

**SECTION 3 – SANITARY SEWERS**  
**CITY OF CARO**  
**ENGINEERING DESIGN STANDARDS**

A. Plans and Specifications - Submittal Procedure

1. The plans and specifications shall be submitted in accordance with Section 1 - General Requirements & Submittals.

B. Plans and Specifications - Design Considerations: General

1. All sanitary sewer designs shall be developed conforming to the current edition of “Recommended Standards for Waste Water Facilities”, published by Health Education Services, also known as the “Ten State Standards”.
2. Prior to starting any sanitary sewer design, the applicant is encouraged to make use of maps and information available at the City offices. It shall be the responsibility of the applicant to field check and verify utility locations provided by the City.
3. The Developer shall research to determine if the sewer has adequate capacity to handle the anticipated volumes. Such research shall be provided to the City for their review and may be required for the MDEQ permit.
4. A cover sheet shall show, in addition to those items required in the General Requirements & Submittals, the following:
  - a. Overall layout of the sewer system with manhole numbers and direction-of-flow arrows. Existing and proposed sewers shall be shown with different symbols and line types.
  - b. A flow calculation for the service area and any future service area that may be ultimately served by the proposed sewer.
5. In general, construction of all sanitary sewers eight (8) inch in diameter and larger shall be considered a public sanitary sewer and will require a permit from the MDEQ.
6. If the Developer determines that it is not possible to service their development with a gravity flow sewer, then the Developer shall discuss the alternatives with the City.
7. Lift stations, grinder pumps and low pressure sewers will require specific approval from the City.

C. Plan and Profile Sheets

1. The plan portion of the sheet shall include, at a minimum, the following:
  - a. Existing topography and all existing or planned surface or underground improvements in streets or easements in which sewer construction is proposed or in contiguous areas, if pertinent to design and construction.
  - b. Location, length, size and direction of flow of each section of the proposed sewer between manholes.
  - c. Locations of all manholes and other sewer appurtenances and special structures.

- d. Building sewers or wye branches are to be constructed or installed concurrently with sewer construction with locations at easement and/or property lines.
- 2. The profile portion of the sheet shall appear below the companion plan portion, generally projected vertically and shall show, at a minimum, the following:
  - a. Size, slope, type, class of pipe and class of bedding material and controlling invert elevations for each section of proposed sewer between manholes.
  - b. Limits of special backfill requirements.
  - c. Location of existing or proposed utilities crossing the line of the sewer or otherwise affecting sewer construction.
  - d. Location by station, of every proposed manhole with manhole number, invert elevation of all inlet or outlet pipes, top of casting elevation and manhole size.
  - e. Length of run between manholes.
  - f. Location by station, from downstream manhole of all building sewers or wye branches to be constructed or installed concurrently with the proposed sewer construction.
  - g. Existing and proposed ground elevation above the route of the sewer.
  - h. Invert elevation at property line for building sewers to be included with sewer construction.
  - i. Manholes shall be identified by numbers assigned consecutively and increasing in direction opposite to direction of flow in each sewer.
  - j. All elevations shall be on U.S.G.S. datum.
  - k. There shall be a minimum of two (2) benchmarks with one (1) benchmark at least every 1,200 feet.

D. Location of Sanitary Sewers

- 1. Sanitary sewers shall generally be located on opposite sides of streets from water mains and shall, whenever possible, be installed on the south side of an east-west street and on the west side of a north-south street.
- 2. Generally, sanitary sewers shall be installed in a public street right of way or in easements exclusively reserved for such use.
- 3. Sewers shall be constructed outside of paved parking areas, streets and drives, whenever possible. The City shall not be liable to repair improved areas within an easement.
- 4. Sewers shall be installed parallel to the property lines or building lines.
- 5. Sanitary sewers shall maintain ten (10) feet of horizontal separation from all parallel utilities.
- 6. Sanitary sewer crossings of other utilities shall have a minimum vertical clearance of eighteen (18) inches, with the sanitary sewer placed below the other utility.

E. Drop Connection

1. Internal drop connections are required at manholes where the invert of the outlet pipe is eighteen (18) inches or more below the invert of the inlet pipe.
2. External drop connections are not allowed, unless specifically approved by the City.

F. Tunneling and Boring

1. Where conditions require tunneling or boring, consult the City for specific requirements. Where sanitary sewers or sanitary sewer leads cross improved roads of any type, the pipe shall be installed by tunneling or boring, located within a steel casing pipe, unless approved otherwise by the City. All boring work shall be in accordance with the current MDOT standards and as approved by the City.

