SECTION V—DESIGN AND CONSTRUCTION STANDARDS

Requirement[1]

a. Design and construction standards and specifications for the installation of new sanitary sewer systems, pump stations and other appurtenances; and for the rehabilitation and repair of existing sanitary sewer systems; and

b. Procedures and standards for inspecting and testing the installation of new sewers, pumps, and other appurtenances and for rehabilitation and repair projects.

Supporting Documents

The City possesses the necessary design and construction standards and specifications to install, rehabilitate, repair, test and inspect new and existing sewers and pump stations required by the Order. A summary of the Benicia standards and other official documents are shown in Table 1.

A copy of each document follows the table.

[1] SWRCB Order No. 2006-0003-DWQ § B.13 (v)

TABLE V.1—SUMMARY OF DESIGN AND CONSTRUCTION STANDARDS

Item Required	Supporting Document
Design and construction standards and specifications for the installation of new sanitary sewer systems, pump stations and other appurtenances	Engineering Design Standards and Standard Plans. December 1992 with Adopted Revisions. City of Benicia Public Works Department. The City's most recent collection system lift station was constructed in 2000. The City does not have a standard specification for lift stations, although it has standardized certain elements of lift station design (e.g., use of Flygt submersible pumps, compatible telemetry, etc). Any future lift stations will be custom designed by qualified engineers based on site-specific factors and the currently available technology. Such designs will be reviewed and approved by the City Engineer and the Wastewater Treatment Plant Superintendent, who is responsible for lift station maintenance. Because new lift stations are constructed so infrequently, the City does not believe that the development of formal standard design specifications for lift stations represent the best use of City resources.
Design and construction standards and specifications for the rehabilitation and repair of existing sanitary sewer systems	Included with above documents
Procedures and standards for inspecting and testing the installation of new sewers, pumps and other appurtenances	Included with above documents
Procedures and standards for rehabilitation and repair projects	Included with above documents

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CITY OF BENICIA

PUBLIC WORKS DEPARTMENT

ENGINEERING DESIGN STANDARDS

AND STANDARD PLANS

THE CITY OF
BENICIA
CALIFORNIA

December 1992

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ENGINEERING DESIGN STANDARDS / STANDARD PLANS

CITY OF BENICIA

ENGINEERING DESIGN STANDARDS

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Revised: April, 1992

SECTION 5

SANITARY SEWER

5.01 GENERAL

A. **Line Size**

1. The minimum main size shall be 8 inch diameter, except that a last length of main which cannot be extended in the future may be 6 inches in diameter.
2. The minimum side sewer (lateral) size shall be:
   a. 4 inches in diameter for single family residential use.
   b. 6 inches in diameter for multi-family residential, commercial, or industrial uses.

B. **Easements/Location**

1. All public sanitary sewer mains should be located within the road right-of-way, or if unavoidable, centered upon a dedicated easement.
2. Easements for sanitary sewers shall meet the following requirements:
   a) For sewer mains less than 12 inches in diameter, the minimum easement width shall be 10 feet.
   b) For sewer mains 12 inches in diameter and larger, the minimum easement width shall be 15 feet.

5.02 DESIGN

A. **Flow Computation**

1. The design sanitary sewer flow shall be equal to the sum of two and one-half times the average flow and the infiltration flow.
   a. The average flow for residential areas is based on the following assumptions:
      1) A single family dwelling is composed of 3.5 persons.
      2) An allowance of 100 gallons per person per day.
   b. For commercial areas the average flow shall be 1800 gallons per acre per day.
   c. Light industrial areas shall utilize an average flow of 1600 gallons per acre per day.
   d. Heavy industrial areas require special design and will be considered on a case-by-case basis.

e. Infiltration rates shall conform to the following:

1) For new construction: 1000 gallons per acre per day.
2) For existing sewers: 3000 gallons per acre per day.

