CHAPTER 4   SANITARY SEWER SYSTEM

4.1.  INTRODUCTION

All sanitary sewer systems shall comply with the requirements of these STANDARDS AND SPECIFICATIONS and may include special criteria established by the City for overall hydraulics of the sanitary sewer system. Special criteria shall be outlined at pre-design meetings, as determined necessary by the City.

4.1.1  USE OF SANITARY SEWER

The use of sanitary sewers within the City of Northglenn shall be in accordance with applicable sections in Chapter 16, of the Municipal Code.

4.2.  DESIGN CRITERIA

4.2.1  SCOPE

It is the intent of this "design criteria" section to provide sufficient detailed information to enable the Engineer for the Owner/Developer to correctly and efficiently design the overall sanitary sewer system for a particular development. If there is a question or a concern regarding the design of any portion of the sanitary sewer system that is not adequately answered within this chapter, the Owner/Developer or his representative shall contact the City to get all issues resolved prior to design. Any deviation from these STANDARDS AND SPECIFICATIONS must be approved in writing by the City.

Outfall sewers, pumping stations, interceptors and appurtenances are included under the definition of "domestic wastewater works" in the State Water Quality Control Act. Section 25-8-702 of the State Water Quality Control Act states: "No person shall commence the construction of any domestic wastewater treatment works or the enlargement of the capacity of an existing domestic wastewater treatment works, unless the site location and the design for the construction or expansion have been approved by the division (Colorado Department of Public Health and Environment, CDPHE)." Section 25-8-103 (5) of the State Water Quality Control Act states: ""Domestic wastewater treatment works means a system or facility for treating, neutralizing, stabilizing, or disposing of domestic wastewater which system or facility has a designed capacity to receive more than two thousand gallons of domestic wastewater per day." Therefore, all plans falling under this criteria shall be submitted to the CDPHE for approval prior to construction of any domestic wastewater treatment works, including wastewater treatment plants, individual sewage disposal systems, lift (pumping) stations and certain interceptor sewers with a capacity of 2,000 gallons per day or greater, as well as certain facilities that produce reclaimed domestic wastewater.

4.2.2  GENERAL

The sanitary sewer system shall be designed by a professional engineer registered in the State of Colorado utilizing the most current technical standards along with good, sound engineering judgment throughout the design process. The design process includes the submittal of a utility study and construction drawings for review and approval by the City. The following note shall be incorporated into the utility study:
"We acknowledge that the City of Northglenn's review of this study is only for general conformance with submittal requirements, current design criteria and standard engineering principles and practices."

4.2.2.1. **Study**

The study shall include, as a minimum, the following information and shall be typed and bound in an 8-1/2-inch x 11-inch report binder:

a. Text, which addresses, a minimum of project location and description, project concept, discussion of any information that would affect the City's ability to serve the new area, and any recommendations and conclusions of the analysis.

b. The area, in acres, which could be served by gravity by the new sewer, shown on a topographic map which delineates the basin boundaries as stated in (G) below.

c. The estimated population densities and total population based on land use projections to be served by the new sewer.

d. The estimated quantity and quality of any industrial wastes to be discharged to the system.

e. Design flow rates, minimum and maximum flow velocities, minimum and maximum pipe slopes, and infiltration allowances.

f. The impact of the additional flows on the existing sanitary sewer system at all critical points between the proposed site and the major interceptor.

g. A utility map which includes, a minimum of, the following information:
   1) Location of all proposed and existing easements and/or right-of-ways.
   2) Existing and proposed sanitary sewer lines and appurtenances with sizes and slopes shown.
   3) Basin delineation
   4) All other existing and proposed utilities.

All other requirements for the CDPHE approval when applicable.

4.2.3 **DESIGN FLOW**

The flows used to design the sanitary sewer system for a particular development vary depending on the type of development. There are three general categories of development for which flow rates are given: residential development, commercial development and industrial development. Once the specific type of development is determined, the peak flows are calculated based on average demand, peak factor and infiltration/inflow amounts.
4.2.4  HYDRAULIC DESIGN/SIZING OF SEWER LINES

4.2.4.1. General

Sanitary sewer shall be designed to carry the discharge calculated in accordance with the Northglenn Collection System Modeling Report and to transport suspended material such that deposits in the sewer are precluded.

The minimum diameter for sanitary sewer mains shall be 8-inches. At peak flow in sanitary sewer main must not exceed 80% of pipe capacity.

Oversizing of mains may be required by the City, and costs of such oversizing shall be borne by the City; however, if such oversizing is required to meet the needs of the developer, the full cost thereof shall be borne by the developer. The Public Works Engineering Division reserves the right to size mains to provide service for future needs.

The minimum diameter for sanitary sewer service lines shall be 4 inches.

4.2.4.2. Sanitary Sewer Mains

a. The following table gives the minimum and maximum allowable slopes for sanitary sewer mains:

<table>
<thead>
<tr>
<th>Diameter (Inches)</th>
<th>Minimum Slope (Foot/Foot)</th>
<th>Maximum Slope (Foot/Foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0.00500</td>
<td>0.190</td>
</tr>
<tr>
<td>10</td>
<td>0.00500</td>
<td>0.140</td>
</tr>
<tr>
<td>12</td>
<td>0.00220</td>
<td>0.110</td>
</tr>
<tr>
<td>15</td>
<td>0.00150</td>
<td>0.082</td>
</tr>
<tr>
<td>18</td>
<td>0.00120</td>
<td>0.064</td>
</tr>
</tbody>
</table>

Note: 21 inch or larger as approved by the City

b. The sewer must be designed at a slope great enough to produce a flow velocity of two feet (2') per second at the peak design flow using the Manning equation and n = 0.015 but not less than the minimum slope given above.

Hydraulic design of pressure sanitary sewers shall be in accordance with chapter 3 of these standard specifications.

