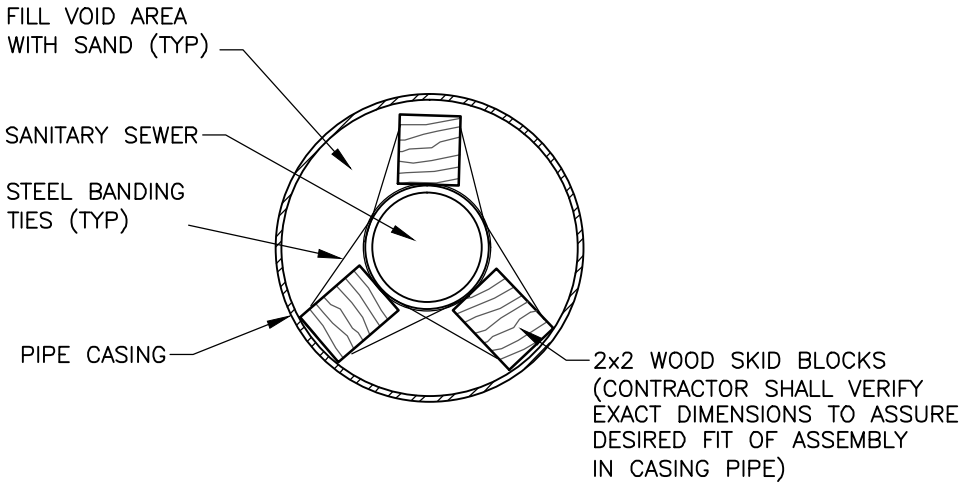
INSULATION FOR FORCEMAIN AND SANITARY

City of St. Francis

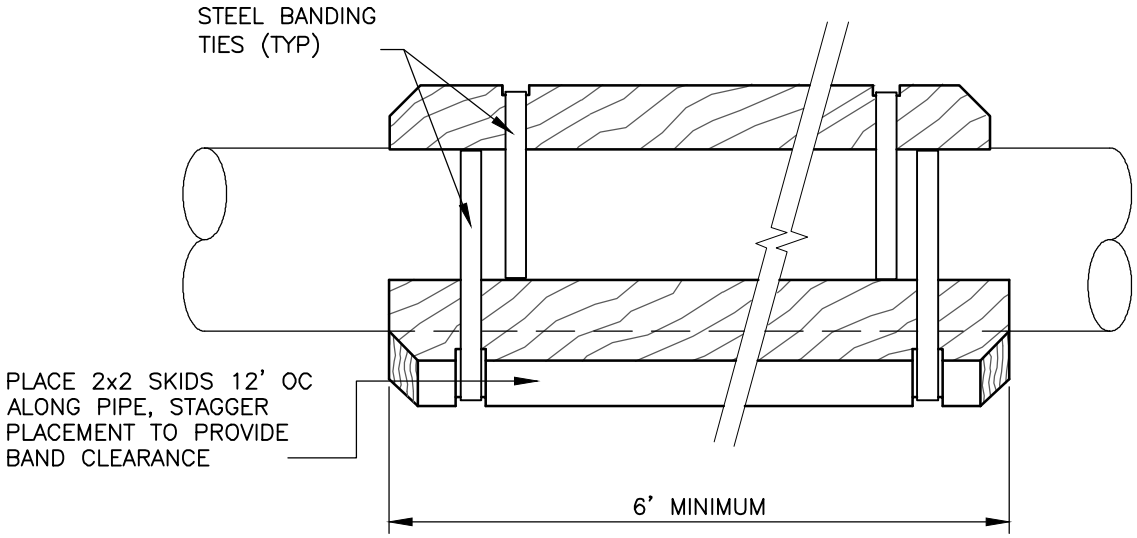
DATE: 07/2013

STD. DETAIL 5–202

Y:\STFR\2013 Details\STFR_5–202.dwg



TYPICAL SECTION



SANITARY SEWER PIPE SUPPORT IN CASING, WOOD SKIDS

NOT TO SCALE

NOTE: SEE DETAIL 6–205
FOR ALTERNATE SPACERS

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

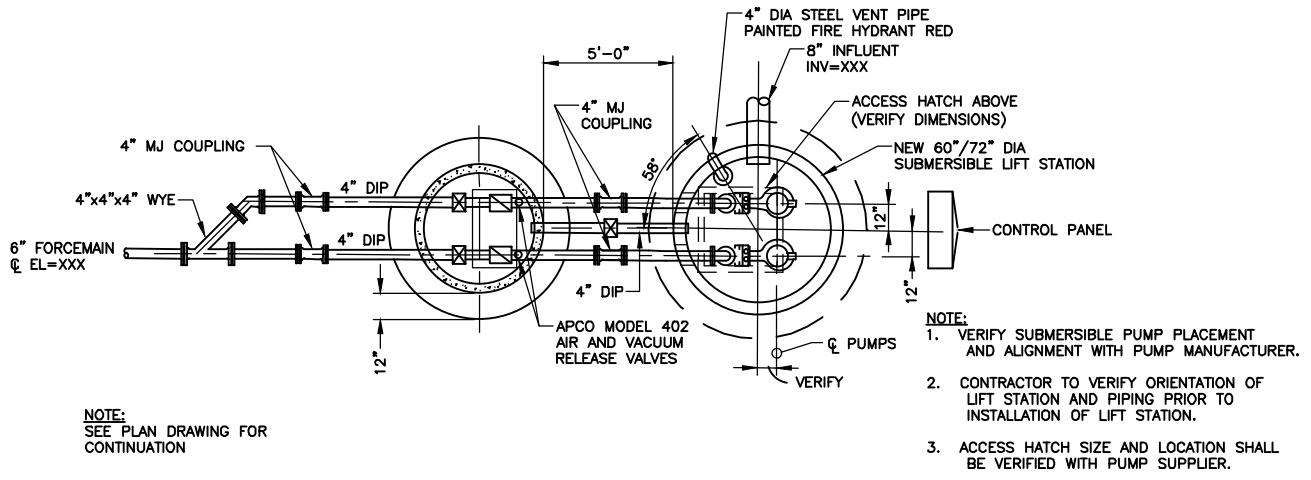
SANITARY SEWER
PIPE SUPPORT
IN CASING
WOOD SKIDS

City of St. Francis

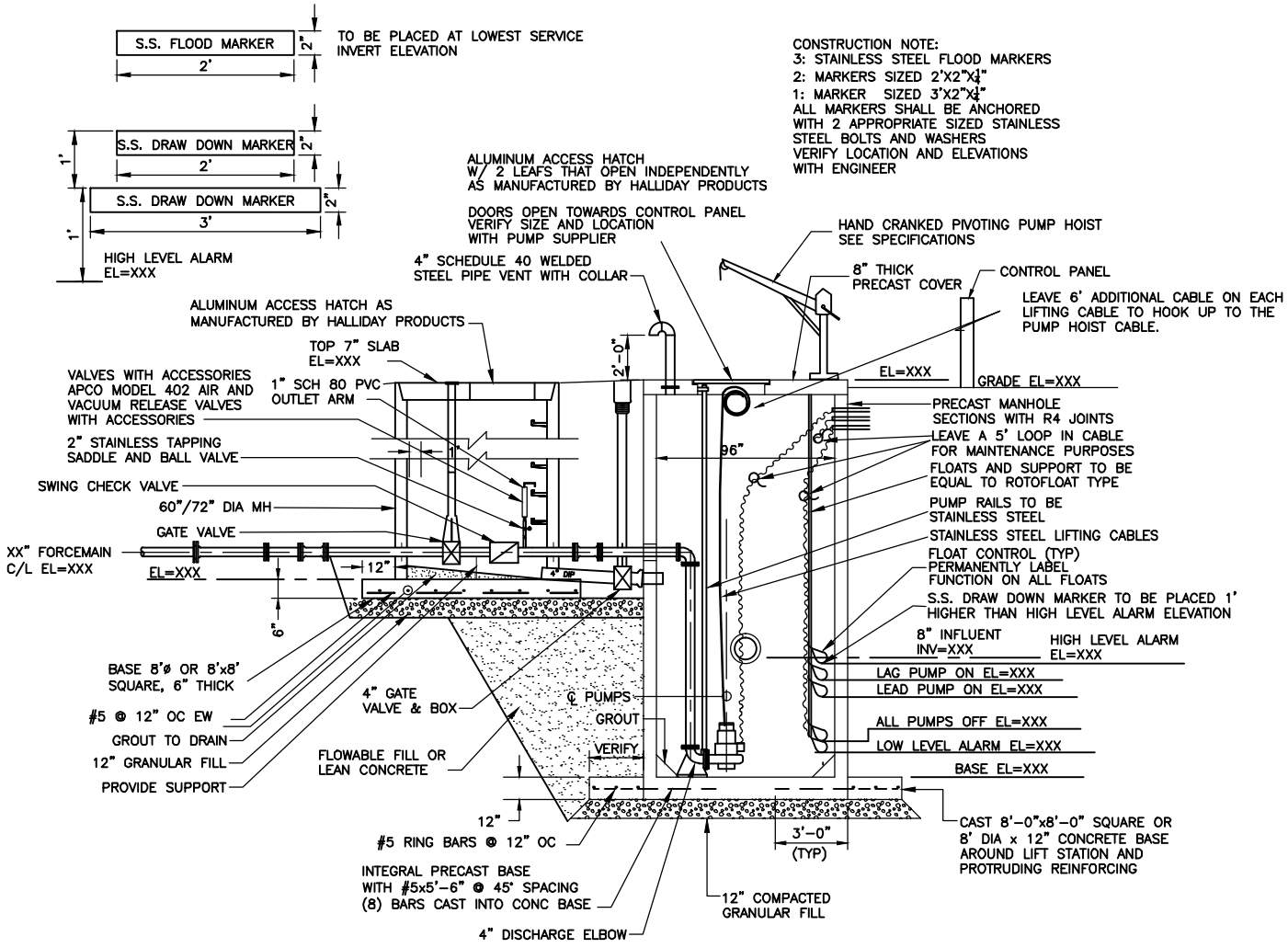
DATE:
07/2013

STD. DETAIL
5–204

Y:\STFR\2013 Details\STFR_5–204.dwg



PLAN



SECTION

DUPLEX PUMP LIFT STATION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

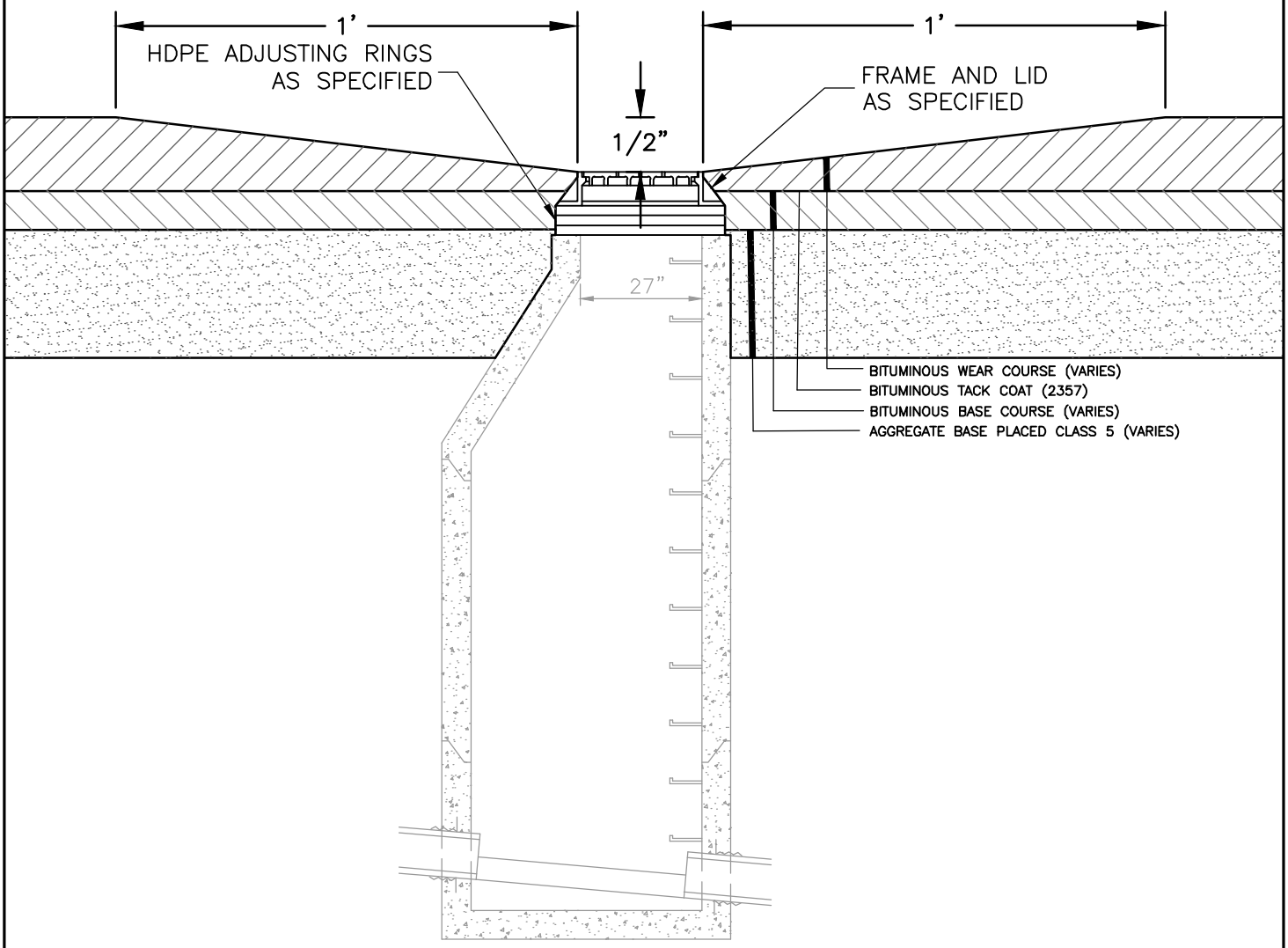
DUPLEX PUMP LIFT STATION

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-301

Y:\STFR\2013 Details\STFR_5-301.dwg



MANHOLE PAVING DETAIL

NOT TO SCALE

NOTE: A FIVE HUNDRED DOLLAR ($500) PENALTY WILL BE ENFORCED FOR EACH CASTING NOT PROPERLY ADJUSTED REQUIRING A PATCH IN THE BITUMINOUS WEARING COURSE.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

MANHOLE PAVING DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 5-400

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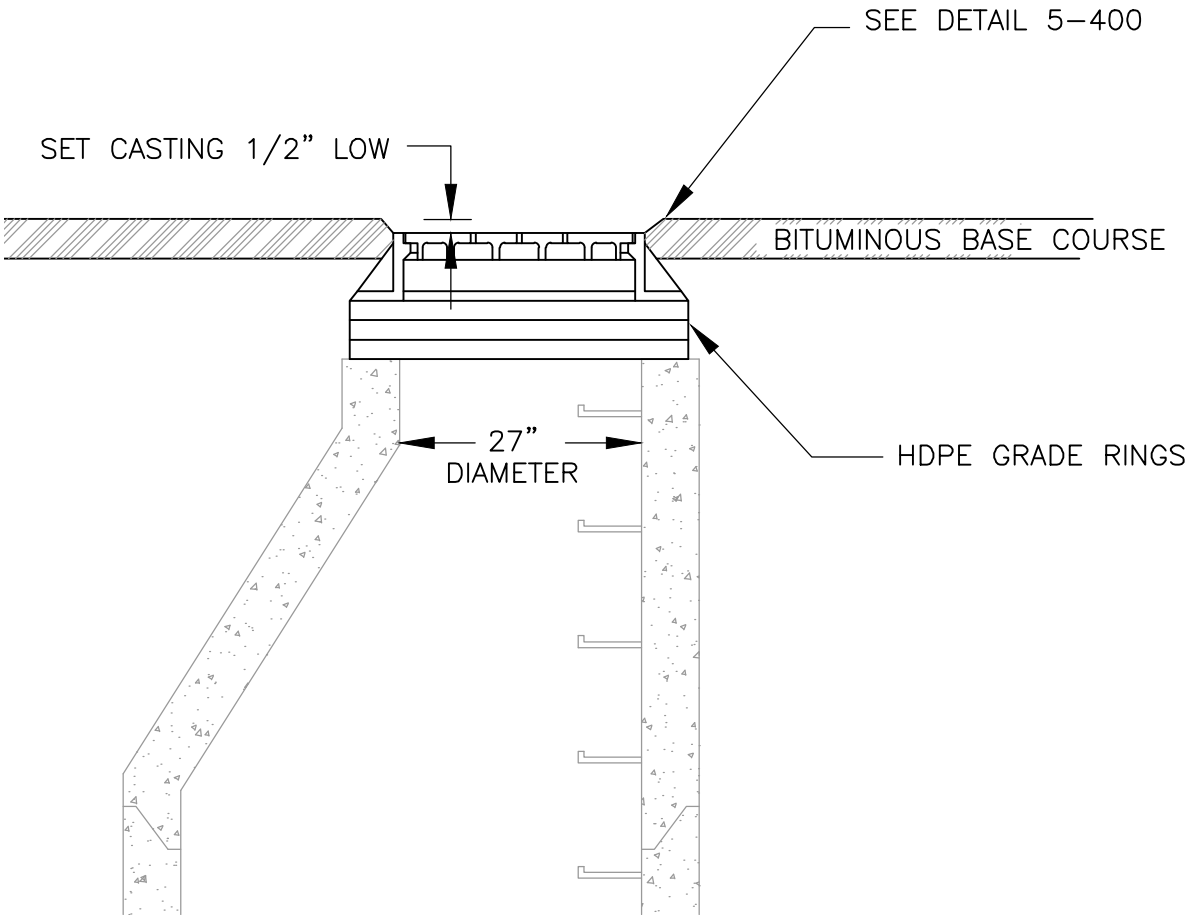

NOTE: A FIVE HUNDRED DOLLAR ($500) PENALTY WILL BE ENFORCED FOR EACH CASTING NOT PROPERLY ADJUSTED REQUIRING A PATCH IN THE BITUMINOUS WEARING COURSE.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

MANHOLE ADJUSTMENT DETAIL BITUMINOUS BASE COURSE

City of St. Francis

DATE: 07/2013

STD. DETAIL 5–401

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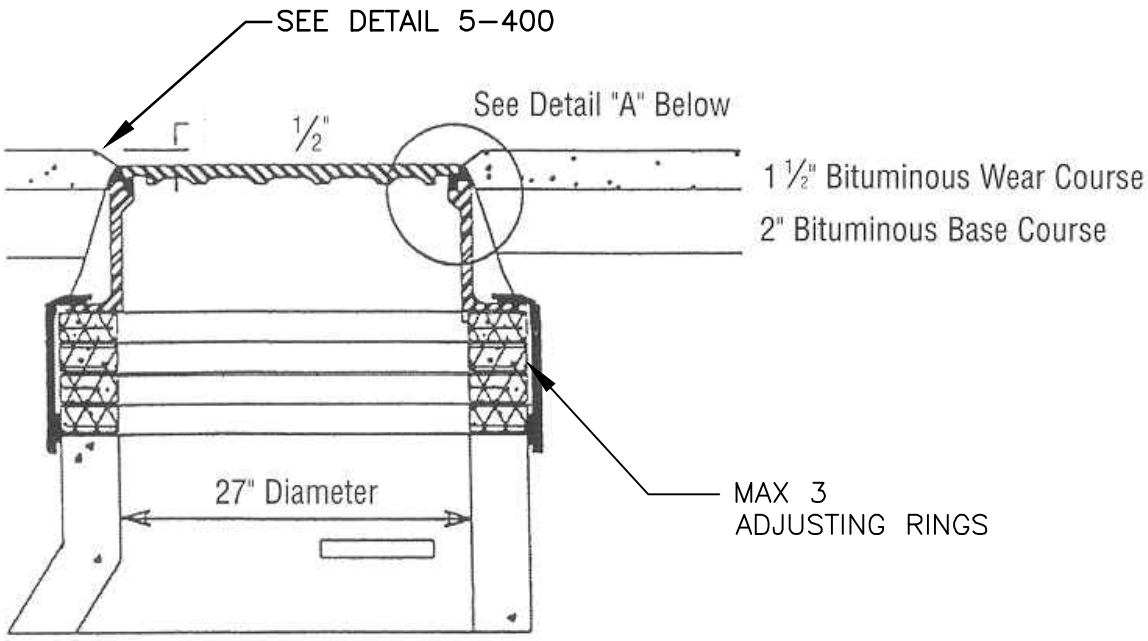
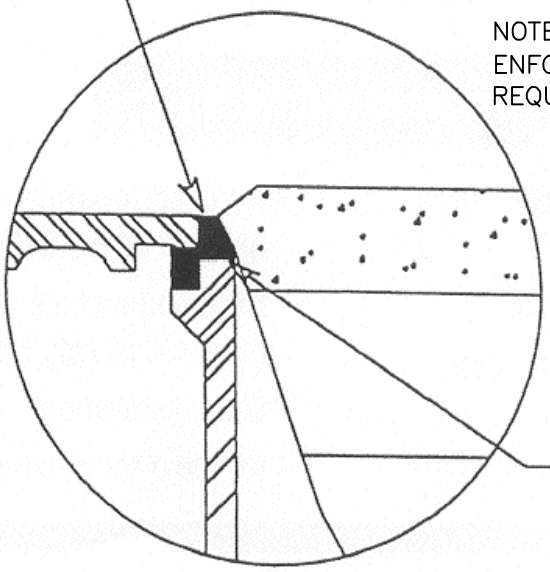


Use a 1 1/2" or 2" riser ring made of cast iron or ductile iron as manufactured by Ess Brothers & Sons, Inc. or an approved equal.

NOTE: A FIVE HUNDRED DOLLAR ($500) PENALTY WILL BE ENFORCED FOR EACH CASTING NOT PROPERLY ADJUSTED REQUIRING A PATCH IN THE BITUMINOUS WEARING COURSE.



Detail "A"

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
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BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

MANHOLE ADJUSTMENT DETAIL BITUMINOUS WEAR COURSE

City of St. Francis

DATE: 07/2013

STD. DETAIL 5–402

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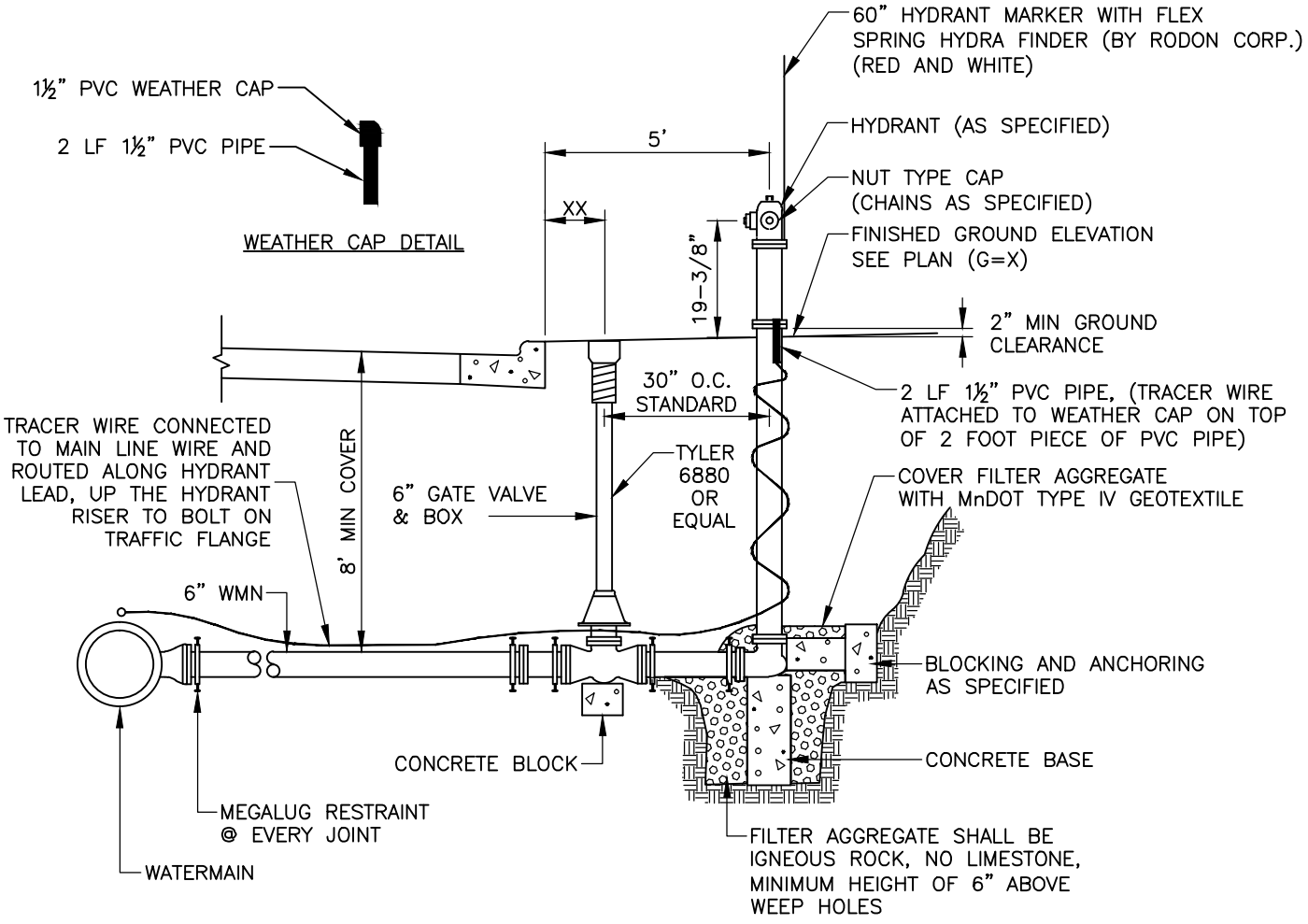

NOTE:
ALL HYDRANTS SHALL BE PAINTED AFTER INSTALLATION. ALL ABRADED SURFACES SHALL BE CLEANED PRIOR TO APPLICATION OF FINAL FIELD COAT.

HYDRANTS LOCATED WHERE THE GROUNDWATER TABLE IS ABOVE THE DRAIN OUTLET SHALL HAVE THE OUTLET DRAIN PLUGGED AND SHALL BE EQUIPPED WITH A TAG STATING "PUMP AFTER USE." PUMPER NOZZLE SHALL BE PAINTED BLUE.

HYDRANT INSTALLATION, MEGALUGS

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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HYDRANT INSTALLATION MEGALUGS

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-000

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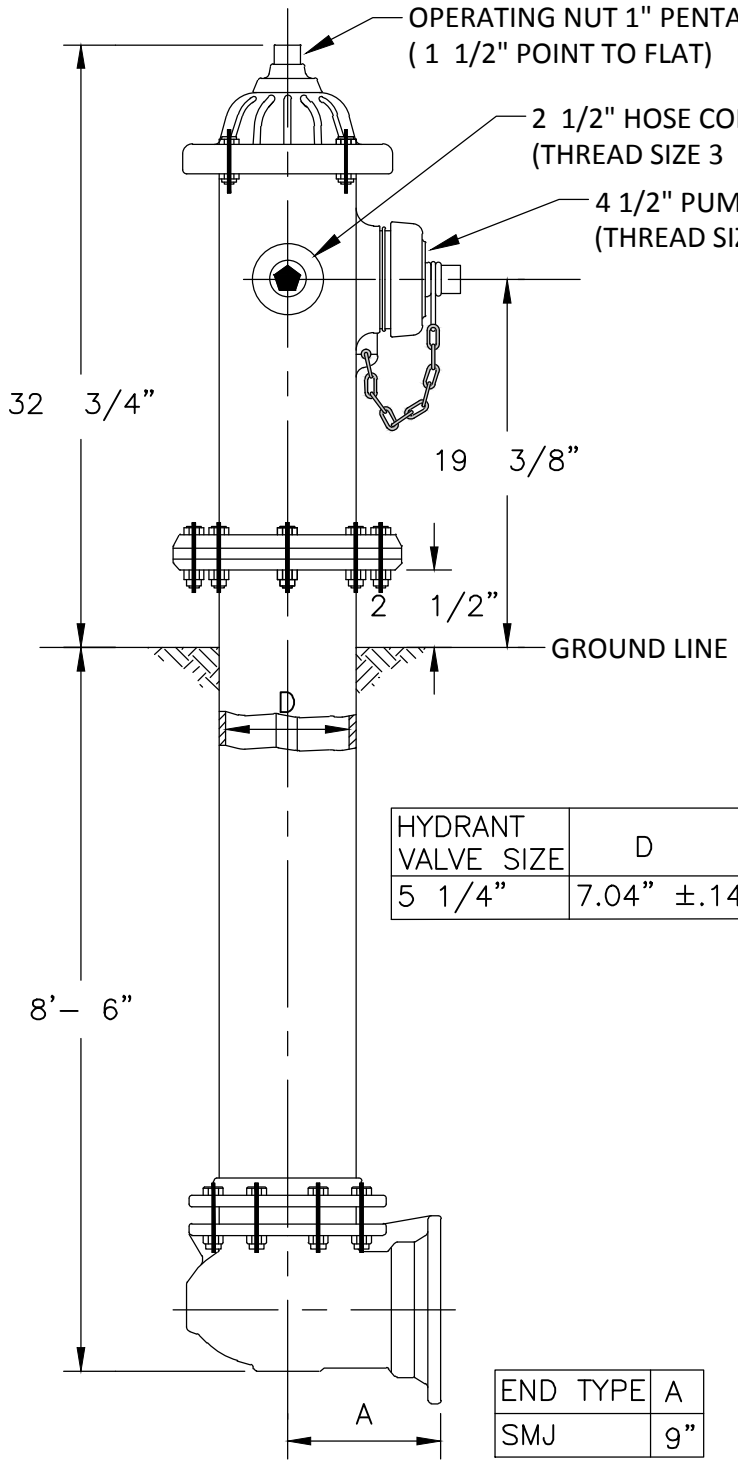

HYDRANT VALVE SIZE	D
5 1/4"	7.04" ±.14

END TYPE	A
SMJ	9"

NOTE:
1. LEFT HAND OPERATING NUT.

