

# **CITY OF WESTBROOK**



## **Wastewater Supplemental Specifications October 2020**

## **General**

This manual is intended as a guideline and it is the Designer's responsibility to review and verify the applicability of all material presented herein as it pertains to the specific project under design.

The portion of the sewer system, which are considered the property and responsibility of the City of Westbrook, are the sewer pipelines, appurtenances and sewer service connections for public buildings which lie in the public right of way, belong to the City or in easements granted to the City of Westbrook. All other systems are in most cases, the responsibility of the respective property owner(s).

Projects that are intended for the City of Westbrook to take over after completion will need to be reviewed by the City and the parameters required will be evaluated on a case-by-case basis.

In the preparation of contract documents, the Designer will take into full account such matters as environmental impact, public impact including maintenance of pedestrian and vehicular traffic, maintenance of existing and proposed utility services, constructability and system maintenance to produce the safest and most efficient long-term design.

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# 1. Terminology and Abbreviations:

The following terms and abbreviations are used in this Design Manual:

## a. General

|                 |  |
|-----------------|--|
| <b>ASTM</b>     | American Society for Testing and Materials                         |
| <b>AWWA</b>     | American Water Works Association                                   |
| <b>ANSI</b>     | American National Standards Institute                              |
| <b>AASHTO</b>   | American Association of State Highway and Transportation Officials |
| <b>CITY</b>     | City of Westbrook  |
| <b>DIPRA</b>    | Ductile Iron Pipe Research Association                             |
| <b>MAINEDEP</b> | Maine Department of Environmental Protection                       |
| <b>MAINEDOT</b> | Maine Department of Transportation                                 |

## b. Definitions

|                                |   |
|--------------------------------|---|
| <b>Lateral or Branch Sewer</b> | Gravity sewer pipeline designed and constructed to convey wastewater from the house/dwelling to the Collector Sewer.              |
| <b>Collector Sewer</b>         | Gravity sewer pipeline designed and constructed to convey wastewater from Lateral or Branch Sewers to the Outfall or Trunk Sewer. |
| <b>Force Main</b>              | Pressure sewer pipeline designed and constructed to convey wastewater from a pumping station to the gravity sewer.                |
| <b>Pressure Sewer</b>          | Sewer pipeline designed and constructed to convey wastewater from a single grinder pump to the Lateral or Branch sewers.          |
| <b>Cover</b>                   | The vertical distance from the finished grade to the top of the pipe.   |
| <b>Depth</b>                   | The distance between the invert and finished grade of the pipe.   |

## c. Pipe Material

|             |                           |
|-------------|---------------------------|
| <b>ACP</b>  | Asbestos Concrete Pipe    |
| <b>DIP</b>  | Ductile Iron Pipe         |
| <b>CIPP</b> | Cast-in-Place Pipe        |
| <b>CIP</b>  | Cast Iron Pipe            |
| <b>HDPE</b> | High Density Polyethylene |
| <b>PVC</b>  | Polyvinyl Chloride        |
| <b>RCP</b>  | Reinforced Concrete Pipe  |
| <b>VCP</b>  | Vitreous Clay Pipe        |

## d. Miscellaneous Terms

|            |                      |
|------------|----------------------|
| <b>HGL</b> | Hydraulic grade line |
|------------|----------------------|

|            |                         |
|------------|-------------------------|
| <b>ID</b>  | Pipe inside diameter    |
| <b>psi</b> | pounds per square inch  |
| <b>OD</b>  | Pipe outside diameter   |
| <b>PUE</b> | Public Utility Easement |
| <b>ROW</b> | Public Right-of-Way     |

## 2. Pipeline Sizes and Materials (Gravity Sewers)

### a. General

- 1) Standard pipe materials: Ensure that all designs allow for use the of materials that conform to all applicable sections of the City of Westbrook Specifications and Standard Details.
- 2) Special pipe materials: Submit any special design features and/or special materials required due to the specific nature of the contract for approval to the Wastewater Division Manager/City Engineer prior to being incorporated into the contract documents. If approved, it will be for the specific case in question and not a general approval for use elsewhere (other contract documents).