4.2.4.3. Sanitary Sewer Service Lines
The following table shows the minimum and maximum allowable slopes for sanitary sewer service lines:

<table>
<thead>
<tr>
<th>Diameter (Inches)</th>
<th>Minimum Slope (Foot/Foot)</th>
<th>Maximum Slope (Foot/Foot)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>.0208</td>
<td>.0800</td>
</tr>
<tr>
<td>6</td>
<td>.0104</td>
<td>.0600</td>
</tr>
</tbody>
</table>

4.2.5 SYSTEM LAYOUT

4.2.5.1 General

All mains shall be installed in dedicated right-of-ways or public easements. Under no circumstances should sanitary sewer mains be installed parallel to and directly below any concrete such as sidewalks, curbs or gutters. Lines shall normally be located five feet south or east of street centerline, unless otherwise approved, in writing, by the City. Sanitary sewer mains shall be straight between manholes, both in horizontal and vertical alignment.

Sewer mains will ordinarily have a minimum of eight feet of cover to finished ground surface. Where this will provide less than nine feet of elevation difference between the finished lot grade at building line and the top of the sewer main, it will be indicated on the plans that the lot is served by a "shallow sewer" and appropriate elevation information will be given.

Sewer mains will be extended at least ten feet uphill from the lowest lot corner of the uppermost lot to be served adjacent to the sewer main. Sewer mains will terminate in a manhole.

Sanitary sewer mains shall be laid a minimum of ten feet horizontally from any existing or proposed utility. Upon written approval by the City, a sanitary sewer main may be laid closer than ten feet to a parallel water main if it is laid in a separate trench and if the elevation of the invert of the water main is at least eighteen inches above the crown of the sewer main and in addition, polyvinyl chloride pressure pipe is used for the sewer main.

When the sanitary sewer main passes under a highway, railroad or drainage or irrigation ditch, there shall be a minimum of 3-1/2 feet of cover and steel casing shall be installed in accordance with the detail drawing in the Appendix. The steel casing shall extend the entire width of the right-of-way or easement of the crossing structure or as directed by the City.

Refer to Section 3.2.8 for minimum vertical clearances for utility crossings.

4.2.6 EASEMENTS

Utility easements shall be attained in accordance with Section 3.2.9 of these STANDARDS AND SPECIFICATIONS.
4.2.7 FUTURE CONNECTIONS

Manholes shall have pipes stubbed out which are sized to accommodate flows from the upstream basin whenever a future extension of the sanitary sewer main is anticipated. The main line stub-out shall be capped and sealed.

4.2.8 SERVICES

Each structure shall be served by a separate service line. Sanitary sewer service lines shall be located a minimum of ten feet away from all water services (measured horizontally). All service lines shall be constructed perpendicular to the property line of the property they are going to serve and not less than five feet from the side property line. Typical installations should locate the sanitary sewer service line five feet downstream of the centerline of the lot. Six inch service lines and larger shall require connection to the main with a manhole. Any service line tying into a main line larger than 8” shall also be made in a manhole. Pressure line must be connected to a manhole prior to entering the City’s sanitary sewer line.

The City shall not be responsible for locating sewer service lateral stub-outs for future connections.

4.2.9 TAPS

All sanitary sewer service connections to the sanitary sewer main shall be made using "wye" fittings, unless otherwise approved by the City.

4.2.10 UNLAWFUL CONNECTIONS

It shall be unlawful to discharge roof drainage, foundation drainage, sump pumps, surface drainage or any other non-acceptable wastes to the sanitary sewer which would violate any of the provisions of the Municipal Code.

4.2.11 SANITARY SEWER PRE-TREATMENT SEWER-MONITORING FACILITY

Any new building to be constructed in an industrially-zoned area with a floor space greater than five thousand square feet or with a water meter size greater than three-quarter inch or if otherwise required by the City shall install a sewer-monitoring facility in accordance with the Detail Drawing in the Appendix prior to final building inspection approval. The monitoring facility shall be situated outside of the building on the user's premises. If the industrial user's service line ties into an existing City manhole and such manhole allows for safe sampling and isolation of the industrial user's discharge, the City may allow said manhole to serve as the industrial user's monitoring facility. Building with multiple tenants will be required to have multiple sewer-monitoring facilities.

4.2.12 APPURTENANCES

4.2.12.1 Manholes

The maximum spacing between manholes shall be 400 feet. Manholes shall not be located in areas which are subject to flooding from surface runoff. Manholes shall be
located in areas which allow direct access by maintenance vehicles when it is not feasible to locate the manhole in the public street.

If the possibility of surface runoff cannot be avoided, an internal watertight insert shall be installed to prevent inflow. All manholes located outside dedicated street right-of-ways shall be designed and constructed with locking-type cover and the manhole ring shall be bolted to the manhole cone and steel marker posts.

At the termination of a force main, outside drop manholes or other locations at which hydrogen sulfide gases (H2S) is deemed to be a problem, a chemical and or gas resistant manhole lining will be required.

4.2.12.2. **Outside Drop Manholes**

Drop manholes will only be allowed when the design engineer proves that alternates are not feasible and when approved, in writing, by the City. Outside drop manholes will be required whenever a sewer entering a manhole is at an elevation twenty-four inches or more above the manhole invert, C-900 piping and physically constrained connection. Outside drop manholes shall be in accordance with the detail drawing in the Appendix.

4.2.12.3. **Underdrains**

Where underdrains are to be constructed under sewer mains, separate clean-outs shall be provided next to each manhole in accordance with the detail drawing in the Appendix. Further, all underdrain service lines originating from within lots shall meet these requirements including size, marking tape and sock.

4.3. **CONSTRUCTION SPECIFICATIONS**

4.3.1 **EXCAVATION AND TRENCHING**

Excavation, trenching and backfilling shall be done in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

4.3.2 **BEDDING**

Bedding shall conform and be installed in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

4.3.3 **PIPELINE INSTALLATION**

4.3.3.1. **General**

The City shall be notified at least 48 hours in advance of any pipe installation. No sewer main pipe shall be installed without prior City approval. No pipes shall be backfilled until they have been inspected by the City. Alignment and grade of the pipe and the location of fittings and manholes shall be staked under the supervision of a professional surveyor registered in the State of Colorado.
Proper implements, tools and facilities shall be provided and used by the contractor for the safe and convenient execution of the work. All pipe fittings and manhole sections shall be carefully lowered into the trench by means of a derrick, ropes or other suitable tools or equipment to prevent damage to sanitary sewer line material. Under no circumstances shall sanitary sewer line materials be dropped or dumped into the trench.