2. PAINT BARREL SECTION RED TO GRADE.

3. HYDRANTS SHALL BE SUPPLIED BY LICENSED CLOW HYDRANT DISTRIBUTORS ONLY.

4. ALL BOLTS AND NUTS SHALL BE STAINLESS STEEL.

5. DO NOT PLUG DRAIN HOLES UNLESS GROUND WATER IS PRESENT.

CLOW MEDALLION HYDRANT

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
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CLOW MEDALLION HYDRANT

City of St. Francis

DATE: 07/2013

STD. DETAIL 6–000A

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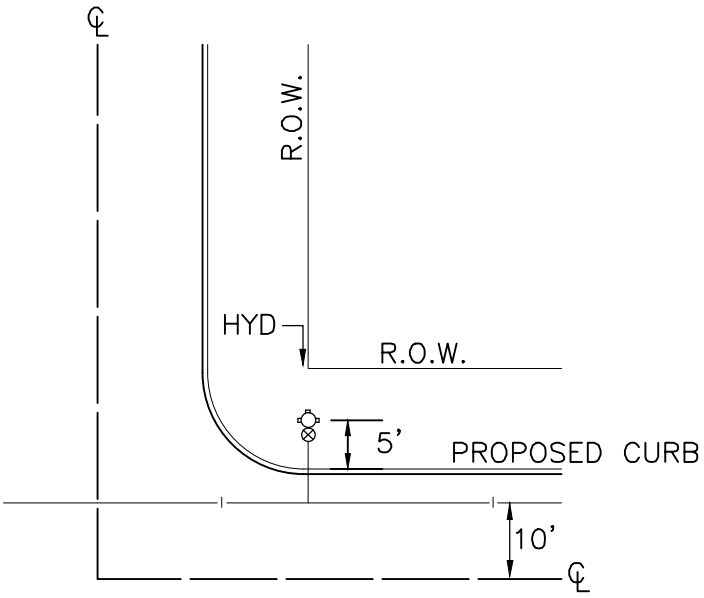

PROPOSED HYDRANT LOCATION

NOT TO SCALE

NOTE:
NO OBSTRUCTIONS WILL BE PERMITTED WITHIN 10 FEET OF ANY HYDRANT I.E. LIGHT POLES, UTILITY BOXES, ETC.

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BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PROPOSED HYDRANT LOCATION

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-003

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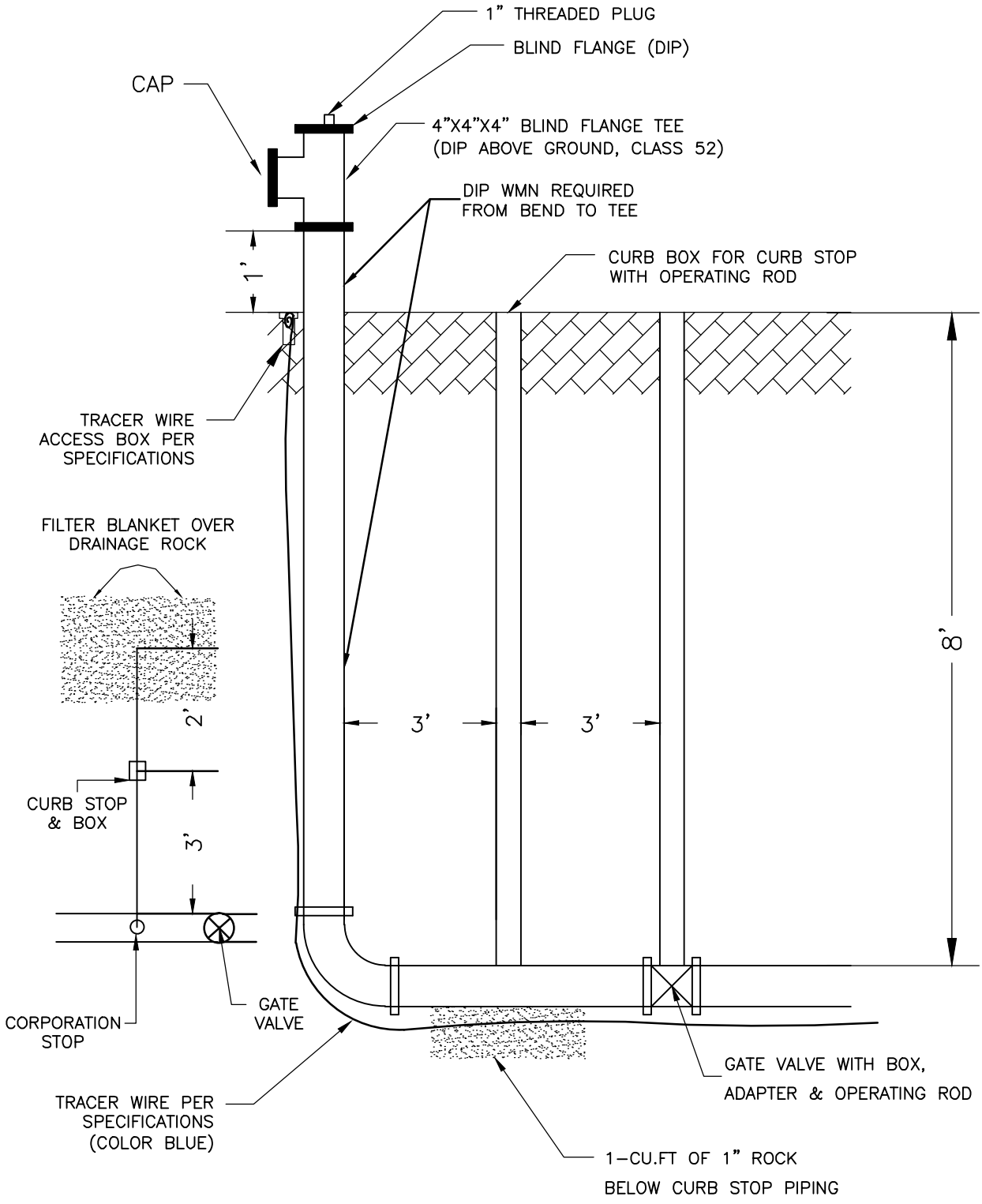

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

IRRIGATION HOOK UP

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-004

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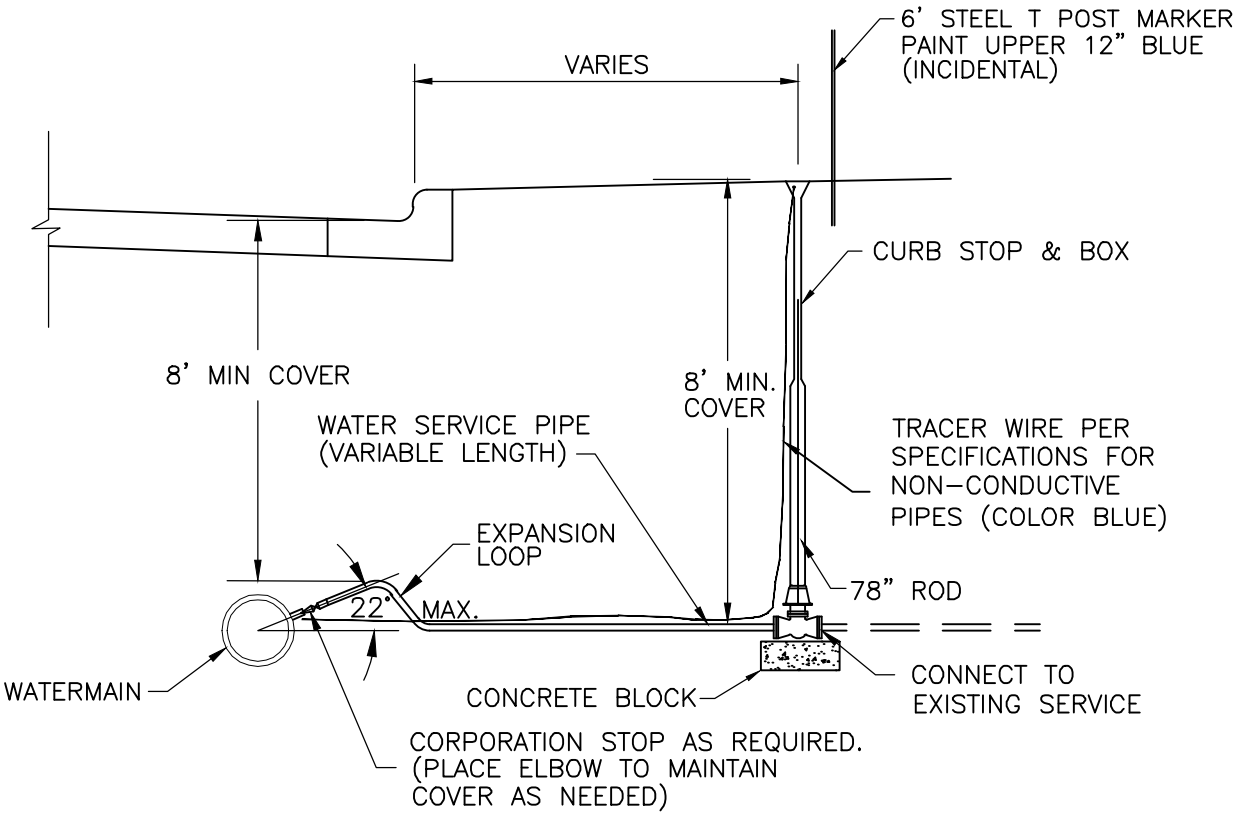

NOTE: WHERE NO EXISTING WATER SERVICE IS INPLACE, INSTALL 0.5' FLARED & CRIMPED WATER SERVICE LINE AND STEEL "T" FENCE POST AT CURB STOP.

WATER SERVICE INSTALLATION, RECONSTRUCTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

WATER SERVICE INSTALLATION RECONSTRUCTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-100

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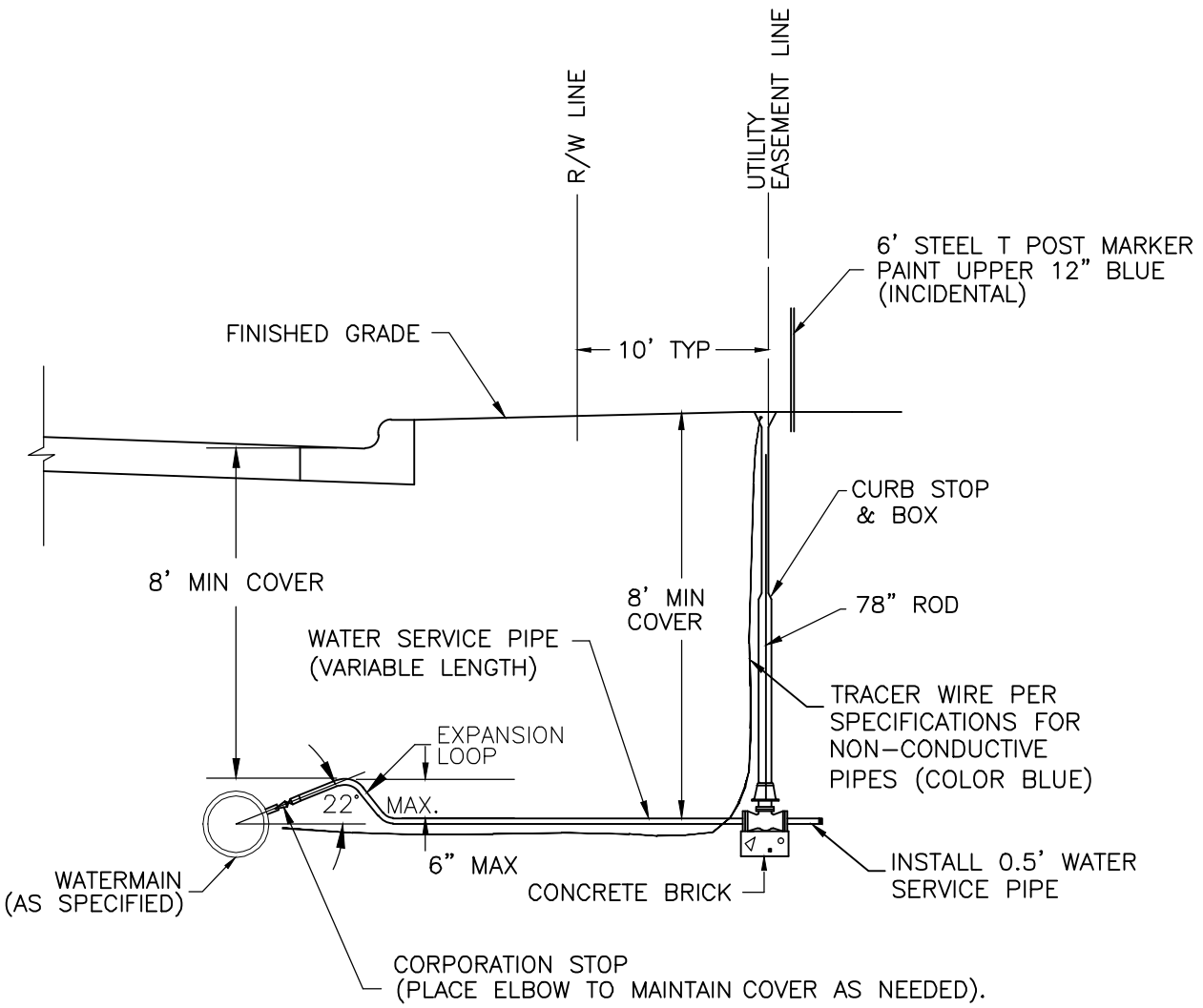

WATER SERVICE INSTALLATION
NEW CONSTRUCTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

WATER SERVICE INSTALLATION
NEW CONSTRUCTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-101

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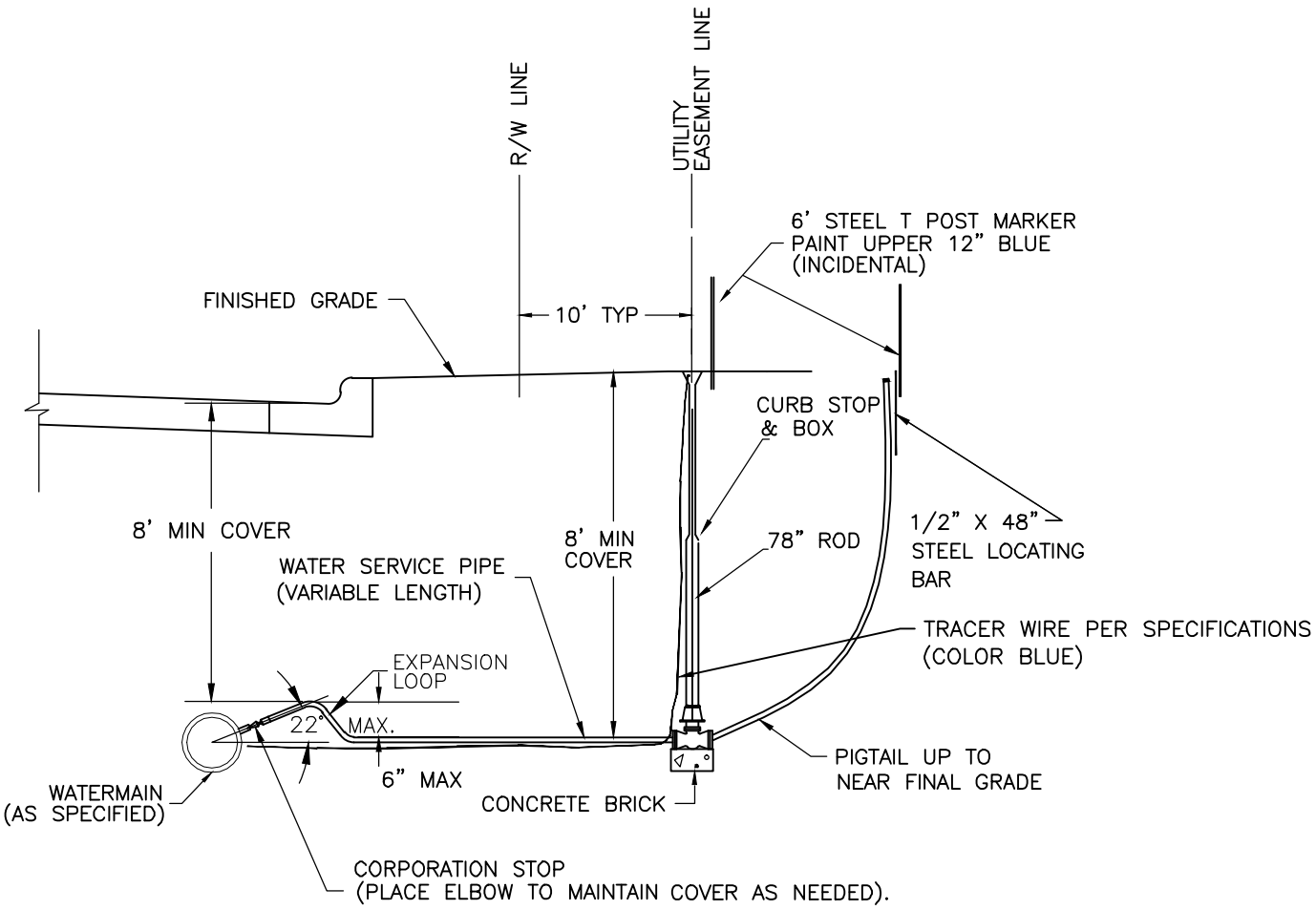

WATER SERVICE INSTALLATION
NEW CONSTRUCTION

NOT TO SCALE

(IN AREAS OF POSSIBLE HIGH GROUND WATER)

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

WATER SERVICE INSTALLATION NEW CONSTRUCTION (HIGH GROUND WATER)

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-101A

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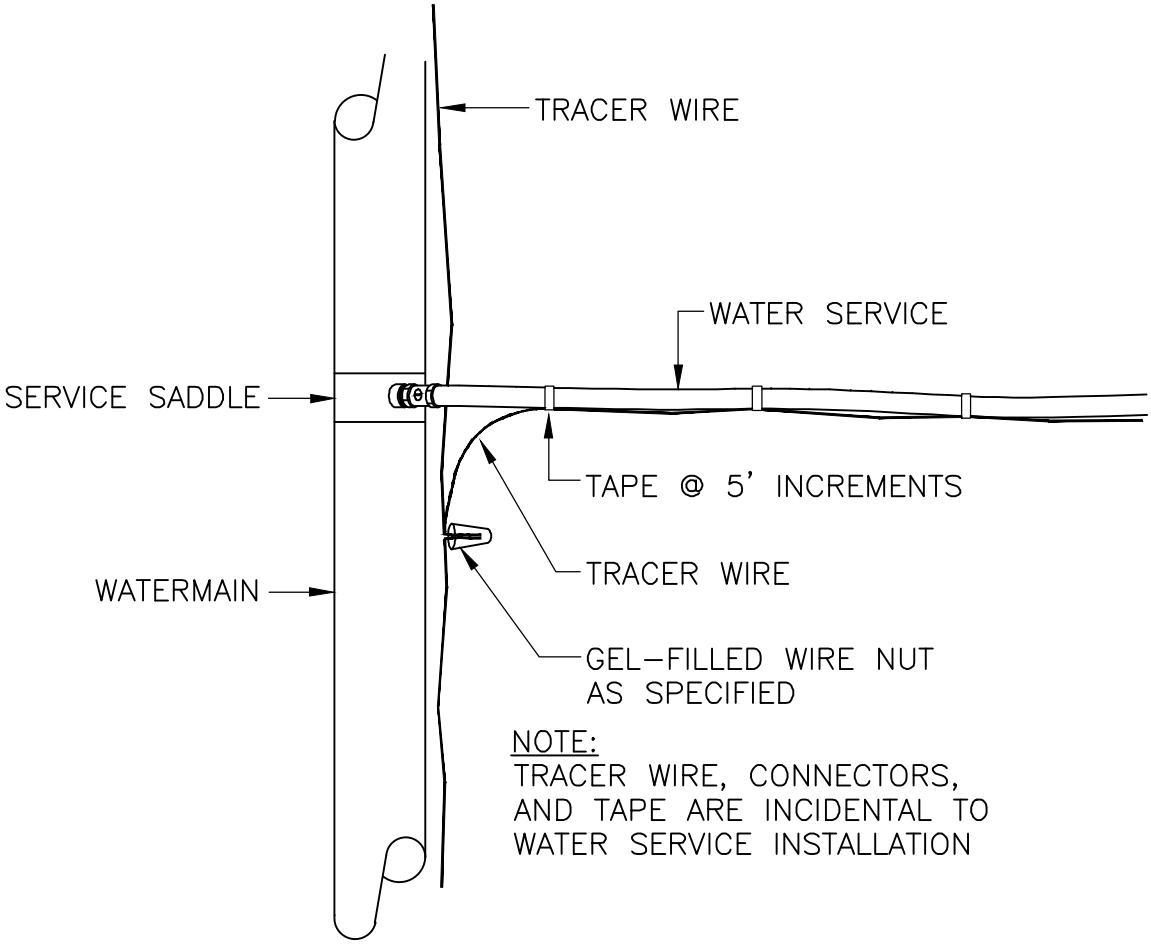

WATER SERVICE TRACER WIRE CONNECTION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

WATER SERVICE TRACER WIRE CONNECTION

City of St. Francis

DATE: 07/2013

STD. DETAIL 6–102

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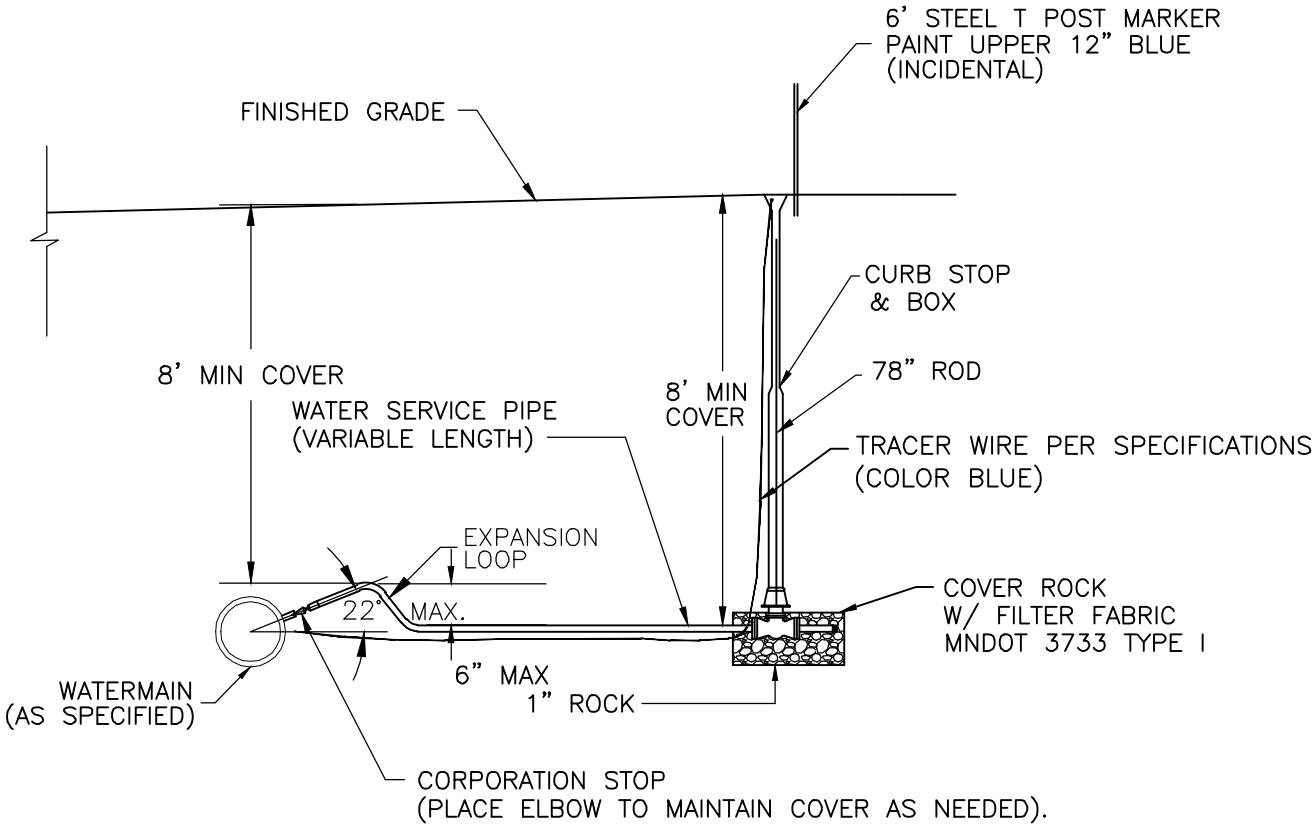

IRRIGATION DRAIN

NOT TO SCALE

NOTE:
CURB BOX SHALL INCLUDE "STOP-AND-WASTE" FEATURE, OR "DRAIN-BACK" FEATURE. SEE SECTION 02510 OF STANDARDS FOR WATER PRODUCT DESIGNATIONS.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

IRRIGATION DRAIN

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-103

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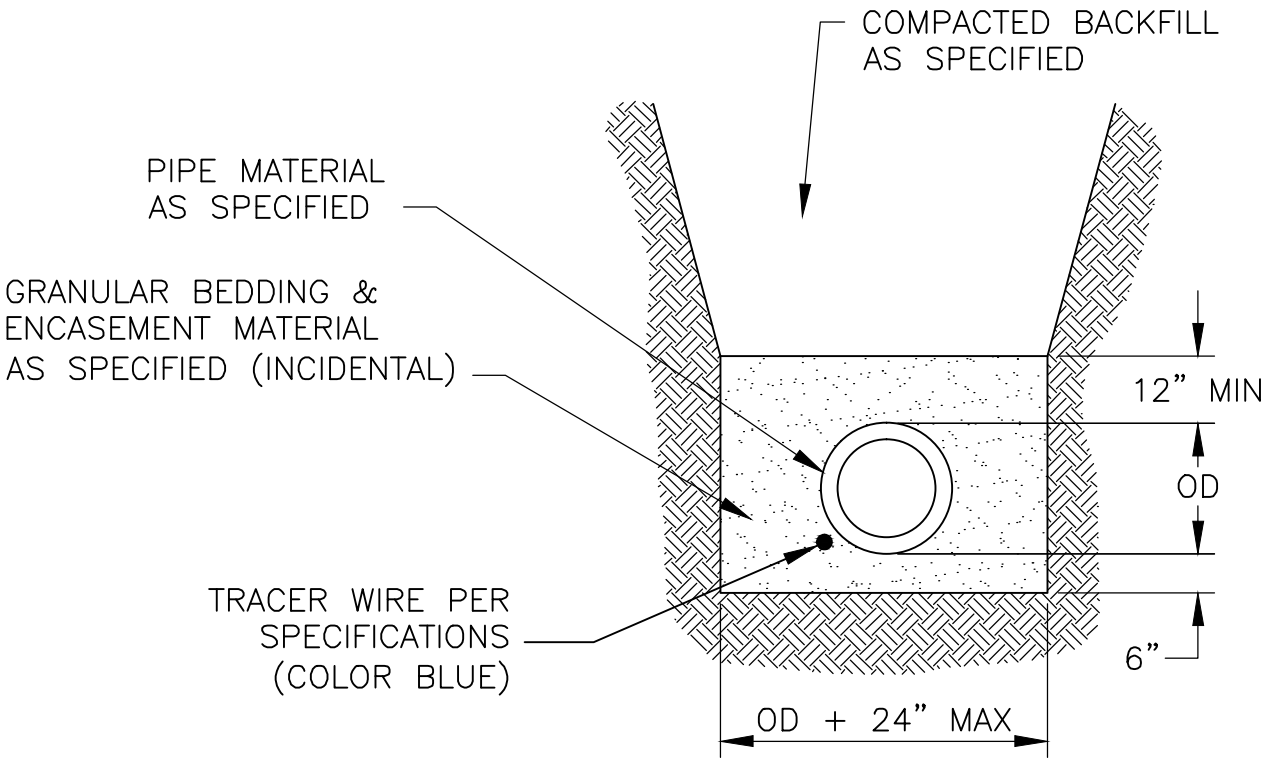

PVC C-900 WATERMAIN TRENCH

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PVC C-900
WATERMAIN TRENCH

City of St. Francis

DATE:
07/2013

STD. DETAIL
6-200

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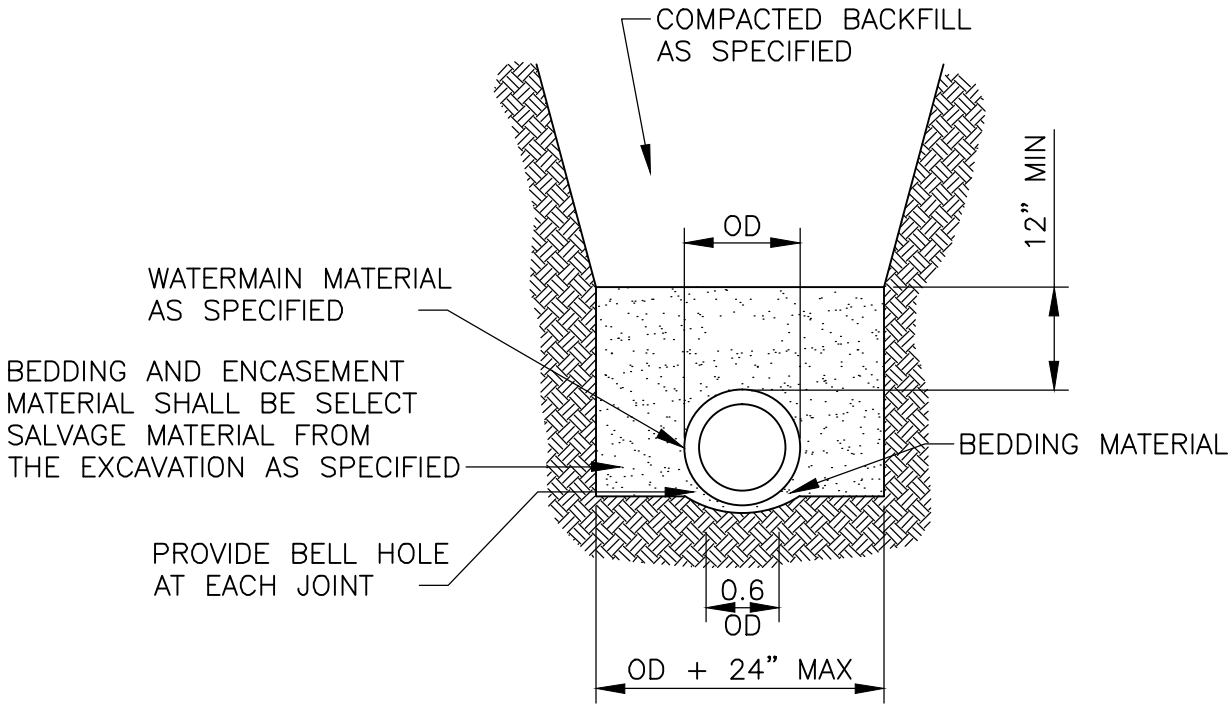