### b. Minimum Pipe Size

| Type of Property | Minimum Pipe Size |
|------------------|-------------------|
| Mainline Sewer   | 8"                |
| Residential      | 4"                |
| Commercial       | 6"                |
| Multifamily      | 6"                |

### c. Required Location of Connections

| Size/Type of Lateral | Size of Main    | Connection Made At |
|----------------------|-----------------|--------------------|
| 6" or smaller        | 15" or smaller  | Main               |
| Same as main         | Same as lateral | Manhole            |
| 8" or larger         | 15" or smaller  | Manhole            |
| Pressure lateral     | Any size        | Manhole            |

**Note:** At no time shall the main be smaller than the lateral.

### d. Hydraulic Design for Sewer Pipelines

- 1) Reserve capacity should be provided when designing pipe sizes. The sewer pipeline should not be designed to flow completely full at the design flow rate.
- 2) Hydraulic calculations should be submitted for sewer pipelines over 12-inches, conveyed via pump station and intended to be taken over by the City.
- 3) For existing sewer pipelines larger than 15-inch diameter, review as-builts and determine existing flow conditions before designing connections to the sewer pipeline.

### 3. Vertical Alignment (Profiles)

- 1) Provide a minimum of four (4) feet of cover over sewer pipelines and private laterals, measured from the lowest profile grade or ground line.
- 2) Sewer over fourteen (14) feet of cover will not be taken over by the City of Westbrook.
- 3) Design of gravity sewer pipelines upstream of a wastewater pumping station: If a surcharge could occur in the gravity sewer pipeline upstream of the pump station due to high wastewater level in the pumping station at the design flow, provide a plot of the HGL on the profile. Identify the location and elevation of wastewater overflow points, as well as frame and cover elevations and basement elevations, as a result of an inoperative wastewater pumping station.

### 4. Vertical Alignment – Pipe Slope

#### a. General

- 1) Design grades to minimize excavation, while satisfying the minimum and maximum velocity, clearance and depth requirements.
- 2) Consider the following maintenance concern when determining pipe grades:
  - a) Very steep grades, low flat grades, deep drop connections at manholes, etc., may save initial costs, but the savings will likely be offset by the increased long-term cost of maintaining the system.
  - b) The release of Hydrogen Sulfide (H<sub>2</sub>S) caused by changed in grade or drop connections at manholes.
  - c) Problems that occur when silt and grease build up where flow exits from a steep pipe grade and enters a pipe on a flat pipe grade. Balance the pipe slopes to provide a more constant grade.

#### b. Minimum Pipe Slopes

- 1) Allowable minimum pipe slopes:

| Pipe Sizes                   | Minimum Slope             |
|------------------------------|---------------------------|
| 4 & 6-inch laterals          | Maine State Plumbing Code |
| 8-inch Terminal Sewer Mains* | 1.00%                     |
| 8-inch Sewer Mains           | 0.60%                     |
| 10-inch Sewer Mains          | 0.46%                     |
| 12-inch Sewer Mains          | 0.34%                     |
| 15-inch Sewer Mains          | 0.24%                     |
| 18-inch Sewer Mains          | 0.19%                     |
| 21-inch Sewer Mains          | 0.14%                     |
| 24-inch Sewer Mains          | 0.12%                     |
| 30-inch Sewer Mains          | 0.10%                     |
| 36-inch Sewer Mains          | 0.07%                     |

\*Terminal sewers are sewer mains at the terminus or end of a pipeline

- 2) Minimum pipe slopes are based upon Manning's Formula,  $n = 0.013$  and a velocity of two and one half (2.5).
- 3) No exceptions will be made for changing minimum slopes.
- 4) Designs for pipe sizes larger than 12-inch in diameter need to include pipe slope design data calculations.

**c. Maximum Pipe Slopes**

- 1) A statement needs to be submitted to the City stating all the pipe velocities are under 10 feet per second, when requested.