All pipe fittings and pre-cast manhole sections shall be carefully examined for cracks and other defects immediately before installation. The groove in the bells of the pipe shall be full and continuous or the pipe will be rejected. Defective pipe or fittings shall be removed from the job site within 24 hours of notification by the City. All foreign matter or dirt shall be removed from the interior and ends of the pipe before they are lowered into position in the trench and prior to connection.

Every precaution shall be taken to prevent foreign material and trench water from entering the pipe and fittings. During construction, the contractor shall provide and maintain adequate equipment to properly remove and dispose of all water entering the trench and any other part of the work.

4.3.3.2. Pipe

Pipe shall be laid from downstream to upstream with spigot ends pointing downstream. All pipe shall be placed true to line and grade and carefully centered and with a smooth invert at the joint. The joint shall be made in a workmanlike manner and shall be watertight. Immediately before joining two lengths of pipe, the inside of the bell and the outside of the spigot end and the gasket shall be thoroughly cleaned. Caution shall be exercised to ensure that the correct type of gasket is used. A thin film of gasket lubricant shall be applied to the inside face of the gasket and the spigot end of the pipe. The spigot end of the pipe shall be placed in the bell with care to prevent the joint from contacting the ground. The joint shall be completed by pushing the pipe home with a slow steady pressure, without jerky or jolting movements. Pipe furnished without a depth mark shall be marked before assembly to ensure insertion to the full depth of the joint. The pipe shall then be properly set and brought to correct line and grade. The pipe shall then be secured in place by installation of bedding material and backfill, in accordance with Chapter 9 and the detailed drawings in the Appendix.

At times when installation is not in progress, the open ends of the pipe shall be closed with a watertight plug. Cutting of pipe for inserting closure pieces shall be done in a neat and workmanlike manner without damage to the pipe or lining, leaving a smooth end at right angles to the axis of the pipe. Pipe ends shall be smooth and beveled with a file or other tools according to the pipe manufacturer’s recommendations.

Extra care should be used in handling PVC pipe during cold weather due to the reduced flexibility and impact resistance as temperatures approach and drop below freezing. PVC pipe to be stored outside and exposed to sunlight for more than 30 days shall be covered with an opaque material such as canvas. Clear plastic sheets shall not be used to cover the pipe. Air circulation shall be provided under the covering. Any over-exposed pipe, as determined by the City, will not be permitted for installation.
No pipe or appurtenant structure shall be installed upon a foundation in which frost has penetrated or at any time when the City deems there is a danger of ice formation or frost penetrations at the bottom of the excavation. No pipe or appurtenant structure shall be installed unless backfilling can be completed before the formation of ice and frost.

4.3.4 MANHOLE CONSTRUCTION

4.3.4.1. Cast-in-Place Base

Manhole bases shall be constructed per ASTM C-478 and C-858 with Class B concrete, placed on undisturbed ground and in conformance with the detail drawing in the Appendix. Changes in direction of flow through the manhole shall be made with a smooth curved channel having as large a radius as possible. The change in size of channels shall be made gradually and evenly and shall be formed directly in the concrete. The floor of the manhole outside of the channel shall be finished to a brushed surface.

Concrete bases shall extend at least eight inches below the invert of the pipe and shall be benched to at least two inches over the top of the pipe. The manhole floor between the sewer pipe and the outer portions of the bench shall be flush with the top edges at the pipe spring line and shall slope upward at least two inches per foot. Wherever grade and alignment permit, the sewer shall be laid continuously through the manhole and the manhole built later. In such cases, the foundation shall be placed as mentioned above and once the manhole is constructed, the upper half of the pipe shall be sawed out and the rough edges smoothed with cement mortar. Breaking out the top of the pipe is not permitted.

Where it is not practicable to use split pipe through manholes due to breaks in alignment, grade or elevation of intersecting sewers, the sewer invert shall be made of concrete deposited between forms. The shape of the invert shall conform to the lower half of the pipe it connects. Side branches shall be constructed with as large a radius of curvature as possible. Inverts shall be plastered with cement mortar and left smooth and clean. Where called for on the plans, a pipe bell shall be stubbed out and plugged. The bell shall be placed as close to the manhole wall as possible, unless showing otherwise on the approved plans.

Reinforcement will be required in all manhole bases. Precast base must be used in all cases except when approved by the Public Works Director or designee. Manhole deeper than 15 feet may require additional reinforcement. Reinforcement shall be approved by the City prior to installation.

4.3.4.2. Precast Base/Inverts

Precast bases will be allowed by the City and shall be in conformance with this section.

The ground surface below the precast concrete base shall be excavated six inches below the elevation of the bottom of the base and backfilled with three quarter inch gravel. The gravel shall be carefully leveled and smoothed to give uniform support to the precast base over its entire area. The precast base shall be set at the proper location to center the manhole over the sewer main.
The precast base shall also conform to the requirements of Section 4.5.5 of these STANDARDS AND SPECIFICATIONS.

4.3.4.3. Precast Barrel

Precast manhole sections shall not be placed on the foundation until it has reached sufficient strength to provide support without damage. The joint between the manhole base and the barrel section shall be made with a flexible butyl resin joint sealing compound. Each succeeding precast section shall be joined in a similar manner and smoothly finished, inside and out.

In the event that the distance between the manhole invert and the ring and cover exceeds seventeen feet (17’’), a precast concrete platform shall be installed. The platform shall conform with Section 4.5.5 and detail drawings in the Appendix.

4.3.4.4. Manhole Grouting Treatment

The horizontal joints between precast manhole sections shall be plastered and troweled smooth, inside and out, with cement mortar. The mortar shall be not less than five eighths inch in thickness over the joint and shall extend at least four inches on either side of the joint.