DIP WATERMAIN TRENCH

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

DIP WATERMAIN TRENCH

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-201

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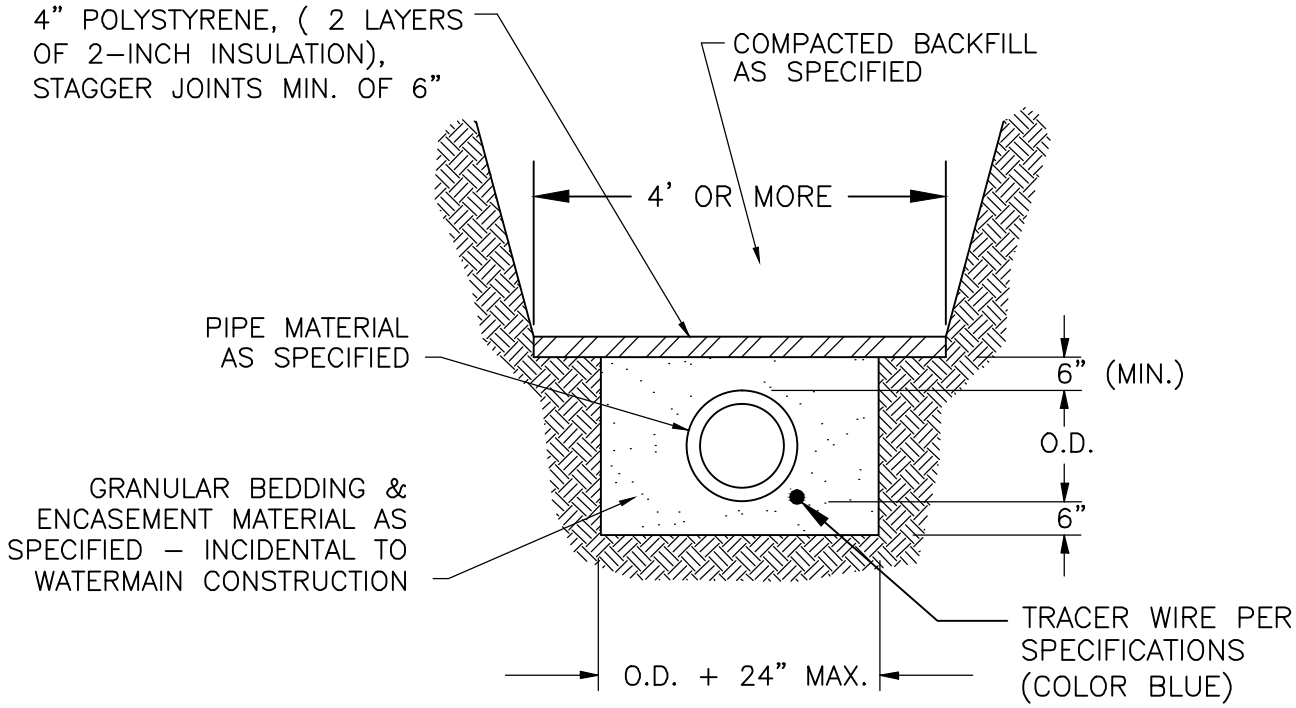

NOTE: IF SERVICE LINE HAS LESS THAN 7.0' OF COVER INSULATION WIDTH SHALL INCREASE AS FOLLOWS:

DEPTH OF COVER	WIDTH OF INSULATION
6 FT. TO 6.5 FT.	6 FT.
5 FT.	8 FT.
4.5 FT.	10 FT.

WATERMAIN INSULATION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

WATERMAIN INSULATION

City of St. Francis

DATE: 07/2013

STD. DETAIL 6–202

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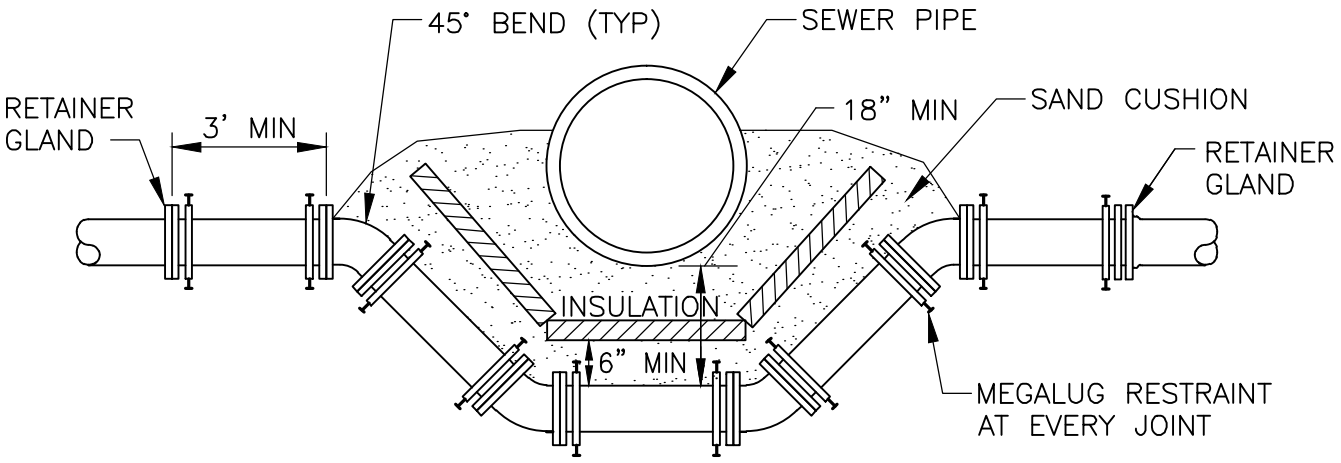

NOTES:

1. PROVIDE MEGALUG RESTRAINT AT JOINT ON BENDS AND AS SHOWN THIS DETAIL
2. COAT ALL ANCHORAGE AS PER SPECS
3. PROVIDE SAND CUSHION BETWEEN TOP OF WATERMAIN AND BOTTOM OF SEWER PIPE, MIN DIMENSIONS AS SHOWN THIS DETAIL (INCIDENTAL)
4. INSULATION TO BE 4" THICK POLYSTYRENE
5. IN AREAS OF GREATER LONGITUDINAL SPACE, THE WATERMAIN SHALL BE GRADUALLY LOWERED AND RAISED, USING NO BENDS, OVER A DISTANCE OF 200'.

WATERMAIN OFFSET

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
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WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

WATERMAIN OFFSET

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-203

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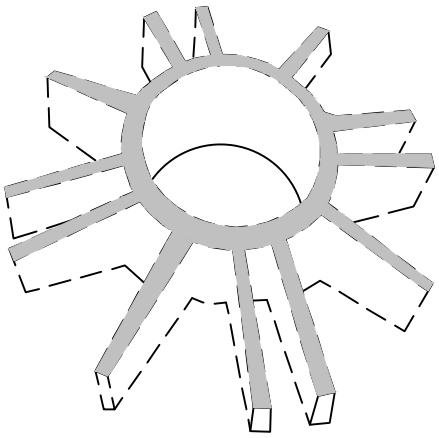
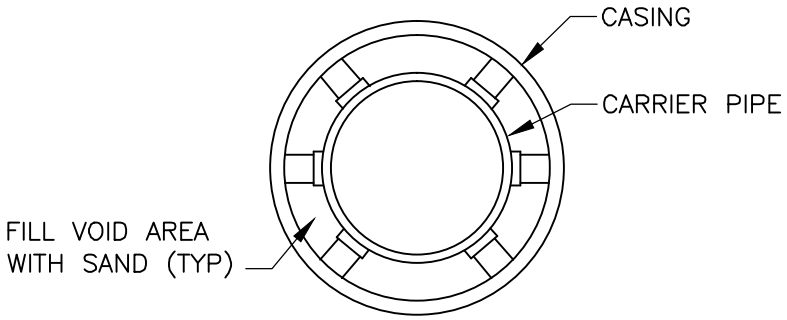
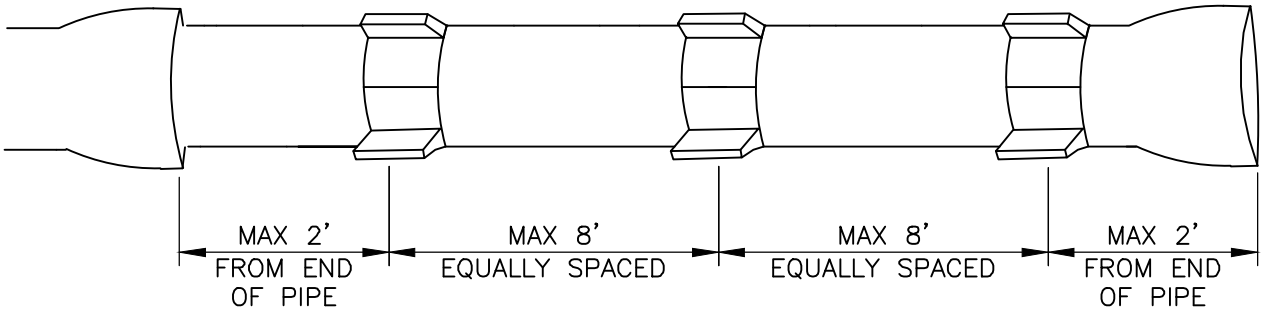


PHOENIX PLASTIC CASING SPACER
OR APPROVED EQUAL





WATERMAIN PIPE SUPPORT IN CASING, PLASTIC SPACERS

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

WATERMAIN PIPE SUPPORT IN CASING PLASTIC SPACERS

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-205

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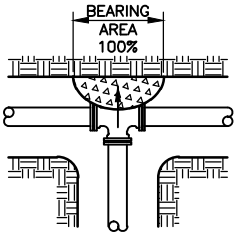
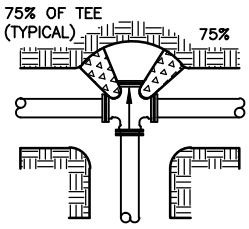
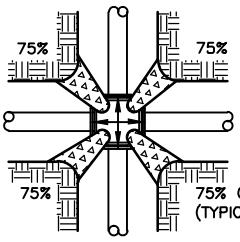
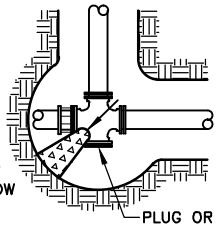
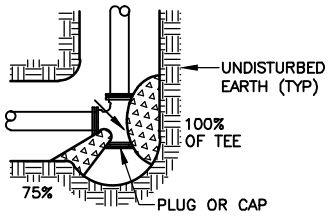


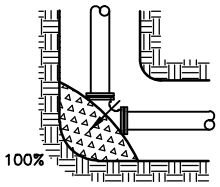


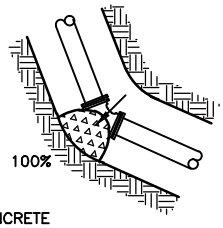
PLANS

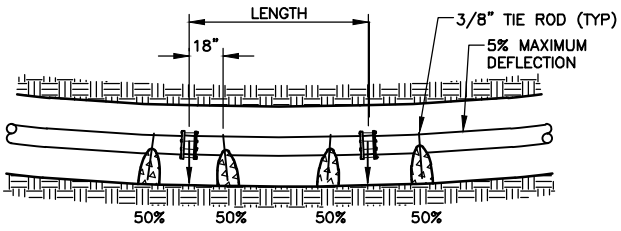




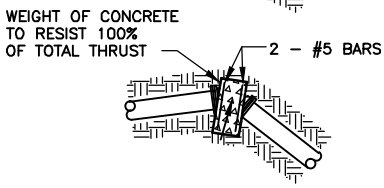




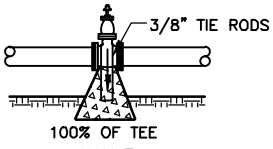




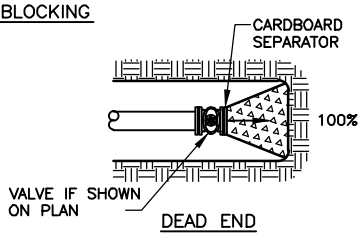
CURVE THRUST BLOCKING



VERTICAL BEND



VALVE



DEAD END

100% BEARING AREA (SQ FT)				
PIPE SIZE	DEAD END OR TEE	90° ELBOW	45° ELBOW	22 1/2° ELBOW
4	2.4	3.4	1.9	0.9
6	4.9	6.9	3.8	1.9
8	8.4	11.8	6.4	3.4
10	13.7	19.3	10.5	5.4
12	19.4	27.3	14.9	7.7
14	26.3	37.0	20.1	10.3
16	34.0	47.9	26.2	13.3
18	43.9	61.8	33.7	17.2
20	54.3	76.4	41.7	21.2
24	77.9	109.8	59.8	30.5

NOTE:
BEARING AREAS ARE BASED ON 250 LB MAXIMUM PRESSURE AND SOIL BEARING STRENGTH OF 2000 LB/SQ FT.

ARROWS (—►) INDICATE THRUST DIRECTION

NOTES:

1. FIGURE (100%) AT THRUST BLOCK INDICATES PER CENT OF TOTAL THRUST TO BE APPLIED FOR BEARING AREA.
2. RESTRAINING RODS ARE REQUIRED AT ALL TEES AND AT BENDS DEFLECTING 22-1/2° OR MORE.
3. SEE SOILS REPORT FOR BEARING STRENGTH OF SOIL. IN ABSENCE OF A SOILS REPORT, AN AVERAGE SOIL (SPADABLE MEDIUM CLAY) CAN BE ASSUMED TO HAVE A BEARING STRENGTH OF 2000 PSI.

SIDE THRUST PER 100 LB/SQ IN PRESSURE PER DEGREE OF DEFLECTION			
PIPE SIZE	SIDE THRUST-LB	PIPE SIZE	SIDE THRUST-LB
4	35	14	377
6	72	16	486
8	122	18	665
10	197	20	790
12	278	24	1150

MULTIPLY THRUST BY DEGREE OF DEFLECTION TO OBTAIN TOTAL THRUST

CONCRETE THRUST BLOCKS

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CONCRETE THRUST BLOCKS

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-207

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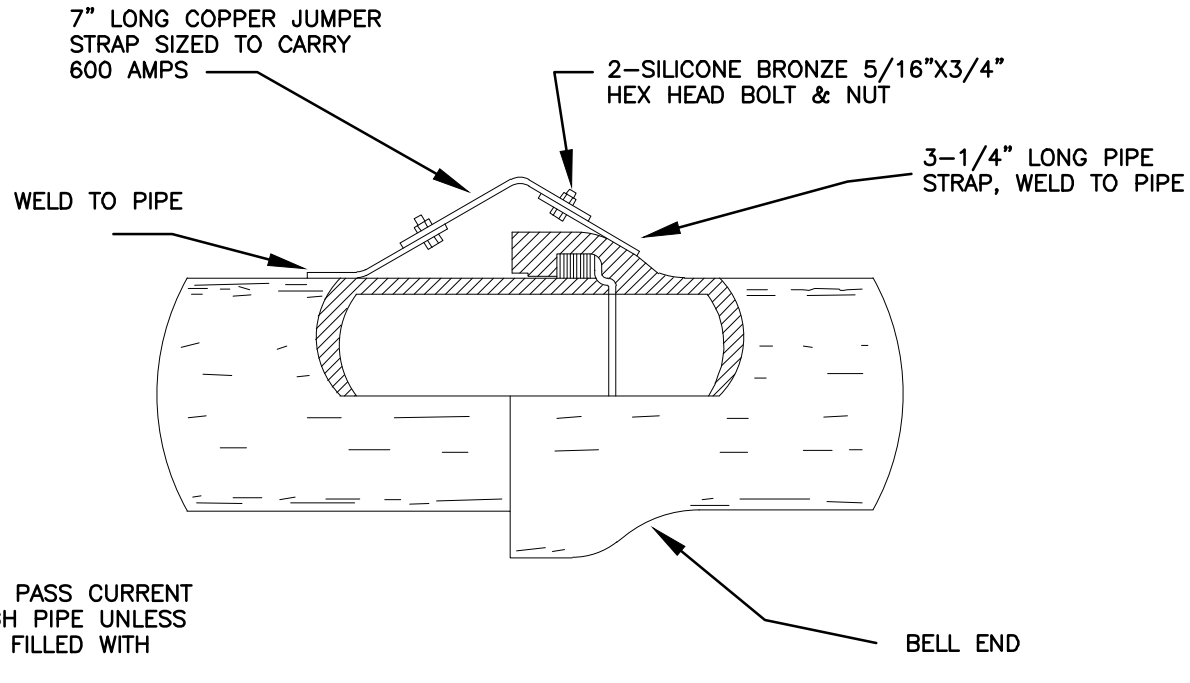

DUCTILE IRON PIPE PUSH ON JOINT

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

DIP WATERMAIN
PUSH ON JOINT

City of St. Francis

DATE:
07/2013

STD. DETAIL
6-208

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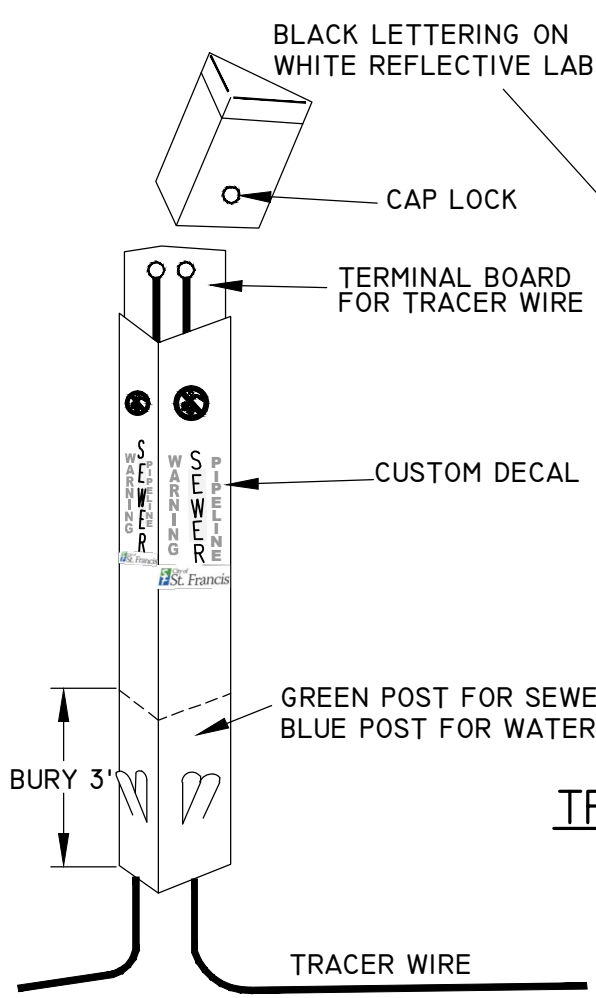
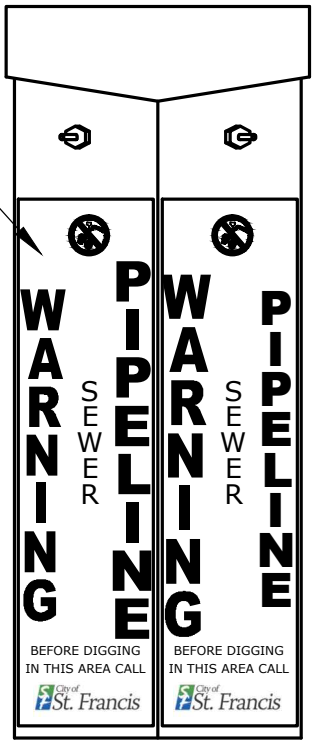
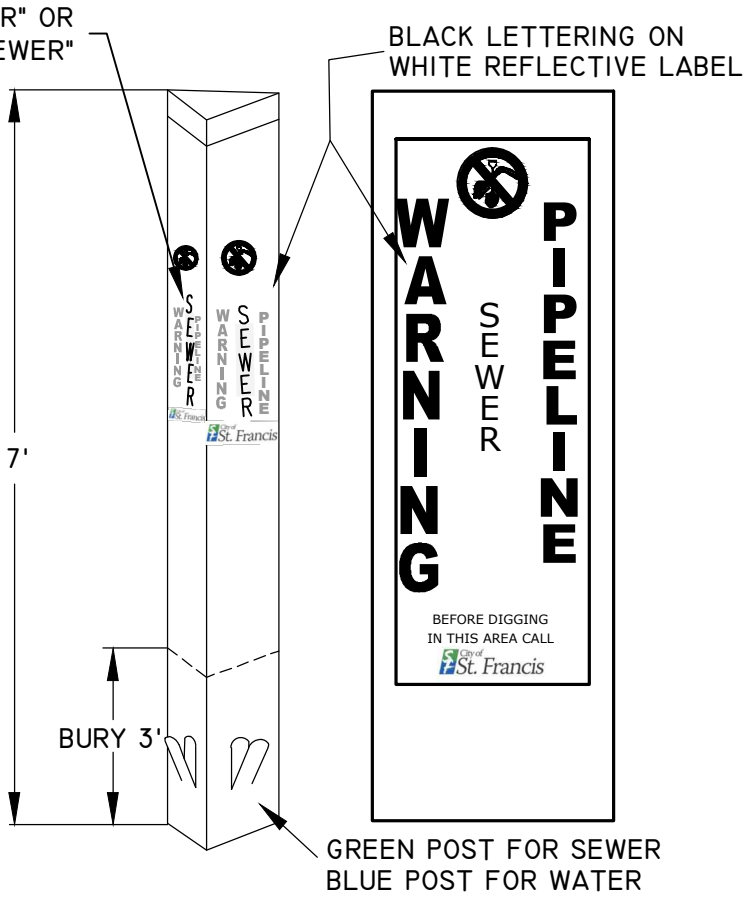


TRACER PED



TRACER PED DECAL



TRACER PED DECAL

RHINO TRIVIEW TRACER PED/UTILITY MARKER

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

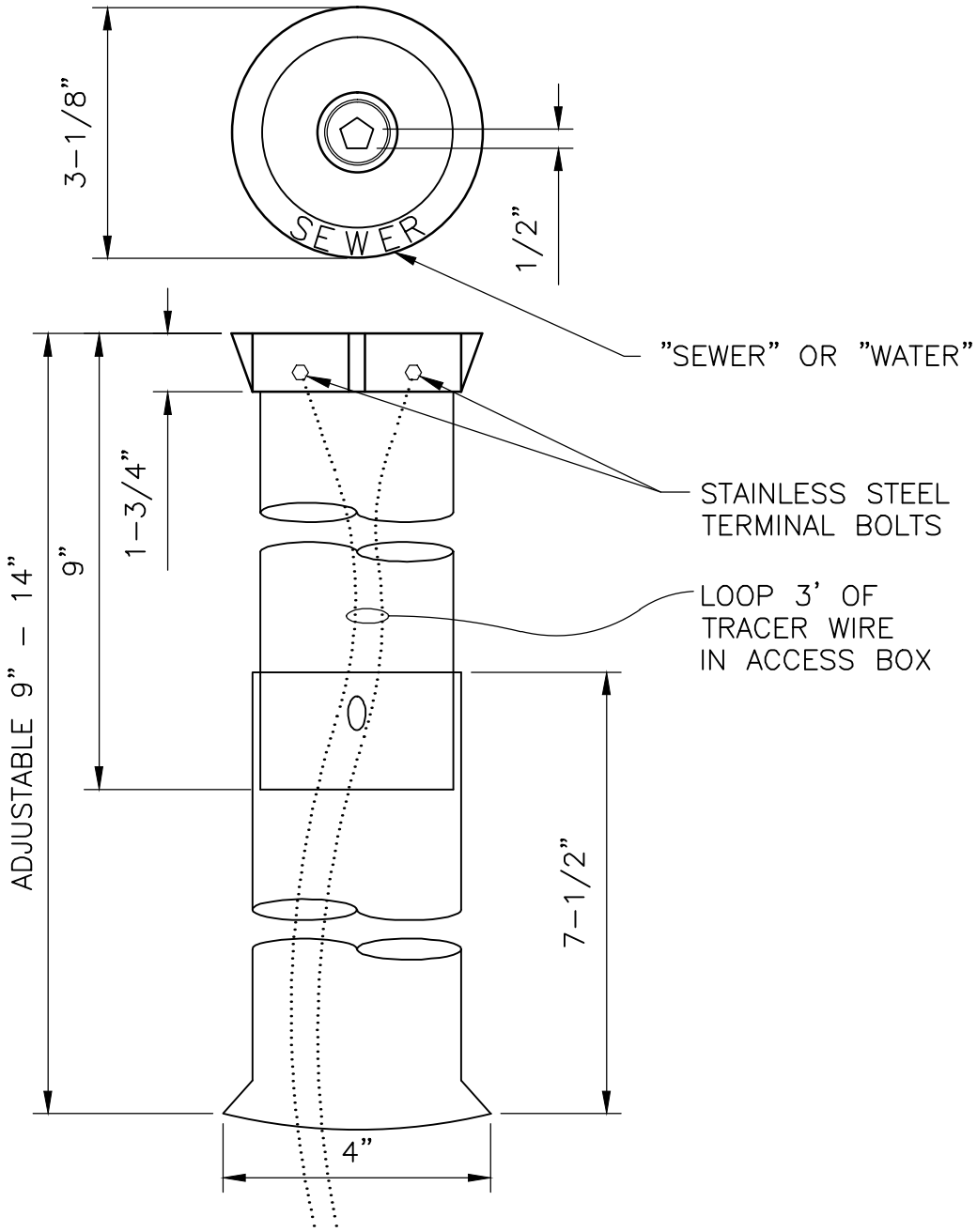
TRACER WIRE PEDESTAL

City of St. Francis

DATE: 07/2013

STD. DETAIL 6–301

Y:\STFR\2013 Details\STFR_6-301.dwg



ADJUSTABLE TRACER WIRE ACCESS BOX

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

ADJUSTABLE TRACER WIRE ACCESS BOX

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-303

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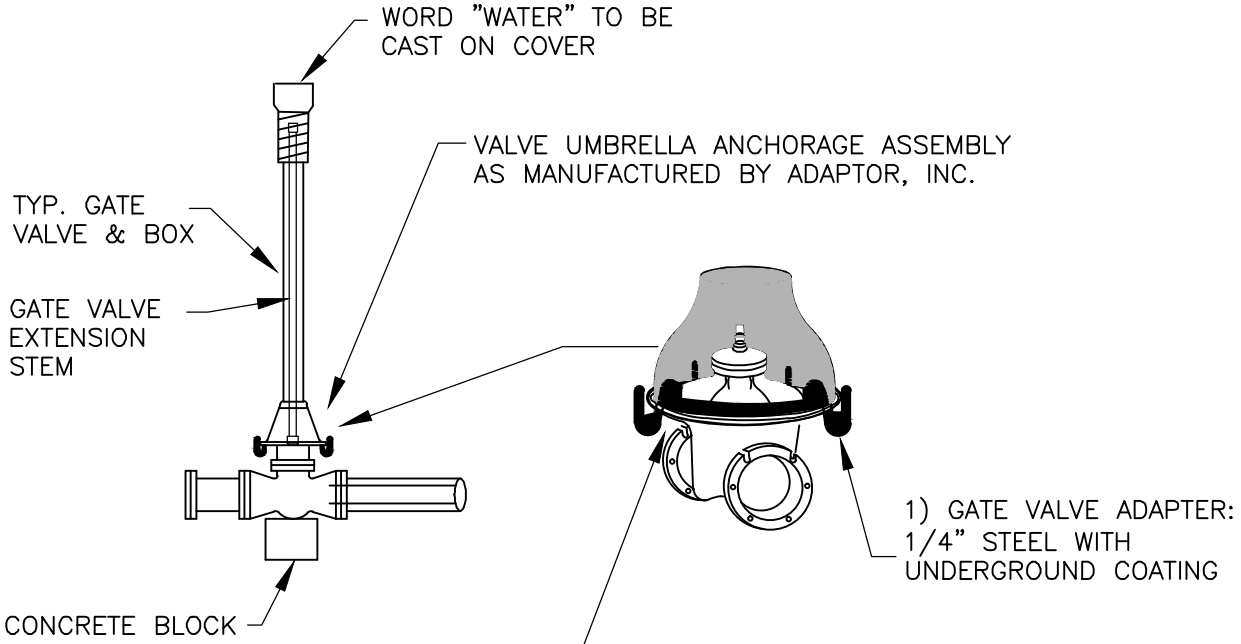
VALVE BOX SHALL HAVE A MINIMUM OF 6" ADJUSTMENT ABOVE AND BELOW GRADE AFTER INSTALLATION

