

# Article 2 Sanitary

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## I. Sanitary Sewer Design

### A. General

1. Adoption of Standards by Reference
  - a) The [Ten State Standards](#) shall be followed, except as modified in these standards.
2. Easement Requirements
  - a) Sanitary sewer easement widths shall be equal to  $2D+10$  feet, where D is the maximum depth of the trench on a particular run of sewer. The minimum sanitary sewer easement width shall be 30 feet.
  - b) The sanitary sewer shall be located 5 feet from the center of the easement, leaving D feet on one side of the sewer and  $D+10$  feet on the other.
  - c) Sanitary sewer easement widths may vary from run to run of sewer, provided that the above requirements are met.
  - d) When sanitary sewer mains cannot be located in standard width easements, the easement width and pipe location therein must be approved by the PSAA. In such cases, increased slope, casing pipe, epoxy-lined ductile iron pipe for sanitary sewer use meeting the standards of ASTM A746 (Standard Specification for Ductile Iron Gravity Sewer Pipe), or other special provisions may be required.
3. Sanitary Sewer Location and Required Extension
  - a) Sanitary sewers shall not be located in areas of unusual topographic conditions or under stormwater detention basins. Location under bioswales, rain gardens, or other green infrastructure are discouraged and require approval of the PSAA.
  - b) See Article 5 (Streets), Section I (Street and Pavement Design), B.13., of these Standards, for utility location requirements.
  - c) For Private Development Projects, sanitary sewers shall be extended to the limits of the development to allow for future extension.

#### 4. Plan Information Required

- a) Plans for sanitary sewers shall include the information required in Article 1 (General), Section III (Content of Plans and Detailed Specifications) of these Standards.
- b) In addition, the following information shall be provided:
  - (1) A copy of the design calculations for all sanitary sewers.
  - (2) The pipe material, size, percent of grade, and length of run between all manholes shall be shown in the profile view. Pipe length shall be measured from center of upstream manhole to center of downstream manhole.
  - (3) All existing and proposed pipe invert elevations at all manhole structures shall be shown in the profile view.
  - (4) The percent of grade and invert elevation at the terminal end of all sanitary sewer service leads shall be shown in the plan view.
  - (5) All service tee or wye locations are to be stationed in the profile view.
  - (6) All basement or first floor elevations (whichever is the lowest served by the sanitary sewer) shall be given on both the plan and profile views.
  - (7) A casting schedule shall be provided including:
    - (a) Manhole number corresponding to the plan view
    - (b) Station
    - (c) Casting type (manufacturer and catalogue number)
    - (d) Top-of-casting elevation
    - (e) Manhole invert
    - (f) Manhole depth

#### **B. Capacity**

1. Sanitary sewer design flow computations shall be submitted for approval with a contour area map showing the tributary area to be serviced. Developmental phases, present and future, with acreages and any offsite areas contributing shall be shown with the number of lots or units included.

2. The Engineer shall submit detailed calculations to establish design flows sufficient for the ultimate tributary population. A copy of the basis of design for the sanitary sewers must be submitted with the construction plans.
3. Once approved, the basis of design shall be included on the plan set.
4. Design flow rates shall be per Appendix B (Sanitary Design Dry Weather Flow Rates) of these Standards. In cases where a proposed Type of Facility or Use is not specifically identified in Appendix B, design flow rate shall be as directed by the PSAA. Sewer capacities (for residential developments) shall be for sewers flowing half-full.

### **C. Size**

1. Minimum size for sanitary sewer mains shall be nominal 8-inch diameter.
2. In no case shall the downstream sewer main diameter be smaller than the upstream diameter.

### **D. Velocity**

1. Minimum design velocity for sanitary sewers shall be 2 feet per second with the pipe flowing full. The PSAA may require a greater minimum velocity where deemed necessary to maintain adequate cleaning velocity through manholes.
2. The maximum design velocity for sanitary sewers shall be 10 feet per second with the pipe flowing full. Special consideration will be given in areas of steep topography.
3. All sewers shall be designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula using an "n" value of 0.013. The minimum slopes required for sewers 36 inches or less are provided in Table A. However, slopes greater than these may be required for construction, to control sewer gases or to maintain self-cleansing velocities at all rates of flow within the design limits.
4. The PSAA may require special provisions to avoid scour and protect against displacement including anchoring with concrete anchors or approved equal.