All smooth surface pipes, such as PVC or VCP shall have a manhole water-stop gasket, to be furnished by the contractor, firmly attached to the pipe prior to grouting into the manhole. The opening in the manhole wall where a pipe enters or leaves shall be sealed and patched in a neat workmanlike manner, both inside and out with cement mortar. All lifting holes and other imperfections in the interior manhole wall shall be filled with cement mortar.

4.3.4.5. Adjustment Rings

Precast concrete adjustment rings shall be used on top of the cone to support and adjust the manhole frame to the required final grade. The maximum depth of the adjustment rings shall be six inches and the maximum depth from top of cone to final grade shall be twelve inches.

The top elevation of the manhole shall be adjusted to match final street grade. If manholes are located in open fields, they shall be left at least eighteen inches above grade and a locking ring and cover shall be installed. In cultivated areas, manholes shall be properly marked by a steel post painted green on the top six inches and located five feet from the centerline of the manhole cover.

4.3.4.6. Cleanouts

Cleanouts shall be installed next to the manhole base in conformance with the detail drawing in the Appendix where an underdrain is installed with the sanitary sewer system.

4.3.5 CONNECTIONS TO EXISTING MANHOLE
Sewer pipe connections to existing manholes where there is no existing pipe stubbed out shall be made in such a manner that the finished work will conform as nearly as practicable to the requirements specified for new manhole construction. The contractor shall break out as small an opening in the existing manhole as necessary to insert the new sewer pipe. The existing concrete foundation bench shall be chipped to the cross-section of the new pipe in order to form a smooth continuous invert similar to what would be formed in a new concrete base. Where practical, the downstream invert shall be plugged during construction to prevent storm and non-sewage flow from entering the system. The contractor shall pump out and clean the manhole before removing the plug. Cement mortar shall be used to smoothly finish the new invert and to seal the new line, both inside and outside, so the junction is watertight.

4.3.6 UNDERDRAINS

4.3.6.1. General

Where excessive ground water is encountered, the City will require construction of a piped underdrain, to reduce infiltration. Underdrains shall be daylighted to the nearest suitable point as approved by the City. Cut-off walls may also be required.

Underdrain main construction shall be done in accordance with engineered construction plans for the work prepared under the direction of a registered professional engineer and approved by the City.

Subsurface investigations to determine soil properties and provide underdrain design recommendations are prerequisite to the underdrain system. A written proposal on the underdrain system must be presented to the City of Northglenn before the Public Improvements Agreement is approved.

4.3.6.2. System Layout

Underdrain shall be placed in its own trench approximately 1-1.5 feet below sanitary sewer main, unless otherwise approved by Public Works Director.

All underdrain cleanouts should be located in either a storm sewer vault or in its own valve box. Underdrain cleanouts will not be permitted in sanitary sewer manholes.

4.3.6.3. Materials

All underdrains shall be constructed in perforated and/or non-perforated ASTM D 3034 SDR-35 PVC pipe or ASTM D3034, with a tracer wire attached for locating purposes.

A minimum of 6 inch PVC pipe shall be used for all underdrain mains and services.

Underdrains shall be lined in filter fabric prior to installation only if perforated.

4.3.6.4. Mapping

As-built mapping and address plats should be provided to the City prior to date of acceptance. All maps must provide adequate details of the underdrain prior to being accepted by the City.
4.3.6.5. **Inspections**

Underdrain mains will be thoroughly inspected by the Public Works Director or designee prior to backfill.

Underdrain cleanouts must be located outside of sanitary sewer manholes, as detailed in the Construction Drawings.

Underdrain daylights shall be placed to avoid being covered by dirt. An engineering drawing of all proposed daylights shall be submitted prior to City approval.

Public Works Director or designee shall have the authority to halt construction when these specifications or standard construction practices are not adhered to. Whenever any portion of these specifications is violated, the City may order further construction to cease until all deficiencies are corrected.

4.3.6.6. **Bedding**

Granular bedding material shall be installed a minimum of 12 inches above the top of the pipe and 12 inches below the invert of the pipe. (Granular bedding material will be the equivalent of squeegee.)

Backfill must be placed in lifts not exceeding 12 inches.

4.3.6.7. **Compacting Ordinary Backfill**

All trenching, backfilling and compaction of underdrain shall be done in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

4.3.7 **PRESSURE SEWERS**

All requirements of Chapter 3 of these STANDARDS AND SPECIFICATIONS shall apply to the installation of pressure sanitary sewer lines. All pressure sanitary sewers shall be installed using PVC AWWA C-900 or AWWA C-905.

A green plastic identification strip, a minimum of a six-inch wide, continuously labeled "Caution Sewer Line Below" shall be installed directly above the pressure sewer, the full length of the sewer, and shall be buried midway between the top of the pipe and the finished ground surface elevation.

4.3.8 **SANITARY SEWER SERVICE LINE CONSTRUCTION**

All sanitary sewer service lines which connect to the City of Northglenn sanitary sewer system shall comply with these STANDARDS AND SPECIFICATIONS.

The contractor shall place wyes, stubs and risers where required by the approved plans. Wyes shall be angled upwards so that the upper invert of a one eighth bend connected to the fitting will have an elevation equal to or higher than the inside crown of the sewer main. Riser connections shall be installed where the elevation of the top of the branch is more than twelve feet below the approved finished grade. Riser connections will ordinarily reach to a grade ten feet below the
finished ground surface. Water-tight plugs shall be installed in each branch pipe or stub. As-built measurements shall be made by the contractor or his representative to reference the wye or riser connection to the nearest manhole before backfill. Said measurements shall be carefully and accurately made and recorded and shall be shown on the as-built plans furnished to the City prior to acceptance.

All installation work shall conform to applicable portions of ASTM D-2321 (latest revision) and to the pipe manufacturer's installation instructions. The grooves shall be cleaned free of all foreign materials prior to assembling the joint. The pipe shall be laid with the spigot end pointing in the direction of the flow.