ADJUSTABLE BOX SHALL BE TYLER 6850 OR APPROVED EQUAL



VALVES LARGER THAN 12" SHALL BE BUTTERFLY VALVES

GATE VALVE INSTALLATION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

GATE VALVE INSTALLATION

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-400

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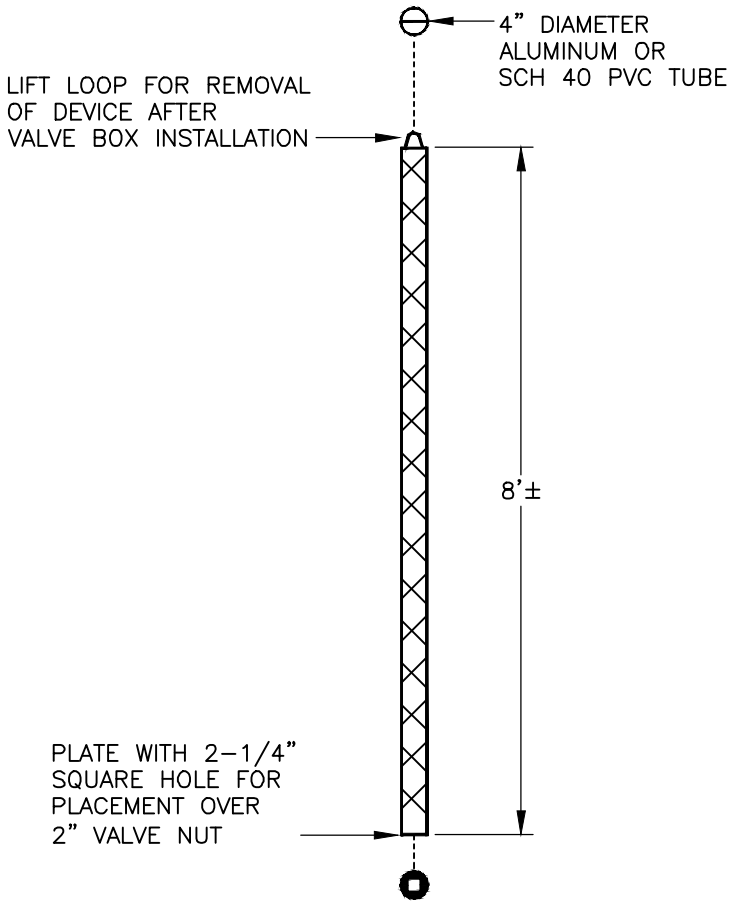
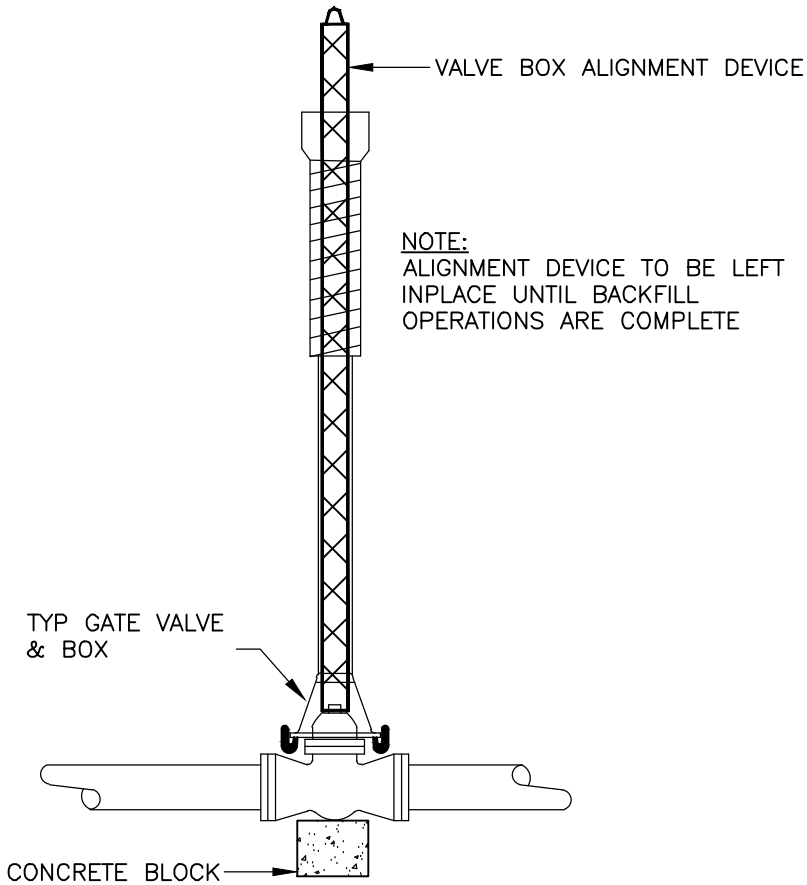




GATE VALVE BOX ALIGNMENT DEVICE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

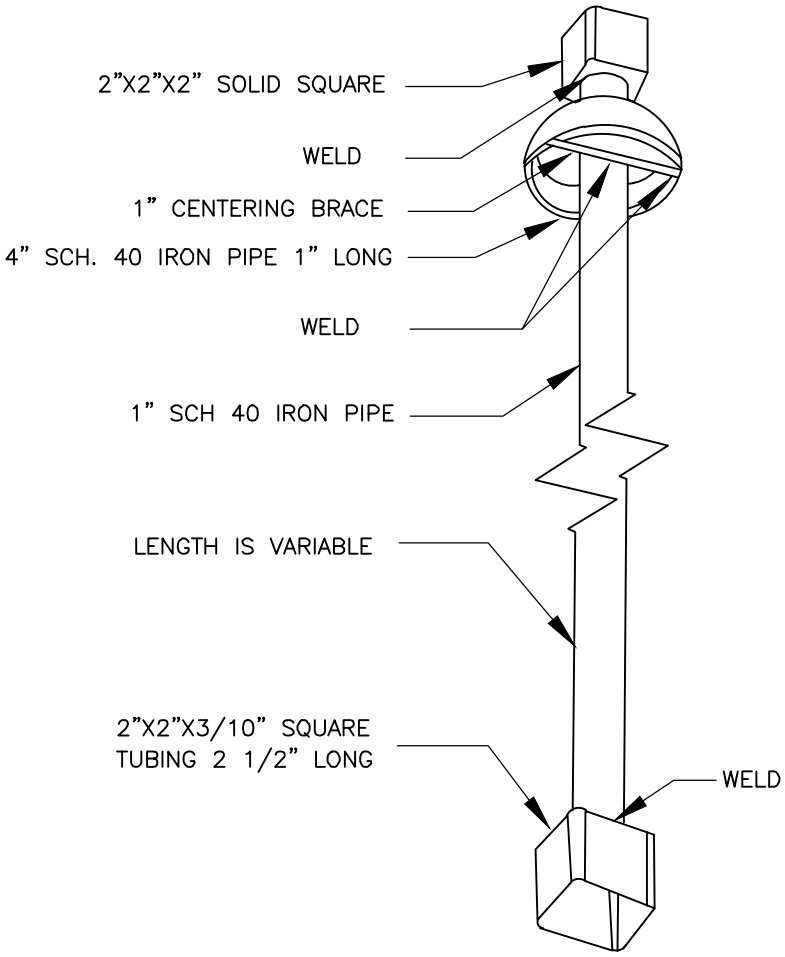
GATE VALVE BOX ALIGNMENT DEVICE

City of St. Francis

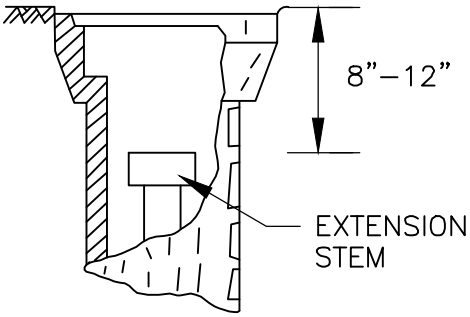
DATE: 07/2013

STD. DETAIL 6-401

Y:\STFR\2013 Details\STFR_6-401.dwg



GATE VALVE BOX



NOTE: BOLTS ARE NOT TO BE USED

AFTER FABRICATION, THE ENTIRE GATE VALVE EXTENSION STEM SHALL BE PAINTED WITH A SHOP APPLIED PRIMER AND EXTERIOR EPOXY PAINT

GATE VALVE EXTENSION STEM

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

GATE VALVE EXTENSION STEM

City of St. Francis

DATE: 07/2013

STD. DETAIL 6–404

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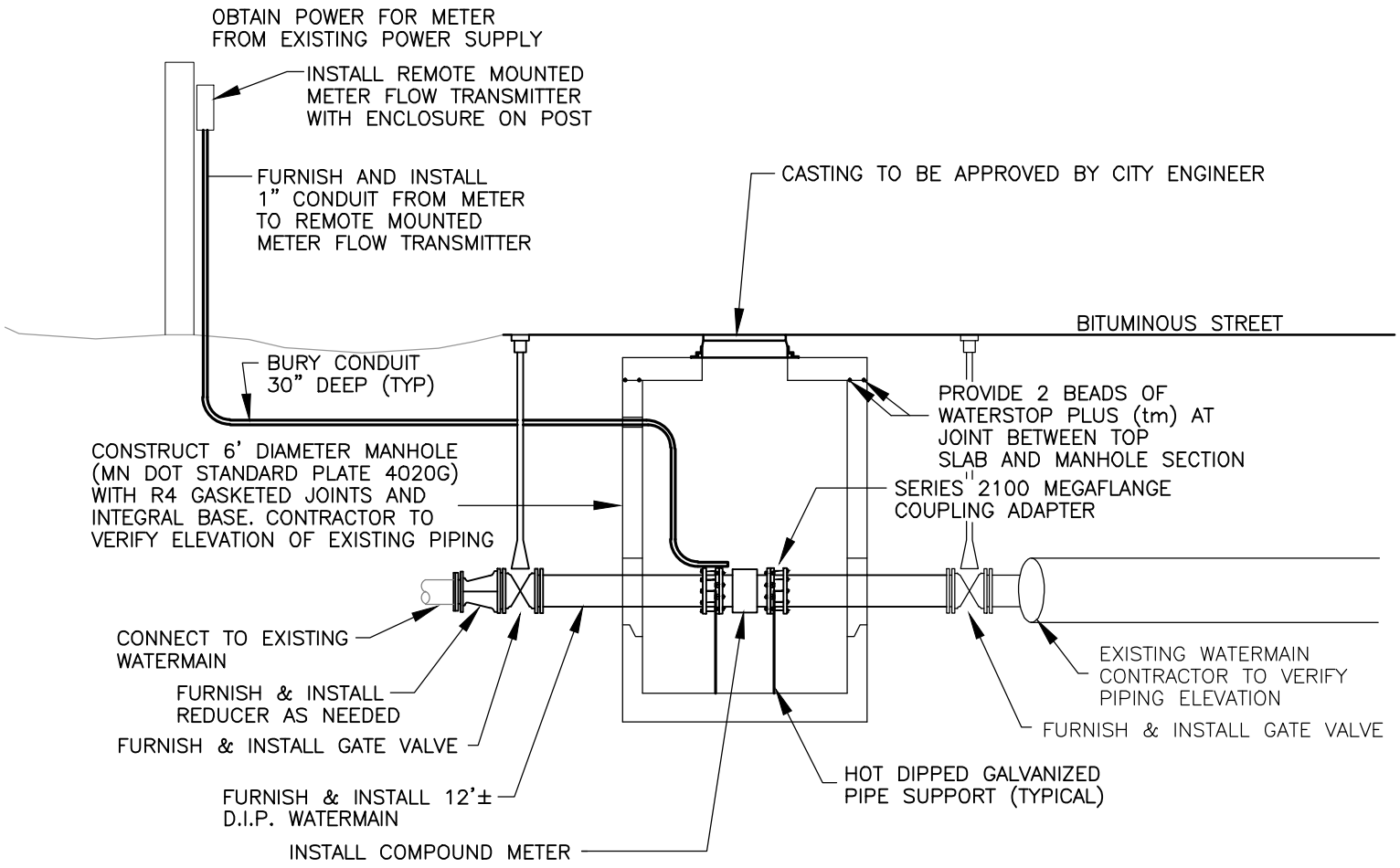

FLOW METER MANHOLE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

FLOW METERING MANHOLE

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-600

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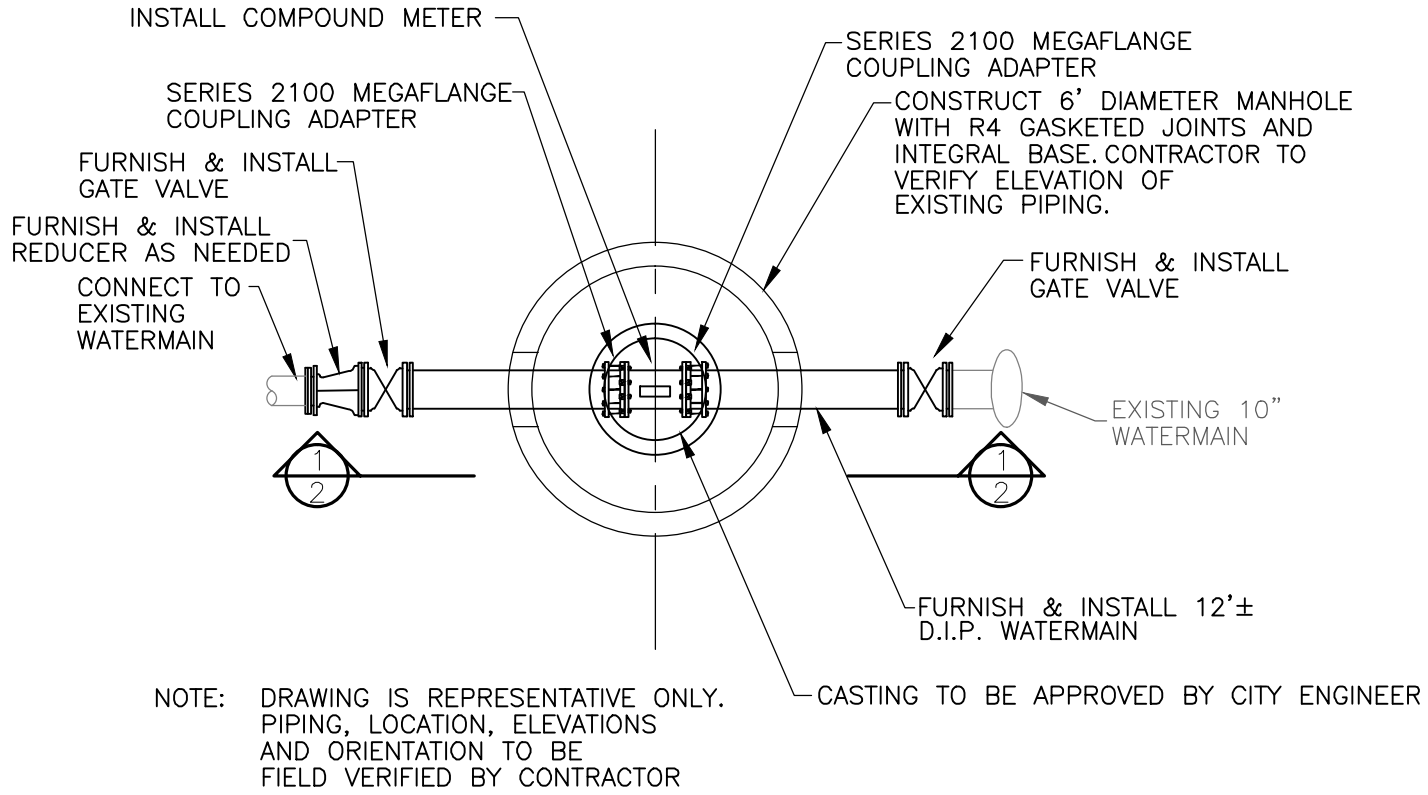

GENERAL NOTES:

1. THE ANNULAR SPACE AROUND THE WATERMAIN ENTRANCES INTO THE MANHOLE SHALL BE JOINTED TO THE MANHOLE WITH A GASKETED, FLEXIBLE, WATERTIGHT CONNECTION, THEN CONSTRUCTED "WATER TIGHT" USING NON-SHRINK GROUT.

2. BACKFILL AROUND MANHOLE WITH SELECTED EXCAVATED MATERIAL. COMPACT THE MATERIAL IN 6-INCH LIFTS.

FLOW METER MANHOLE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

FLOW METERING MANHOLE

City of St. Francis

DATE: 07/2013

STD. DETAIL 6-600A

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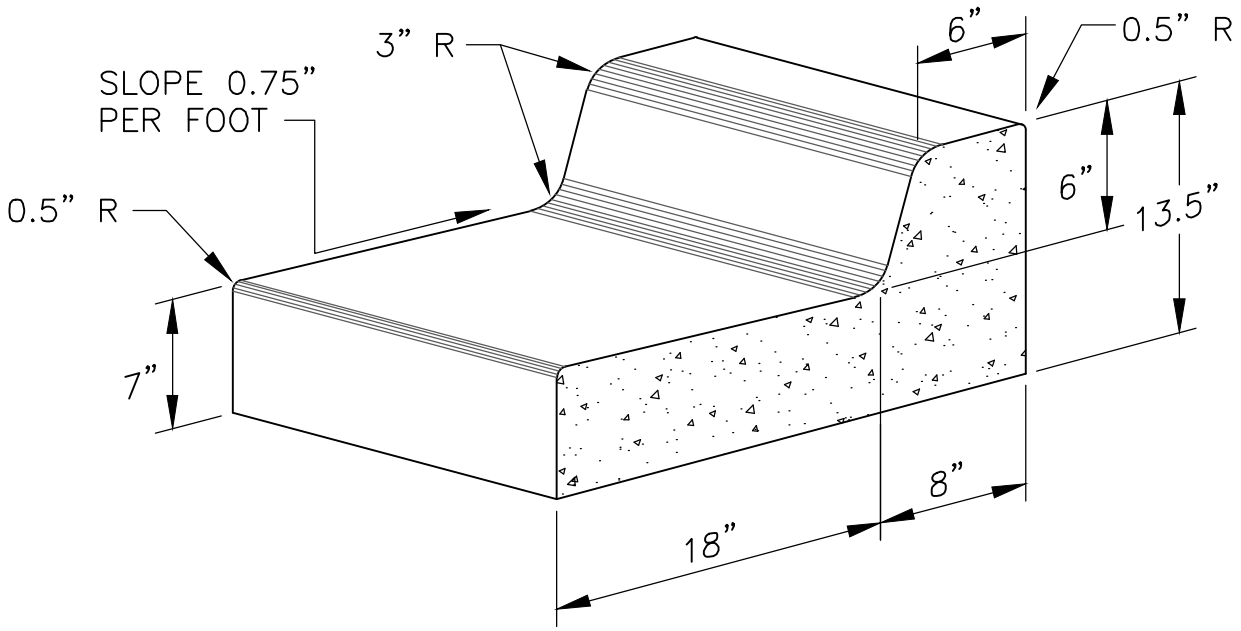

CONCRETE CURB & GUTTER DESIGN B618

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CONCRETE CURB & GUTTER DESIGN B618

City of St. Francis

DATE: 07/2013

STD. DETAIL 7-000

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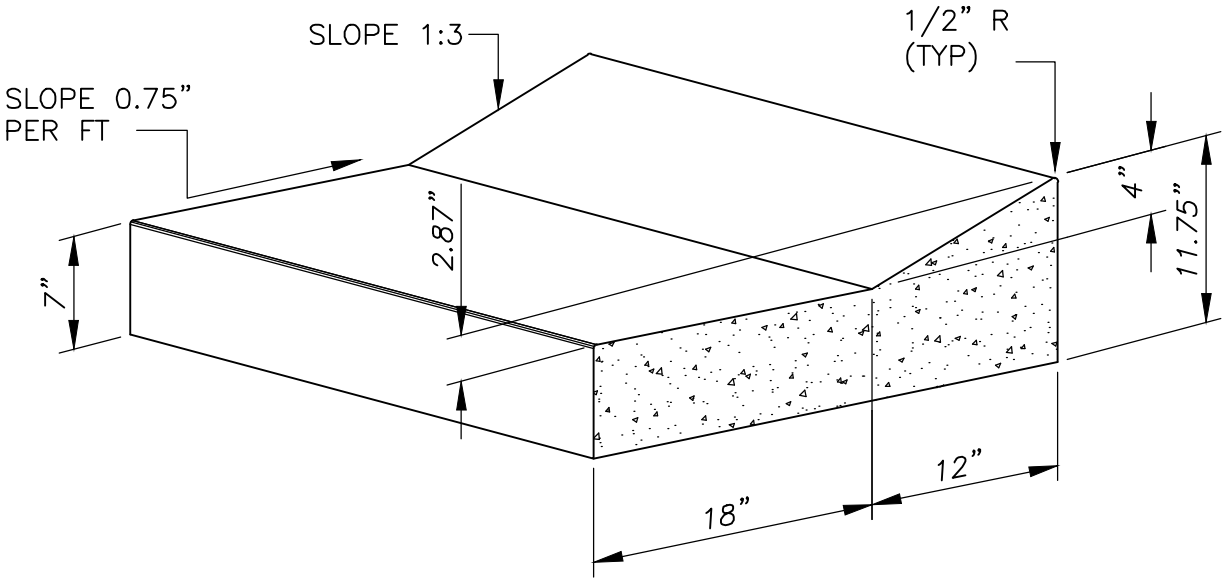

CONCRETE CURB & GUTTER
DESIGN D418

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CONCRETE
CURB & GUTTER
DESIGN D418

City of St. Francis

DATE:
07/2013

STD. DETAIL
7-004

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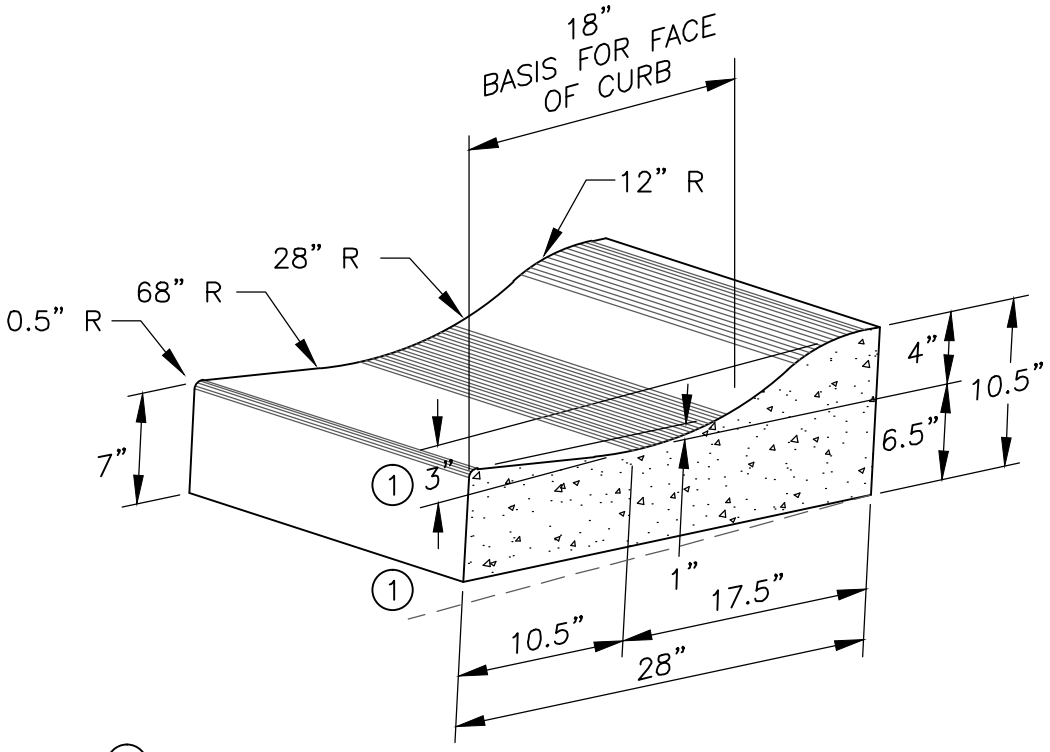

1 NOTE:
CURB SHALL BE PLACED IN A TILTED POSITION AS SUCH TO PROVIDE A 3" DEPTH FROM THE TOP OF CURB TO THE FLOWLINE WHEN MEASURED ON A LEVEL PLANE.

MOUNTABLE CONCRETE CURB & GUTTER

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

MOUNTABLE CONCRETE CURB & GUTTER

City of St. Francis

DATE: 07/2013

STD. DETAIL 7–006

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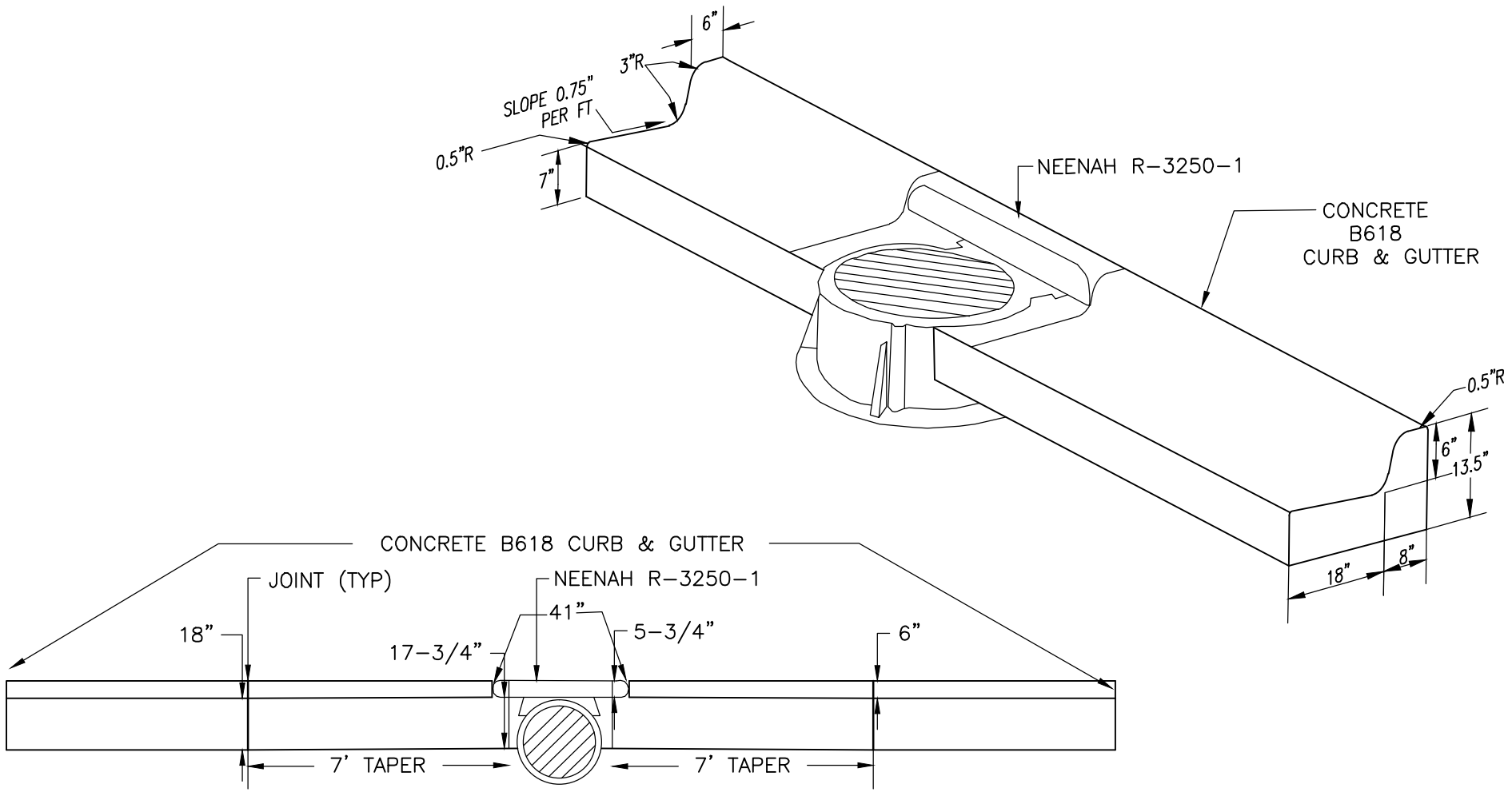

