CHAPTER 4. SEWER COLLECTION SYSTEM DESIGN CRITERIA

4.1 DESIGN CRITERIA BACKGROUND

A hydraulic model is the primary tool for evaluating the capacity of the pipes in a sewer collection system. An effective hydraulic model accurately represents collection system facilities and collection system flows for capacity analysis. This chapter describes the selection of system criteria, the development of collection system facilities, and the calculation of flows in the collection system model for the City.

In analyzing a wastewater system, it is necessary to derive standards regarding the amount of flow that may be efficiently conveyed by a given wastewater pipeline. In an effort to provide reliable gravity sewer service while minimizing excessive wear or energy usage through force mains and lift stations, sanitary sewers shall be designed according to the following criteria:

4.1.1 GRAVITY MAIN DESIGN CRITERIA

Sizing a new pipeline is based on the Manning's equation and the following design criteria shown in Table 4-1.

Table 4-1: Pipeline Design Criteria

Gravity Main Requirements	Design Criteria
[1]New Pipes 12-inches in diameter and smaller:	0.50 (50%) full at peak wet weather flow
[2]New Pipes over 12-inches in diameter:	0.75 full at peak wet weather flow
Minimum velocity:	2 feet per second (1/2 full or full)
Maximum velocity:	10 feet per second
Manning's n:	.013
New Pipe Minimum pipe diameter:	8 in
Force Main Requirements	Design Criteria
Minimum Force Main Diameter:	4 inches
Minimum Velocity:	3 feet per second
Maximum Velocity:	5 feet per second
Maximum allowable headloss:	10 feet/1000 feet of pipeline
Maximum desirable headloss:	5 feet/1000 feet of pipeline
Hazen-Williams C factor:	120

Notes:
(1) Design plans will be required when d/D reaches 0.60 for existing 12" diameter pipes or smaller, and improvements will be required once d/D reaches 0.70 at peak wet weather flows.
(2) Design plans will be required when d/D reaches 0.75 for existing pipes larger than 12" diameter, and improvements will be required once d/D reaches 0.85 at peak wet weather flows.

The National Clay Pipe Institute (NCPI) recommends that smaller pipelines (8" and smaller) be designed to flow at levels not exceeding half-full (d/D=0.50) during peak conditions. For larger pipelines, the tributary area is larger. Local deviation from design wastewater flows tend to balance one another for larger areas, resulting in a closer correlation of actual and design wastewater flows. Consequently, the NCPI recommends that these larger wastewater pipelines should be designed for a d/D not to exceed 0.75.

In analyzing the City's existing sewer gravity mains, it is unnecessary to allow for an excessive factor of safety. This is because the City's sewer basins are largely built out, and future development patterns are

relatively certain. As new major wastewater users apply for wastewater service, they should be evaluated on a case-by-case basis, including estimated flow rates and impacts to City-owned sewer facilities. Therefore, City-owned sewer gravity mains may be flowing at levels above a d/D of 0.50 and still be operating satisfactorily.

Remaining pipeline capacity, above d/D = 0.75 has been reserved to handle emergency flows such as I&I beyond that planned for in a design storm, and to provide for ventilation within the pipe. This should not be considered a component of the pipeline capacity.

In an effort to account for the City being mostly built-out and ensure that gravity main segments are replaced due to capacity and flow constraints, the following describes the City's replacement criteria:

- Maximum Peak Wet Weather Flow for pipelines 12-inch or less, depth-to-Diameter d/D = 0.70
- Maximum Peak Wet Weather Flow for pipelines greater than 12-inches, depth-to Diameter d/D = 0.85

All pipes requiring replacement shall be designed in accordance with the City's design criteria. In the event that a gravity main satisfies these replacement criteria, but the pipeline immediately upstream requires upsizing, one (1) additional replacement stipulation may be applicable. The purpose of this replacement stipulation is to insure that pipe-reaches increase in diameter as they progress downstream, and prevent, wherever possible, pipe-reaches from fluctuating up and down in diameter. If a gravity main requires upsizing to a diameter larger than the diameter of the gravity main(s) immediately downstream in the same pipe-reach, and the downstream pipe(s) are less than 750 ft in length before conveying flow to a gravity main of equal or larger diameter than the diameter recommended for the deficient upstream gravity main, then the downstream gravity main(s) of less than 750 ft shall be upsized to the same diameter of the upstream pipe.

4.1.2 LIFT STATION DESIGN CRITERIA

Lift Stations should be sized for the peak wet weather flow rate plus an additional 20% capacity to account for wear, miscellaneous debris, etc. that may reduce pumping performance. Lift stations should be capable of meeting the following criteria with the largest capacity pump serving as standby:

- Manufacturers recommended cycling times for pumping equipment.
- All lift stations will incorporate dual force mains beginning from pumps and ending at gravity flows.
- 60 percent pump efficiency should be assumed, except where other information is available.
- 90 percent motor efficiency should be assumed, except where other information is available.
- Wet well sized to minimize retention time such that maximum pump cycling time (usually at ½ design inflow) is within manufacturer's recommendations.
- Separate from wet well operating volume, emergency storage volume shall be sufficient to accommodate storage of six-hour pumping volume at average ultimate flow.