G. Extensions and Future Connections

1. Where the sanitary sewer must be extended from off-site, sanitary sewer leads extending two (2) feet beyond the property line of all adjacent property on both sides of the right of way, the entire length of the off-site sanitary sewer installation shall be provided.

H. Allowable Minimum Pipe Slopes

Pipe Diameter (inches)	Minimum Slope (feet per 100 feet)
6 (services only)	1.00
8	0.40
10	0.28
12	0.22
15	0.15
18	0.12

I. Manhole Locations

1. Manholes shall be constructed at every change in sewer grade, alignment and pipe size and at the end of each sewer line. Maximum distance between manholes shall not exceed four hundred (400) feet.
2. Where future connections to a manhole are anticipated, stubs with watertight bulkheads shall be provided.



J. Hydraulic Calculations

1. Calculations

- a. Gravity sanitary sewers: Manning's Formula shall be used.
- b. Low-pressure sewer systems and force mains: Hazen-Williams Formula shall be used.

2. Minimum and Maximum Velocities

Minimum design velocities for gravity and low pressure sanitary sewers shall be two (2) feet per second, and a maximum design velocity shall be ten (10) feet per second with pipe flowing full.

K. Allowances for Changes in Pipe Size

1. Maximum flow velocity for full pipe flow shall be maintained by continuity of the 0.80 diameter depth above invert for pipe size increases and also with intersecting sewer grade raised to compensate for head loss due to direction change.
2. Provide a drop of 0.10 feet in the downstream sewer invert for all manholes to compensate for velocity head loss of the incoming flow.

L. Building Sewers

1. Unless otherwise approved by the City, construction of building sewers from the public sewer beyond the easement and/or property line for each fronting parcel which the sewer is designed to serve, shall be included with the construction of each sanitary sewer.
2. Where construction of building sewers to the property line is not required concurrently with sanitary sewer construction, a wye branch with riser, if required, and a watertight stopper or plug with type of joint used for the sewer pipe shall be installed for every lot or building site which the sewer is designed to serve.
3. Minimum size for building sewers shall be six (6) inch nominal internal diameter. Each structure shall have a separate individual sanitary service lead connected to a public sanitary sewer.
4. For service leads beyond the right of way, cleanouts shall be provided every ninety (90) feet and at any bend forty-five (45) degree or greater.

M. Sewer Capacity Design

1. Tributary Area

- a. Sanitary sewers shall be designed to serve all tributary areas, with due consideration given to topography, the master sanitary sewer plan, established zoning and the adopted Master Land Use Plan.

2. Population

- a. For design purposes, population shall be based on a minimum of 3.5 persons per detached single-family home site (or equivalent single family unit), and 2.5 persons for each multiple-family dwelling unit.
- b. Submissions for review shall include a tabulation of occupancy (usage) types and the conversion of these into terms of equivalent single-family units. The areas of

the site, in acres, may be used to calculate dwelling units based on density allowed in the Zoning Ordinance.

3. Sewage Quantities for Pipe Design

- a. For all service areas, sewer design flows shall be in accordance with the "Ten State Standards".