CATCHBASIN-CURB DETAIL FOR R-3250-1 IN B STYLE CURB

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CATCHBASIN-CURB DETAIL FOR R-3250-1 IN B STYLE CURB

City of St. Francis

DATE: 07/2013

STD. DETAIL 7-009

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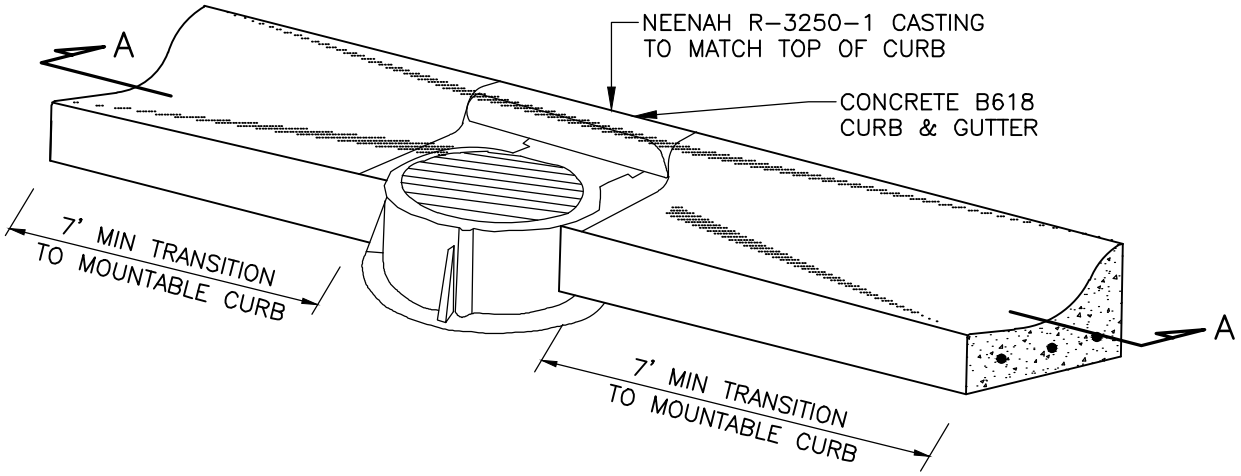
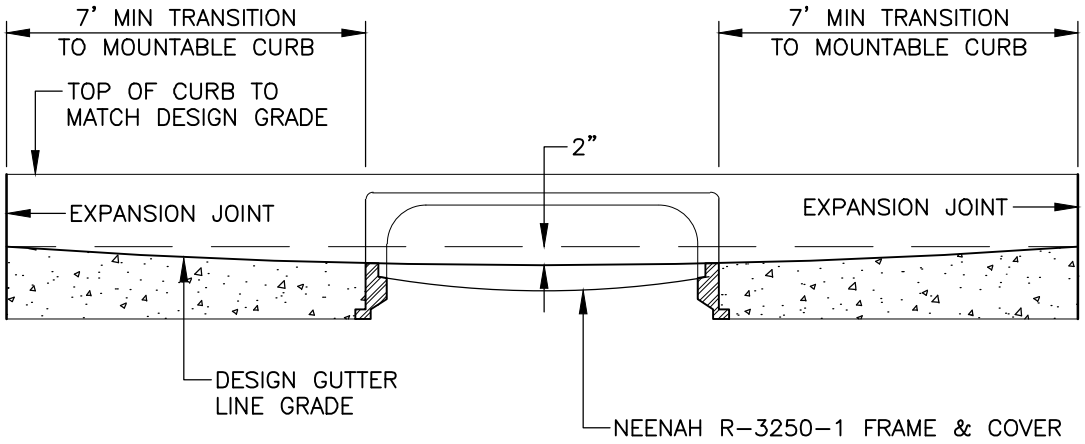
NOTE:
SURMOUNTABLE CURB & GUTTER TO BE
FORMED INTO A B618 TYPE AT CATCHBASIN





SECTION A–A

CATCHBASIN – CURB DETAIL FOR R–3250–1 IN MOUNTABLE CURB

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CATCHBASIN–CURB DETAIL FOR R–3250–1 IN MOUNTABLE CURB

City of St. Francis

DATE: 07/2013

STD. DETAIL 7–010

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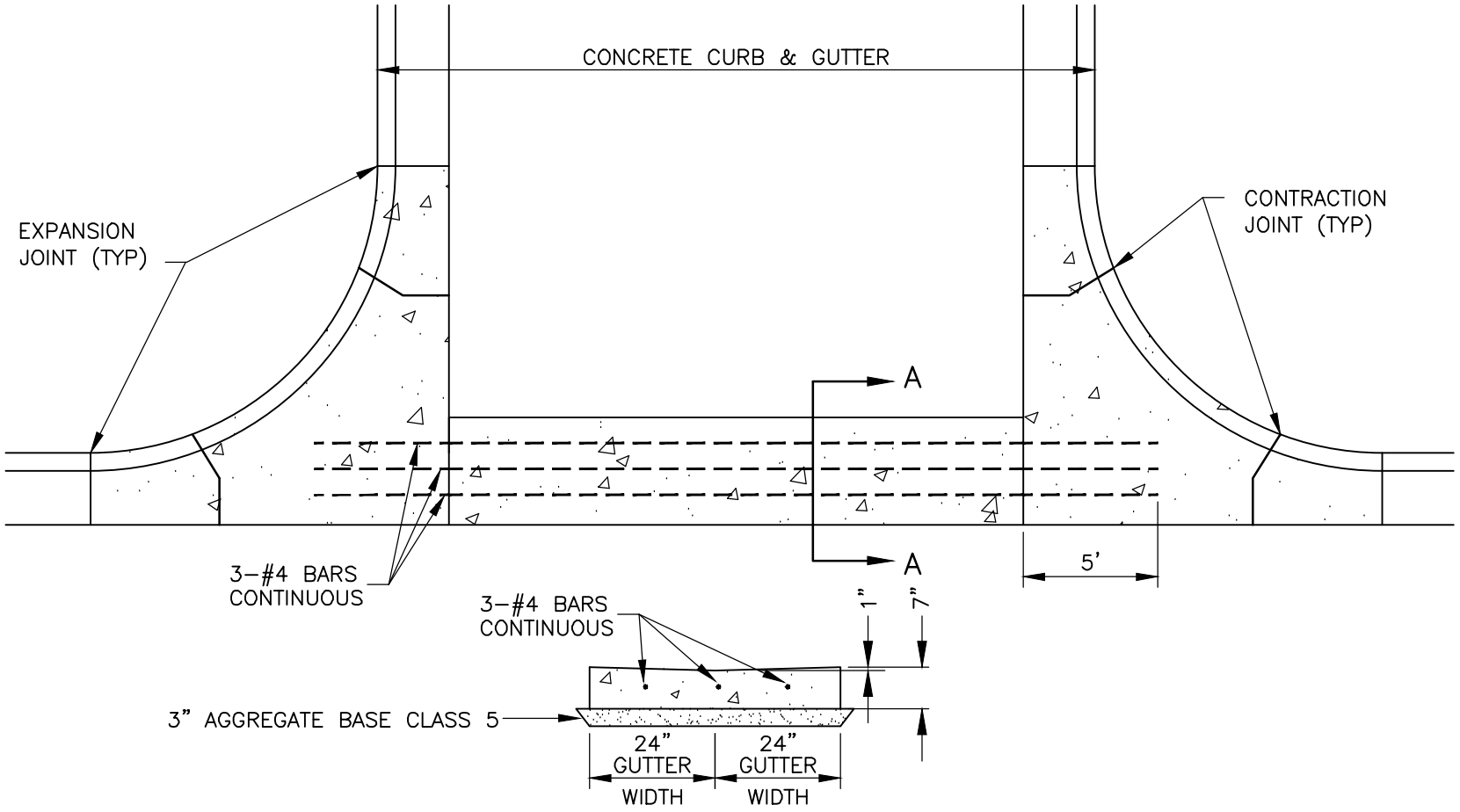

SECTION A

CONCRETE VALLEY GUTTER

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CONCRETE VALLEY GUTTER

City of St. Francis

DATE: 07/2013

STD. DETAIL 7–100

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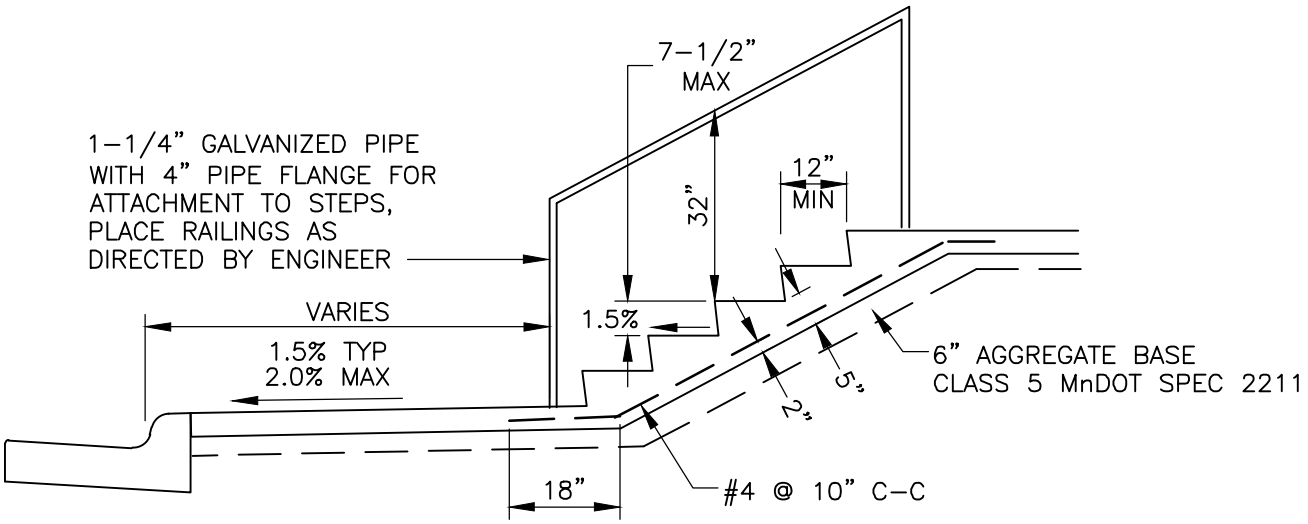

NOTE:
WIDTH TO MATCH EXISTING OR 4' MIN

CONCRETE STEPS

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CONCRETE STEPS

City of St. Francis

DATE: 07/2013

STD. DETAIL 7–204

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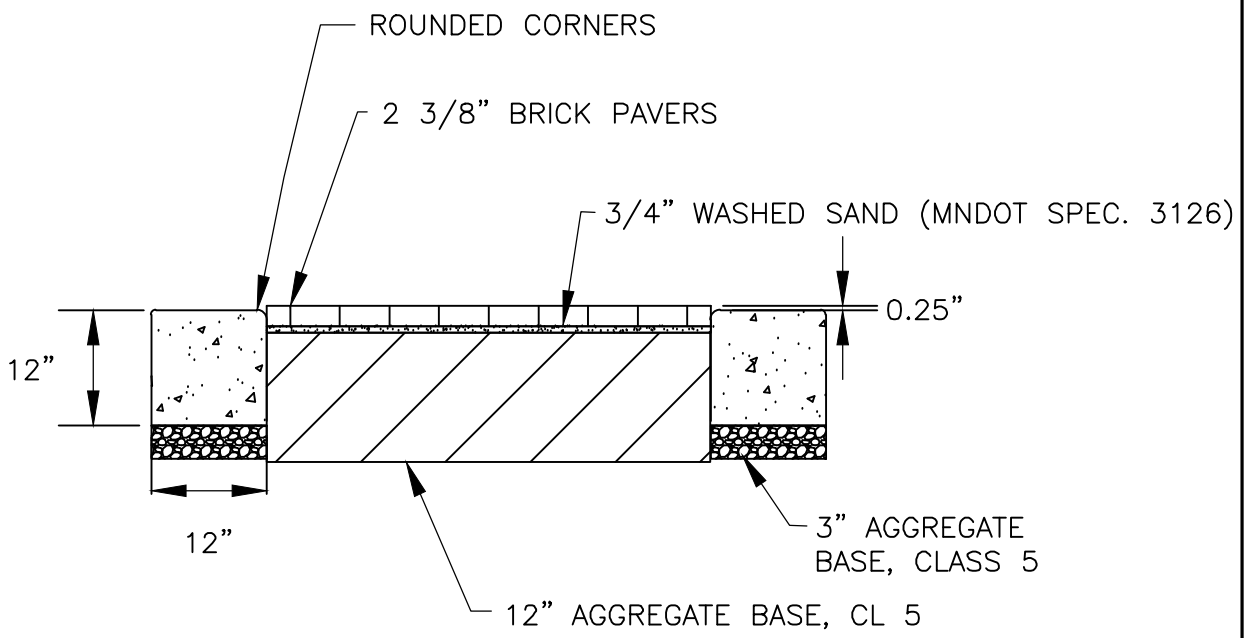
SPECIAL CURB

12"X12" RIBBON CURB MUST BE USED AS EDGING FOR INSTALLATION OF BRICK PAVERS UNLESS PAVERS ADJOIN EXISTING CURB AND GUTTER OR CONCRETE SLAB WITH A THICKNESS GREATER THAN 6".

NOTES:

1). PAVER STONES SHALL BE HOLLAND STYLE, 2 3/8" THICK.
2). PAVER STONE SHALL HAVE A MINIMUM AVERAGE COMPRESSIVE STRENGTH OF 8,000 PSI.
3). PAVER STONE TO BE INSTALLED USING HERRINGBONE PATTERN.
4). COLOR & STYLE OF PAVER STONE SHALL BE APPROVED BY THE CITY ENGINEER & OWNER.
5). INSTALLATION OF PAVERS STONES SHALL CONFORM TO THE REQUIREMENTS OF THE MANUFACTURERS SPECIFICATIONS.
6). SUBMIT THREE UNITS AS SAMPLES ALONG WITH MANUFACTURERS SPECIFICATIONS TO THE CITY ENGINEER A MINIMUM OF 15 DAYS PRIOR TO INSTALLATION.
7). MAXIMUM ALLOWABLE SURFACE DEFORMATION IN THE COMPLETED WORK SHALL NOT EXCEED + OR – 1/8" AS MEASURED WITH A 10' STRAIGHT EDGE.



CONCRETE PAVER SIDEWALK

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CONCRETE PAVER SIDEWALK

City of St. Francis

DATE: 07/2013

STD. DETAIL 7–205

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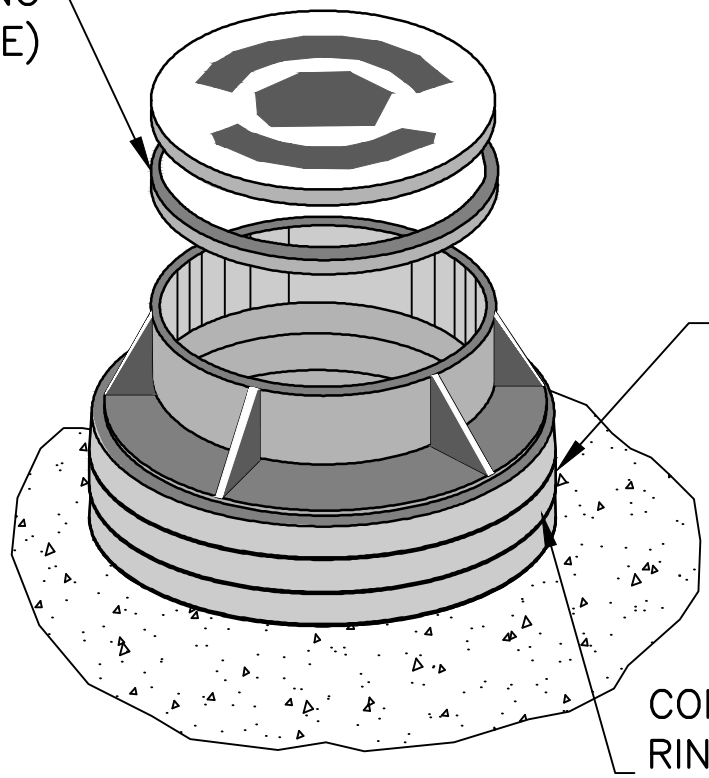

NOTE: A FIVE HUNDRED DOLLAR ($500) PENALTY WILL BE ENFORCED FOR EACH CASTING NOT PROPERLY ADJUSTED REQUIRING A PATCH IN THE BITUMINOUS WEARING COURSE.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CASTING AND GRADE ADJUSTMENT RING DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 7-500

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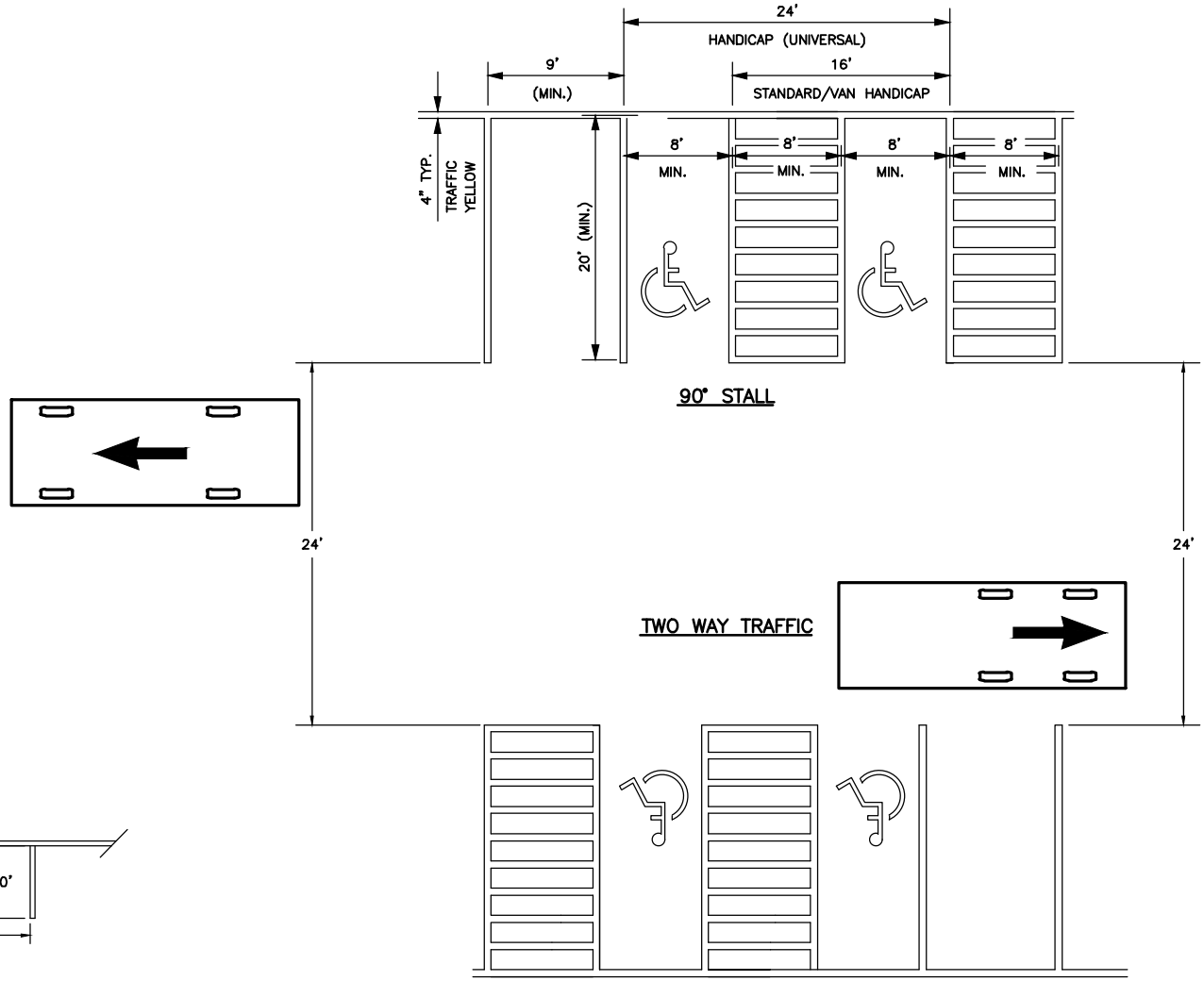

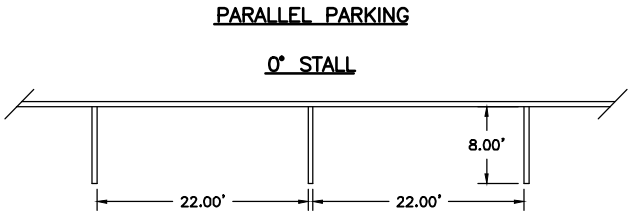

* FOR UNIVERSAL HANDICAP PARKING SPACES, THE 8' WIDE STRIPED PAINTED LANE AREA IS SHARED FOR PASSENGER AND DRIVER LOADING/UNLOADING.

PARKING STRIPING DETAILS

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PARKING LOT DETAIL (0° AND 90° STALL)

City of St. Francis

DATE: 07/2013

STD. DETAIL 8-000A

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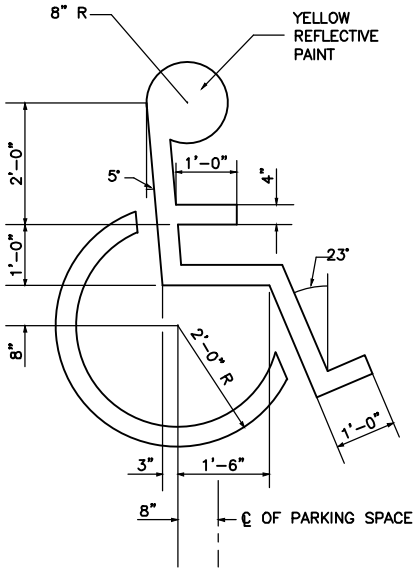
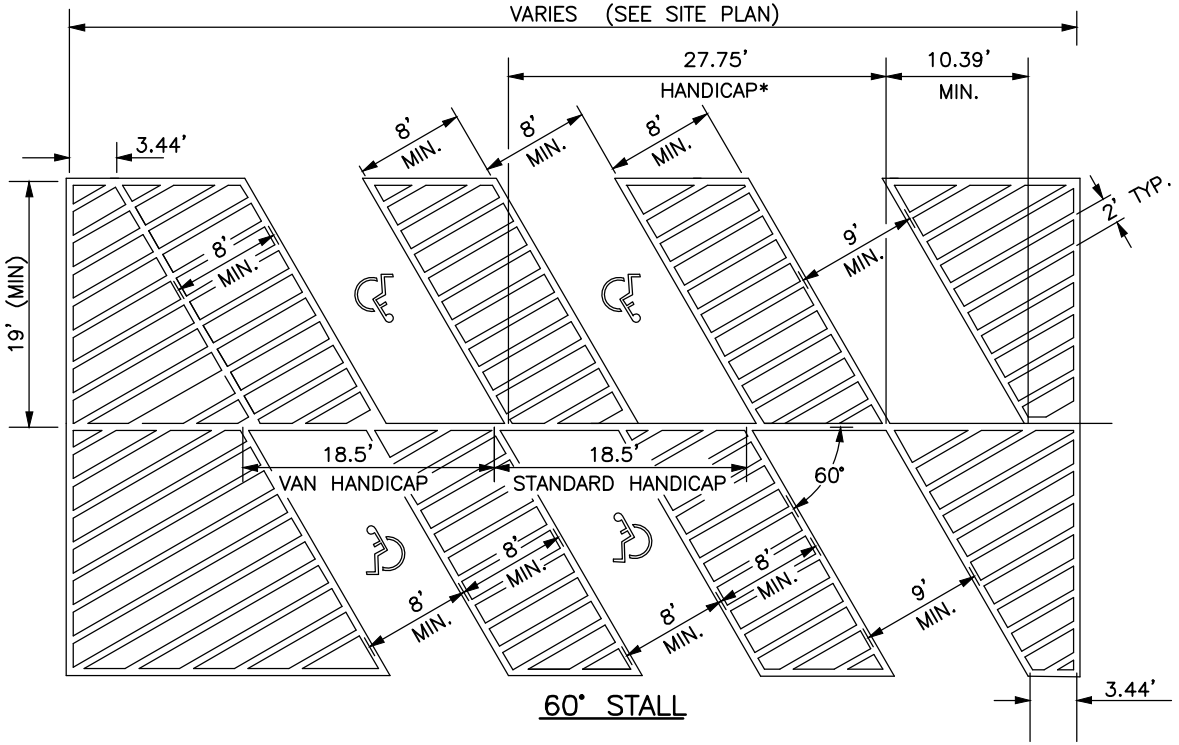


INTERNATIONAL HANDICAP SYMBOL



60° STALL

* FOR 60° HANDICAP PARKING, AN 8' WIDE PAINTED LANE AREA IS NEEDED FOR PASSENGER AND DRIVER LOADING/UNLOADING. LANES CAN BE SHARED BY ADJACENT HANDICAP STALLS.

TYPICAL PARKING STRIPING DETAILS

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PARKING LOT DETAIL (60° STALL)

City of St. Francis

DATE: 07/2013

STD. DETAIL 8-000B

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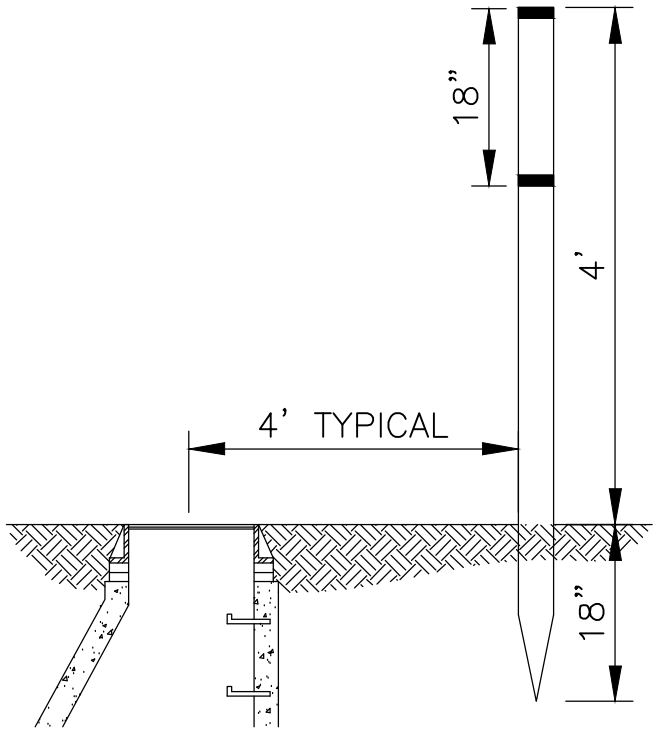

NOTES:

1. STAKE SHALL BE "FLEX STAKE ECONOMY EZ DRIVE SERIES" AS MANUFACTURED BY ROADTECH MANUFACTURING.

2. REFLECTIVE TAPE SHALL BE ATTACHED AT THE TOP AND 18" BELOW THE TOP OF THE STAKE.

3. FLEX STAKES SHALL BE POSTED AT ALL MANHOLE AND VALVE BOXES IN UNIMPROVED AREAS.

4. FLEX STAKES SHALL BE PLACED AT CULVERT ENDS, GATE VALVES, MANHOLES AND CLEAN-OUTS AS DIRECTED BY THE ENGINEER.

5. COLOR OF THE FLEX STAKE SHALL BE:

GREEN - FOR ALL SANITARY STRUCTURES, AND STORM SEWER MANHOLES.
BLUE - FOR ALL WATER SYSTEMS, INCLUDING GATE VALVES, ETC.
GRAY - FOR ALL CULVERT ENDS.

CITY UTILITY MARKER POST

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

CITY UTILITY MARKER POST

City of St. Francis

DATE: 07/2013

STD. DETAIL 8-110

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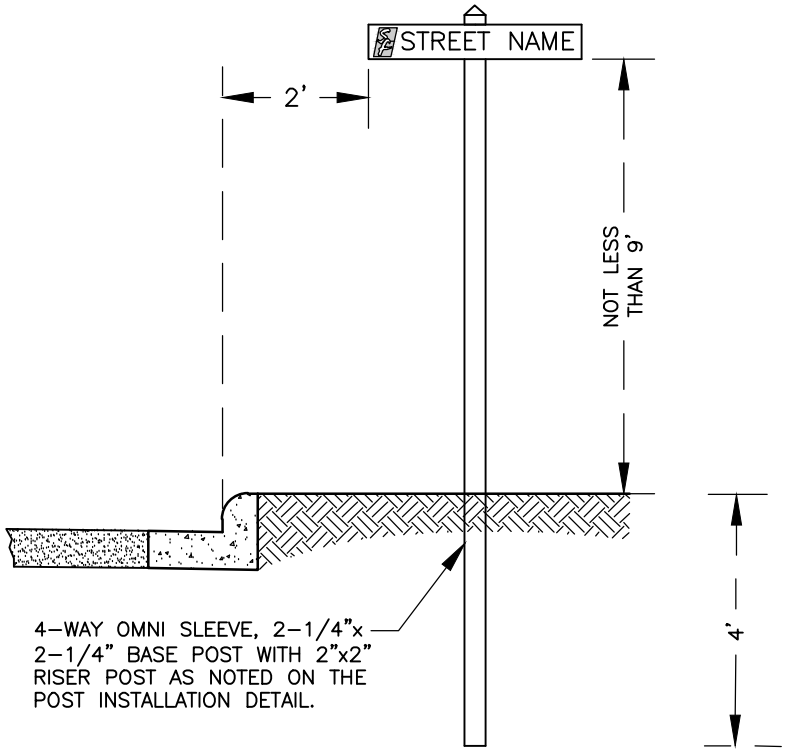

NOTES:

SIGN POSTS SHALL BE TELESPAR POSTS WITH BASE AS NOTED ON THE SIGN POST INSTALLATION DETAIL.

THE POST AND SIGN HARDWARE SHALL INCLUDE PLASTIC SPACERS FOR MOUNTING SIGNS.

POST SHALL HAVE A 2" PYRAMID CAP ON THE TOP OF THE POST OR EXTEND SIGN PANEL TO TOP OF POST.

STREET SIGNS SHALL BE A 9" ALUMINUM .080 GAUGE PLATE WITH 6" UPPERCASE WHITE LETTERS, NUMBERS, WHITE BORDER, AND MARKINGS, SERIES B LETTERS ON A GREEN BACKGROUND. THE REFLECTIVITY OF THE SIGN SHALL BE 3M VIP GRADE.

THE "5 SF" PORTION OF THE CITY OF ST. FRANCIS LOGO SHALL BE INSTALLED ON ALL STREET NAME SIGN PANELS TO THE LEFT OF THE STREET NAME.

SIGNS AND INSTALLATION OF SIGNS SHALL BE IN ACCORDANCE WITH THE "MINNESOTA MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES", LATEST EDITION.

SIGN BASE MATERIAL SHALL BE ALUMINUM.