### **E. Deflection**

1. There shall be a minimum of 0.10-foot fall through a manhole where the sewer has a horizontal deflection of up to 30 degrees.

2. For manholes where the sewer has a horizontal deflection from 30 degrees to 90 degrees, there shall be a minimum of 0.20-foot fall.
3. There shall be no more than 90 degrees of horizontal deflection through a manhole.

**F. Slope**

1. Minimum slope for each sanitary sewer pipe size shall be per Table A below unless otherwise specified herein.

<b>Table A Minimum Slopes for Sanitary Sewers</b>	
<b>Pipe Diameter</b>	<b>Minimum Grade (%)</b>
8"	0.50 *
10"	0.28
12"	0.22
15"	0.15
18"	0.12
21"	0.10
24"	0.08
27"	0.07
30"	0.06
36"	0.05
*A grade of 0.40% may be permitted where special conditions exist. This must be approved in writing by the PSAA.	

2. Caution must be used when designing sewers with minimum grades to insure proper installation.
3. The terminal run of an 8-inch diameter sewer shall be laid at a uniform grade of not less than 0.6% between manholes.
4. Wherever there is an increase in pipe size at a manhole, the grades shall match at the eight tenths flow lines, which is 0.8 of the diameters of incoming and the outgoing pipes, as measured from the inverts.

## **G. Depth and Cover**

1. Sewer depth design shall be deep enough to serve neighboring properties when the sewer is extended at a future date.
2. Sewer depth shall be sufficient to serve proposed basements both onsite and for neighboring parcels. A minimum depth of 10 feet shall typically be necessary. See Article 12 (Standard Details), SD-SN-5 (Sanitary Sewer Depth) of these Standards.
3. If basements are not to be constructed, the finished first floor elevation shall be treated as the “basement” floor elevation for purposes of standards per Article 12 (Standard Details), SD-SN-5 (Sanitary Sewer Depth) of these Standards and the pertinent assumptions regarding the sewer and lead depth below that elevation shall apply.
4. Minimum depth of cover to the top of the pipe shall be 5 feet. The minimum depth may, however, be reduced to 4 feet for short stretches not to exceed 50 feet in length if the reduction is approved in writing by the PSAA.
5. The maximum depth to invert of any sanitary sewer shall not exceed the depth recommended by the manufacturer for each size and class of pipe. Where required depth cannot be achieved with one type of pipe, a suitable alternative pipe shall be used as approved by the PSAA. Alternative material must extend from manhole to manhole.

## **H. Separation Clearances**

1. There shall be a minimum of 10 feet of horizontal clearance and 18 inches of vertical clearance at perpendicular crossings between sanitary sewers and water mains measured outside edge to outside edge of pipe. The PSAA may permit exceptions subject to Ten State Standards and with approval of EGLE.
2. There shall be adequate horizontal separation between sanitary sewers and all utilities to allow a 1:1 trench slope from the bottom of the deeper utility that will not undermine any shallower utility, or a minimum of 5 feet of separation whichever is greater.
3. There shall be a minimum of 1 foot of vertical clearance at perpendicular crossings of sanitary sewers with utilities other than water mains.

## **I. Manhole Size, Location, and Maintenance Access**

1. Manholes shall be placed at the terminus of each line, at every change of grade, direction, and pipe size, at each junction of sewer mains, and at high flow service lead locations where directed by the PSAA.
2. The maximum distance between manholes shall be 400 feet for pipes 15 inches or less in diameter and 500 feet for pipes 18 inches or larger in diameter.
3. Minimum inside diameter of manholes shall be 4 feet. Diameters greater than 4 feet shall be required based on the size, number, and alignment of pipes entering the manhole in accordance with Article 12 (Standard Details), SD-SN-1 (Sanitary Manhole) of these Standards.
4. Minimum access diameter shall be 2 feet.
5. All manholes shall be located such that they will be directly accessible by vehicular maintenance equipment. Manholes shall be located within 10 feet of edge of pavement.
6. All surfaces to be utilized for manhole access shall be designed to support a fully loaded sewer cleaning vehicle (66,000 pounds).
7. Unless approved by the PSAA, manholes shall not be located in areas subject to flooding. If such locations cannot be avoided and are approved, watertight manhole covers and castings or other measures as directed by the PSAA are required.
8. No openings shall be made in precast units which would leave less than 18 inches of undisturbed circumferential wall length, or which would remove more than 40% of the circumference along any horizontal plane.

