

CHAPTER 12

LOW PRESSURE SANITARY SEWER DESIGN

1. GENERAL

- A. This chapter covers the minimum design criteria to be used for designing low pressure sanitary sewer (LPSS) private home or commercial pump stations, pipelines, and appurtenances including those portions of low-pressure sewer service connections that lie in public rights-of-way and in easements granted to Charlotte Water. All other systems are the responsibility of the respective property owner unless otherwise documented by an agreement with Charlotte Water.
- B. Low pressure sewers are only allowed in the areas designated in the *2022 Lake Area Study* and generally include the areas bordering Lake Norman, Lake Wylie, and Mountain Island Lake where gravity service would involve numerous, small lift stations. LPSS will only be considered where a thorough study of all alternatives clearly indicates a gravity collection and disposal system with or without a central lift station is not practical or feasible.
- C. All engineering plans for low pressure sewers must meet the Charlotte Water design standards as presented, the State standards as indicated in the most recent amended *Administrative Code, Title 15A, Subchapter 2T Waste Not Discharged to Surface Waters* by the North Carolina Department of Environmental Quality (NCDEQ), and the most current edition of the North Carolina State Plumbing Code. In general, the Charlotte Water standards should be the primary source for design guidance with the State standards as a supplement. In some cases, the Charlotte Water standard is more stringent than the State standard.
- D. These design standards do not apply to private home pump stations pumping into the public gravity sewer system.
- E. These design standards do not apply to Septic Tank Effluent Pump (STEP) systems. Any proposed STEP system must be reviewed by Charlotte Water and permitted by NCDEQ. Conversion of septic tanks for use with a low-pressure sewer system must first be approved by the Mecklenburg County Water Quality Program.
- F. Inspection and testing by a Charlotte Water inspector will be required of the new LPSS system prior to acceptance of the system.

2. SUBMITTAL REQUIREMENTS

- A. All low-pressure sewers must be designed by a professional engineer licensed in the state of North Carolina and submitted to NCDEQ and Charlotte Water for technical review and approval for conformance to *15A NCAC 02T Section .0300 Sewer Extensions* and utilizing the most current *Form ASEA: Alternative Sewer Extension Application with Supporting Documentation*.
- B. In addition to the application documentation required under Paragraph 2.A, the Engineer of Record shall provide Charlotte Water a Customer Information Packet that shall include:

- 1) Installation Checklist
- 2) Maintenance Checklist
- 3) Commonly asked questions and answers
- 4) Typical installation drawings
- 5) Pump manufacturer's literature such as pump curves, features, and specifications
- 6) List of all lots to be served by the proposed system with the following information:
 - a. Address
 - b. Tax parcel number
 - c. Pump elevation
 - d. Pump design point
 - e. Pump on/off float switch elevations
 - f. High level alarm float elevation
 - g. Top of the wet well elevation
 - h. Ballast data (dimensions, material)

3. HYDRAULIC DESIGN

A. Calculating Flows

- 1) Flow analysis shall include a sewer basin map showing the project's total potential sewered area and downstream connection to an existing sewer.
- 2) Populations to be served shall be calculated from Future Land Use (FLU) plans for the sewer basin. Population may include residential, commercial, industrial, and institutional categories. Population should be estimated based on developable area. Depending on complexity of the project, Charlotte Water may request the population projection calculations. For subdivisions, populations may be based on planned lots to be built in the subdivision including all future phase lots.
- 3) All residential, commercial, industrial, and institutional unit wastewater design flow rates shall be as per 15A NCAC 02T .0114 unless that design flow has been adjusted as granted pursuant to paragraph (f) of that regulation.
- 4) Peak daily flow shall be proportional to population and calculated using the following equation:

$$PF = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

Where:

