SECTION 33 30 00
SANITARY SEWER

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section specifies installing sanitary sewers.

B. Related Work Specified Elsewhere:
   1. Grading, excavating and backfilling: Section 31 23 00.
   2. Maintenance, support and restoration of utility facilities: Section 33 01 00.

1.02 SUBMITTALS:

Submit the following for approval in accordance with the General Requirements and with the additional requirements as specified for each:

A. Shop Drawings:
   1. Drawings for each size and configuration of precast manhole with details of accessories and joints.
   2. Diagrams showing dimensioned locations for openings in precast concrete manhole walls.

B. Documentation:
   1. Submit calculations for modified or special designs to demonstrate compliance with required load-bearing capacity, certified by a professional engineer registered in the jurisdiction where the work is to be installed.

C. Samples:
   1. Sewer brick: Ten.
   2. Manhole brick: Ten.

D. Certification.

1.03 QUALITY ASSURANCE:

A. Codes, Regulations, Reference Standards and Specifications:
   1. Comply with codes and regulations of the jurisdictional authorities.
   2. Building Stone Institute: Stone Catalog
   3. CISPI: HSN 85.
   4. AASHTO: H20, M33, M36, M153, M175, M176, M190, M252, M288, T85, T96, T104.
   5. ACI: 318.
   6. ASTM: A36, A48, A53, A74, A167, C14, C32, C33, C76, C144, C150, C207, C361, C425, C443, C478, C700, D698, D3034, D5034. D5035.
   7. MS: MIL-P-23236.
   8. SSPC: SP-6.

B. Allowable Tolerances:
   1. Rate of infiltration into sanitary sewer lines not to exceed 100 gallons per inch diameter per 24 hours per mile of sewer.
   2. Subgrade: Plus-or-minus 1/2 inch of elevation shown.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Formwork: Section 03 10 00.

B. Reinforcing Steel: Section 03 20 00.

C. Portland Cement Concrete: Section 03 30 00, Class 4000, unless otherwise shown.

D. Aggregate for Subgrade Foundation: ASTM C33, coarse aggregate, No. 4. Where shown use layers of No. 4 and No. 67 in combinations and proportions determined by field conditions and as approved.

E. Aggregate for Pipe Cradle: ASTM C33, coarse aggregate No. 67.

F. Concrete Pipe:
   1. 10-inch diameter and smaller:
      a. STM C14, Class 2, nonreinforced concrete pipe.
      b. Bell-and-spigot type.
      c. Joints fabricated in accordance with ASTM C361. Physical characteristics for rubber gaskets in accordance with ASTM C443.
   2. 12-inch diameter and larger:
      a. ASTM C76, bell-and-spigot or tongue-and-groove, Class IV, unless otherwise shown.
      b. Radius (bevel) pipe, with drop between two pipe sections not exceeding the common wall thickness.
      c. Rubber gasket joints, when required, fabricated in accordance with ASTM C361. Physical characteristics for rubber gaskets in accordance with ASTM C443.
      d. Acceptance tests as specified in ASTM C76 form basis of acceptance for concrete pipe in accordance with the following:
         1) 72-inch diameter and smaller: Acceptance on the Basis of Plant Load Bearing Test, Material Tests and Inspection of Manufactured Pipe for Visual Defects and Imperfections.
         2) Larger than 72 inches in diameter: Acceptance on the Basis of Material Tests and Inspection of Manufactured Pipe for Defects and Imperfections.
         3) Minimum laying lengths:
            a) Sanitary sewer and combined system construction:
            b) 72-inch diameter and smaller: Eight feet.
            c) Larger than 72-inch diameter: Six feet.
      e. Rubber gaskets: ASTM C443.

f. Jointing mastic: Elastic, water-resistant, formulation of plastic bituminous materials, nonflammable solvent and inert fillers so combined that:
   1) When applied to a vertical metal surface and heated to 120F, jointing mastic will neither slump nor lose plasticity.
   2) When applied directly from container without further fixing, jointing mastic can be applied in even, adherent coat within temperature range of 20F to 100F.

G. Plastic Pipe:
   1. Polyvinyl chloride (PVC) pipe: ASTM D3034, SDR-35.

H. Vitrified Clay Pipe: ASTM C700; Joints, ASTM C425, using plastic materials.

I. Cast-Iron Soil Pipe and Fittings: ASTM A74, extra-heavy (XH), with hub and spigot ends so constructed that joints may be made with gaskets conforming to CISPI Designation HSN 85 and the requirements of the relevant plumbing codes.