**d. Steep Pipe Slopes to Flatter Pipe Slopes**

- 1) When steep pipe segments are followed by sections with flatter slopes, problems may occur such as: debris accumulating, surcharging and/or potential for hydrogen sulfide generation.
- 2) For sewer 12-inch in diameter and smaller: When incoming upstream pipe slopes are over five percent (5%) and the outgoing downstream slope is less than one half (1/2) the incoming upstream slope, change the pipe slopes so that the incoming upstream pipe has a slope less than twice the slope of the immediate downstream pipe.

Example: If the incoming upstream pipe slope is set at 6%, design the next downstream sewer segment steeper than 3%.

## 5. Design of Structures

**a. Manholes**

- 1) The following requirements must be met for the City to take over a project's wastewater structures:
  - a. Manhole frames and covers must be heavy duty General Foundries #12461, or equivalent, and marked SEWER on the cover. Reference Standard Detail **[5a-1a]**.
  - b. Manholes should be a minimum of four (4) feet in diameter and shall adhere to Standard Detail **[5a-1b]**.
  - c. Manhole depth cannot exceed a depth of fourteen (14) feet from the outgoing invert to the rim elevation.
  - d. A shallow manhole will be considered anything between four (4) and five (5) feet from the incoming invert to the rim elevation.

- i. Shallow manholes must be insulated with the channel lined.
- ii. A minimum of a four (4) foot diameter manhole with a heavy-duty General Foundries thirty (30) inch diameter frame and cover are required.

2) Spacing

a. Maximum Spacing

| Pipe Size          | Maximum Manhole Spacing |
|--------------------|-------------------------|
| 8-inch to 24-inch  | 300 feet                |
| 27-inch to 42-inch | 600 feet                |

b. Minimum Spacing

- i. Outside diameter (OD) of adjacent manholes (including the bottom slabs) should have a minimum of five (5) feet horizontal clearance.

3) Drop Connections

- a. Do not design any drop connection to existing brick manholes.
- b. Do not design drop connections for future connections.
- c. All proposed manhole drop connection details, either internal or external, shall be approved by the City Engineer or Wastewater Division Manager.
- d. Drop manholes that do not fall within the standard details provided will need to be individually reviewed and approved by the Engineering/Wastewater Department.
- e. Standard Detail [5-3d] – Drop Manhole Type “A”: Outside drop, 8-inch through 12-inch diameter sewer pipes: Maximum drop allowed at the manhole is 3’-9” and the minimum drop allowed is 2’-2”
- f. Standard Detail [5-3e] – Drop Manhole Type “B”: Outside drop, 8-inch through 12-inch diameter sewer pipe inverts of pipe and manhole are greater than 3’-9”:  
Maximum drop allowed is based on the following pipe slopes of the influent pipe entering the drop connection:
  - i. Pipe slopes of five (5%) percent or less, the maximum drop allowed is twelve (12) feet
  - ii. Pipe slopes of greater than five (5%) percent to eight (8%) percent, the maximum drop allowed is seven (7) feet
- g. Standard Detail [5-3f]: Inside drop manhole for 8-inch PVC sewer pipelines connection to precast concrete manholes. Only one inside drop can be constructed in the manhole.
  - i. Maximum pipe slope of the influent pipe is five (5%) percent.