2. Pipe capacities shall be computed utilizing Manning's formula with an "n" valve of either 0.013 or the pipe manufacturer's recommendation, whichever is greater, for pipes flowing full.

B. **Mains**

1. In general, sanitary sewer mains will be located 5 feet south and/or east of street centerline.
2. Minimum slope for mains shall be three-quarters of one percent. Where possible, slope shall provide for a velocity of at least 2 feet per second.
3. Minimum depth for sewer mains shall be 4 feet of cover from top of pipe to subgrade. Ductile iron mains may have as little as 18 inches of cover from subgrade.
4. A minimum of 12 inches of vertical clearance shall be maintained in crossings with water mains, and at least 6 inches vertical clearance in crossings with other utilities.
5. At least 5 feet clearance shall separate sewer mains from other parallel utility main installations.
6. Horizontal and/or vertical curves are allowed between structures, provided that:
   a. The total deflection does not exceed 45 degrees, and
   b. The deflection at each joint does not exceed 80 percent of the manufacturer's published recommended allowable maximum.
   c. Reverse curves are not allowed.

C. Side Sewers (Laterals) are those portions of the sewerage system between the sewer main and the right-of-way line. The limit of City maintenance responsibility is the right-of-way line and is denoted by a clean-out. In all cases the City maintained facilities will lie within the limits of either the street right-of-way or the easement sidelines.

1. All 4-inch diameter sewer laterals shall have a minimum slope of two percent (0.02).
2. All 6-inch diameter sewer laterals shall have a minimum slope of one percent (0.01).
3. In all new work, the sewer lateral shall be installed concurrently with the sewer main, and shall be drawn to scale and stationed on the plan view of the improvement plan.

4. The angle of intersection between the side sewer and the upstream main sewer shall 90 degrees.

D. **Appurtenances**

1. Manholes
   a. Manholes shall be provided at all junctures of mains and at all changes of direction and main line size, but in no case more than 300 feet from the downstream manhole.
   b. Manholes which are not located at a change of direction or size shall have the main extended straight through. In other situations match crowns of pipes of different sizes or allow for a 0.1 foot drop through the manhole. Channels shall be formed in the bottom of the manhole to provide positive direction for low flows.
   c. A drop of more than 2.0 feet from the invert of one line to another will not be allowed within a manhole. Drop manholes, if unavoidable, require special design and approval by the City Engineer.
2. A rodding inlet may be used for the end structure of a section of main serving no more than 5 laterals since the last manhole.
3. Pressure systems (pumps) require prior approval of the City Engineer and will be allowed only if a gravity system is not feasible. The pressure systems will be private and therefore will not be maintained by the City.

E. **Pipe Materials**

Sewer pipe shall be one of the following types:

1. Polyvinyl Chloride (PVC), extra strength minimum of SDR=35.
2. Ductile Iron Pipe (DIP) class 50 wrapped with polyethylene tubing.
3. Other types of pipe may be used but only with prior approval of the City Engineer.

5.03 INSTALLATION

A. **Installation**

1. The trench shall be excavated to the lines and grades established by the Engineer.
2. All mains and laterals must receive City inspection after installation to verify proper placement. Contractor must receive authorization from the City Inspector before placement of backfill.
3. Trench backfilling, placement of aggregate base material, and compaction shall be done in conformance with City standard plan ST-7.