## **J. Manhole Drop Connections**

1. Outside drop manhole connections shall be permitted only whenever a sewer main enters a manhole at an invert elevation of more than 2 feet above the outlet pipe invert elevation and if approved by the PSAA.
2. Outside drop connections for sewer mains shall be one size smaller than the size of the incoming sewer but in no case less than 8-inch diameter. Larger diameter drop connections may be required as directed by the PSAA.
3. Inside drop connections will not be permitted unless approved in writing by the PSAA.



4. Where drop connections are permitted, a formed channel shall be provided.

#### **K. Pollutant Interceptors and Monitoring Points**

1. Grease, oil and sand interceptors and monitoring points shall be provided where required by City Code, Title II (Utilities and Services), [Chapter 28 \(Solid Waste Management\), Section 2.43.1\(9\) \(Prohibited discharges\)](#).

#### **L. Sanitary Service Leads and Risers**

1. Minimum diameter of new sanitary service leads shall be 6-inch. Existing 4-inch diameter leads may be replaced with 4-inch leads.
2. Maximum lead size shall be one standard size smaller than the sewer main unless otherwise approved by the PSAA.
3. Construction of sanitary service leads from a new public sanitary sewer main to each fronting parcel that the sewer is designed to serve shall be included with construction of the main.
4. For a Private Development project, the sanitary service lead shall be constructed to 10 feet beyond the public or private right-of-way line.
5. For a City Project, the sanitary service lead shall be constructed to within 5 feet of the right-of-way line.
6. Where sanitary sewer mains are constructed in easements for a Private Development project, the sanitary service lead shall be constructed to within 5 feet of the proposed building.
7. Typical sanitary service lead location shall be at the middle of the lot.
8. Sanitary service leads shall have a minimum of 5 feet of cover.
9. Sanitary service leads may not be tapped into a manhole except as otherwise specified herein or as specifically approved by the PSAA. In such cases, the PSAA may require any other needed modifications to these lead standards.
10. Sanitary service lead connections to an existing sanitary sewer main that are greater than one-half the main diameter shall be made as a cut-in wye.
11. The maximum diameter of a sanitary service lead tap into an existing sanitary sewer main via coring shall be one-half the diameter of the main. All such cored taps shall be performed by the City.

12. For all new leads greater than 6" diameter, a new manhole shall be installed on the main and the new lead tapped into that manhole at the 0.8 line of the sewer and in a formed channel.
13. Location of the wye shall be marked from the downstream manhole and from the nearest property corner on the sanitary sewer record plans. Where leads are not perpendicular to the property line, they shall be dimensioned to the side lot line at the property line.
14. When placed in the same trench as a water service lead, the water service lead shall be a minimum of 18" above the sewer lead and placed on a shelf of undisturbed earth. A minimum horizontal separation of 3 feet shall be maintained between the water and sanitary leads.
15. Minimum grade of sewer service leads shall be  $\frac{1}{8}$ " per foot or 1.0% for 6-inch diameter leads. If a sewer service lead is 8 inches in diameter or greater, the minimum grade of the lead shall be that of the minimum grade of a sewer main of equal size.
16. The maximum allowable grade of sewer service leads shall be 10%.
17. Downspouts, pool backwash, weep tile, footing drains, sump pump discharges, or any other conduit that carries storm or ground water shall not be allowed to discharge into sanitary sewers.
18. All risers shall be tapped at the 10 and 2 o'clock position of the receiving pipe. Connection shall be via a cut-in wye unless otherwise approved by the PSAA.