- ii. Verify the following before specifying an inside drop manhole connection for an existing manhole:
  - 1. Existing manhole is precast.
  - 2. Adequate room for personnel to work inside the manhole.
  - 3. The inside drop connection piping is not within the area that is defined by the projection of the manhole entrance vertically down to the manhole bottom. If necessary, relocate the existing frame and cover, existing precast cone section and existing manhole steps to allow unobstructed entry and exit.
- h. Standard Detail [5-3f]: Inside drop manhole for 8-inch PVC sewer pipelines connecting to precast concrete manholes utilizing fiberglass drop bowl. Only one inside drop can be constructed in the manhole.
  - i. Maximum pipe slope of the influent pipe is **less than ten (10%) percent**.
  - ii. Verify the following before specifying an inside drop manhole connection for an existing manhole:
    - 1. Existing manhole is precast.
    - 2. Adequate room for personnel to work inside the manhole.
    - 3. The inside drop connection piping is not within the area that is defined by the projection of the manhole entrance vertically down to the manhole bottom. If necessary, relocate the existing frame and cover, existing precast cone section and existing manhole steps to allow unobstructed entry and exit.
- 4) Connection into Existing Manhole
  - a. A lateral should be connected into a manhole at the shelf level.
  - b. If a connection into an existing manhole is 6-inches in diameter or greater, a new channel will need to be constructed with the new line coming in at a 45-degree angle.

## 6. Sewer Service (House) Connections/Laterals

- 1) Type of Service Connections
  - a. Per City Ordinance, an individual service is required for each building. Reference Standard Detail **[6-1a]**.
- 2) Size of Private House Laterals
  - a. Laterals for residential services are generally 4-inch or 6-inch. Larger sizes may be approved, if required, with proper justification.

### 3) Connection of Residential Lateral to Mainline Sewer

- a. No connection of any kind will be permitted between a transition manhole with a force main larger than 4-inches in diameter and the next downstream manhole.
- b. A minimum separation of 10 feet between adjacent service connections is required.
- c. Existing connections can be used if televised and approved by the Wastewater Division Manager.
- d. Only three services at 4-inches each are allowed per manhole.
- e. Only two force main private services are allowed per manhole. The connection into the manhole must be made with at least one standard piece of 4" PVC to dissipate pressure and enter at the shelf level. A channel shall be constructed that is the same width as the inner diameter of the pipe and that discharges into the main line channel (not shelf).
- f. When two or three residential laterals are connected at the same location, provide a manhole at mainline sewer.
  - i. Channel each residential sewer with a smooth curved channel through the manhole.
  - ii. The interior angle of intersection of the centerline of multiple residential laterals and the discharge mainline sewer pipe, shall not be less than ninety (90) degrees.
  - iii. Provide 9-inch minimum between outside diameters of residential sewer laterals at the interior manhole wall.

### 4) Horizontal Alignment of Private Laterals

- a. The Designer shall coordinate with the Applicant to determine the appropriate location, slope and size.
  - i. Lateral information shall be required as part of the application process in the form of a sketch. The sketch should include spot grades, limits of the lateral from the mainline sewer to the mainline sewer, length, slope, material and size of lateral.
  - ii. Types of lots that can be service with a lateral:
    - 1. Improved lots
      - a. For existing dwellings or buildings, show the elevation of the lowest level of the dwelling or building (basement or first floor) on the plans and profiles. If the lowest level cannot be served, a note must be provided on the drawings

stating what can be served in the dwelling or building with the proposed lateral.

- b. For new/proposed dwellings or buildings, show the proposed elevations on the plans and profiles.

2. Unimproved lots

- a. Existing lots with no dwellings or buildings
- b. Proposed or future lots with no plans for any dwellings or buildings

- 5) Vertical Alignment of Private Laterals

- a. Provide a minimum cover of four and a half (4 ½) feet over a private lateral to protect from frost if lateral is located underneath soil.
- b. Provide a minimum cover of five and a half (5 ½) feet over a private lateral to protect from frost if lateral is located underneath pavement.
- c. Determining the dept of the private lateral at the mainline sewer
  - i. Improved lots: Submit a sketch of the new sewer connection with elevations and slopes.
  - ii. Unimproved lots
    1. In existing areas with existing mainline sewers, the private lateral is controlled by the invert elevation of the existing mainline sewer. The private lateral will need to be able to connect with enough slope, while not exceeding maximum slope (based on pipe size).
- d. Maximum depth of private laterals
  - i. For mainline sewer 14 to 20 feet deep, connect the private lateral with a manhole and not directly into the mainline sewer pipe.
  - ii. For mainline sewer over 20 feet deep, the private lateral should be relocated out of deep areas when possible. If approved by the City of Westbrook, the private lateral should be connected via a manhole and not directly to the mainline sewer pipe.

