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# General Information for Storm Sewer Design

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## A. Introduction

Storm sewer facilities collect stormwater runoff and convey it away from structures and through the roadway right-of-way in a manner that adequately drains sites and roadways and minimizes the potential for flooding and erosion to properties. Storm sewer facilities consist of curbs, gutter, intakes, manholes, and storm sewers. The placement and hydraulic capacities of storm sewer facilities should be designed to take into consideration damage to adjacent property and to secure as low a degree of risk of traffic interruption by flooding as is consistent with the importance of the road, the design traffic service requirements, and available funds.

## B. Location of Storm Sewers

### 1. Storm Sewers in Street Right-of-way:

- a. Storm sewers parallel to the street and in the right-of-way should be placed behind the back of curbs, as close as practical, to fit specific manhole or intake connections.
- b. Storm sewers perpendicular to the street are to connect at each end by intakes or manholes.
- c. Storm sewers in the street right-of-way should be concrete pipe to prevent utility cuts through the pipe. This includes storm sewer service stubs equal to or greater than 12 inches in diameter, extended 10 feet outside of the right-of-way.
- d. If a type of flexible pipe is approved for use by the Engineer, it is important to take steps to protect the integrity of the trench backfill since the pipe depends on the backfill envelope for its strength. The pipe can be damaged if the backfill is disturbed.

### 2. Public Storm Sewers Outside of Street Right-of-way but within Public Easement: Storm sewers outside of the street right-of-way will be placed in a public storm sewer easement. Public storm sewer easements should have a minimum width of 20 feet or two times the depth of the sewer, whichever is greater. Additional width may be required by the Engineer to ensure proper access for maintenance purposes. When determining the width of the easement, consideration needs to be given to placement of excavated materials for the repair of the pipe.

- a. Storm sewer outlets should be concrete pipe.
- b. Upon the approval of the Engineer, flexible pipe and CMP may be used outside of the street right-of-way where the granular backfill is not likely to be disturbed by other utilities or other construction in the area.
- c. Storm sewer along a side property line should run the length of the property line and outlet past the rear property line to a receiving drainageway.

## C. Pipe Materials

1. **Storm Sewer Pipes:** The approved storm sewer pipe materials are included in SUDAS Specifications Section 4020.
2. **Culverts:** The approved culvert materials are included in SUDAS Specifications Section 4030.
3. **Subdrains and Footing Drain Collectors:** The approved subdrain and footing drain collector materials are listed in SUDAS Specifications Section 4040.

## D. Physical Requirements

1. **Minimum Cover over Storm Sewer Pipes:** The recommended minimum cover over storm sewer pipes should be 1 foot or as specified by the type of pipe as described in Chapter 9 - Utilities, whichever is greater. Where the clearance is less than 1 foot below the pavement, the Project Engineer will provide a design method to maintain the integrity of the pipe and pavement. For storm sewer pipe outside of the pavement, the minimum cover should be 1 foot or as specified by the type of pipe (described in Chapter 9 - Utilities), whichever is greater.
2. **Minimum Flow Line Depth for Footing Drain Sewers:** 3 feet 6 inches.
3. **Minimum Pipe Size:**
  - a. **Storm Sewers:** 15 inches in diameter.
  - b. **Subdrains:** 6 inches in diameter.
  - c. **Footing Drain Collector Sewers in Public Right-of-way:** 8 inches in diameter.
  - d. **Building Storm Sewer Stubs:** 4 inches in diameter
4. **Velocity within Storm Sewer Pipe:**
  - a. Minimum flow (1/2 full pipe) = 3 fps cleaning velocity
  - b. Maximum flow (1/2 full pipe) = 15 fps
5. **Velocity at Outlet of Pipe:** Energy dissipation is required when discharge velocities exceed those allowed for downstream channel. (See Tables 2F-2.03 and 2F-2.04).
  - a. With flared end section, maximum of 5 fps.
  - b. Maximum with flared end section, footing, and rip rap = 10 fps
  - c. Maximum with energy dissipation device = 15 fps
6. **Partially Full Pipe Flow:** For convenience, charts for various pipe shapes have been developed for calculating the hydraulic properties (Table 2D-2.01 in Section 2D-2). The data presented assumes that the friction coefficient, Manning's "n" value, does not vary throughout the depth.

**7. Minimum Storm Sewer and Footing Drain Grades:**

- a. **Storm Sewer Mains:** Minimum grade is set by the required minimum velocity for storm sewers and footing drain sewers - 3 fps for design storm.
- b. **Cross Runs:** Minimum grade of 1%. Desired minimum velocity of 3 fps for design storm.
- c. **Building Storm Sewer Stubs:** Minimum grade of 1%.
- d. **Subdrains:** Minimum grade of 0.5%.

**8. Intakes:** See Section 2C-3.

**9. Manholes:** See Section 2C-3.

**E. Horizontal Alignment**

Sewer will be laid with a straight alignment between structures with the following exception: where street layouts are such that straight alignments are difficult to maintain without an increased number of structures, and where the storm sewers are 54 inches in diameter or greater, the sewers may be curved. The curvature will be factory fabricated pipe bends and should be concentric with the curvature of the street. The radius of curvature must not be less than 200 feet. The pipe manufacturer's recommended maximum deflection angle may not be exceeded.

**F. Separation of Water Mains from Sewer Mains**

The following comply with the Iowa Department of Natural Resources separation requirements.

1. **Horizontal Separation of Gravity Sewers from Water Mains:** Separate gravity storm sewer mains from water mains by a horizontal distance of at least 10 feet unless:
  - The top of a sewer main is at least 18 inches below the bottom of the water main, and
  - The sewer is placed in a separate trench or in the same trench on a bench of undisturbed earth at a minimum horizontal separation of 3 feet from the water main.

When it is impossible to obtain the required horizontal clearance of 3 feet and a vertical clearance of 18 inches between sewers and water mains, the sewers must be constructed of water main materials meeting the requirements of SUDAS Specifications Section 5010, 2.01. However, provide a linear separation of at least 2 feet.

2. **Separation of Sewer Force Mains from Water Mains:** Separate storm sewer force mains and water mains by a horizontal distance of at least 10 feet unless:
  - The force main is constructed of water main materials meeting a minimum pressure rating of 150 psi and the requirements of SUDAS Specifications Section 5010, 2.01, and
  - The sewer force main is laid at least 4 linear feet from the water main.
3. **Separation of Sewer and Water Main Crossovers:** Vertical separation of storm sewers crossing under any water main should be at least 18 inches when measured from the top of the sewer to the bottom of the water main. If physical conditions prohibit the separation, the sewer may be placed not closer than 6 inches below a water main or 18 inches above a water main. Maintain the maximum feasible separation distance in all cases. The sewer and water pipes must be adequately supported and have watertight joints. Use a low permeability soil for backfill material within 10 feet of the point of crossing.

Where the storm sewer crosses over or less than 18 inches below a water main, locate one full length of sewer pipe of water main material or reinforced concrete pipe (RCP) with flexible O-ring gasket joints so both joints are as far as possible from the water main.