Trenches shall be kept free of water during laying and jointing. Lines longer than fifty feet shall be laid with batter boards, a laser, or other means approved by the City.

Clean-outs are required at a minimum interval of 100 feet or at all bends or changes in grade. The area around a clean-out shall be graded so water runs away from the clean-out. No clean-outs, other than those installed as part of the sewer main underdrain system, shall be installed in publicly owned right-of-ways or easements.

Service stub-ins shall be extended at least 10’ into the property and be plugged with a compression stop.

Backfilling shall be in accordance with Chapter 9 of these STANDARDS AND SPECIFICATIONS.

4.3.9 TAPPING EXISTING SANITARY SEWERS

Where tees have not been installed in the sewer main, the main shall be tapped by machine drilling a hole sized to fit the saddle for the service line. The drilling machine and method of drilling and the saddle shall be approved by the City. The saddle shall be sealed when attached to the main and held in place with metal straps or other approved methods. The saddle and sewer main shall be encased in concrete.

4.4 TESTS

4.4.1 GENERAL

All sanitary sewer mains and appurtenances shall be cleaned and tested after backfill operations have been completed and compaction test results have been submitted to and approved by the City. All required testing must be completed and approved prior to acceptance. Should the City find that the completed line or any portion thereof fails any of the specified tests, the City will not accept the new sewer line until such time as the sewer line meets the test specifications. Once the sewer line is completed and before a "Release for Service" letter is issued, the contractor shall perform an air test and television inspection of the completed line. The use of alternate testing methods may be allowed or required in addition to those stated herein and as determined necessary by the City. Alternate testing methods include water infiltration test, deflection test and additional television inspection.

The contractor shall furnish all labor, materials, tools and equipment necessary to clean the pipe and appurtenances, make the tests and perform all work incidental thereto. Any damages to the
pipeline caused by cleaning or testing operations shall be repaired or replaced by the contractor at his expense.

4.4.1.1. **Air Tests**

The contractor shall perform these tests with suitable equipment specifically designed for air testing sewers. The pipe or sections of concrete pipe to be tested, may be wetted before the air test. The line shall be plugged at each manhole with pneumatic balls. All service plugs shall be secured in place to prevent displacement during testing operations. Low pressure air shall be introduced into the plugged lines until the internal air pressure reaches 4.0 psi plus 0.4 psi per foot of water table above the pipe invert, if any. At least two minutes shall be allowed for the air temperatures to stabilize before readings are taken and the timing started.

The portion being tested shall pass if it does not lose air at a rate to cause the pressure to drop from 3.5 to 3.0 psi (plus any adjustments for water table pressure as mentioned previously) in less time than listed below:

<table>
<thead>
<tr>
<th>Pipe Diameter (Inches)</th>
<th>Minimum Allowable Time for Pressure Drop from 3.5 to 3.0 psi (Minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>3.0</td>
</tr>
<tr>
<td>6</td>
<td>3.0</td>
</tr>
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<td>8</td>
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<td>21</td>
<td>10.5</td>
</tr>
<tr>
<td>24</td>
<td>12.0</td>
</tr>
</tbody>
</table>

Table 4.3 - Minimum allowable minutes for pressure to drop from 3.5 to 3.0 psi

If the installation fails this test, the testing equipment may be used to determine the location of the pipe leak.

4.4.1.2. **Deflection Test:**

The maximum vertical deflection for PVC pipe shall not exceed manufacture’s recommendations. The City may require the contractor to perform deflection tests of the
pipe before acceptance. Optional devices for testing include calibrated television, photography, properly sized go-no-go mandrel, sewer ball or deflectometer. The method used shall be approved by the City. To ensure accurate testing, the line shall be thoroughly cleaned prior to testing. Testing shall be done no sooner than 30 days after the pipe has been backfilled.

The contractor shall schedule the test with the City 48 hours prior to the test and the City shall be present during the test and shall verify the accuracy of the equipment used. The City may require the contractor to perform another deflection test prior to the end of the warranty period.

4.4.1.3. **Pressure Test for Pressure Sewers**

After the pipe has been laid, including fittings, thrust blocks, and backfill in accordance with the specifications, it shall be subjected to a hydrostatic pressure of not less than 150 P.S.I. for one hour. The allowable leakage shall not exceed the following formula:

\[
L = \frac{S \cdot D \cdot \sqrt{P}}{148,000}
\]

- \(L\) = Testing allowance (makeup water), in gallons per hour
- \(S\) = Length of pipe tested, in feet
- \(D\) = Nominal diameter of pipe, in inches
- \(P\) = Average test pressure during the hydrostatic test, in pounds per square in gauge

Each valved section or the entire line if there are no valves, shall be slowly filled with water and the specified test pressure, measured at the highest point of elevation, shall be applied by means of a pump connected to the pipe in a satisfactory manner. The pump, pipe connection, gauges and all necessary apparatus shall be furnished by the contractor. Gauges and measuring devices shall be approved by the City and the necessary taps made as required by the contractor. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made at the highest elevations of the test section and plugged with brass plugs once the pipeline has passed the test.

Any cracked or defective pipes, fittings, or valves discovered in the pressure test shall be removed and replaced by the contractor with sound material. The test shall be repeated until the pipeline passes the pressure test and is accepted by the City.

4.4.1.4. **Manhole Leakage Test**

Manholes shall be tested for leakage separately from the pipe when required. The sewer pipe in the manhole shall be plugged. If the ground water table is below the invert, the manhole shall be filled with water to a depth five feet above the invert. If the ground water table is above the invert of the manhole, then the manhole shall be filled to a level at least three feet above the ground water table or to the top of the uppermost precast manhole section, whichever is less, but not less than five feet above the invert. After
soaking for one hour, the manhole shall be filled to the original level. It shall then be tested for two hours. The allowable drop in the water level shall be one-quarter inch. No manhole shall be accepted that has any visible infiltration when empty. Any manhole whose test is unsatisfactory shall be repaired at the contractor's expense and retested until satisfactory results are obtained.