PF = peaking factor, minimum of 2.5

P = service population in thousands

B. System Design

- 1) Residential LPSS systems may be served by a simplex grinder pump if average daily design is less than or equal to 600 gpd. Larger residential, commercial, industrial, and institutional land uses must be served by a duplex grinder pump system as required by State regulations.
- 2) A separate private pump station and lateral shall be provided for each residential, commercial, industrial, or institutional building and for each parcel.
- 3) The private pressure sewer shall connect to the Charlotte Water maintained system at a stub from the property line side of the dual ball valve/check valve assembly in accordance with the service connection Standard Detail.
- 4) The LPSS system shall be under positive pressure at all time with the discharge elevation above all intermediate high points.
- 5) Cleanouts/manual air release valves shall be provided at all high points along the force main.
- 6) Cleanouts shall be provided at 500-foot intervals along mains and placed on the upstream side of a main line isolation plug valve.
- 7) A hydraulic model of the LPSS system may be used to provide output including the network layout, nodes, actual internal diameter of pipe sizes between nodes, expected velocity and flow in each line segment, and TDH. Manufacturer's software can be utilized; however, the Engineer of Record shall seal the model as to the accuracy of the input and output values. The model shall reflect the use of the appropriate average and peak flows as calculated in Section B, a Hazen-Williams "C" coefficient for the pipe material used, and an allowance for minor losses associated with the network. The model shall account for connections to existing pressure sewer systems and not affect the operation of the existing system (i.e., shut other pumps out).
 - a. A Hazen-Williams "C" coefficient of 130 to 140 may be used for PVC and HDPE.
 - b. Hydraulic Calculations shall demonstrate pumps selected are capable of meeting TDH conditions at any proposed or potential grinder pump location.

1 8) The hydraulic model shall provide an initial activation, an average flow discharged
2 from the LPSS system, and a maximum flow discharged with all pumps operating.
3 The maximum flow condition will be experienced upon restoration of power following
4 a system-wide power outage.

5
6 9) The hydraulic model shall confirm the downstream capacity of the receiving gravity
7 sewer at both full-pipe flow at peak flow and half-full pipe at average flow.
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9 **4. PRIVATE PUMPS**

- 10
11 A. Private pumps must be centrifugal design; no positive displacement pumps are allowed.
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13 B. LPSS pump manufactures include Pentair/Myers, Keen, Xylem, or approved equal by
14 Charlotte Water.
15
16 C. The impeller diameter of individual pumps in a system with varying pump elevations
17 shall be sized such that full size impellers are used at pumps at the lowest elevations
18 and reduced size impellers are used at higher pumps such that the total TDH of any one
19 pump is within 20% of all other pumps.
20
21 D. Pressure shall not exceed pump and/or pipe pressure limitations.
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23 **5. PRIVATE SINGLE FAMILY WET WELL**

- 24
25 A. The wet well shall be a minimum of 3 feet in diameter and a minimum of 6 feet deep and
26 be provided with a screened vent. Other sizes may be considered for individual site
27 constraints at Charlotte Water's discretion.
28
29 B. The wet well shall be designed to prevent flotation.
30
31 C. The wet well shall provide a minimum of 240 gallons or 24 hours of wastewater storage
32 above the pump on level and under the wet well lid, no higher than 1-foot below finished
33 floor elevation unless otherwise approved by Charlotte Water.
34
35 D. In general, the wet well shall contain the grinder pump(s), pump on/off float switches,
36 high level alarm float, pump discharge pipe(s) and check valve(s). The control panel
37 shall be mounted for easy access on the building served and contain an audible and
38 visual high-water alarm.
39
40 E. Large residential, commercial, industrial, and institutional duplex lift stations are required
41 to have a standby power source and telemetry system to provide remote notification of a
42 problem condition.
43

44 **6. PUBLIC LOW-PRESSURE MAINS**

- 45
46 A. Minimum pipe size is 2 inches; maximum pipe size is 4 inches. Service lines shall be
47 provided per the standard details.
48

- B. Minimum velocity in any pipe segment shall be 2 fps with a minimum of 2 pumps operating simultaneously and maximum velocity 10 fps under simultaneous pump operating conditions.
- C. Pipe shall be located in publicly maintained road right of way or properly recorded public easements on private property at Charlotte Water's discretion.
- D. Pipe shall not be located in either public or private alleys.
- E. Pipe material for various size LPSS pipes is provided in Table 12.2.