STREET NAME SIGN AND POST

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

STREET NAME SIGN AND POST

City of St. Francis

DATE: 07/2013

STD. DETAIL 8–114

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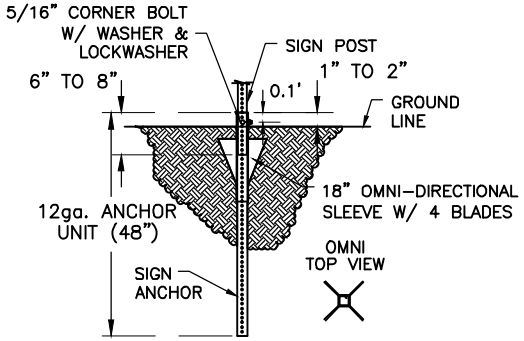
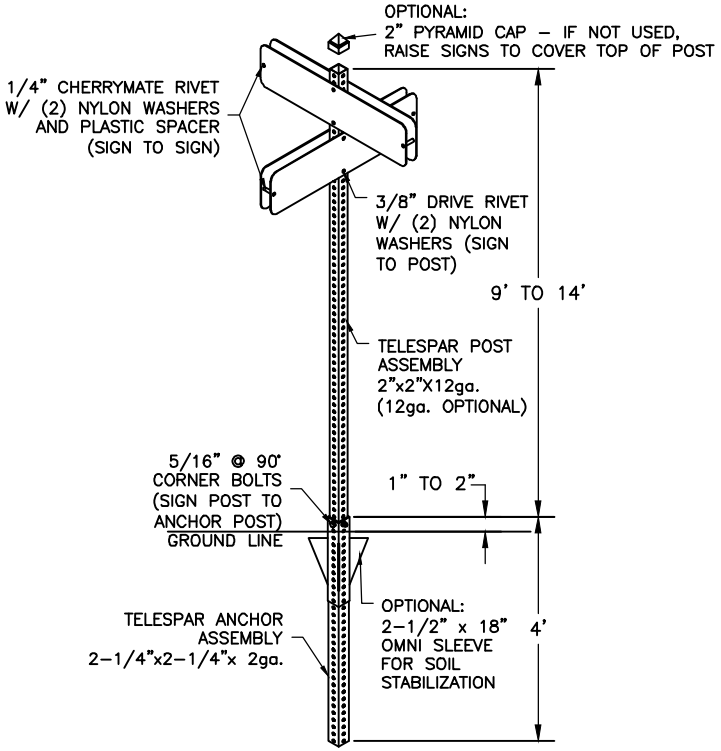


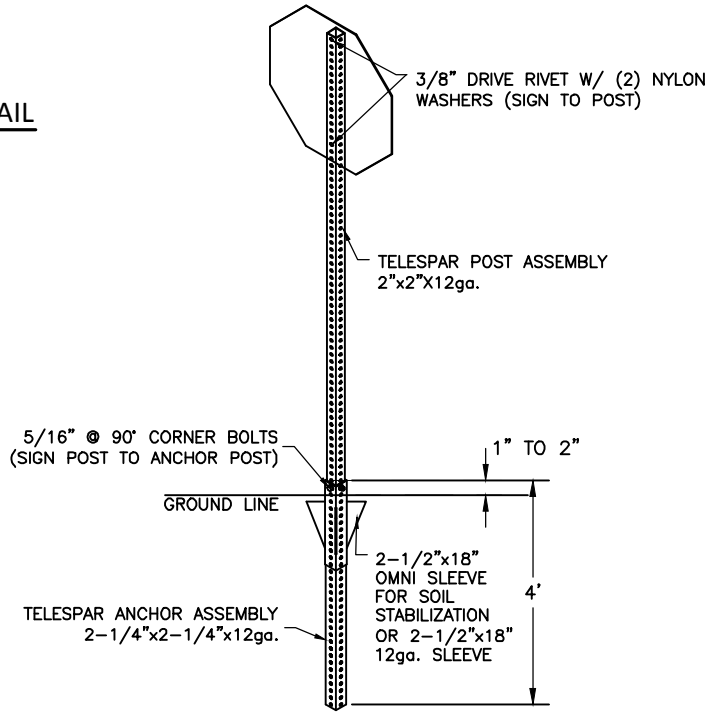
TELESPAR ANCHOR DETAIL

NOT TO SCALE



STREET NAME SIGN POST DETAIL

NOT TO SCALE



TRAFFIC SIGN POST DETAIL

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SIGN POST INSTALLATION

City of St. Francis

DATE: 07/2013

STD. DETAIL 8-115

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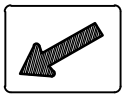
FURNISH AND INSTALL NEW SIGNS			
SIGN NUMBER	SIGN	COLOR & SIZE	DESCRIPTION
*R1-1		18"X18" 30"X30" 36'X36" WHITE ON RED	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM STOP SIGN
R2-1		24"X30" BLACK ON WHITE	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM SPEED LIMIT SIGN
W11-X5		30"X30" BLACK ON YELLOW	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM WATCH FOR CHILDREN SIGN
SPECIAL		18"X24" RED ON WHITE	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM NO PARKING ON CITY STREETS SIGN
W11-2		30"X30" BLACK ON WHITE	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM PEDESTRIAN CROSSING SIGN
R5-3		24"X24" 18"X18" BLACK ON WHITE	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM NO MOTOR VEHICLES SIGN

SIGN NUMBER	SIGN	COLOR & SIZE	DESCRIPTION
W16-7		24"X12" BLACK ON YELLOW	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM DIAGONAL ARROW SIGN
SPECIAL		18"X24" BLACK ON WHITE	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM DOGS MUST BE LEASHED SIGN
SPECIAL		18"X24" BLACK ON WHITE	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM PARK CLOSED SIGN
SPECIAL		18"X24" BLACK ON WHITE	TYPE IX 3M DIAMOND GRADE VIP ALUMINUM FUTURE STREET SIGN

NOTES:

1. SIGNS AND INSTALLATION OF SIGNS SHALL BE IN ACCORDANCE WITH THE "MINNESOTA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", MOST RECENT EDITION.
2. SIGN BASE MATERIAL SHALL BE ALUMINUM.
3. SIGNS REQUIRE 3M DIAMOND GRADE VIP GRADE SHEETING
4. ALL SIGNS SHALL BE CLEARLY MARKED ON THE BACK SIDE WITH THE INSTALLATION DATE OF THE SIGN AS WELL AS THE MANUFACTURER'S RETRO REFLECTIVITY WARRANTY.

STREET SIGNS

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

STREET SIGNS

City of St. Francis

DATE: 07/2013

STD. DETAIL 8-116

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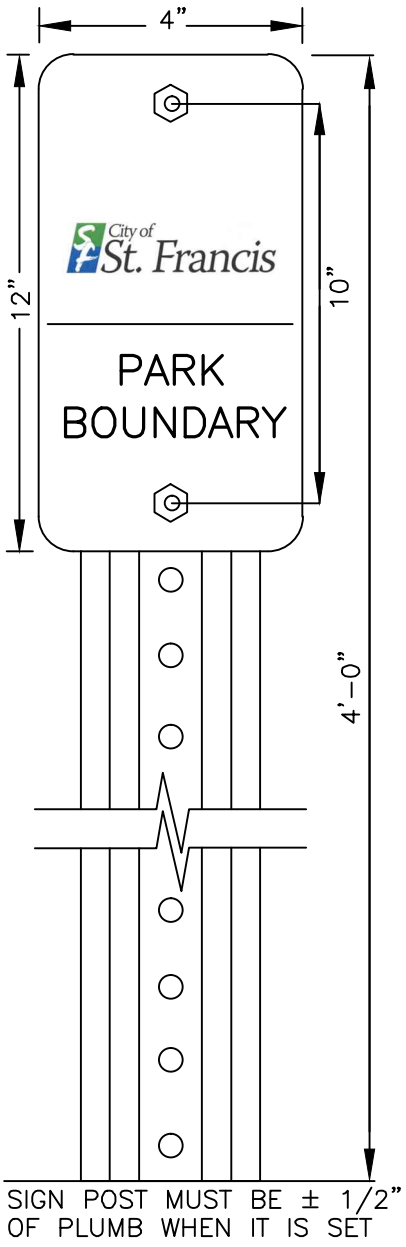
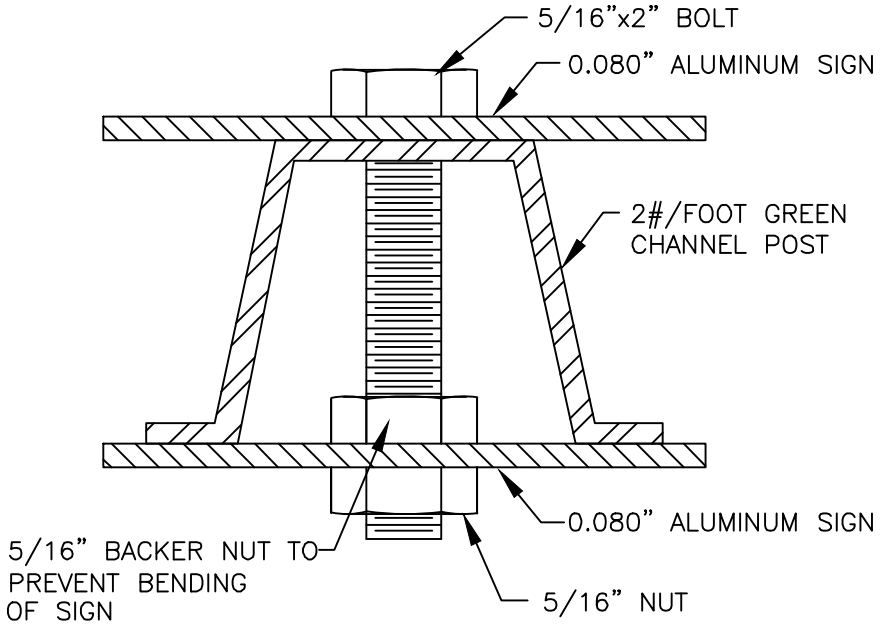


SIGN POST MUST BE ± 1/2" OF PLUMB WHEN IT IS SET



TYPICAL SECTION

NOTES:

1. MATERIALS TO BE SUPPLIED BY THE DEVELOPER/CONTRACTOR INCLUDE THE FOLLOWING:
   (2) 4"x12"x0.080" ALUMINUM PARK BOUNDARY SIGNS
   (2) 5/16"x2" CAD PLATED BOLTS
   (4) 5/16" CAD PLATED NUTS
   (1) 7' (2#/FOOT) GREEN CHANNEL POST
2. EACH BOUNDARY MARKER SHALL HAVE TWO SIGNS. ONE FACING THE PARK AND ONE FACING PRIVATE PROPERTY
3. SIGNS TO BE INSTALLED BY THE DEVELOPER PER THE DRAWING SHOWN AT THE LEFT.
4. AS A GENERAL RULE, PARK BOUNDARY SIGNS SHOULD BE PLACED AT EVERY OTHER LOT CORNER. HOWEVER, AT NO TIME SHOULD THERE BE MORE THAN 200' BETWEEN SIGNS IN UNFORESTED AREAS AND 150' IN FORESTED AREAS.
5. SIGN PANELS SHALL CONSIST OF WHITE BACKGROUND, TYPE IX, 3M DIAMOND GRADE VIP SHEETING.

PARK BOUNDARY SIGN INSTALLATION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

PARK BOUNDARY SIGN INSTALLATION

City of St. Francis

DATE: 07/2013

STD. DETAIL 8-117

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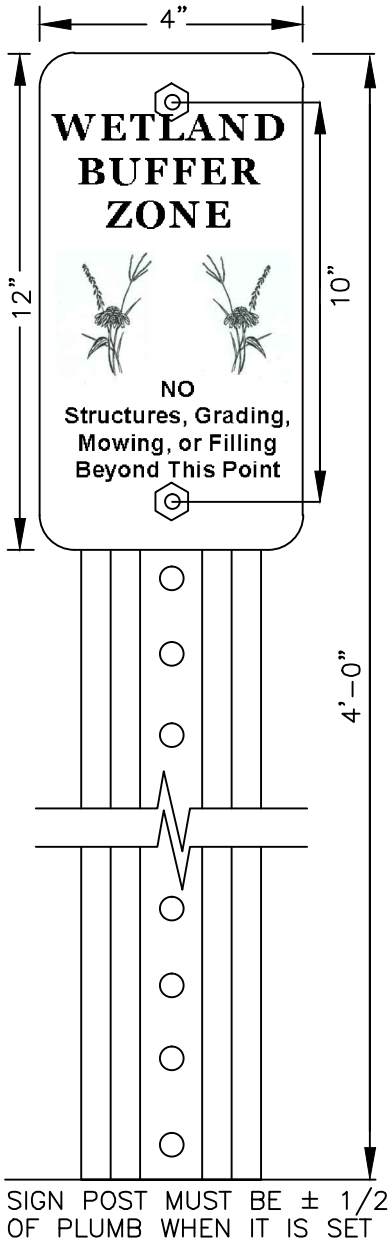

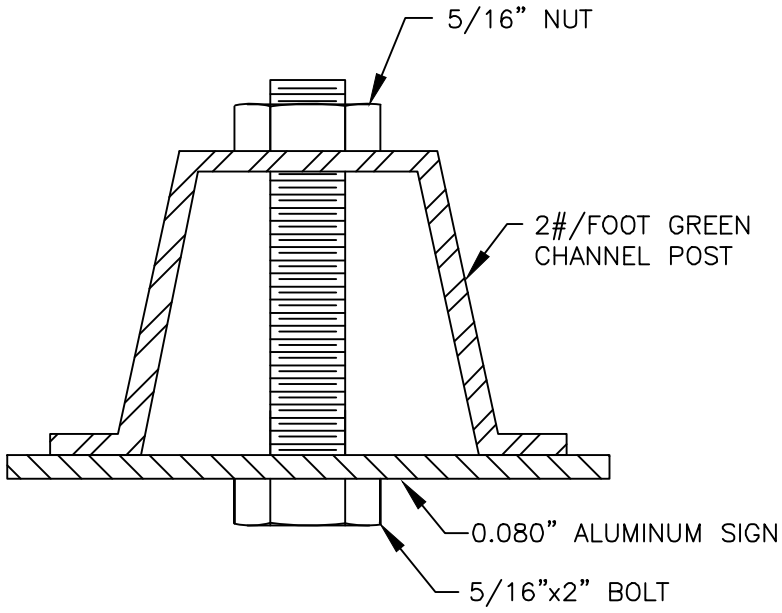

TYPICAL SECTION

NOTES:

1. MATERIALS TO BE SUPPLIED BY THE DEVELOPER/CONTRACTOR INCLUDE THE FOLLOWING:
   (2) 4"x12"x0.080" ALUMINUM WETLAND BUFFER SIGNS
   (2) 5/16"x2" CAD PLATED BOLTS
   (4) 5/16" CAD PLATED NUTS
   (1) 7' (2#/FOOT) GREEN CHANNEL POST
2. EACH BUFFER MARKER SHALL HAVE ONE SIGN FACING PRIVATE PROPERTY.
3. SIGNS TO BE INSTALLED BY THE DEVELOPER PER THE DRAWING SHOWN AT THE LEFT.
4. AS A GENERAL RULE, WETLAND BUFFER SIGNS SHOULD BE PLACED AT EVERY OTHER LOT CORNER. HOWEVER, AT NO TIME SHOULD THERE BE MORE THAN 200' BETWEEN SIGNS IN UNFORESTED AREAS AND 150' IN FORESTED AREAS.
5. SIGN PANELS SHALL CONSIST OF GREEN BACKGROUND WITH WHITE LETTERING, TYPE IX, 3M DIAMOND GRADE VIP SHEETING.

WETLAND BUFFER ZONE SIGN INSTALLATION

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

WETLAND BUFFER ZONE SIGN INSTALLATION

City of St. Francis

DATE: 07/2013

STD. DETAIL 8-118

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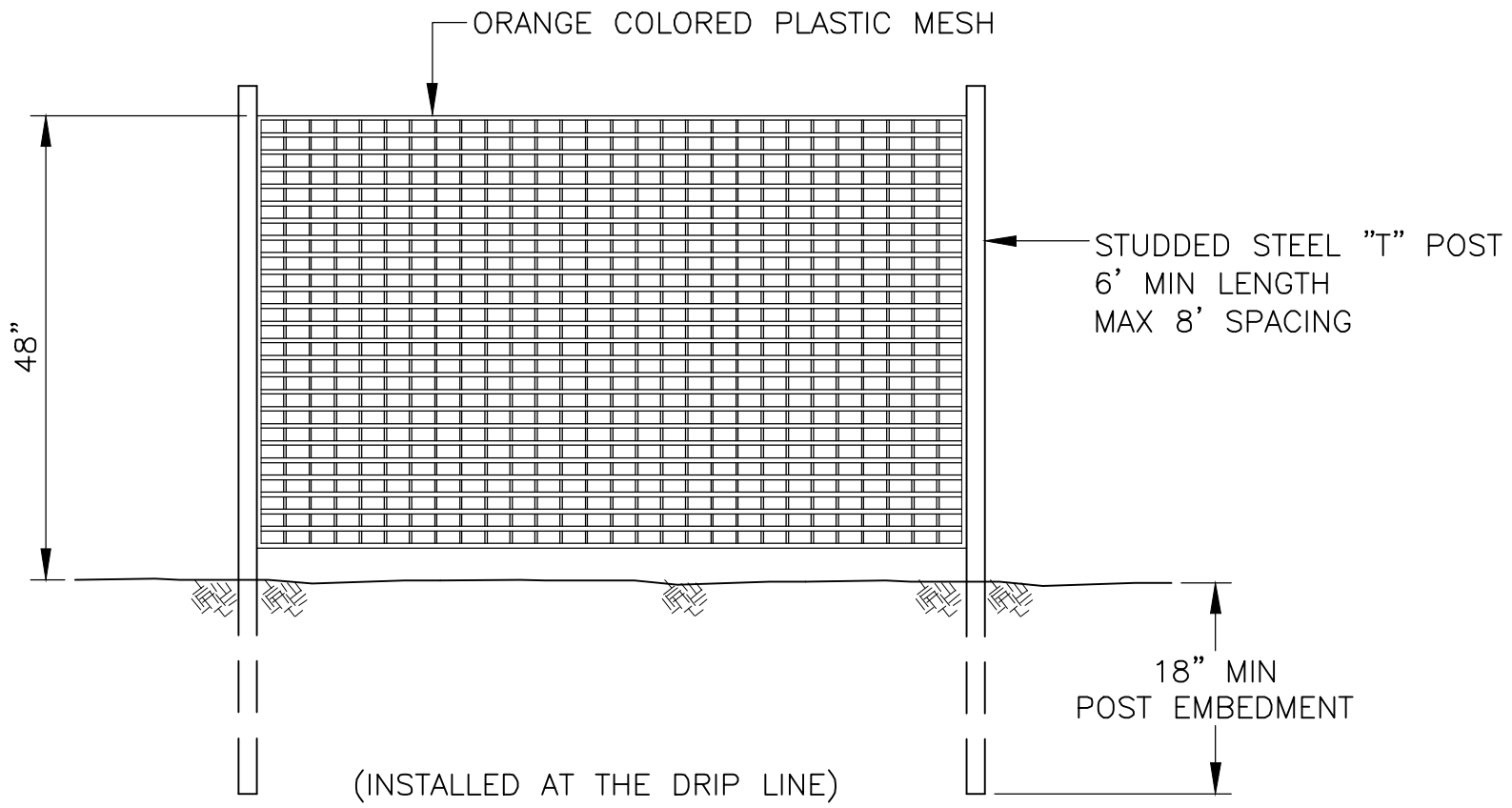

TREE PRESERVATION FENCE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

TREE PRESERVATION FENCE

City of St. Francis

DATE: 07/2013

STD. DETAIL 9–003

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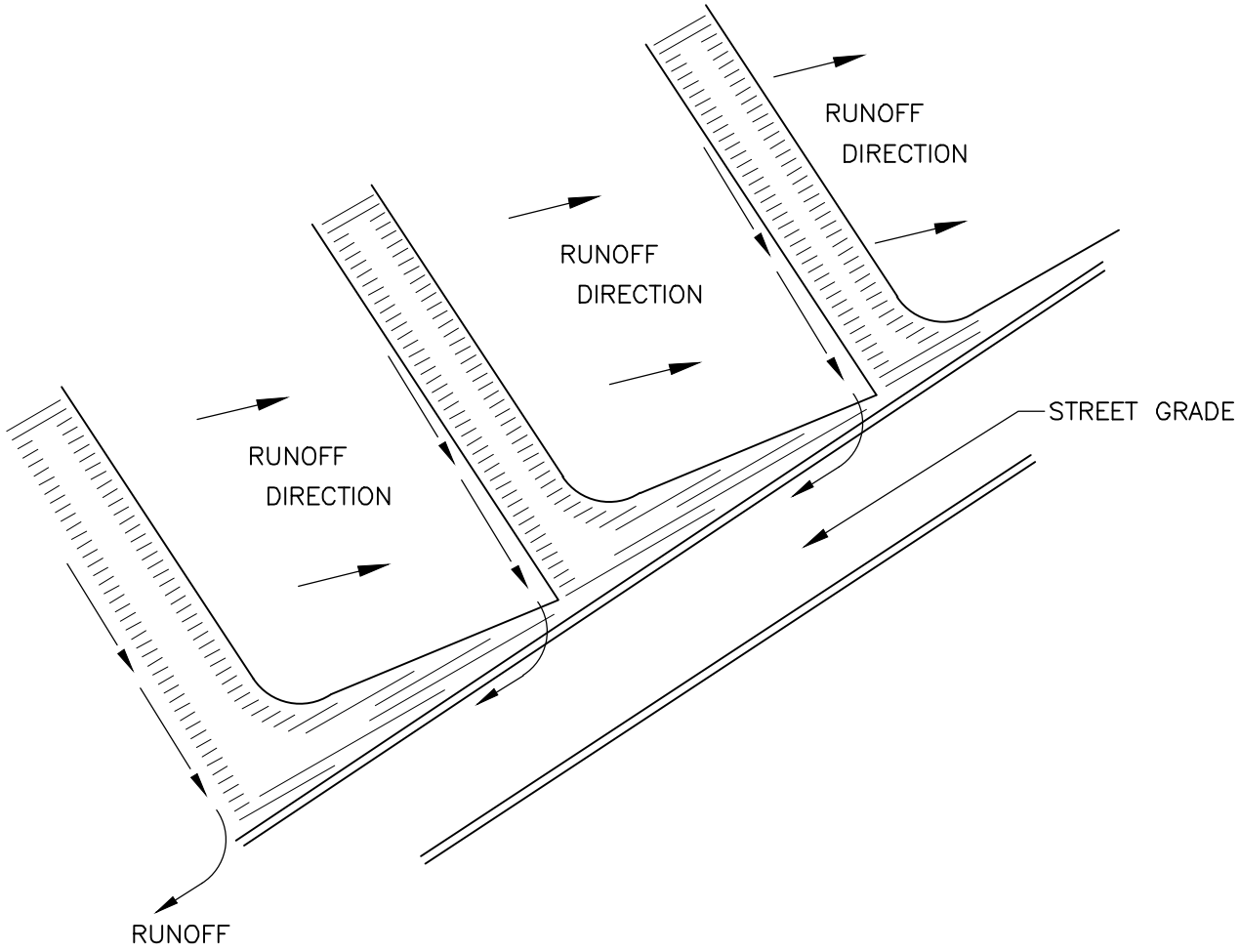

TYPICAL LOT BENCHING LAYOUT

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

TYPICAL LOT BENCHING LAYOUT

City of St. Francis

DATE: 07/2013

STD. DETAIL 9–201

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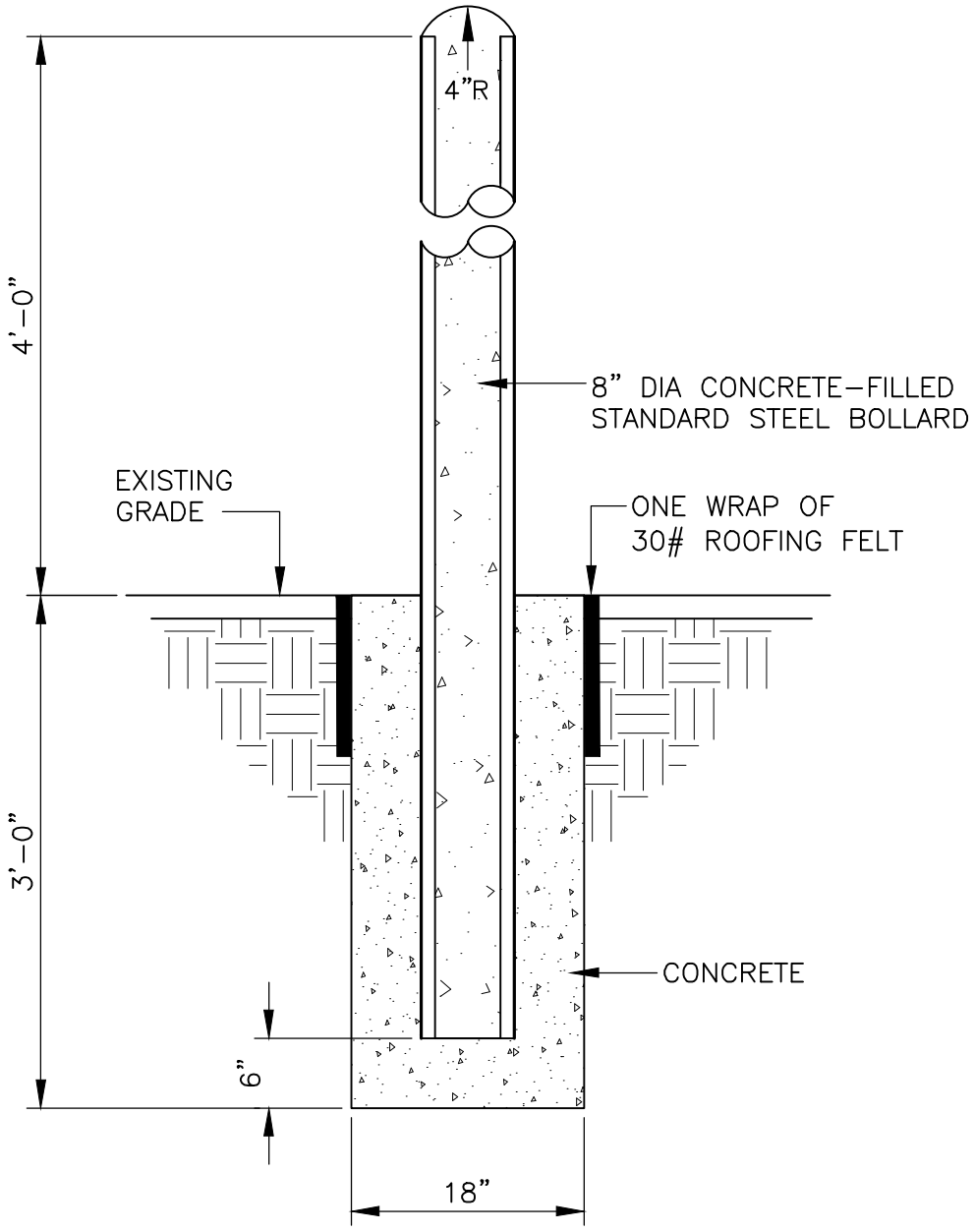

BOLLARD GUARD POST

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

BOLLARD GUARD POST

City of St. Francis

DATE: 07/2013

STD. DETAIL 9-300

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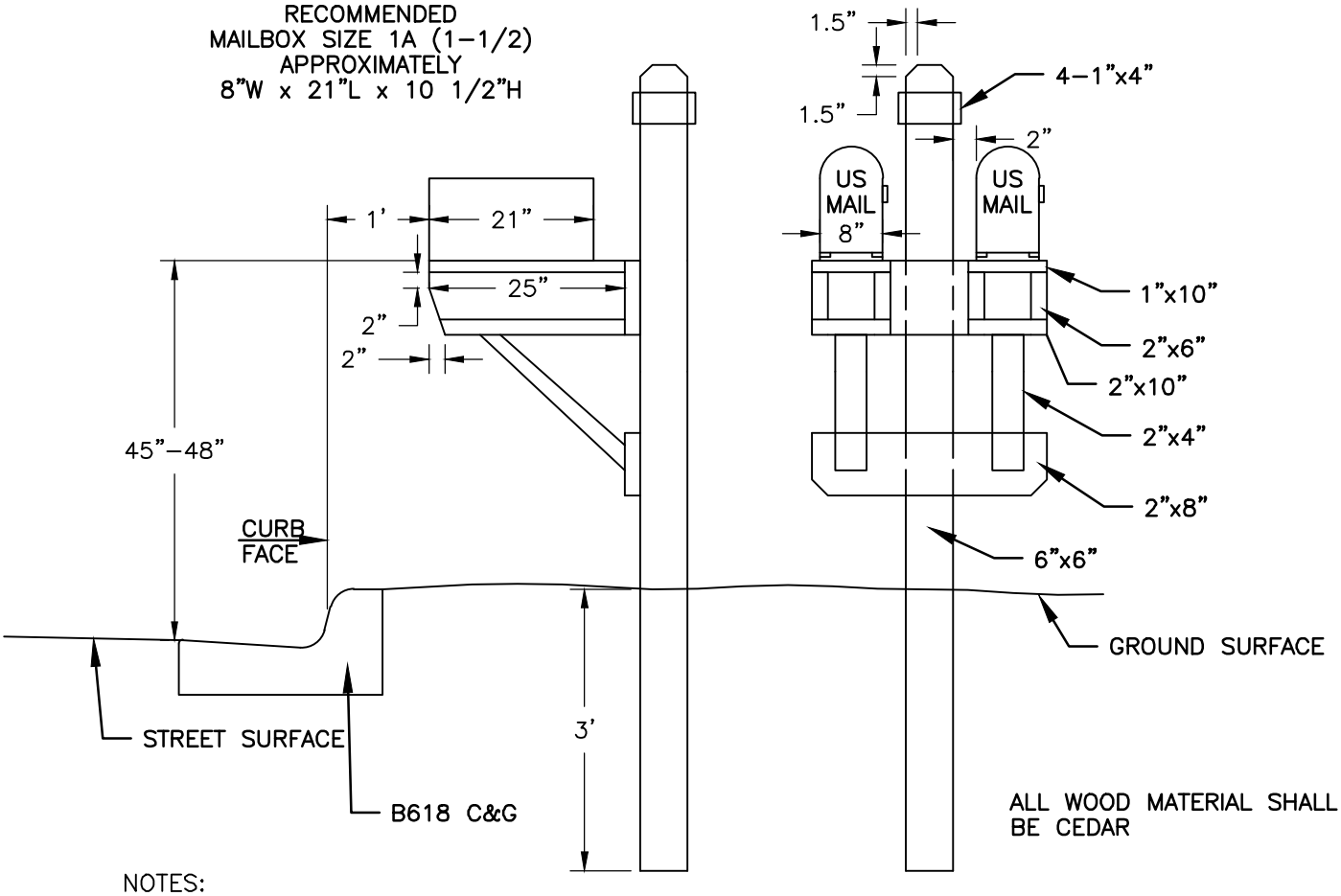

NOTES:

FOR SINGLE OR MULTIPLE BOXES AS DIRECTED BY THE ENGINEER.