## 7. Common Design Guidelines

- a. Easements

- 1) When sewer pipeline(s) extends into property that is not publicly owned, show the limits of the easement and construction strip on the drawings. Required easement

widths for public ownership of sewer are shown below for pipelines up to a depth of 14 feet:

| Pipeline Diameter   | Width of Easement |
|---------------------|-------------------|
| 12-inch and smaller | 30 feet           |
| 14-inch to 30-inch  | 35 feet           |
| 36-inch             | 40 feet           |

- 2) Consider the area required to facilitate future maintenance, excavation, and repairs when determining the width of the easement.

**b. Pipeline Crossings and Clearances**

- 1) Horizontal Separation with Other Utilities/Structures
  - i. Horizontal separation should be measured from the outside diameter (OD) or edge of each pipe or utility, unless otherwise noted.
  - ii. Provide a minimum of five (5) feet horizontal separation between sewer pipelines and other utilities, related structures and erosion control structures.
  
- 2) Minimum Separation When a Sewer Pipeline is Parallel or Adjacent to Existing or Proposed Buildings or Dwellings
  - i. For sewer pipelines 12-inch in diameter and smaller, provide a minimum separation from a building or dwelling: fifteen (15) feet horizontal separation or a distance on a 1:1 slope from the bottom of the foundation of the existing or proposed building or dwelling to the bottom edge of the pipeline trench, whichever is greater.
  - ii. For sewer pipelines larger than 12-inch diameter, the minimum separation from building or dwelling is to be determined based on the following factors: maintain a minimum horizontal separation of twenty-five (25) feet and consider potential property damage and physical injury during construction, maintenance and failure of the pipeline in assessing whether a greater separation is warranted. Select the separation so that the existing or proposed foundation of the building or dwelling unit will not be damaged during the construction, maintenance and failure of the pipeline.
  
- 3) Minimum Separation Requirements Between Existing and Relocated Sewer Pipelines (when existing sewer is to remain in service until the relocation is complete)
  - i. For sewer pipelines smaller than 14 inches in diameter, provide a minimum of ten (10) feet separation, centerline to centerline of the two pipelines.
  - ii. For sewer pipelines between 14 and 24 inches in diameter, provide a minimum of ten (10) feet separation, OD to OD of the two pipelines.

- iii. Pipelines larger than 24 inches in diameter will need to be reviewed by the Westbrook Wastewater Division for separation.
- 4) Minimum Separation Requirements Between and Existing or New Sewer and a New Force Main
  - i. If both pipelines are 12-inch and smaller in diameter, provide a minimum of ten (10) feet of separation, centerline to centerline of the two pipes.
  - ii. If either pipeline is larger than 12-inches in diameter, provide a minimum of ten (10) feet separation, OD to OD of the two pipelines.
- 5) Crossing Under Existing Pipelines and Utilities
  - i. Supporting the existing pipe or utility across the proposed trench is accomplished by limiting the proposed pipe trench width so that the existing pipe is self-supporting or specially designing a support.
    - a. It is the responsibility of the contractor to provide support as necessary when trenching under existing utilities.
    - b. If there is considerable interest in protecting the existing pipeline or utility which may be undermined by a wide trench, etc. and if directed by the City of Westbrook, provide a design for the support of the excavation and the utility as part of the contract documents.

**c. Sewer Service (House) Connections/Lateral Abandonment**

- 1) Sewer service connections or laterals that need to be removed need to be either entirely removed to the sewer main or plugged at the sewer main and filled with concrete fill.
  - i. Concrete Fill Option: The contractor shall excavate and expose the lateral at the property line. An inflatable plug must be placed in the lateral where the lateral connects into the City main and secured by a cable or chain. The lateral will then be filled with pumped grout starting at the plug and filling out to the point of excavation.