Chapter 20: Sanitary Sewer (SAS) Design

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The following design parameters are derived mainly from the Great Lakes and Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers: (GLUMRB) Recommended Standards for Wastewater Facilities, a reference manual widely known as "Ten State Standards." In addition, requirements of the City of Columbus Sanitary Sewer Design Manual and current City of Delaware policy are included in this section.

1. Administrative Policy

A. All sanitary sewers serving more than one building are to be public.

B. All public SAS require an OEPA PTI prior to construction. The PTI application can be filled out by the Consultant, however, the COD must be listed as the Owner (and Applicant) of the sewer, and the Utility Director must review and sign the application prior to submission to the OEPA. The COD does not participate in the concurrent review process with the OEPA for PTIs.

C. Whenever possible, all SAS should be located outside of right of way centered within Utility Easements granted to the City. Minimum easement width for SAS is 20 feet for standard installations. Deeper and/or larger sewers may require wider easements.

D. Developers are required to extend SAS through their site, at their own expense, in order to provide for future upstream tributary area service connections.

E. SAS lift stations will not be permitted without written permission from the City. In the event a lift station is permitted, and the station will serve a single-entity ownership development, the lift station shall be considered privately owned and maintained. However, the lift station still must be built to public standards. If the lift station serves multiple ownership developments, the lift station shall be considered public, and will be maintained the City. The public designation does not preclude the City from assessing a monthly maintenance fee to such organizations as homeowner's associations. Lift stations are not common enough in the City to publish standards and specifications for their design. Requirements for lift stations will be developed by the Public Works Department and approved by the Department of Public Utilities on a case-by-case basis.

F. Temporary holding tanks will not be permitted in areas capable of being served by City sanitary sewer system. In the event a temporary holding tank is necessary to serve a property while a SAS is being built, the Owner must first obtain permission from the Utility Director, OEPA, and the Delaware County General Health District.

G. Aerial sewers and inverted siphons (if deemed appropriate by the Director of Public Utilities) shall be designed per OEPA and Ten State Standards.

H. When SAS are proposed in the vicinity of any water supply facilities, requirements of the GLUMRB Recommended Standards for Water Works must be used to confirm acceptable isolation distances in addition to the following requirements.

I. The sub-divider shall provide the City with all required OEPA submittals and pay all OEPA review fees.

2. Technical Requirements

A. SAS must maintain a minimum separation of 20 feet from any part of any building or structure. More foundation separation may be required for deeper SAS.

B. SAS shall be constructed on the opposite side of the street from water lines in new subdivisions.

C. SAS may be built under proposed residential subdivision streets if the Developer can absorb the cost of compacted granular backfill (COC Item 912 – no exceptions) for the entire trench depth, and only by City approval on a case-by-case basis.

D. SAS must maintain a minimum separation of 10 feet from all water lines and stormwater management systems (i.e., sewers, channels, etc.) SAS should not be aligned under any part of a detention/retention facility. If no other feasible alternative exists, then SAS near these facilities and the water pipe and/or storm pipe must be specified as slip-on or mechanical joint pipe complying with potable water supply requirements and be pressure tested to 150 psi to assure water tightness prior to backfilling.

E. All water supply structures (public and private) within 200 feet of a proposed sewer must be highlighted and shown on the plans

F. All SAS mains must be kept at an elevation to provide basement gravity service to the entire tributary area, regardless of the proposed development plan (generally, 10-foot minimum depth). A critical horizontal/vertical alignment to the end of the tributary boundary may be required as part of any development, in order to determine the appropriate depth of the SAS through a proposed development.

G. State Plane Coordinates must be provided for all manholes in a tabular format. Provide blank columns for coordinates to be entered as part of the conversion to Record Drawings.

H. Buoyancy of sewers shall be considered and the flotation of the pipe shall be prevented with appropriate design considerations wherever high groundwater conditions are anticipated.

3. Manholes

Manholes are required at the following locations:

A. Change in pipe slope, size, or alignment

B. Change in pipe material

C. At intermediate intervals not exceeding 400 feet

D. Upstream of all service connections (i.e. no stubs with service connections)

E. At the end of a sewer stub greater than 50 feet in length (even if no services are proposed into the stub)

F. Manholes for proposed sewers are to be pre-cast and the appropriate size per the City of Delaware Standard Drawings.

G. Manholes over existing flexible SAS 8 to 12 inches in diameter shall be Type C with flexible connections. Otherwise, manholes over existing SAS shall be Type E manholes (cast-in-place base) unless otherwise approved by the City.

H. Manhole bases shall provide a minimum of 0.1 foot drop between the inlet and outlet pipes.

I. Sewers entering proposed manholes 2-feet or more above the invert of the manhole must be designed with an outside drop per Standard Drawings.

J. Proposed sewers entering existing manholes 2-feet or more above the invert of the manhole shall be designed with an inside drop per the Standard Drawings. Only one inside drop is allowed per manhole for accessibility reasons.

K. Drops within the 0.5 to 2.0 feet range should be avoided in the design as they are undesirable from a maintenance standpoint. Avoid such drops by adjusting the grade of the run of sewer to enter the manhole, or design the drop to be greater than 2.0 feet and specify an outside drop. It is understood that 0.5 to 2.0 foot drops cannot always be avoided when attempting to match pipe crowns. Under these circumstances, the invert shall be filleted to prevent solids deposition. A note should appear on the plans to this effect.