J. Lubricant for Rubber Gasket Pipe Joints: Vegetable oil soap.

K. Mortar Materials:
   1. Portland cement: ASTM C150, Type I.
   2. Sand: ASTM C144, natural sand.
   3. Lime: Pressure-hydrated, ASTM C207, Type S.
   4. Water: Potable.
   5. Pigment: As approved.

L. Brick: ASTM C32; solid brick; Grade MS for manhole brick, Grade SS for sewer brick; 2-1/4 inches by 3-3/4 inches by eight inches.

M. Precast Concrete Manholes:
   1. Cylindrical, eccentrical and conical: ASTM C478.
   2. Other configurations: ACI 318, AASHTO H20.

N. Manhole Steps:
   1. Cast iron: ASTM A48 Class 30 A.
   2. Rebar: No. 4 reinforcing bar with molded polypropelene or rubber encasement.

O. Manhole Frame and Cover; And Other Castings For Service With Utility Systems:
   1. Authority manhole: Cast-iron, ASTM A48, Class 30, with METRO logo.
   2. Utility company manhole: Manhole frame and cover furnished as part of the Contract or furnished by the utility as shown on the drawings.
   3. Rust-resistant cast iron or rust-resistant malleable cast iron.
   4. True to pattern in form and dimensions, free from pouring faults, sponginess, cracks, blowholes and defects affecting strength.
   5. Fillets at angles in casting with arises sharp and perfect.
   6. Sandblasted to effectively remove scale and sand, presenting smooth, clean and uniform surfaces. Coated with bituminous coating.
   7. Metro logo: For utility components which will remain METRO property and are not within boundaries of utility easements as shown: Cast METRO logo as shown.

8. Covers that receive paver tile:
   a. Omit bituminous coating.
   b. Provide positioning lug and lug receptor as a permanent part of the cover and frame rim so that the cover can only be installed (flush) in one position.

P. Metal Water Seals for Basin Connections: Neenah Foundry Model No. R-3707 or equal.

Q. Structural Steel Members: ASTM A36.

R. Steel Pipe: ASTM A53, black finish, extra strong wall class.

S. Stainless Steel Angle: ASTM A167, Type 304.

T. Jute for Caulking: Good quality jute, free from tar, oil, or grease and dry when installed.

U. Preformed Expansion Joint Fillers: AASHTO M153, Type I, Type II or Type III.

V. Bituminous Expansion Joint Filler: AASHTO M33.

W. NOT USED

X. Miscellaneous Metal: Section 05 50 00.

Y. Coal-Tar Epoxy Coating:
   1. Two-component.
   2. Chemically cured.
   3. Conforming to MS MIL-P-23236 (Ships), Type I, Class 2.
   4. Thinner: As recommended by manufacturer of coating and as approved.

2.02 MORTAR AND GROUT MIXES:

A. General Requirements:
   1. Mix dry in specified proportions by volume. Control and maintain accurate measurement throughout progress of work.
   2. Add sufficient water as specified to produce approved consistency.
   3. Do not mix in amount exceeding that which can be used within one hour after introduction of water.
   4. Do not retemper mix that has begun to set nor use such mix in the work.
   5. Where shown, specified or directed, mix pigment into dry mix to attain color selected by the Engineer. Pigment not to exceed 10 percent of dry batch weight of cement.

B. Proportions:
   1. Mortar: One part portland cement, 2-1/2 parts sand and water sufficient to produce stiff workable mix.
   2. Grout: One part portland cement, 2-1/2 parts sand and water sufficient to produce plastic flowable mix.
   3. Mortar for setting and pointing granite: One part portland cement, four to five parts sand, one part lime and water sufficient to produce approved consistency.
   4. Mortar for setting granite paving and grouted granite blocks: One part portland cement, four parts sand, with water sufficient to produce approved consistency.

PART 3 - EXECUTION

3.01 EXCAVATION FOR SEWER:

A. Perform excavation for sewers line and grade shown in accordance with Section 31 23 00 and the following additional requirements:
   1. Excavate test pits sufficiently in advance of construction of sewers so that reasonable changes in line and grade can be made where location of existing structures varies from that shown.
   2. Excavate below horizontal plane extending two feet above top of sewer to maximum width of trench pay width shown. Where dimensions are not shown, make maximum horizontal width of excavation 18 inches from outside of sewer and minimum six inches. Where approved, excavation above such plane may exceed specified dimensions.
   3. If excavation exceeds permissible dimensions, encase pipe or install pipe of higher strength.
   4. Where necessary to place backfill or embankment so that trench can be excavated, extend backfill or embankment full depth laterally at least 2-1/2 times diameter of pipe on each side measured from centerline of pipe.