N. Acceptance of Utilities

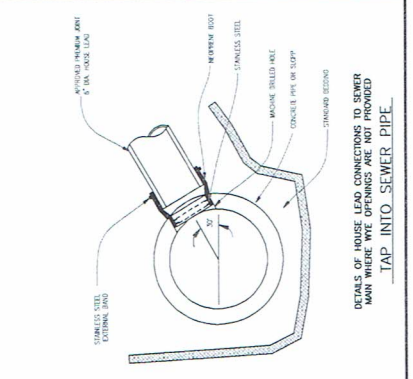
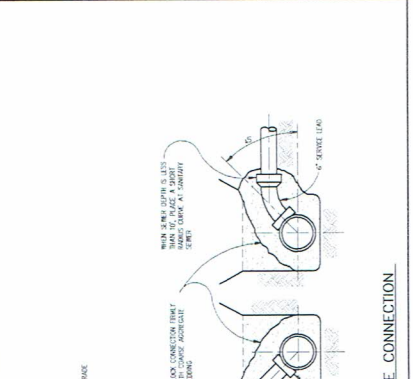
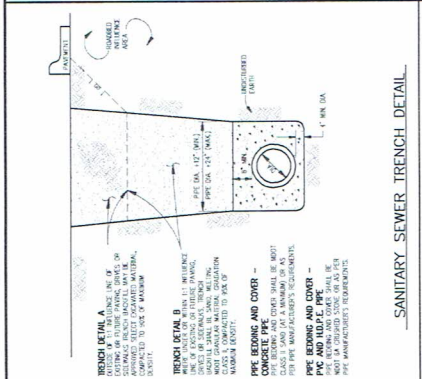
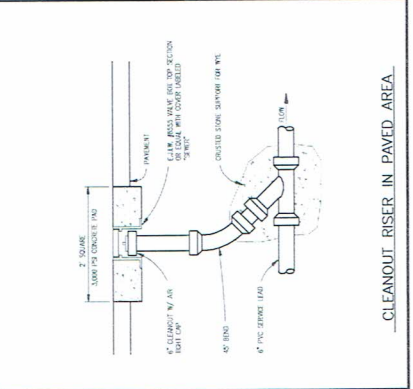
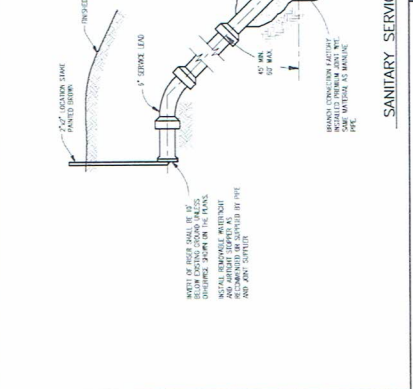
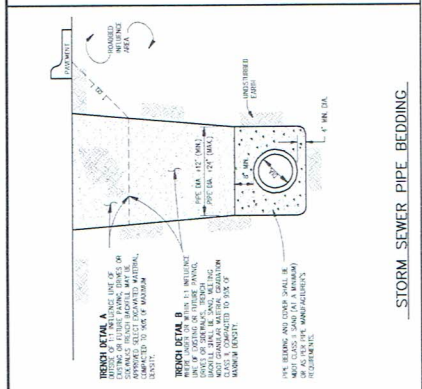
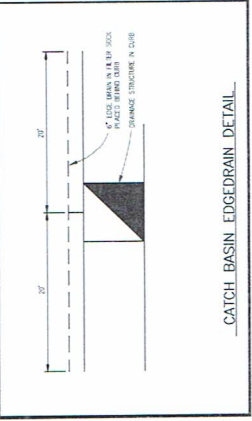
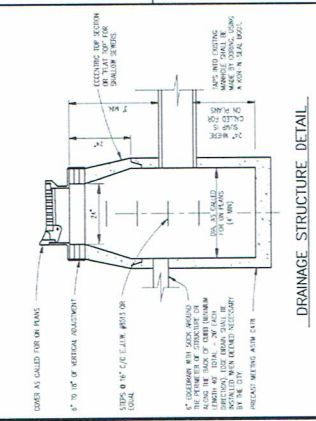
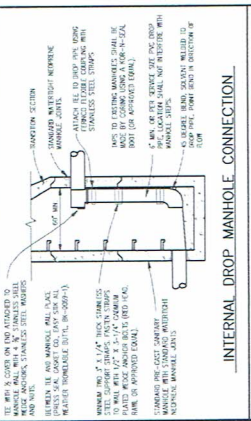
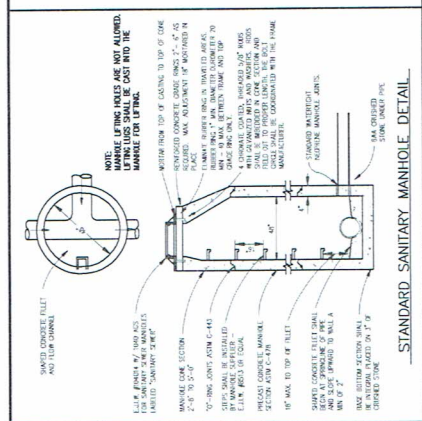
1. Preliminary Acceptance

- a. Prior to acceptance, all sanitary sewers shall be flushed and cleaned in accordance with City Standards.
- b. Air Test or Infiltration Test shall be completed in accordance with the "Ten State Standards".
- c. Televising shall be completed in accordance with the City Standards (see Sewer Detail Sheet).
- d. The Developer shall submit record drawings, which must include rim elevations, inverts, pipe size, and slopes.

2. Final Acceptance

- a. Approved "mylar" record drawings shall be submitted to the City prior to final acceptance of the sanitary sewer. The City will review the record drawings and video tapes to determine if the sewer is acceptable. If the City determines the sewer has deficiencies, they shall be corrected to the City's satisfaction prior to the City accepting the sewer.





**REVISIONS**

NO.	DATE	DESCRIPTION
1	10-11-14	ADOPTED BY CITY
2	10-11-14	ADOPTED BY CITY

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