## II. Sanitary Sewer Materials

### A. Pipes, Joints, and Sewer Leads

1. Allowable Pipe and Sewer Lead Materials
  - a) SDR 26 polyvinyl chloride (PVC) pipe 4-15" conforming to current ASTM D3034, (Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings). Pipe shall have an integral wall bell and spigot.
  - b) PS115 PVC pipe 18-48" conforming to current ASTM F679 (Standard Specification for PVC Large Diameter Plastic Gravity Sewer Pipe and Fittings). Pipe shall have an integral wall bell and spigot.
  - c) Extra strength vitrified clay pipe conforming to ASTM C700 (Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated). Pipe shall be bell and spigot type and glazed. This material may be required when sewage flows may cause caustic conditions.
  - d) Concrete pipe conforming to ASTM C76 (Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe), Class IV or Class V, as required based on depth and loading, is permitted for sizes 18-inch diameter and larger.
  - e) Ductile iron pipe for sanitary sewer conforming to requirements of ASTM A746 (Standard Specification for Ductile Iron Gravity Sewer Pipe). Pipe shall be Pressure Class (PC) 350 for 12-inch and smaller, PC 250 for 14-20-inch, and PC 200 for 24-inch or as specified by PSAA. This material may be required by the PSAA in situations such as extreme or insufficient depth, narrow easements, well isolation, etc. Such pipe shall be ceramic epoxy lined.
  - f) For any class of pipe, a higher strength or greater thickness of pipe may be substituted for the minimum strength or minimum thickness of pipe specified for that class of pipe.
  - g) ASTM specified couplings shall be used for joining dissimilar materials. Couplings shall have a stainless-steel shield designed for resistance to shear forces.

## 2. Joints and Lubricants

- a) Lubricants used in making up joints shall be supplied by the pipe manufacturer, and the joints shall be coupled in accordance with the manufacturer's requirements.
- b) Joints for PVC pipe shall be elastomeric gasketed push-on joints conforming to the requirements of ASTM D3212 (Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals). Gaskets shall conform to ASTM F477 (Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe).
- c) Joints for reinforced concrete pipe shall meet ASTM C443 (Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets).
- d) Joints for vitrified clay sewer pipe and leads shall be premium compression type joints conforming to the requirements of ASTM C425 (Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings).
- e) Joints for ductile iron pipe for sanitary sewer shall conform to the requirements of ANSI/AWWA C111/A21.11 (Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings).

## 3. Pipe Marking

- a) The following information shall be clearly marked on each length of pipe:
  - (1) The pipe designation and class (e.g., C 76, Class IV). For PVC pipe, this shall include the PVC cell classification.
  - (2) The name or trademark of the manufacturer.
  - (3) Identification of the manufacturing plant.
  - (4) The date of manufacture.
  - (5) Testing lot number or testing lab stamp.
  - (6) Beveled pipe shall be marked with the amount of bevel, and the point of maximum length shall be marked on the beveled end.

4. Manufacturer's Certification

- a) All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the relevant standard specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the PSAA and must be pre-approved prior to the start of construction.

5. Materials Inspection

- a) All pipe furnished shall be subject to inspection on arrival at the job site by the PSAA. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Standards.
- b) The Contractor shall notify the PSAA sufficiently in advance so that an Inspector can be on the job site during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.
- c) Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor without cost to the City.
- d) Pipe shall be subject to rejection on account of any of the following:
  - (1) Variation in any dimension exceeding the permissible variations given in the material specifications.
  - (2) Blistered, fractured, creased, or cracked pipe or fittings.
  - (3) Variation of more than  $\frac{1}{16}$  inch per lineal foot in alignment of pipe intended to be straight.
  - (4) Insecure attachment of fittings.
  - (5) Unpigmented or non-uniformly pigmented pipe.
  - (6) Defects that indicate imperfect proportioning, mixing, or molding.
  - (7) Surface defects indicating honeycombed or open texture.
  - (8) Damaged ends where, in the judgment of the PSAA, such damage would prevent making a satisfactory joint.