4.4.1.5. **TV Inspection**

The Contractor will perform TV inspections unless otherwise specified by the City of all new sewer lines and all defects that have been repaired prior to acceptance. Upon completion of the TV inspection, the Contractor shall provide a DVD containing the inspection prior to the Owner releasing the retainage. In order to be considered for inspection, the improvements shall have been completed, accessible and cleaned sufficient to allow for detailed inspection.

4.4.1.5.1 **Cleaning Prior To Inspections**

Sewer cleaning shall be by high-pressure jet cleaning to remove foreign materials from lines. The jet cleaning machine shall be capable of removing stones, grit, grease, sludge and other debris from the sanitary lines by the flushing action of high pressure water. Dumping of large volumes of water from hydrants or tankers is expressly prohibited.

The jet cleaning machine must be capable of providing a continuous flow of water at a minimum of 40GPM and 2000 PSI. At a minimum, the cleaner shall use a 90% interior pipe diameter proofer skid at all times. Cleaning shall begin at the upper end of the system and proceed downstream to the outfall. The hose should be brought back at a proper yet steady speed for appropriate and satisfactory cleaning. If necessary, repeat the process to remove all debris. All debris shall be captured and prevented from entering the downstream portion of the existing collection system.

Sewers found to be improperly cleaned shall be cleaned and reinspected at the contractor’s expense.

4.5. **MATERIALS**

4.5.1 **GENERAL**

Only those pipeline materials described in this section are approved for sanitary sewer installations. Any other material proposed as an equal shall be approved by the City prior to construction. All pipe materials to be incorporated in the construction of sanitary sewers shall conform to the requirements specified herein or as modified elsewhere in these STANDARDS AND SPECIFICATIONS. All materials furnished shall be new and undamaged. Everything necessary to complete all installations shall be furnished and installed whether shown on the approved drawings or not and all installations shall be completed and fully operational. Acceptance of materials or the waiving of inspection thereof shall in no way relieve the developer of the responsibility for furnishing materials meeting the requirements of these STANDARDS AND SPECIFICATIONS.
All materials delivered to the job site shall be adequately housed and protected to ensure the preservation of their quality and fitness for the work.

4.5.2 DEFECTS

The presence of any of the following defects in an individual pipe or in a shipment of pipe, may constitute sufficient cause for rejection of the pipe. Rejected materials shall be removed from the work site within 24 hours unless otherwise permitted by the City.

A. Pipe length varying more than two inches from the specified length. Pipe shall not be ordered in random lengths.

B. Pipe having a deviation from straight which exceeds the following:

\[
\frac{\text{Length of Pipe in Feet}}{32} = \text{Maximum Deviation in Inches}
\]

C. Porous areas on either the inside or the outside surface of a concrete pipe having an area of more than five square inches and a depth of more than one-half inch.

D. Pipe which has been patched or repaired without written approval of the City.

E. Exposure of the reinforcement.

F. Pipe damaged during shipment or construction.

G. Any deficiencies noted in applicable ASTM Specifications

4.5.3 CERTIFICATION

A manufacturer's certification that material was manufactured and tested in accordance with applicable ASTM designations, together with a report of all test results, may be required by the City prior to final acceptance of the work.

4.5.4 PIPE

4.5.4.1 Polyvinyl Chloride Pipe (PVC) - Gravity

All gravity pipe materials and fittings shall meet the minimum requirements of ASTM D-3034, latest revision or ASTM F-679. Pipe shall be subjected to drop-impact tests in accordance with ASTM D-2444. The pipe shall have bell and spigot joints with gasketed joint per ASTM D-3212. The spigot end shall be marked so the installer and the inspector can determine when the pipe is properly inserted into the bell. The maximum pipe length shall be twenty feet.

Table 4.4 - Minimum Pipe Wall Thickness for Gravity PVC Pipe

<table>
<thead>
<tr>
<th>Pipe Diameter (Inches)</th>
<th>Wall Thickness (Inches)</th>
</tr>
</thead>
</table>

4-16
All fittings and accessories shall be as manufactured and furnished by the pipe supplier and have bell and/or spigot configurations compatible with that of the pipe.

Pipe stiffness for all pipe sizes shall be tested in accordance with ASTM D-2412. Joint tightness shall be tested in accordance with ASTM D-2855.

4.5.4.2. Polyvinyl Chloride Pipe (PVC) - Pressure

All pressure pipe materials and fittings shall meet the minimum requirements of AWWA C-900 (latest revision) or AWWA C-905 (latest revision). Pipe shall be subjected to sustained pressure tests in accordance with ASTM D-1598. The pipe, couplings and fittings shall meet the requirements of ASTM D-1784. Gaskets and lubricants must be compatible with the pipe as well as in combination. The spigot end shall be marked so the installer and the inspector can determine when the pipe is properly inserted into the bell. The maximum pipe length shall be twenty feet.

### Table 4.5 - Minimum Pipe Wall Thickness for Pressure PVC Pipe

<table>
<thead>
<tr>
<th>Pipe Diameter (Inches)</th>
<th>Wall Thickness DR18 (Inches)</th>
<th>Wall Thickness DR14 (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.267</td>
<td>0.343</td>
</tr>
<tr>
<td>6</td>
<td>0.383</td>
<td>0.493</td>
</tr>
<tr>
<td>8</td>
<td>0.503</td>
<td>0.646</td>
</tr>
<tr>
<td>10</td>
<td>0.617</td>
<td>0.793</td>
</tr>
<tr>
<td>12</td>
<td>0.733</td>
<td>0.943</td>
</tr>
<tr>
<td>16</td>
<td>0.967</td>
<td>-</td>
</tr>
<tr>
<td>18</td>
<td>1.083</td>
<td>-</td>
</tr>
</tbody>
</table>
All fittings and accessories shall be as manufactured and furnished by the pipe supplier and have bell and/or spigot configurations compatible with that of the pipe.

PVC pipe and all fittings shall conform to Sections 3.4.2.2 and 3.4.3 of these STANDARDS AND SPECIFICATIONS.