Table 12.2: Pipe Material for LPSS Sewers	
Sewer Pipe Size (inches)	Material
2 - 4	PVC, SDR 13.5, ASTM D2241, IPS
2 – 3	HDPE, SDR 9, AWWA C901, IPS
4	HDPE, SDR 9, AWWA C906, IPS

- F. Pipe size and material shall be listed on the design drawings.

7. UTILITY SETBACKS AND SEPARATIONS

The minimum clearance requirements for conflicts with utilities and other features, in accordance with NCAC 02T.0305 and governing utility guidelines, is shown in Table 12.3. Depth of cover shall be defined from the top of the pipe.

Table 12.3: Minimum Separations for Sewers per NCAC 02T.0305	
Setback Parameter	Separation Requirements*
Storm Sewers and other utilities not listed below (vertical)	2 feet
Where separation cannot be met, DIP or structural bridging to prevent crushing the underlying pipe shall be used.	
Water Lines	18 inches
Vertical, water over sewer including in shared, benched trenches	
Horizontal	
Where a water main crosses over a sewer, one full length of water pipe shall be located so that both joints will be as far from the sewer as possible.	10 feet
Reclaimed Water Lines	18 inches
Vertical, reclaimed over sewer	

Horizontal, reclaimed over sewer	2 feet
Any private or public water supply source, including any wells, WS-I waters of Class I or Class II impounded reservoirs used as a source of drinking water (stream classifications from Division's NC Surface Water Classifications webpage) For public or private wells where minimum separation cannot be met, piping materials, testing methods and acceptability standards meeting water main standards shall be used. All appurtenances shall be outside the 100' radius. The minimum separation shall however not be less than 25' from a private well or 50' from a public well.	100 feet
Waters classified WS (except WS-I or WS-V), B, SA, ORW, HQW, or SB from normal high water (or tide elevation) and wetlands (stream classifications from Division's NC Surface Water Classifications webpage)	50 feet
Any other stream, lake, impoundment, or ground water lowering and surface drainage ditches	10 feet
Any building foundation	10 feet
Any basement	10 feet
Top slope of embankment or cut of 2 feet or more vertical height	10 feet
Drainage systems and interceptor drains	5 feet
Swimming pools	10 feet
Final earth grade (vertical) Where minimum cover cannot be met, DIP casing pipes shall be used. Where sewers are subject to traffic bearing loads, pipe with proper bedding to develop design supporting strength shall be provided.	5 feet
For all other separations, materials, testing methods, and acceptability standards meeting water main standards (15A NCAC 18C) shall be required in any alternative.	

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Table 12.4: Minimum Separations for Sewers to Other Features	
Stormwater BMP	Sewer easement remains outside 1:1 slope to the BMP easement
Retaining Wall	Sewer to remain a minimum of 5 feet from footings and outside of geogrid area/structural impact of retaining wall
Roadways and Driveways	2 feet from edge of pavement and/or back of curb measured to center of pipe

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1 **8. CORROSION PROTECTION**

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3 A corrosion resilient manhole shall be provided where the low-pressure sewer discharges
4 into a downstream manhole. Corrosion protection may include protective coatings on
5 exposed concrete surfaces, concrete additives, or polymer concrete structures at Charlotte
6 Water's discretion.
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8 **9. DESIGN OF EROSION AND SEDIMENT CONTROL MEASURES**

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10 Regardless of size, all LPSS projects shall include measures and/or devices to prevent
11 erosion and to contain sediment within the limits of the right-of-way and/or proposed
12 easements. Design and permitting of erosion and sediment control devices shall be in
13 accordance with Charlotte Land Development Standards including the City of Charlotte Soil
14 Erosion and Sedimentation Control Ordinance for Developer-Donated projects. Charlotte
15 Water designed projects shall meet NCDEQ requirements, as outlined in the North Carolina
16 Erosion and Sediment Control Planning and Design Manual. Projects outside of City limits
17 but within Mecklenburg County or outside of Mecklenburg County shall follow the
18 appropriate county, town, and/or state requirements.
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20
21
END OF SECTION

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