L. Cleanouts are not permitted on SAS mains.

M. Manhole castings must be 1 foot above the 100-year floodplain elevation.

4. Materials/Bedding/Backfill

A. SAS pipe materials shall be per COC CMS Section 900.

B. Flexible sewers are subject to deflection testing requirements per COC CMS Section 900. Rigid pipe should be considered when the SAS must be put into use soon after installation.

C. When flexible SAS is deeper than 20 feet, PVC SDR 26 must be specified for pipe and fittings.

D. Bedding per COC Standard Drawings. Type of bedding must be specified in the quantities table.

E. COC Item 912 (compacted granular material) is required full depth of the trench under pavement and up to the pavement influence line (when not directly underneath pavement). See RDWD Standard Drawings for definition of pavement influence line. Vertical limits of the Item 912 must be shown in profile view.

F. Large aggregate backfill material (No. 4 stone) is not an acceptable alternative to Item 912.

G. Outside of the pavement influence, but within ROW or easements, COC Item 911 is the backfill requirement.

H. If neither Item 911 nor 912 requirements apply, then backfill must be compacted to 95% (Standard Proctor) within +/- 2% of optimum moisture content.

I. If a flexible sewer is required to be encased in concrete, it must be encased from structure to structure.

J. The decision to jack-n-bore versus open cut a roadway for sewer installation will be made by the City Engineer on a case-by-case basis. Criteria that affect the decision are ADT, roadway width, number of lanes, pavement condition, etc. Reference the Standard Drawings for a jack-n-bore casing detail.

K. Trench dams shall be installed between each pair of manholes utilizing native compacted clay soil or Benonite Clay material. No granular bedding is permitted at the locations of trench dams.

5. Capacity

A. The minimum diameter for any SAS main is 8-inch; The minimum diameter for any SAS lateral is 6-inch.

B. If velocities exceed 15 feet/second, special provisions shall be made to protect against displacement by erosion and impact.

C. SAS on 20% slopes or greater shall be anchored per Ten States Standards

D. When smaller sewers outlet into larger sewers, attempt to match 0.8 D

E. Reduction in pipe size in the downstream direction will not be permitted regardless of the slope of the downstream pipe.

F. SAS should not be oversized in order to accommodate flatter design slopes.

G. SAS design shall utilize the following hydraulic design criteria:

Table 20-1:

Sanitary Sewer Hydraulic Design Criteria

Pipe Diameter (Inches)	**Minimum Grade (%)**
8	0.4
10	0.28
12	0.22
14	0.17
16	0.14
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046
Population Density	12 capita/acre*
Average Sanitary Flow	120 gpd/capita OR 600 gpd/acre for select areas
Greenspace Factor	10%
Peaking Factor (P = population in thousands)	$\frac{18+\sqrt{P}}{4+\sqrt{P}}$
I/I Allowance	969.5 gpd/acre
Minimum Velocity	2.0 feet/second
Manning's "n" value	0.013 (all materials)
Peak Flow	(Peaking factor) x (Avg. Flow)
Design Flow	Peak flow + I/I Allowance
Design Capacity	**Flowing Full %**
8"-15"	50
18"-27"	75
30" and up	92

** For areas of greater population density of 12 persons per acre, the design flow shall be determined on a basis of population instead of area.*

6. Services

A. No services into manholes, or within 8 feet of a manhole.

B. Service schedule must be provided on the plans showing: stationing, riser height, length, and end of service elevation.

C. All wyes must have a minimum 2-foot riser or extension to reduce the risk of future damage to the SAS main.

D. The length of riser called out in the plan view/service schedule shall be the distance from the pipe invert to a point +/- 9 feet below the existing or proposed ground surface, whichever is higher. This means the Quantities table does not have to match the sum of the riser heights in the plan view/service schedule.

E. Services under new subdivision streets shall be paired per the Standard Drawings.

F. Cleanouts should be specified every 100 feet on a service.

G. Services must extend at least 2 feet beyond other buried utilities.

7. Stream and Utility Crossings

A. SAS crossing open channels must be designed to cross as nearly perpendicular to the channel as possible. Also, stream crossings are to be kept to an absolute minimum within a development.

B. The depth from the channel bed to the crown of the pipe shall be a minimum of 4 feet. Trench backfill shall be in accordance with COC Item 911, with the exception of the upper portion of the trench which must be per COC Item 919 (Watercourse Erosion Protection).

C. If the above requirement cannot be met, 6-inch concrete encasement on all sides of the pipe will be required for all pipe materials. A special detail of the encasement must be included in the plans.

D. All additional requirements as set forth by the OEPA for the stream crossing must be strictly adhered to.

E. Where the SAS crosses under a proposed storm sewer or water line (and minimum clearance is maintained), specify COC Item 912 backfill to the bottom of the storm sewer or water line.

F. Sewers crossing other buried utilities shall be designed and laid to provide a minimum vertical distance of 18 inches (measured from outside of pipe to outside of pipe). The crossing shall be arranged such that the sewer joints are equidistant and as far away as possible from the other utility (especially for crossings of water mains and storm sewers). If it is impossible to meet the 18-inch clearance requirement, then the SAS shall be designed and constructed equal to water main pipe and shall be pressure tested at 150 psi to assure water tightness prior to backfilling.

G. In the rare case where a SAS crosses over a water main, adequate structural support must be provided for the sewer to maintain line and grade. A special detail must be included in the plans. Either the water main or the SAS may be enclosed in a casing pipe which extends 10 feet on both sides of the crossing (measuring perpendicular to the water main). The carrier pipe shall be ductile iron.