4.5.4.3. **Reinforced Concrete Pipe (RCP)**

Reinforced concrete pipe in sizes twenty-one inches or larger shall conform to the requirements of the standard specifications for reinforced concrete sewer pipe, ASTM Designation C-76 for Classes II, III, IV, and V and as modified in this Section.

All RCP shall be constructed with Type II modified cement. The absorption of the pipe shall meet the minimum requirements of ASTM C-76.

All concrete pipe fittings, wyes, tees and bends shall be cast as an integral part of the pipe to which they are attached and shall be the same pipe classification.

The following shall be clearly marked on the exterior surface of all pipe with waterproof paint.

- ASTM Specification.
- Class and Size.
- Date of Manufacture.
- Name or Trademark of Manufacturer.

4.5.5 **MANHOLES**

4.5.5.1. **General**

Manholes, reducing sections, ladder rungs and traffic lids shall be precast and conform to ASTM Standard Designation C-478. All traffic lids shall be designed for AASHTO H-20 traffic loading. All ladder rungs or manhole steps shall be cast into the manhole barrel when the manhole barrel is poured unless approved otherwise, in writing, by the City. Concrete reducing sections shall not be used. Concrete extension collars shall be used to bring the manhole ring and cover up to approved street or ground surface elevation. All manholes not within the right-of-way shall have cast-iron locking lids.

Concrete used in the manufacturing or construction of manholes shall be a minimum of Class B concrete in accordance with Chapter 7 of these STANDARDS AND SPECIFICATIONS.

4.5.5.2. **Manhole Rings and Covers**

All cast iron manhole rings and covers and other iron castings shall conform to the requirements of AASHTO M105/ASTM A48. Ductile Iron castings shall conform to the requirements of ASTM A536. All castings shall conform to Federal Specification,
Commercial Item Description A-A-60005, for shape and dimension required. Castings shall be free from sand, blowholes, shrinkage, cracks and other cold shuts and be well cleaned by shot blasting. Runners, risers, fins and other cast-on pieces shall be removed from the castings and ground smooth. Bearing surfaces between manhole rings and covers shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact.

Manhole frame or ring dimensions shall be 24” diameter, 8” tall or as otherwise approved.

Fittings shall be hot dipped, factory applied, water base, asphalt paint to form a firm and tenacious coating.

Aluminum covers may be used for meter vaults where approved and must have a recessed cut out for a transponder. Aluminum rings may not be used.

Acceptable product is East Jordan Iron Works #2405A, Product #240561 (sanitary vault only).

4.5.5.3. **Manhole Base Slabs**

Manhole base slabs may be poured in place or precast. The slab shall be designed to uniformly support AASHTO H-20 traffic loading and any earth loading. The minimum slab thickness shall be eight inches below bottom of the pipe and 2-inches above the top of the pipe. The minimum reinforcement required in all base slab shall conform to the detail drawings in the Appendix.

4.5.5.4. **Joint Material**

Joint material used to set barrel sections shall be a flexible buytl resin joint sealing compound meeting Federal Specifications SS-S-00210(210-A) and AASHTO M 198-B.

4.5.5.5. **Mortar**

Mortar used in repair of precast sections shall be composed of one part Portland Cement and not more than three nor less than two parts of fine aggregate. Hydrated lime or masonry cement shall not be used. Portland cement shall meet the requirements of ASTM C-150, Type II. Fine aggregate shall consist of well-graded natural sand having clean, hard, durable, uncoated grains, free from organic matter, soft or flaky fragments or other deleterious substances. The fine aggregate shall be thoroughly washed and shall be uniformly graded from coarse to fine with a minimum of 95 percent passing a No. 4 sieve and a maximum of seven percent passing a No. 100 sieve.

4.6. **INDUSTRIAL PRETREATMENT DEVICES**

4.6.1 **GENERAL**

The section pertains to interceptor devices only. All pretreatment devices must be approved in writing through the City’s Industrial Pretreatment Program.
4.6.2 GREASE INTERCEPTORS

4.6.2.1. General

The requirements established in the Municipal Code shall apply to facilities subject to the Fats, Oil and Grease (FOG) Sector Control Program established by the City. Non-domestic dischargers where preparation, manufacturing or processing of food occurs include but are not limited to, restaurants, cafes, fast food outlets, pizza outlets, delicatessens, sandwich shops, coffee shops, schools, nursing homes and other facilities that prepare, service or otherwise make foodstuff available for consumption. These users shall install and maintain a gravity grease interceptor as directed by the City.

All facilities subject to this section must comply with the requirements in the FOG Sector Control Program which includes both the requirement for installation and operation of a grease interceptor and the Best Management Practices.

4.6.2.2. Control Requirements

a. A gravity grease interceptor shall be required when, in the judgment of the City, it is necessary for the proper handling of liquid wastes which may be harmful to, or cause obstruction in the wastewater collection system or cause or contribute to Interference or Pass Through.

b. It shall be the responsibility of the industrial/commercial user and/or owner of the property, business or industry or an Authorized Representative of the Industrial/Commercial User to contact the City for the purpose of obtaining a plan review. The plan review shall determine the need, size, location, and other requirements of the interceptor required to control discharges into the Publically Owned Treatment Works (POTW). Written approval from the City must be obtained prior to installation of the interceptor. The review of such plans and operating procedures shall in no way relieve the industrial/commercial user from the responsibility of modifying or replacing such facilities as necessary to produce a discharge acceptable to the City under the provisions of this Article.

c. The design and sizing of gravity grease interceptors shall be in accordance with the FOG Sector Control Program in this Section. The gravity grease interceptor shall be designed, sized, installed, maintained and operated so as to accomplish their intended purpose of intercepting pollutants from the industrial/commercial user’s wastewater and preventing the discharge of such pollutants to the City’s wastewater collection system. (worksheet). Minimum size for a grease interceptor is 750 gallons (1000 gallons with a dishwasher).