6. Sewer Service Leads, Risers, and Fittings
  - a) Sewer service leads, risers and fittings shall meet the requirements of current City of Ann Arbor Construction Code as adopted per [City Code, Title VIII \(Building Regulations\), Chapter 100 \(Construction Code\)](#).
  - b) Whenever adapters are required to properly connect the pipe with pipe of another material or manufacturer, the adapters shall be manufactured for that specific purpose and nominal inside diameter of same shall be the same size as the nominal diameter of pipe connected thereto.
  - c) Adapters shall also be furnished and used as required by the manufacturer and shall conform to Plumbing Code as adopted per [City Code, Title VIII \(Building Regulations\), Chapter 100 \(Construction Code\)](#).

## **B. Manholes**

1. Manhole Materials
  - a) All sanitary sewer manholes shall be constructed of precast reinforced concrete sections and must have an eccentric cone.
  - b) Precast reinforced concrete bases, bottom sections, manhole risers, grade adjustment rings, concentric cones, eccentric cones, and flat slab tops shall conform to the requirements of ASTM C478 (Standard Specification for Circular Precast Reinforced Concrete Manhole Sections).
  - c) Concrete brick shall conform to the requirements for concrete building brick, ASTM C55 (Standard Specification for Concrete Building Brick), Grade N-1.
2. Joints, Tees, and Radius Pipe Sections
  - a) Joints on precast manholes used on all sanitary sewers shall meet ASTM C443 (Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets), rubber O-ring gasket.
  - b) Precast manhole tees and radius pipe sections shall conform to requirements for reinforced concrete pipe, ASTM C76 (Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe), Class IV, and shall be approved by the PSAA.

3. Frames and Covers
  - a) Cast iron frames and covers for manholes shall conform to the requirements of ASTM A48 (Standard Specification for Gray Iron Castings), Class No. 35, per Article 12 (Standard Details), SD-GU-1 (Standard Casting Schedule) of these Standards.
4. Manhole Steps
  - a) Plastic-coated manhole steps shall be injection molded of copolymer, polypropylene, encapsulating a ½" grade 60 steel reinforcing bar.
  - b) Steps shall meet the performance test described in ASTM C478 (Standard Specification for Circular Precast Reinforced Concrete Manhole Sections), and shall have an impact resistance of 300 ft.-lbs., with only minor deflection and no cracking or breaking.
  - c) Steps shall resist pull-out forces of 1500 lbs.
5. Connections of Sewer Pipe to Precast Manholes
  - a) A flexible neoprene rubber boot conforming to ASTM C923 (Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals), securely clamped into a core-drilled or cast pipe port shall be utilized.
  - b) Pipe ports shall be core-drilled or cast at the point of manhole manufacture and shall be accurately located within ½" of proposed sewer centerline.
  - c) Pipe clamp bands shall be of stainless steel.
6. Chimney Seals
  - a) See Article 10 (Construction Specifications), Section II. (Utilities), DD.3. for external chimney seal requirements and specifications.

### **C. Cured in Place Pipe (CIPP)**

1. CIPP shall conform to ASTM F1216 (Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube).
2. Use of CIPP shall require approval of the PSAA.

3. Materials and construction installation shall conform to Article 10 (Construction Specifications) of these Standards.

#### **D. Pipe Bursting**

1. Pipe bursting for sanitary sewer replacement shall be permitted with approval of the PSAA. In such cases, all techniques and materials shall be subject to review and approval.

#### **E. Boring and Directional Drilling**

1. Boring and directional drilling shall be subject to Article 10 (Construction Specifications) of these Standards.
2. Directional drilling shall only be permitted with approval of the PSAA. In such cases, all techniques and materials shall be subject to review and approval.
3. For directional drilling, a minimum 2% slope shall be required.
4. Casing pipe shall conform to Article 1 (General), Section XXVI (Casing Pipe) of these Standards.
5. A drilling fluid of water and bentonite clay or a polymer shall be used. The fluid shall be inert. The fluid should remain in the tunnel to ensure the stability of the tunnel, reduce drag on the pulled pipe, and provide backfill within the annulus of the pipe and tunnel.