B. **Testing**

1. The following tests shall be performed by the contractor after the sewer system is installed, backfilled, and street base is in place, compacted and ready for paving:
   a. Air pressure test - All new main lines with connecting laterals shall be tested in separate sections. The main and laterals shall be pressurized under 4.0 psi for a minimum of 4 minutes with a maximum allowable pressure drop of 0.5 psi. If pressure drops more than this amount, then repressurize to 3.5 psi and hold for an additional 4 minutes. Pressure must not drop below 3 psi at the end of this retest.
   b. Hydrostatic test - All manholes and isolated laterals shall be tested by plugging at the main connection(s) and then filling structure or lateral with water, (laterals require a 4 foot head). The water shall stand for a 4 hour period without exceeding the allowable loss as determined by the City Engineer.
   c. Mandrel test - All mains shall be cleaned and then mandrelled to measure for obstructions. A rigid mandrel with a circular cross section of at least 98% of the inside pipe diameter shall be pulled through the pipe by hand.
2. Upon failure of any test as determined by the City Engineer the contractor shall, at his expense, remedy the cause and retest that portion of the system. Retesting may require that additional inspection fees be paid to the City.
3. For large subdivisions and for installations that fail to receive proper City inspection or fail any test, the City Engineer may require that the sewer mains be inspected internally by TV equipment using VHS tape format.

STANDARD PLANS

CITY OF BENICIA, CALIFORNIA

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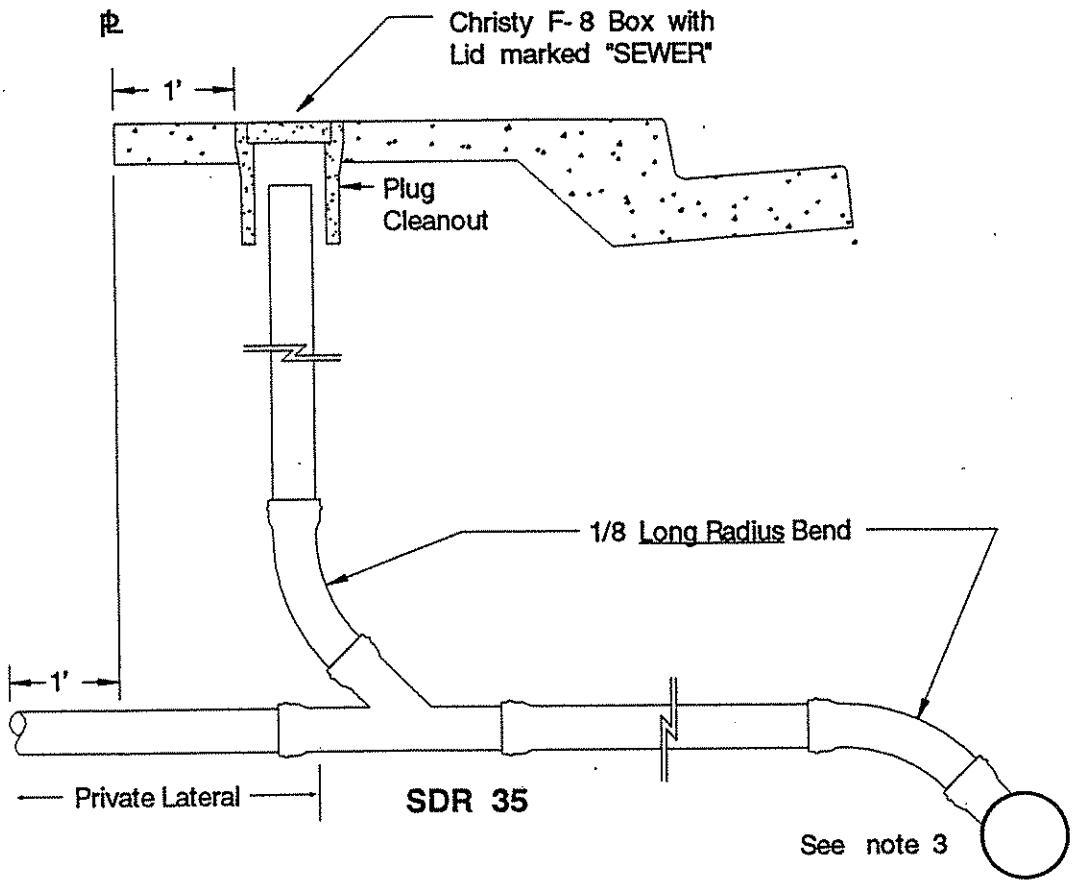

NOTES:

1. Allowable minimum slopes for the following sewer lateral diameters: 4" - 2%, 6" - 1%, 8" - 0.5%.
2. Minimum cover shall be 30".
3. If the lateral is part of a main line construction use "wyes". If the lateral is to an existing main the connection shall be drill tapped.
4. In areas without sidewalk, the cleanout box shall be surrounded by a minimum of 12" of concrete.