MAILBOX LOCATIONS SHOULD BE STAKED BEFORE INSTALLATION FOR PROPER HEIGHT AND DISTANCE FROM THE ROADWAY. ONCE STAKED, THE INSTALLER MUST NOTIFY THE CITY ENGINEER AND THE POST OFFICE. THE ENGINEER AND POSTMASTER/MAILCARRIER WILL BE ALLOWED 48 HOURS TO REVIEW AND MODIFY THE STAKED LOCATIONS PRIOR TO FINAL INSTALLATION.

OTHER MAILBOX SUPPORT DESIGNS MAY BE USED. THE OWNER SHALL SEND THE CITY ENGINEER SHOP DRAWINGS FOR APPROVAL.

ALL MAILBOX SUPPORTS MUST BE CRASH WORTHY AND MEET MINNESOTA RULES, 8818, U.S. POST OFFICE AND FEDERAL HIGHWAY ADMINISTRATION (FHWA) STANDARDS AND RECOMMENDATIONS.

MAILBOX INSTALLATION DETAIL

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

MAILBOX INSTALLATION DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 9–301

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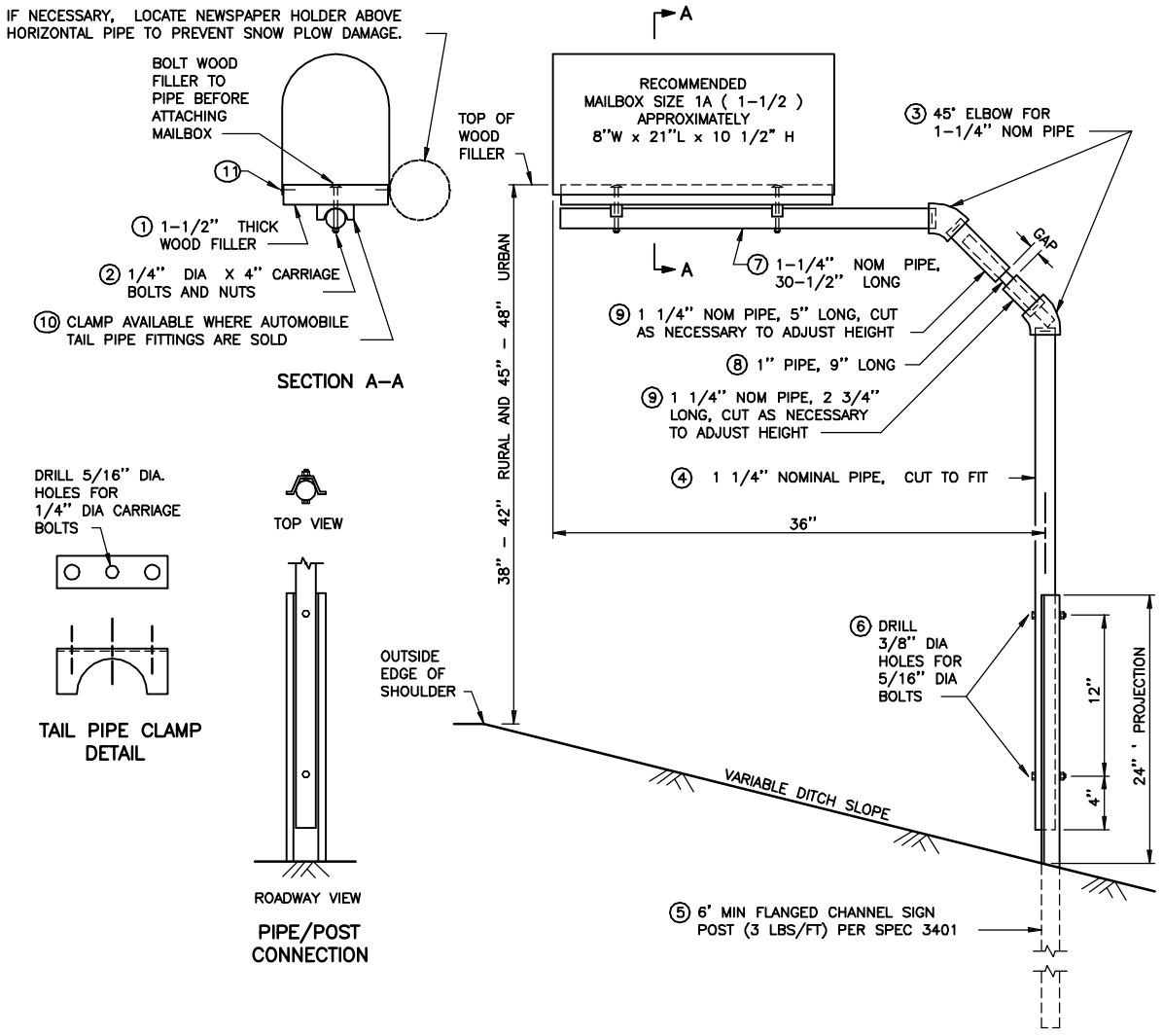

LIST OF MATERIALS FOR CONTRACTORS

ITEM NO.	NUMBER REQUIRED	DESCRIPTION
1	1	1 1/2" THICK WOOD FILLER CUT TO FIT SNUG UNDER MAIL BOX
2	2	1/4" DIA x 4" LONG CARRIAGE BOLTS & NUTS
3	2	45° ELBOW FOR 1 1/4" NOMINAL PIPE
4	1	1 1/4" NOMINAL PIPE, CUT TO FIT
5	1	6 FT MIN SIGN POST (3 LBS/FT)
6	2	5/16" DIA BOLT, NUT & LOCK WASHER
7	1	1 1/4" NOMINAL PIPE, 30 1/2" LONG
8	1	1" PIPE, 9" LONG
9	1	1 1/4" NOMINAL PIPE, 5" LONG 1 1/4" NOMINAL PIPE, 2 3/4" LONG
10	2	1 1/2" TAIL PIPE CLAMP
11	9	No. 10 x 1" SHEET METAL SCREWS

NOTES:

ALL PIPE AND PIPE FITTINGS SHALL CONFORM TO SPEC 3362

ALL FASTENERS SHALL CONFORM TO SPEC 3391

ALL MATERIALS SHALL BE GALVANIZED PER SPEC 3392

MAILBOX LOCATIONS SHOULD BE STAKED BEFORE INSTALLATION FOR PROPER HEIGHT AND DISTANCE FROM THE ROADWAY. ONCE STAKED, THE INSTALLER MUST NOTIFY THE ENGINEER AND THE POST OFFICE. THE ENGINEER AND POSTMASTER/MAILCARRIER WILL BE ALLOWED 48 HOURS TO REVIEW AND MODIFY THE STAKED LOCATIONS PRIOR TO FINAL INSTALLATION.

OTHER MnDOT APPROVED MAILBOX SUPPORTS MAY BE USED. THESE INCLUDE THE DESIGNS DEVELOPED BY MARSHALL COUNTY, THE ROCHESTER MnDOT DISTRICT, FRIEND INNOVATIONS AND MINNCOR INDUSTRIES.

DESIGN MODIFICATIONS TO PREVIOUSLY APPROVED SUPPORTS SHALL BE DOCUMENTED AND SENT TO THE DESIGN STANDARDS ENGINEER, OFFICE OF TECHNICAL SUPPORT.

THE MAILBOX TO BE 8 INCHES TO 12 INCHES OUTSIDE THE EDGE OF SHOULDER OR 6 INCHES TO 12 INCHES FROM FACE OF CURB.

NO MORE THAN THREE MAILBOXES SPACED 30" CENTER TO CENTER ARE TO BE USED IN ONE LOCATION.

MAILBOX SUPPORT

STEEL PIPE WITH FITTINGS AND STEEL FENCE POST

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

RURAL MAILBOX INSTALLATION DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 9-301A

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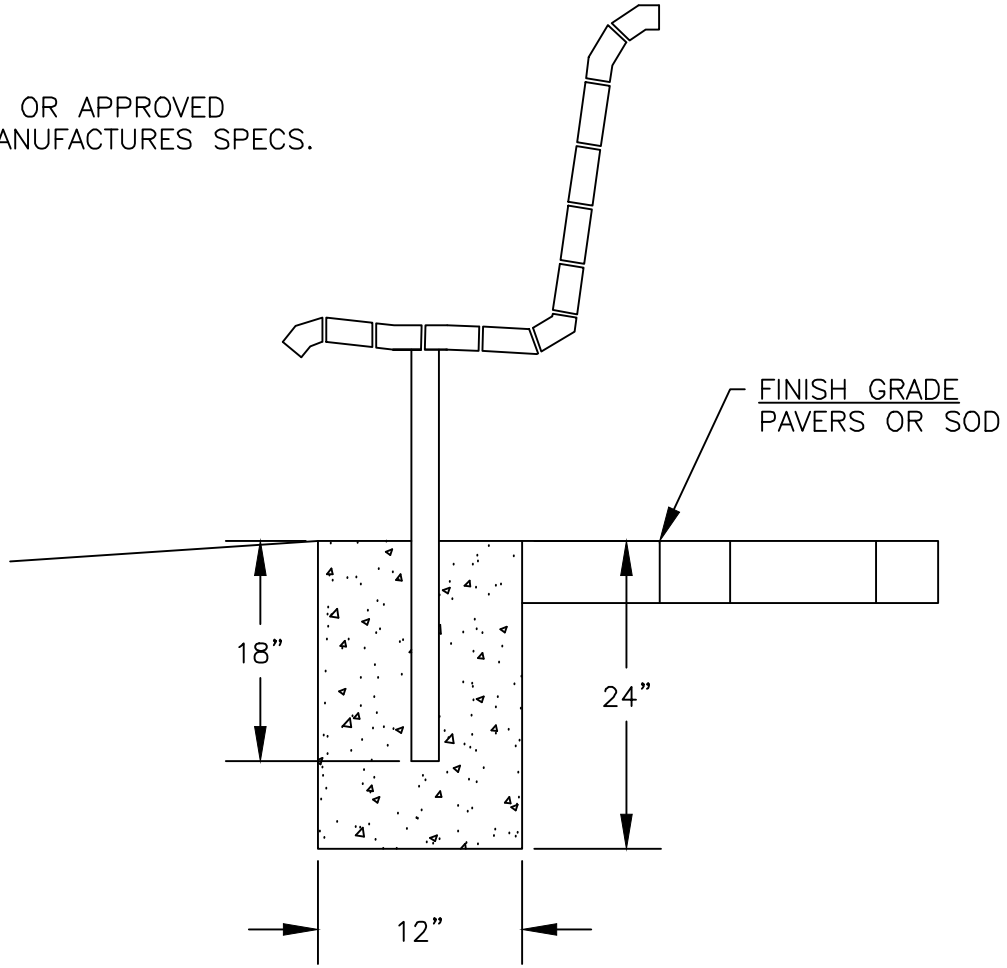
DU-MOR NO.# 34-60R OR APPROVED
EQUAL, INSTALL PER MANUFACTURES SPECS.



TYPICAL BENCH DETAIL

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

TYPICAL BENCH DETAIL

City of St. Francis

DATE: 07/2013

STD. DETAIL 9-303

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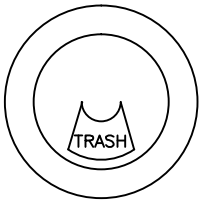
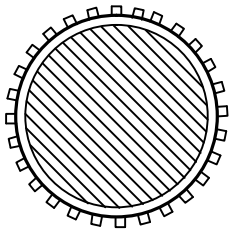


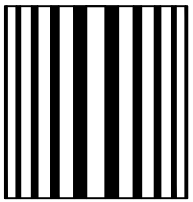
TOP VIEW

FRONT VIEW

TRASH RECEPTACLE COVERS SHALL BE STEEL DOMED COVERS WITH SELF CLOSING DOORS DU-MOR MODEL 47-00)BRONZE OR APPROVED EQUAL



TOP VIEW



FRONT VIEW

TRASH RECEPTACLE SHALL HAVE 2" X 3" REDWOOD SLATES WITH A 30 GALLON PLASTIC LINER AND HAVE AN EMBEDABLE MOUNTING SUPPORT

TRASH RECEPTACLE DU-MOR MODEL 41-30R WITH MOUNTING SUPPORT S-1 FOR MODEL 41 OF APPROVED EQUAL

TRASH RECEPTACLE

NOT TO SCALE

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

TRASH RECEPTACLE

City of St. Francis

DATE: 07/2013

STD. DETAIL 9-304

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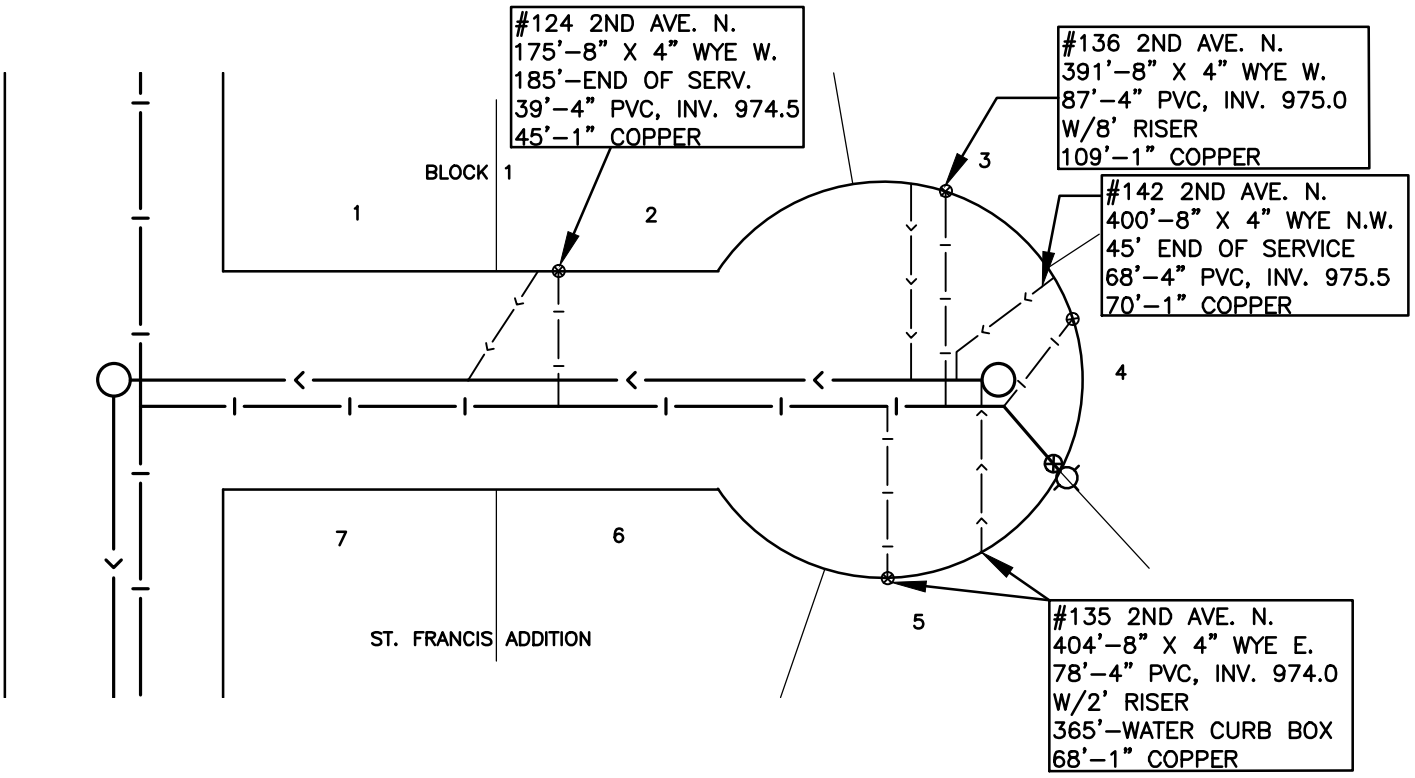

INFORMATION NEEDED TO COMPLETE CITY RECORD DRAWINGS

1. ADDRESS, IF AVAILABLE, OR LOT AND BLOCK NO. AND NAME OF ADDITION.
2. DISTANCE TO WYE FROM NEAREST DOWNSTREAM MANHOLE.
3. DISTANCE TO END OF SERVICE FROM NEAREST DOWNSTREAM MANHOLE (IF END OF SERVICE IS SKEWED MORE THAN 3' FROM THE WYE).
4. DISTANCE FROM NEAREST DOWNSTREAM MANHOLE TO WATER SERVICE CURB BOX (IF WATER SERVICES ARE IN THE SAME TRENCH WITH SEWER SERVICES, A NOTE INDICATING THAT SHOULD BE USED).
5. SIZE AND TYPE OF WYE.
6. SIZE AND TYPE OF SERVICE (SEWER OR WATER).
7. DIRECTION OF SERVICE.
8. LENGTH OF SERVICE (SEWER OR WATER).
9. INVERT ELEVATION AT END OF SEWER SERVICE.
10. RISER LENGTH
11. IF SERVICES IN CUL-DE-SACS ARE TO THE CENTER OF THE LOTS, A NOTE INDICATING THAT SHOULD BE USED. THIS COULD TAKE THE PLACE OF AN END OF SERVICE STATION.
12. WATER SERVICES ARE IN THE SAME TRENCH WITHIN 3' UPSTREAM OF SEWER SERVICES UNLESS OTHERWISE INDICATED.

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN
WILLMAR, MN CHASKA, MN RAMSEY, MN MAPLEWOOD, MN
BAXTER, MN ROCHESTER, MN AMES, IA SPENCER, IA

SEWER & WATER SERVICE RECORD DRAWING

City of St. Francis

DATE: 07/2013

STD. DETAIL 9-600

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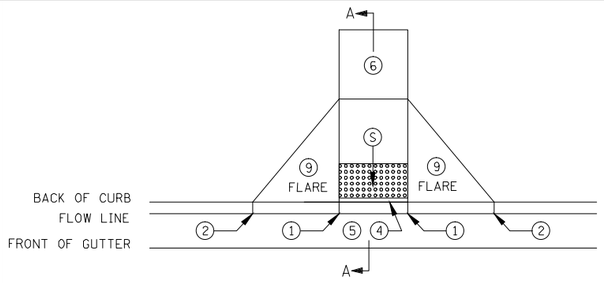
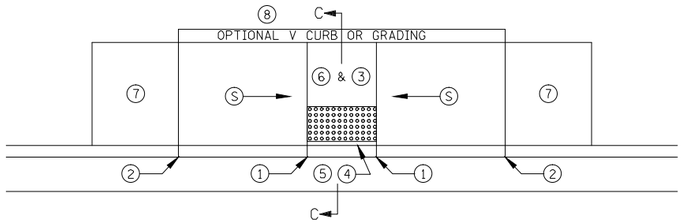
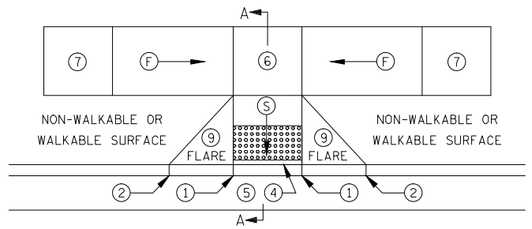
PEDESTRIAN CURB RAMP DETAILS
MnDOT STANDARD PLANS



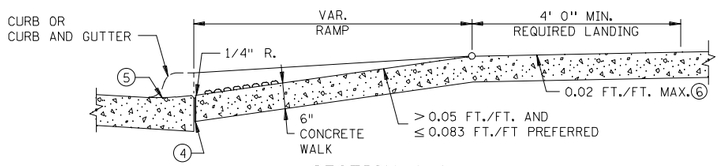
PERPENDICULAR



PARALLEL

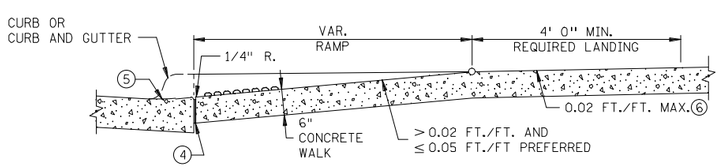


TIERED PERPENDICULAR



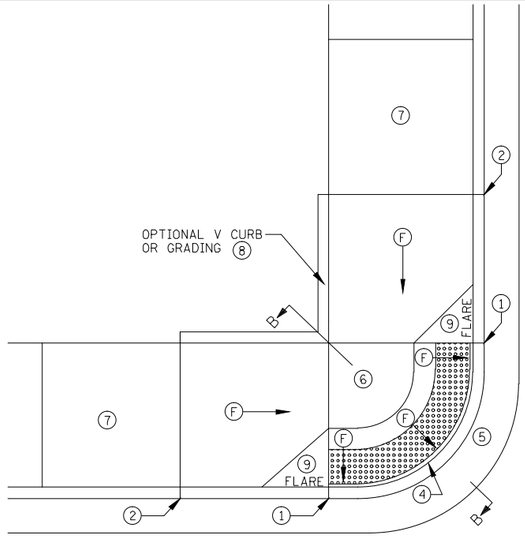
SECTION A-A

PERPENDICULAR/TIERED/DIAGONAL



SECTION B-B

FAN



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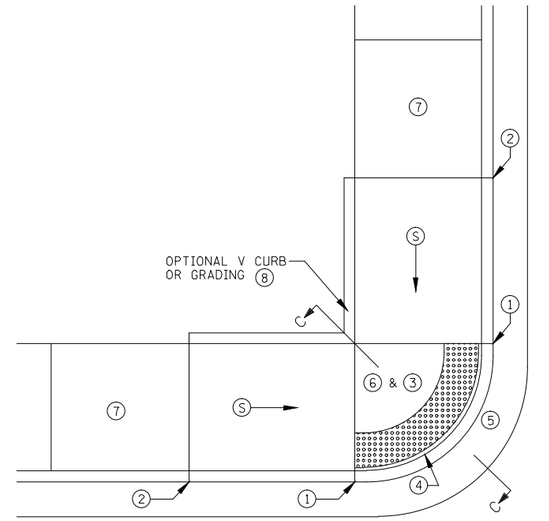
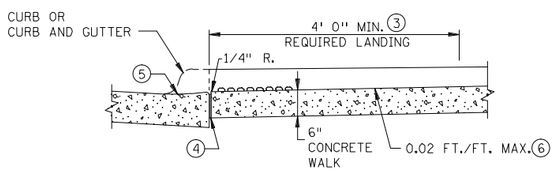
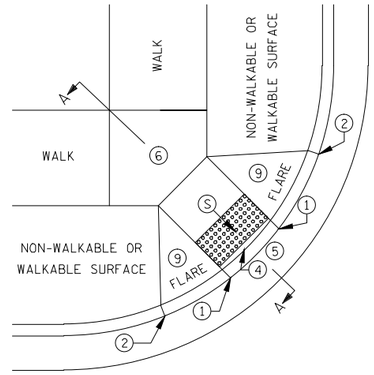


DEPRESSED CORNER



SECTION C-C

PARALLEL/DEPRESSED CORNER



DIAGONAL ⑩

NOTES:

LANDINGS SHALL BE LOCATED ANYWHERE THE PEDESTRIAN ACCESS ROUTE CHANGES DIRECTION, AT THE TOP OF RAMPS THAT HAVE RUNNING SLOPES GREATER THAN 5.0%, AND IF THE APPROACHING WALK IS INVERSE GRADE.

INITIAL CURB RAMP LANDINGS SHALL BE CONSTRUCTED WITHIN 15' FROM THE BACK OF CURB, WITH 6' FROM THE BACK OF CURB BEING THE PREFERRED DISTANCE.

SECONDARY CURB RAMP LANDINGS ARE REQUIRED FOR EVERY 30" OF VERTICAL RISE WHEN THE LONGITUDINAL SLOPE IS GREATER THAN 5.0%.

CONTRACTION JOINTS SHALL BE CONSTRUCTED ALONG ALL GRADE BREAKS.

ALL GRADE BREAKS WITHIN THE PAR SHALL BE PERPENDICULAR TO THE PATH OF TRAVEL.

TO ENSURE RAMPS AND LANDINGS ARE PROPERLY CONCTRUCTED, LANDINGS MAY BE CAST SEPARATELY. FOLLOW SIDEWALK REINFORCEMENT DETAILS ON SHEET 5 WHEN LANDINGS ARE CAST SEPARATELY.

ALL SLOPES ARE ABSOLUTE, RATHER THAN RELATIVE TO SIDEWALK/ROADWAY GRADES.

TOP OF CURB SHALL MATCH PROPOSED ADJACENT WALK GRADE.

4' MINIMUM WIDTH OF DETECTABLE WARNING IS REQUIRED FOR ALL RAMPS. DETECTABLE WARNINGS SHALL CONTINUOUSLY EXTEND FOR A MINIMUM OF 24" IN THE PATH OF TRAVEL. SHARED USE PATHS SHALL HAVE DETECTABLE WARNING ACROSS THE ENTIRE WIDTH OF PATH WHEN THE PATH CROSSES A ROAD.

SEE STANDARD PLATE 7038 AND SHEET 4 OF 5 FOR ADDITIONAL DETAILS ON DETECTABLE WARNING.

(1) 0" CURB HEIGHT.

(2) FULL CURB HEIGHT.

(3) DETECTABLE WARNINGS MAY BE PART OF 4' X 4' LANDING AREA IF IT IS NOT FEASIBLE TO CONSTRUCT THE LANDING OUTSIDE OF THE DETECTABLE WARNING AREA.

(4) 1/2" PREFORMED JOINT FILLER MATERIAL AASHTO M 213. JOINT FILLER SHALL BE PLACED FLUSH WITH THE BACK OF CURB AND ADJACENT SIDEWALK. JOINT SHALL BE FREE OF DEBRIS. RECTANGULAR DETECTABLE WARNINGS SHALL BE SETBACK 3" FROM THE BACK OF CURB. RADIAL DETECTABLE WARNINGS SHALL BE SETBACK 3" MINIMUM TO 6" MAXIMUM FROM THE BACK OF CURB.

(5) SEE PEDESTRIAN ACCESS ROUTE CURB AND GUTTER DETAIL FOR INFORMATION ON CONSTRUCTING CURB AND GUTTER AT CURB OPENINGS. SEE SHEET NO. 3 OF 5.

(6) 4' BY 4' MIN. LANDING WITH MAX. 2.0% SLOPE IN ALL DIRECTIONS.

(7) IF LONGITUDINAL SLOPE IS GREATER THAN 5.0%, 4' X 4' MIN. LANDING WITH MAX 2.0% SLOPE IN ALL DIRECTIONS REQUIRED.

(8) V CURB, IF USED, SHALL BE PLACED OUTSIDE THE SIDEWALK LIMITS WHEN RIGHT OF WAY ALLOWS. SEE SHEET 5 OF 5.

(9) SEE SHEET 4 OF 5, TYPICAL SIDE TREATMENT OPTIONS, FOR DETAILS ON FLARES AND RETURNED CURBS.

(10) DIAGONAL RAMPS SHOULD ONLY BE USED AFTER ALL OTHER CURB RAMP TYPES HAVE BEEN EVALUATED AND DEEMED IMPRACTICAL.