3.02 DOES NOT APPLY:

3.03 PIPE CRADLE:

A. Place pipes on cradle of aggregate or concrete where shown.

B. Place aggregate so as to avoid segregation; compact to maximum practicable density so that pipe can be laid to required tolerances.

3.04 LAYING PIPE:

A. General Requirements:
   1. Excavate to lines and grades shown in accordance with Sections 31 23 00 and herein. Excavate depressions for bells.
   2. Protect pipe and fittings during handling to prevent damage.
   3. Place, shape and compact bedding material to receive barrel of pipe. Type and thickness of bedding material as shown.
   4. Start laying pipe at lowest point; lay true to line and grade shown.
   5. Install pipe to bear on bedding material along entire length. Shape bedding material to fit bells and flanges.
   6. Install pipe so that bells and grooves are on upstream end.
   7. Align each section of pipe with adjoining section with uniform annular space between bell and spigot and so as to prevent sudden offsets in flow line.
   8. As each section of pipe is laid, place sufficient backfill to hold it firmly in place.
   9. Keep interior of sewer clean as work progresses. Where small pipe size makes cleaning difficult, keep suitable swab or drag in pipe and pull through each joint immediately after jointing is completed.
   10. Keep trenches and excavations free of water during construction and until backfilled. Each day, excavate only as much trench as needed to lay pipe.
   11. When work is not in progress, securely plug ends of pipe and fittings to prevent trench water or other substances from entering pipes and fittings.

12. Where length of stub is not shown, install four-foot length and seal free end with brick masonry bulkhead or approved stopper.
13. Have work approved prior to covering pipe.
14. Where shown, place additional aggregate filter around and over pipe in lifts not exceeding six inches loose. Compact each lift before placement of next lift.
15. Backfill in accordance with Section 31 23 00.
16. Accomplish compaction by method that will avoid damage to pipe and will not disturb its alignment and grade. The use of vibratory rollers is prohibited until compacted cover over pipe has reached three feet or half the pipe diameter, whichever is greater.
17. Where cathodic protection is shown, apply coal-tar epoxy coating.

B. Vitrified Clay Pipe:
1. Nonperforated pipe:
a. Use pipe hoist, crane or other approved device when laying pipe greater than 18 inches diameter.
b. Prevent damage to premolded joint rings or attached couplings.
c. Clean joint contact surfaces immediately prior to jointing. To complete joint, use lubricants, primers or adhesives as recommended by pipe or joint manufacturer.

C. Concrete Pipe:
1. Bell-and-spigot joints:
a. Lay bell-and-spigot joint pipe as specified for vitrified clay pipe.
2. Tongue-and-groove joints:
a. Clean groove end of preceding pipe with wet brush and apply soft mortar to lower 1/4 of groove. Clean tongue end of succeeding pipe with wet brush and position it. Remove mortar from interior surface if squeezed out of joint.
b. Complete mortaring interior and exterior portions of joint for entire circumference, extending from previously placed mortar. Perform final exterior mortaring of joints three lengths of pipe behind laying.

D. Plastic Pipe:
1. Nonperforated pipe:
2. Join sections of pipe with couplings recommended by pipe manufacturer.

3.05 BACKFILL:

A. Perform backfilling only after inspection and approval of pipe laying.

B. On completion of construction, backfill excavation in accordance with Section 31 23 00.

3.06 DOES NOT APPLY.

3.07 DOES NOT APPLY.

3.08 JOINTS FOR COMBINED SEWER SYSTEM CONCRETE PIPE:

A. Use rubber gasket and bell-and-spigot pipe as specified.

B. Prior to jointing pipe, liberally coat pipe joints with lubricant.

C. Fit bell or spigot with gasket in accordance with manufacturer's instructions.

D. Joint pipes with equipment designed for purpose.

E. Before joint is completely home, check position of gasket using suitable gauge. If gasket is found to be dislocated, repeat entire joining process using new gasket.

3.09 JOINTS FOR VITRIFIED CLAY PIPE:

A. Immediately before joining vitrified pipe, liberally coat bell with lubricant and fit spigot with gasket.

B. Join pipes using equipment designed for purpose.

3.10 JOINTS FOR CAST-IRON SOIL PIPE AND FITTINGS:

A. Immediately before joining cast-iron soil pipe and fittings, liberally coat hub with lubricant and fit spigot with pipes using equipment designed for purpose.