CITY OF BENICIA

DEPARTMENT OF PUBLIC WORKS

SEWER LATERAL

A. M. Bertolero

ANTOINETTE M. BERTOLERO, CITY ENGINEER

DATE: MARCH 1992

REVISED:

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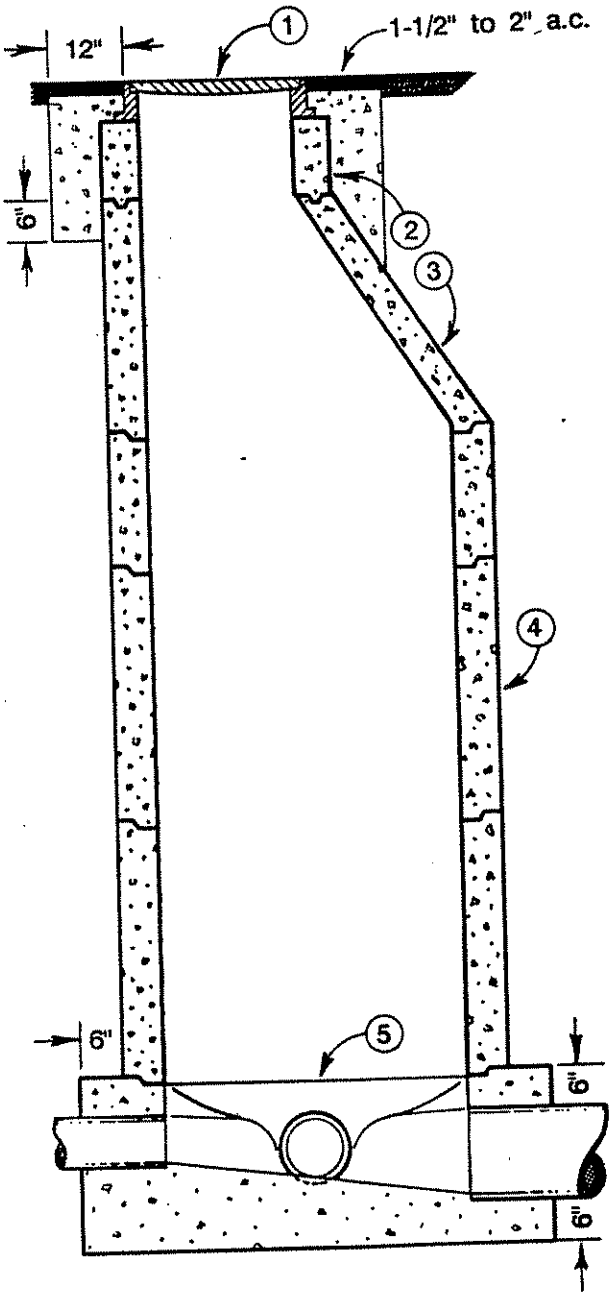

NOTES:

1. Manhole frame and cover to be D. & L. Supply A-1024 or an approved equal marked "Sanitary Sewer".
2. 24" diameter manhole rings, 12" maximum total height.
3. 24" to 48" eccentric manhole cone, 36" in height.
4. 48" diameter manhole barrel sections.
5. Form base to provide a smooth flow channel.
6. 1:3 grout mix or Ram-Nek joint compound to be used in all joints.
7. All concrete to be 560 - C - 3250.