LEGEND
THESE LONGITUDINAL SLOPE RANGES SHALL BE THE STARTING POINT. IF SITE CONDITIONS WARRANT, LONGITUDINAL SLOPES UP TO 8.3% OR FLATTER ARE ALLOWED.
(S) INDICATES PEDESTRIAN RAMP - SLOPE SHALL BE BETWEEN 5.0% MINIMUM AND 8.3% MAXIMUM IN THE DIRECTION SHOWN AND THE CROSS SLOPE SHALL NOT EXCEED 2.0%
(F) INDICATES PEDESTRIAN RAMP - SLOPE SHALL BE GREATER THAN 2.0% AND LESS THAN 5.0% IN THE DIRECTION SHOWN AND CROSS SLOPE SHALL NOT EXCEED 2.0%

STANDARD PLAN SHEET NO. 5-297.250 (1 OF 5)	PEDESTRIAN CURB RAMP DETAILS
STANDARD APPROVED: APRIL 10, 2013	ST. FRANCIS, MN

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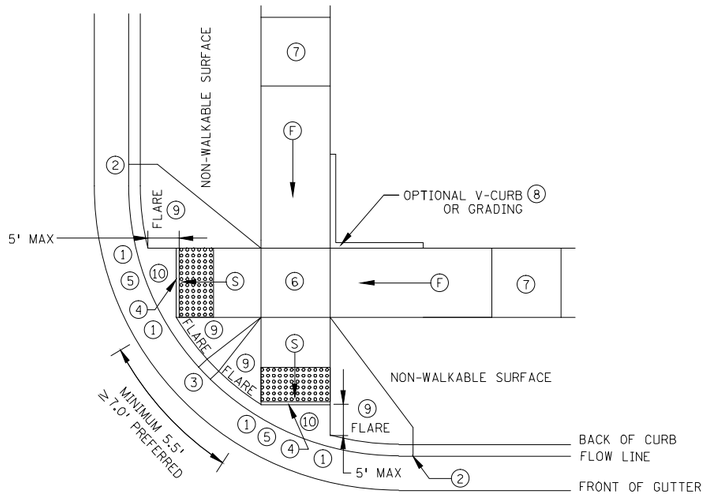
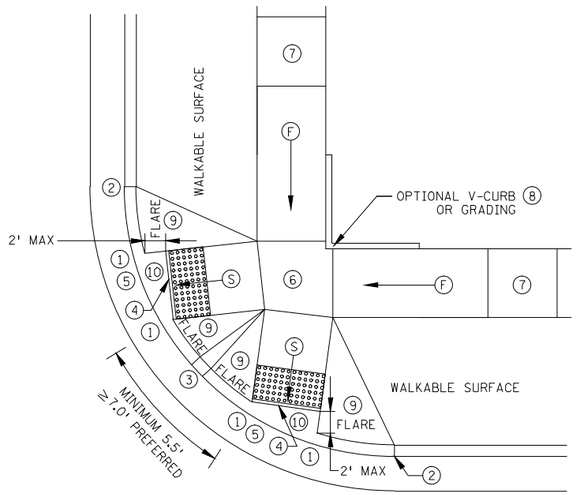
ST. FRANCIS, MINNESOTA
DEVELOPMENT STANDARDS
PEDESTRIAN RAMP DETAILS (1 OF 5)

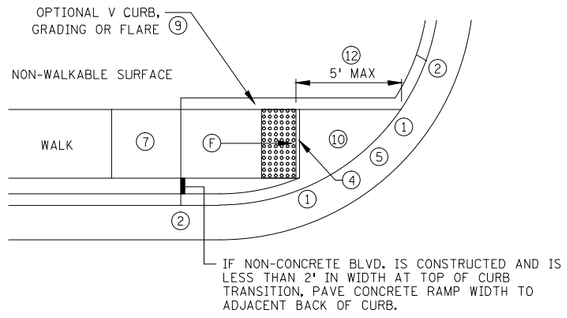


ADJACENT TO NON-WALKABLE SURFACE

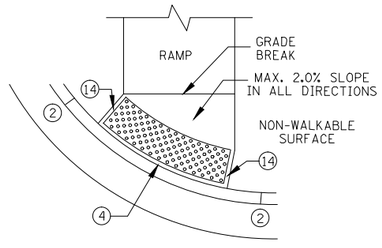


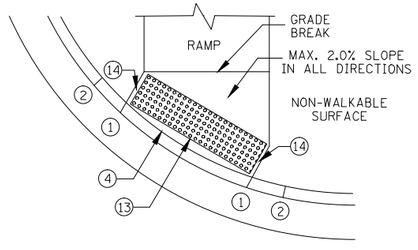
ADJACENT TO WALKABLE SURFACE

COMBINED DIRECTIONAL (15)

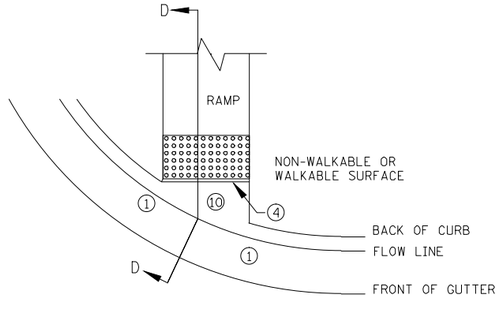


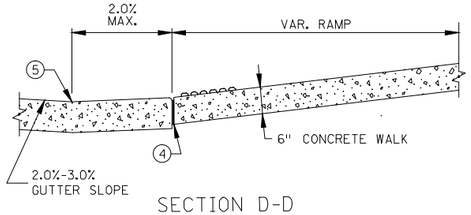
ONE-WAY DIRECTIONAL





DETECTABLE WARNING PLACEMENT WHEN
SETBACK CRITERIA IS EXCEEDED





SECTION D-D

CURB FOR DIRECTIONAL RAMPS (11)

NOTES:

LANDINGS SHALL BE LOCATED ANYWHERE THE PEDESTRIAN ACCESS ROUTE CHANGES DIRECTION, AT THE TOP OF RAMPS THAT HAVE RUNNING SLOPES GREATER THAN 5.0%, AND IF THE APPROACHING WALK IS INVERSE GRADE.

INITIAL CURB RAMP LANDINGS SHALL BE CONSTRUCTED WITHIN 15' FROM THE BACK OF CURB, WITH 6' FROM THE BACK OF CURB BEING THE PREFERRED DISTANCE.

SECONDARY CURB RAMP LANDINGS ARE REQUIRED FOR EVERY 30" OF VERTICAL RISE WHEN THE LONGITUDINAL SLOPE IS GREATER THAN 5.0%.

CONTRACTION JOINTS SHALL BE CONSTRUCTED ALONG ALL GRADE BREAKS.

ALL GRADE BREAKS WITHIN THE PAR SHALL BE PERPENDICULAR TO THE PATH OF TRAVEL.

TO ENSURE RAMPS AND LANDINGS ARE PROPERLY CONCTRUCTED, LANDINGS MAY BE CAST SEPARATELY. FOLLOW SIDEWALK REINFORCEMENT DETAILS ON SHEET 5 WHEN LANDINGS ARE CAST SEPARATELY.

ALL SLOPES ARE ABSOLUTE. RATHER THAN RELATIVE TO SIDEWALK/ROADWAY GRADES.

TOP OF CURB SHALL MATCH PROPOSED ADJACENT WALK GRADE.

4' MINIMUM WIDTH OF DETECTABLE WARNING IS REQUIRED FOR ALL RAMPS. DETECTABLE WARNINGS SHALL CONTINUOUSLY EXTEND FOR A MINIMUM OF 24" IN THE PATH OF TRAVEL. SHARED USE PATHS SHALL HAVE DETECTABLE WARNING ACROSS THE ENTIRE WIDTH OF PATH WHEN THE PATH CROSSES A ROAD.

SEE STANDARD PLATE 7038 AND SHEET 4 OF 5 FOR ADDITIONAL DETAILS ON DETECTABLE WARNING.

(1) 0" CURB HEIGHT.

(2) FULL CURB HEIGHT.

(3) 3" MINIMUM CURB HEIGHT, 4" PREFERRED.

(4) 1/2" PREFORMED JOINT FILLER MATERIAL AASHTO M 213. JOINT FILLER SHALL BE PLACED FLUSH WITH THE BACK OF CURB AND ADJACENT SIDEWALK. JOINT SHALL BE FREE OF DEBRIS. RECTANGULAR DETECTABLE WARNINGS SHALL BE SETBACK 3" FROM THE BACK OF CURB. RADIAL DETECTABLE WARNINGS SHALL BE SETBACK 3" MIN. TO 6"MAX. FROM THE BACK OF CURB.

(5) SEE PEDESTRIAN ACCESS ROUTE CURB AND GUTTER DETAIL FOR INFORMATION ON CONSTRUCTING CURB AND GUTTER AT CURB OPENINGS. SEE SHEET NO. 3 OF 5.

(6) 4' BY 4' MIN. LANDING WITH MAX. 2.0% SLOPE IN ALL DIRECTIONS.

(7) IF LONGITUDINAL SLOPE IS GREATER THAN 5.0%, 4' X 4' MIN. LANDING WITH MAX 2.0% SLOPE IN ALL DIRECTIONS REQUIRED.

(8) V CURB, IF USED, SHALL BE PLACED OUTSIDE THE SIDEWALK LIMITS WHEN RIGHT OF WAY ALLOWS.

(9) SEE SHEET 4 OF 5, TYPICAL SIDE TREATMENT OPTIONS, FOR DETAILS ON FLARES AND RETURNED CURBS.

(10) MAX. 2.0% SLOPE IN ALL DIRECTIONS IN FRONT OF GRADE BREAK AND DRAIN TO FLOW LINE. SHALL BE CONSTRUCTED INTEGRAL WITH CURB AND GUTTER.

(11) TO BE USED FOR ALL DIRECTIONAL RAMPS.

(12) PLACE DOMES AT THE BACK OF CURB WHEN ALLOWABLE SETBACK CRITERIA IS EXCEEDED.

(13) RECTANGULAR DETECTABLE WARNINGS MAY BE SETBACK 9" FROM THE BACK OF CURB WITH CORNERS SET 3" FROM BACK OF CURB. IF 9" SETBACK IS EXCEEDED USE RADIAL DETECTABLE WARNINGS.

(14) WHEN NO CONCRETE FLARES ARE PROPOSED, THE CONCRETE WALK SHALL BE FORMED AND CONSTRUCTED PERPENDICULAR TO THE BACK OF CURB. MAINTAIN 3" BETWEEN EDGE OF DOMES AND EDGE OF CONCRETE.

(15) FRONT EDGE OF DETECTABLE WARNING SHALL BE SET BACK 2' MAXIMUM WHEN ADJACENT TO WALKABLE SURFACE, AND 5' MAXIMUM WHEN ADJACENT TO NON-WALKABLE SURFACE WITH ONE CORNER SET 3" FROM BACK OF CURB. WHETHER A SURFACE IS WALKABLE OR NOT SHALL BE DETERMINED BY THE ENGINEER

LEGEND

THESE LONGITUDINAL SLOPE RANGES SHALL BE THE STARTING POINT. IF SITE CONDITIONS WARRANT, LONGITUDINAL SLOPES UP TO 8.3% OR FLATTER ARE ALLOWED.

(S) INDICATES PEDESTRIAN RAMP - SLOPE SHALL BE BETWEEN 5.0% MINIMUM AND 8.3% MAXIMUM IN THE DIRECTION SHOWN AND THE CROSS SLOPE SHALL NOT EXCEED 2.0%

(F) INDICATES PEDESTRIAN RAMP - SLOPE SHALL BE GREATER THAN 2.0% AND LESS THAN 5.0% IN THE DIRECTION SHOWN AND CROSS SLOPE SHALL NOT EXCEED 2.0%

STANDARD PLAN SHEET NO. 5-297.250 (2 OF 5)	PEDESTRIAN CURB RAMP DETAILS
STANDARD APPROVED: APRIL 10, 2013	ST. FRANCIS, MN

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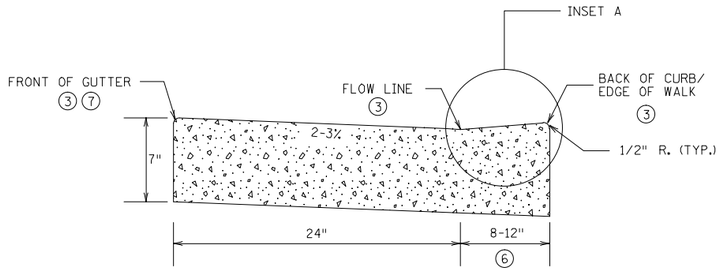
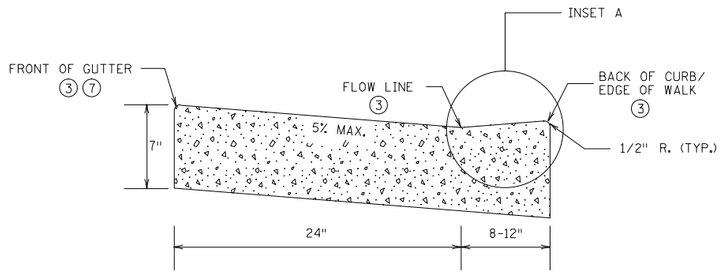
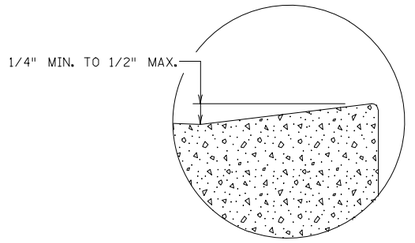
ST. FRANCIS, MINNESOTA
DEVELOPMENT STANDARDS
PEDESTRIAN RAMP DETAILS (2 OF 5)



NON PERPENDICULAR ①

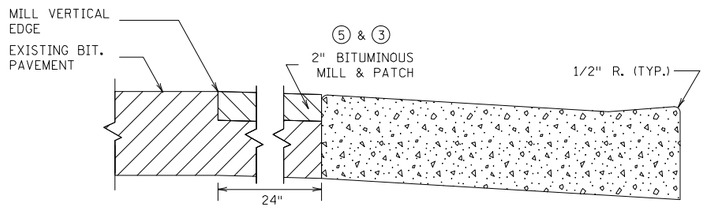


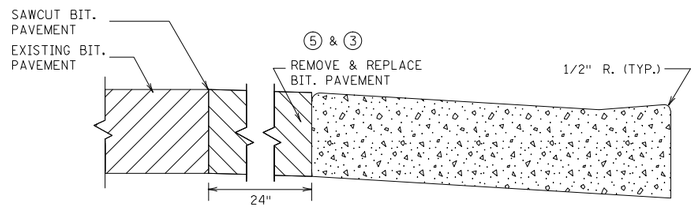
PERPENDICULAR ②

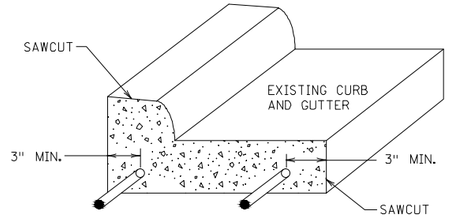


INSET A

PEDESTRIAN ACCESS ROUTE CURB & GUTTER DETAIL

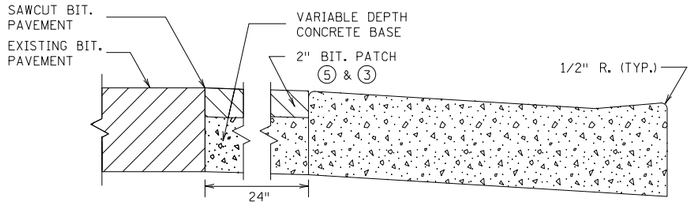


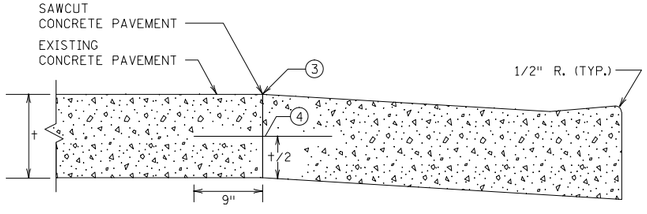




CURB AND GUTTER REINFORCEMENT ⑧

FOR USE ON CURB RAMP RETROFITS





PAVEMENT TREATMENT OPTIONS IN FRONT OF CURB & GUTTER

FOR USE ON CURB RAMP RETROFITS

NOTES:

POSITIVE FLOW LINE DRAINAGE SHALL BE MAINTAINED THROUGH THE PEDESTRIAN ACCESS ROUTE (PAR) AT A 2% MAXIMUM.

NO PONDING SHALL BE PRESENT IN THE PAR.

ANY VERTICAL LIP THAT OCCURS AT THE FLOW LINE SHALL NOT BE GREATER THAN 1/4 INCH.

① FOR USE AT CURB CUTS WHERE THE PEDESTRIAN'S PATH OF TRAVEL IS ASSUMED NON PERPENDICULAR TO THE GUTTER FLOW LINE. RAMP TYPES INCLUDE: FANS, DEPRESSED CORNERS, & ONE WAY AND COMBINED DIRECTIONALS.

② FOR USE AT CURB CUTS WHERE THE PEDESTRIAN'S PATH OF TRAVEL IS ASSUMED PERPENDICULAR TO THE GUTTER FLOW LINE. RAMP TYPES INCLUDE: PERPENDICULAR, TIERED PERPENDICULAR, PARALLEL, AND DIAGONAL RAMPS.

③ THERE SHALL BE NO VERTICAL DISCONTINUITIES GREATER THAN 1/4".

④ DRILL AND GROUT NO. 4 EPOXY-COATED 18" LONG TIE BARS AT 30" CENTER TO CENTER INTO EXISTING CONCRETE PAVEMENT.

⑤ ELEVATION CHANGE TAKES PLACE FROM THE EXISTING TO NEW FRONT OF GUTTER. PATCH IS USED TO MATCH THE NEW GUTTER FACE INTO THE EXISTING ROADWAY.

⑥ VARIABLE WIDTH FOR DIRECTIONAL CURB APPLICATIONS.

⑦ TOP FRONT OF GUTTER SHALL BE CONSTRUCTED FLUSH WITH PROPOSED ADJACENT PAVEMENT ELEVATION. PAR GUTTER SHALL NOT BE OVERLAID.

⑧ WHERE PLAN SPECIFIES, DRILL AND GROUT 2 - NO. 4 X 12" LONG REINFORCEMENT BARS (EPOXY COATED).

STANDARD PLAN SHEET NO. 5-297.250 (3 OF 5)	PEDESTRIAN CURB RAMP DETAILS
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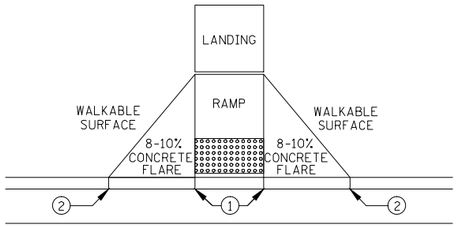
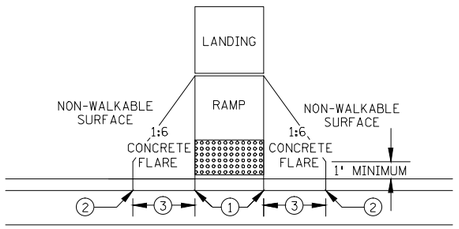
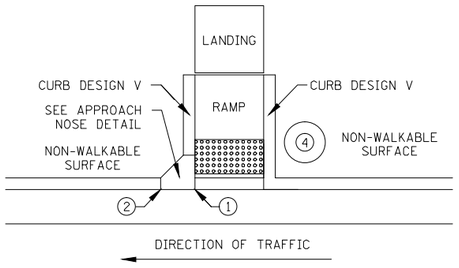
ST. FRANCIS, MINNESOTA
DEVELOPMENT STANDARDS
PEDESTRIAN RAMP DETAILS (3 OF 5)



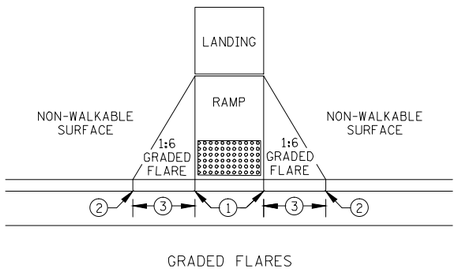
PAVED FLARES
ADJACENT TO WALKABLE SURFACE



PAVED FLARES
ADJACENT TO NON-WALKABLE SURFACE

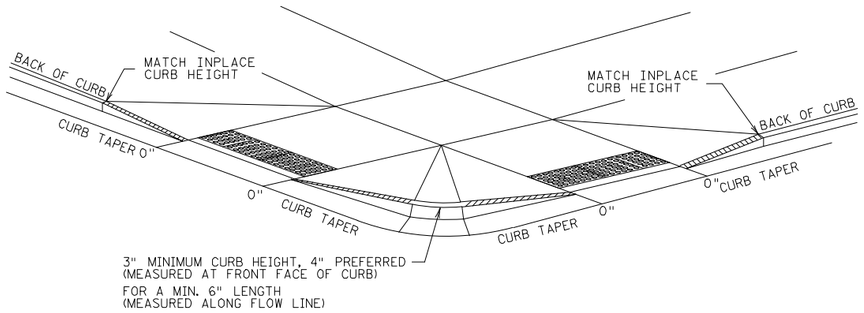


RETURNED CURB

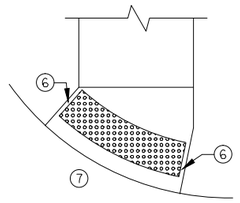


GRADED FLARES

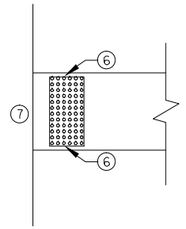
TYPICAL SIDE TREATMENT OPTIONS ⑤



DETECTABLE EDGE WITH
CURB AND GUTTER ⑧

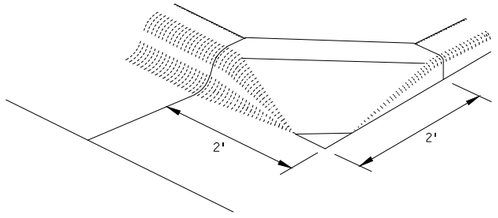


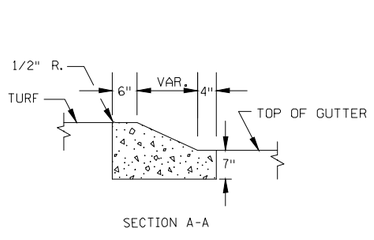
RADIAL DETECTABLE WARNING



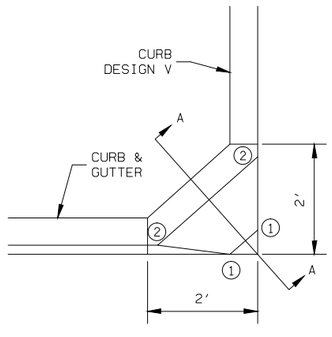
RECTANGULAR DETECTABLE WARNING

DETECTABLE EDGE WITHOUT CURB AND GUTTER





SECTION A-A



APPROACH NOSE DETAIL
FOR DOWNSTREAM SIDE OF TRAFFIC

NOTES:

SEE STANDARD PLATE 7038 AND THIS SHEET FOR ADDITIONAL DETAILS ON DETECTABLE WARNING.

WHETHER A SURFACE IS WALKABLE OR NOT SHALL BE DETERMINED BY THE ENGINEER.

CONCRETE FLARE LENGTHS ADJACENT TO NON-WALKABLE SURFACES SHOULD BE LESS THAN 8' LONG MEASURED ALONG THE RAMPS FROM THE BACK OF CURB.

① 0" CURB HEIGHT.
② FULL CURB HEIGHT.
③ 2' - 3' FLARE.
④ IMMOVABLE OBJECT OR OBSTRUCTION.
⑤ SIDE TREATMENTS ARE APPLICABLE TO ALL RAMP TYPES AND SHOULD BE IMPLEMENTED AS NEEDED ON ALL RAMPS AS FIELD CONDITIONS DICTATE. THE ENGINEER SHALL DETERMINE THE RAMP SIDE TREATMENTS BASED ON MAINTENANCE OF BOTH ROADWAY AND SIDEWALK, ADJACENT PROPERTY CONSIDERATIONS, AND MITIGATING CONSTRUCTION IMPACTS.
⑥ WHEN NO CONCRETE FLARES ARE PROPOSED, THE CONCRETE WALK SHALL BE FORMED AND CONSTRUCTED PERPENDICULAR TO THE EDGE OF ROADWAY. MAINTAIN 3" BETWEEN EDGE OF DOMES AND EDGE OF CONCRETE.
⑦ IF NO CURB AND GUTTER IS PLACED IN RURAL SECTIONS, DETECTABLE WARNINGS SHALL BE PLACED 1' FROM THE EDGE OF ROADWAY TO PROVIDE VISUAL CONTRAST.
⑧ ALL CONSTRUCTED CURBS MUST HAVE A CONTINUOUS DETECTABLE EDGE FOR THE VISUALLY IMPAIRED. THIS DETECTABLE EDGE REQUIRES DETECTABLE WARNINGS WHEREVER THERE IS ZERO-INCH HIGH CURB. CURB TAPERS ARE CONSIDERED A DETECTABLE EDGE WHEN THE TAPER STARTS WITHIN 3" OF THE EDGE OF THE DETECTABLE WARNINGS AND UNIFORMLY RISES TO A 3-INCH MINIMUM CURB HEIGHT. ANY CURB NOT PART OF A CURB TAPER AND LESS THAN 3 INCHES IN HEIGHT IS NOT CONSIDERED A DETECTABLE EDGE AND THEREFORE IS NOT COMPLIANT WITH ACCESSIBILITY STANDARDS.

STANDARD PLAN SHEET NO. 5-297.250 (4 OF 5)	PEDESTRIAN CURB RAMP DETAILS
STANDARD APPROVED: APRIL 10, 2013	ST. FRANCIS, MN

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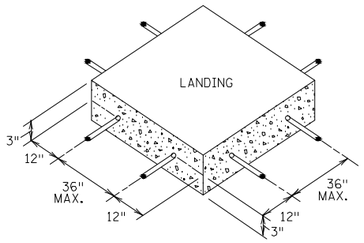
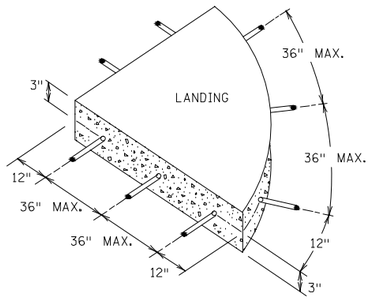
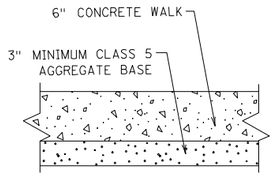
ST. FRANCIS, MINNESOTA
DEVELOPMENT STANDARDS
PEDESTRIAN RAMP DETAILS (4 OF 5)

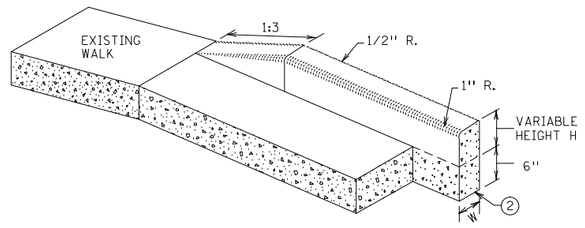




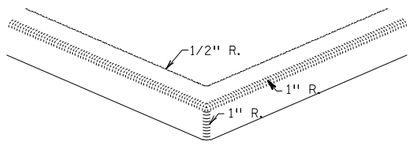
SIDEWALK REINFORCEMENT ⑤ ⑥



TYPICAL SIDEWALK SECTION WITHIN INTERSECTION CORNER

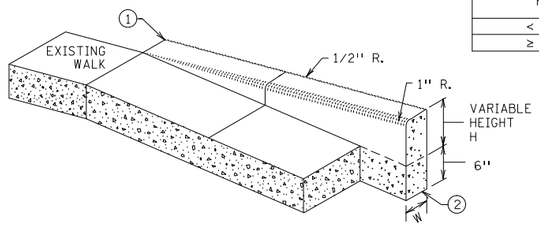


V CURB ADJACENT TO LANDSCAPE
CURB WITHIN SIDEWALK LIMITS

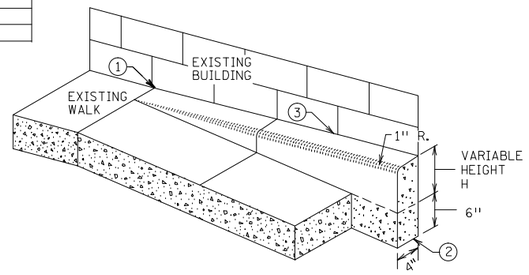


V CURB INTERSECTION

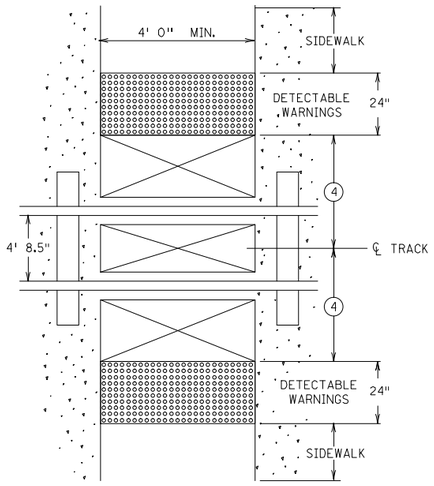
CONCRETE CURB DESIGN V	
CURB HEIGHT H	CURB WIDTH W
< 6"	4"
≥ 6"	6"



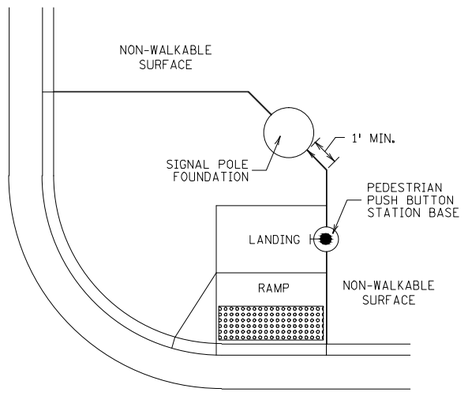
V CURB ADJACENT TO LANDSCAPE
CURB OUTSIDE SIDEWALK LIMITS



V CURB ADJACENT TO BUILDING OR BARRIER



RAILROAD CROSSING
PLAN VIEW



CONCRETE WALK EDGES ADJACENT
TO CONCRETE STRUCTURES

NOTES:

ALL V CURB CONTRACTION JOINTS SHALL MATCH CONCRETE WALK JOINTS.

WHERE RIGHT-OF-WAY ALLOWS, USE OF V CURB SHOULD BE MINIMIZED. GRADING ADJACENT TURF OR SLOPING ADJACENT PAVEMENT IS PREFERRED.

V CURB SHALL BE PLACED OUTSIDE THE SIDEWALK LIMITS WHEN RIGHT OF WAY ALLOWS.

V CURB NEXT TO BUILDING SHALL BE A 4" WIDTH AND SHALL MATCH PREVIOUS TOP OF SIDEWALK ELEVATIONS.

① END TAPERS AT TRANSITION SECTION SHALL MATCH INPLACE SIDEWALK GRADES.

② ALL V CURB SHALL MATCH BOTTOM OF ADJACENT WALK.

③ EDGE BETWEEN NEW V CURB AND INPLACE STRUCTURE SHALL BE SEALED AND BOND BREAKER SHALL BE USED BETWEEN EXISTING STRUCTURE AND PLACED V-CURB.

④ EDGE OF DETECTABLE WARNING SURFACES SHALL BE PLACED 15' MAXIMUM FROM THE CENTERLINE OF THE TRACK. WHEN PEDESTRIAN GATES ARE PROVIDED, DETECTABLE WARNING SURFACES SHALL BE PLACED ON THE SIDE OF THE GATES OPPOSITE THE RAIL, 17" - 19" FROM THE APPROACHING SIDE OF THE GATE ARM.

⑤ WHEN PLAN SPECIFIES, DRILL AND GROUT NO. 4 12" LONG REINFORCEMENT BARS AT 36" MAX. CENTER TO CENTER (EPOXY COATED).

⑥ TO ENSURE RAMPS AND LANDINGS ARE PROPERLY CONCTRUCTED, LANDINGS MAY BE CAST SEPARATELY. FOLLOW SIDEWALK REINFORCEMENT DETAILS ON THIS SHEET WHEN LANDINGS ARE CAST SEPARATELY.

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