3.11 CONNECTIONS WITH EXISTING SEWERS:

A. Make connections with existing public sewers in accordance with requirements of the jurisdictional authority.

B. Connect house sewers in accordance with local plumbing code.

C. Connect house sewers by means of Y-branches. Approved cast-iron thimble may be used, provided it is bonded into sewer pipe wall with approved epoxy at manufacturer's plant.

D. Do not connect existing sewer to sewer under construction unless approved.

3.12 TUNNELING AND JACKING:

A. Perform tunneling and jacking by approved methods.

B. Where open cut is specified and the Engineer permits the work to be done by tunneling or jacking, perform such work as specified and as approved.

C. Cost of material substitutions required by change of methods will be borne by the Contractor.

D. Make horizontal borings necessary to lay pipe lines true to line and grade.

E. When sewers are laid in borings, completely fill void between outside barrel of pipe and boring with cement grout pumped into place.

F. When drainage pipes are laid in borings, completely fill void between pipe and boring with sand, using water pressure to ensure that voids are filled.

G. Methods of boring and filling of voids between pipe and boring are subject to approval.

3.13 CAST-IN-PLACE CONCRETE CONSTRUCTION:

A. Conform to applicable requirements of Sections 03 10 00, 03 20 00 and 03 30 00. Section designer to specify the type of cement to be used. The type of cement will vary depending upon the jurisdiction where the work is performed.
   1. Cement - per local jurisdiction standards.

B. Construct concrete support systems where shown. Section designer to specify the type of mortar to be used. Mortar type will vary depending upon jurisdiction in which the work is performed.
   1. Mortar and cement - per local jurisdiction standards.

3.14 NOT USED

3.15 MANHOLES:

A. Construct manholes of precast sections, cast-in-place concrete or brick as shown.

B. Provide base of precast or cast-in-place construction. Make watertight connection between base and risers.

C. Unless otherwise shown, place axes of manholes directly over centerlines of pipes.

D. Construct appropriate flow channels in bottom of manholes.

E. Where necessary, build connections for public and residential sewers into manholes. Cut pipe flush with inside wall of structure. Do not build pipe into wall; provide mortar joint between pipe and structure.

F. Install manhole steps and cast iron frame and cover for each manhole; adjust frame and cover to proper grade by brick construction.

3.16 COATING APPLICATION AND REPAIR:

A. Preparation of surface: Perform the following in order given:
   1. Clean surfaces contaminated with oil or grease using naphtha or xylol.
   2. Remove rust and mill scale from surfaces by dry abrasive blasting to commercial finish in accordance with SSPC SP-6.
   3. Coat surfaces within 24 hours and before dew point is reached.
   4. Apply coating only to surfaces which are dry and free of contaminants. Whip blast surfaces not coated within specified time limit.

B. Application of coating:
   1. Mix coating in quantity which can be applied within its pot life if in accordance with manufacturer's recommendation. Thin only with approval.
   2. Apply coating to exterior surfaces of pipes and fittings in accordance with recommendations of coating manufacturer and as follows:
      a. Two coats of equal thickness.
      b. Total dry film thickness: 20 mils.

c. Pretreat first coat as required prior to application of second coat.

d. Apply second coat before first coat has dried tack-free but not later than 24 hours after application of first coat, unless otherwise recommended by coating manufacturer.

e. Inspect coating prior to burial. Repair damages in accordance with recommendations for field corrections by coating manufacturer.

3.17 DOES NOT APPLY

3.18 FIELD QUALITY CONTROL:

A. Maximum Surface Variation Tolerances:

1. Grouted riprap: 1-1/4 inches in four feet from true plane.
2. Bituminous concrete: Plus-or-minus 1/4 inch from specified grade in 25 feet.
3. Cast-in-place concrete: Plus-or-minus 1/4 inch from specified grade in 15 feet.
4. Precast concrete block: Plus-or-minus 1/2 inch from specified grade in 25 feet.
5. Paving brick: Plus-or-minus 1/2 inch from specified grade in 25 feet.

B. Leakage Tests:

1. Perform leakage tests on sanitary sewer lines to verify compliance with allowable tolerances specified.

C. Obstruction Tests:

1. Perform field tests to verify that installed storm and sanitary systems are free from obstructions.
2. Remove obstructions by excavating at the apparent obstruction and repairing or replacing the defective pipe as directed by the Engineer.

END OF SECTION