Sizing of interceptors is determined will be based on the following chart:
### City of Northglenn Standards and Specifications

#### Fixture Type:

<table>
<thead>
<tr>
<th>Fixture Type</th>
<th>Quantity</th>
<th>Flow (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand Sink</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Bar Hand Sink</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Single Compartment Sink</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Double Compartment Sink</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Triple Compartment Sink</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Mop Sink</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Wok Range (1-5 Wok Stations)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Wok Range (5+ Wok Stations)</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Dishwasher (0-30 gallons)</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Dishwasher (30-50 gallons)</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Dishwasher (50-100 gallons)</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>Floor Drains</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Total Flow (gpm)

- **Loading Factor**
  - Coffee Shop = 0.5
  - Other Users = 1.0

- **Retention Time (min)**: 30

- **GI Size (gallons)** = Total Flow x Loading Factor x Retention Time

- **GI Inlet Pipe Size**

- **Maximum GI Size (Gallons)**

**d.** Bedding for gravity grease interceptors is required. Bedding shall follow a geotechnical engineer’s recommendations with an six minimum.

**e.** Upon change of ownership or tenant of any existing facility which would be required to have an interceptor under this Section, the applicant for sanitary sewer service shall have the burden to demonstrate that a properly sized and functioning grease interceptor is installed.

**f.** Hydromechanical grease interceptors shall not be permitted in lieu of a gravity grease interceptor to comply with the requirements of this Article.
Toilets, urinals and similar fixtures shall not waste through a gravity grease interceptor. Such fixtures shall be plumbed directly into the building sewer and waste system.

All fixtures not equipped with a garbage disposal (garbage grinder) which are connected to a gravity grease interceptor shall be equipped with a fixed or removable mesh or screen which shall catch garbage and food debris and prevent it from entering the gravity grease interceptor.

The industrial/commercial user must ensure interceptors are easily accessible for inspection, cleaning and removal of FOG.

The industrial/commercial user must maintain interceptors at their expense and keep in efficient operating condition at all times by the regular removal of accumulated FOG.

**4.6.3 SAND INTERCEPTORS**

**4.6.3.1. General**

The requirements established in this Section shall apply to facilities subject to the Petroleum, Oil, Grease and Sand (POGS) Program requirements established by the City. Non-domestic dischargers where work or service is performed includes automotive service, machine shops, parking garages, automotive care centers, auto body shops, car washes or any other facility that generates sand, petroleum oil, grease or other petroleum product, grit, gravel or other aggregate that may discharge into a wastewater collection system. Access to the wastewater collection system is often via floor drains located inside shop areas that are not limited to non-polluting wastewater sources; such drains must be connected to a sand/oil interceptor and must be approved.

All facilities subject to this section must comply with the requirements in the POGS Sector Control Program which includes both the requirement for installation and operation of a sand/oil interceptor and the Best Management Practices.

**4.6.3.2. General Control Requirements**

a. A sand/oil interceptor shall be required when, in the judgment of the City, it is necessary for the proper handling of liquid wastes which may be harmful to, or cause obstruction in the wastewater collection system or cause or contribute to Interference or Pass Through.

b. It shall be the responsibility of the industrial user and owner of the property, business or industry or an authorized representative of the Industrial User to contact the City for the purpose of obtaining a plan review. The plan review shall determine the need, size, location and other requirements of the interceptor required to control discharges into the POTW. Written approval from the City must be obtained prior to installation of the interceptor. The review
of such plans and operating procedures shall in no way relieve the industrial user from the responsibility of modifying such facilities as necessary to produce a discharge acceptable to the City under the provisions of this Article.

c. The design and sizing of sand/oil interceptors shall be in accordance with the POGS Sector Control Program. The sand/oil interceptor shall be designed, sized, installed, maintained and operated so as to accomplish their intended purpose of intercepting pollutants from the industrial user’s wastewater and preventing the discharge of such pollutants to the City’s wastewater collection system. City must approve the design, size and location of the sand/oil interceptor.

d. Bedding for sand/oil interceptors is required. Bedding shall follow a Geotechnical engineer’s recommendations with a minimum of six inches below the vault.

e. Upon change of ownership of any existing facility which would be required to have an interceptor under this Section, the applicant for sanitary sewer service shall have the burden to demonstrate that a properly sized and functioning sand/oil interceptor is installed.

f. Toilets, urinals and similar fixtures shall not waste through a sand/oil interceptor. Such fixtures shall be plumbed directly into the building sewer and waste system.

g. The industrial user shall ensure interceptors are easily accessible for inspection, cleaning, and removal of POGS.

h. The industrial user shall maintain interceptors at their expense and keep in efficient operating condition at all times by the regular removal of POGS.

4.7. LIFT STATIONS SPECIFICATIONS

4.7.1 GENERAL

Lift stations will be allowed only in accordance with City’s Standards. In those locations that cannot be served by gravity into the existing City system, the City may approve the construction of a sewage lift station.

The lift station must satisfy all of the requirements of the Colorado Department of Public Health and the Environment (CDPHE), 208 agencies and in accordance with the City requirements. The requirements set forth in this section are minimum requirements and additional requirements may be applied. The City will require that the Developer's engineer and/or contractor prepare the "Application for Site Approval" for the submittal to the Colorado Department of Health and a set of as-built drawings of the sewage lift station in accordance with these Standards and Specifications. The Owner/Developer will be responsible to acquire approval through the applicable agencies and must keep the City involved in the process. Upon completion of the lift station, the Contractor shall also provide the City with four copies of an "Operation and Maintenance Manual" for the lift station. All lift stations must be approved before installation.
Typically new lift stations will be duplex station, where each of the two pumps will be capable of meeting 110% the station design flow. All hardware exposed metal surfaces to sewage or are outside must be 316 stainless steel. Lift stations greater than 100 gallons per minute shall not have submersible pumps. Submersible pumps shall be a grinder pumps and all pumps shall pass a minimum 2 inches diameter solids. Lift Stations maximum detention time in the wet well must not exceed 30 minutes. In some cases, larger pumps station may be required, which shall be constructed with three of more pumps. All lift stations shall discharge to a manhole prior to gravity flowing to a sewer main. All lift stations have unique sites and/or characteristics requiring review and approval on a case by case basis.