REGISTERED PROFESSIONAL ENGINEER
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Expires 12/31/89
CIVIL
STATE OF CALIFORNIA

CITY OF BENICIA

DEPARTMENT OF PUBLIC WORKS

SEWER MANHOLE

Donald F. Curtis
DONALD F. CURTIS CITY ENGINEER

DATE: SEPTEMBER 1988
REVISED: 4/92

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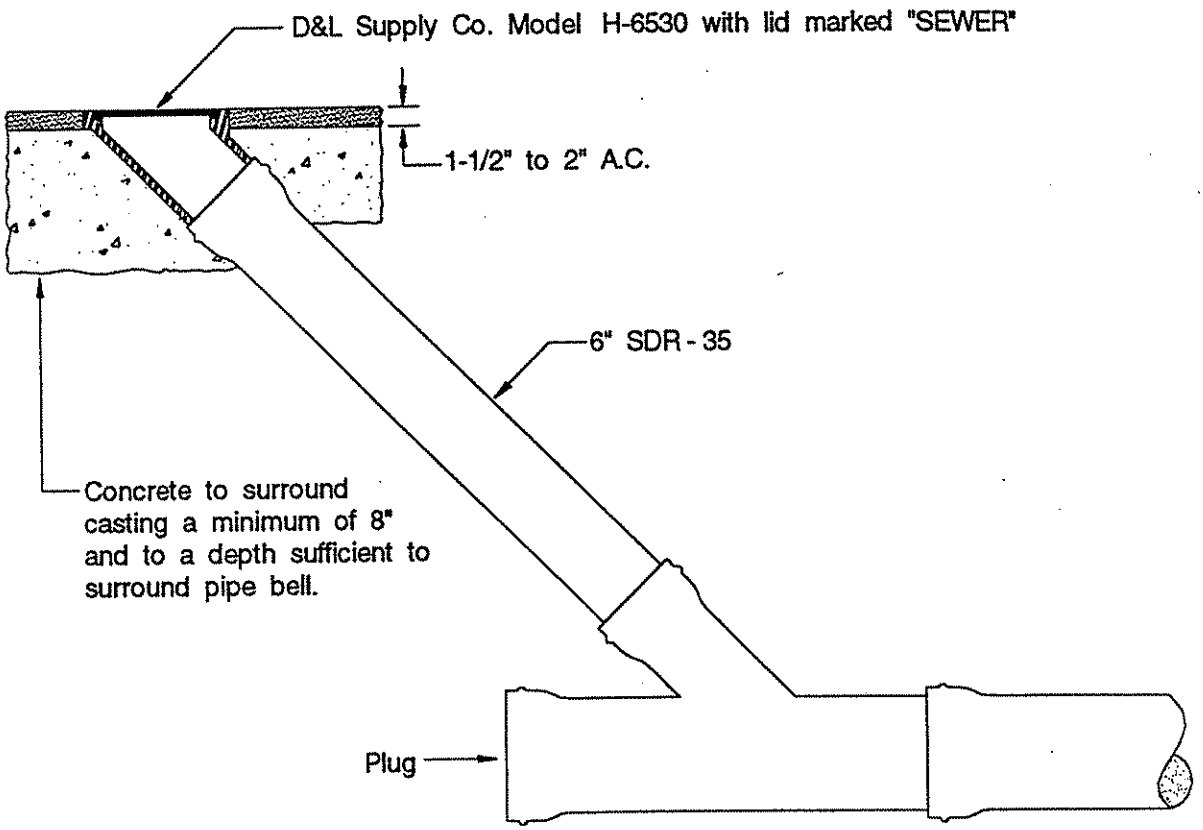

CITY OF BENICIA

DEPARTMENT OF PUBLIC WORKS

RODDING INLET

A. M. Bertolero

ANTOINETTE M. BERTOLERO, CITY ENGINEER

DATE: MARCH 1992

REVISED:

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