CITY OF LONGMONT
SECTION 400 – WASTEWATER COLLECTION
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400.00 MINIMUM DESIGN CRITERIA

400.01 GENERAL

A. All wastewater collection systems shall comply with the requirements of these City Standards for sanitary sewer and service line construction, applicable provisions of City Code, in particular Title 14, City Code, and any additional criteria established by the City Engineer for the overall hydraulics of the wastewater collection system. Other criteria may be outlined in the Approved Plans as determined by the City.

B. Design and planning criteria shall be in conformance with the City's Wastewater Master Plan, as periodically amended, which may be available upon request.

C. These standards and specifications apply to pipe sizes up to and including 15 inches in diameter. Design Standards for sizes larger than15 inches shall be determined by the City Engineer on a case-by-case basis.

D. Interceptors 24 inches or larger will need to be reviewed and approved by CDPHE.

E. Installation of cut-off walls or other precautions shall be done in accordance with Section 109 of these City Standards or as required by the City Engineer.

F. Contractors installing utilities shall comply with C.R.S. § 9-1.5-101 et seq. (referred to herein as the "Underground Utility Location Law"). Refer to Section 100 in these City Standards.

G. All sanitary sewer mains must be locatable. Refer to Section 100 of these City Standards for requirements of tracing wire, warning tape, and electronic marker systems.

400.02 SANITARY SYSTEM PLANNING AND DESIGN

A. DESIGN STUDIES AND DESIGN REPORTS

(1) A Sanitary Sewer Study is required with a development application. The study shall detail the impacts of the proposed development on the City's sanitary sewer system and shall include the information outlined in the Sanitary Sewer Study Checklist which can be found in the Appendix C-9 of these City Standards.

(2) A design report may be required prior to, or as part of, the plan submittal with the development application.

B. DESIGN PERIOD

Improvements to the City's sanitary sewer system shall be designed for a 50-year service life.

400.03 SANITARY SEWER FLOW DESIGN CRITERIA

A. AVERAGE DAILY FLOWS

(1) Average daily flow rates for planning and design purposes shall be based on the "Average Daily Flow Over 5 Years" values from the Longmont 2020 Wastewater Collection System Master Plan, as amended, and tabulated in Table 4-1, below.

Table 4-1 Wastewater Design Flow Per Envision Longmont Land Use Classification*

Residential Land Uses	Dwelling Units per Acre / Land Categories	Average Daily Flow Over 5 Years (2018 - 2022)	90th Percentile (2005 - 2022)
Rural Neighborhood	1	190	230
Single-Family Neighborhood	1-8	605	751
Mixed Neighborhood	6-18	859	1,030
Multi-family Neighborhood	18-35	1,651	1,919

Mixed Use	Dwelling Units per Acre / Land Categories	Average Daily Flow Over 5 Years (2018 - 2022)	90th Percentile (2005 - 2022)
Downtown Central Business District	N/A	1,001	1,203
Regional Center	N/A	541	736
Mixed Used Corridor	N/A	904	1,115
Neighborhood Center	N/A	959	1,092

Employment Land Uses	Dwelling Units per Acre / Land Categories	Average Daily Flow Over 5 Years (2018 - 2022)	90th Percentile (2005 - 2022)
Mixed-Use Employment	N/A	383	464
Primary Employment	N/A	395	437

Community	Dwelling Units per Acre / Land Categories	Average Daily Flow Over 5 Years (2018 - 2022)	90th Percentile (2005 - 2022)
Parks, Greenways, Open Space	N/A	42	38
Public/Quasi-Public	N/A	240	393

*Sewer Demand per Land Use Gallons per day per platted lot acreage (gpd/acre)

(2) Sanitary sewer flow calculations for design shall use the Average Daily Flow. Sanitary sewer mains exceeding eight (8) inches in diameter may need to be designed to the 90th percentile flow, per the determination of the City Engineer.

(3) For design purposes, a 20% infiltration and inflow (I & I) component should be included in the daily flow rates. The I & I component shall be applied after the application of the peaking factor (as defined below). High groundwater tables, poor soil conditions, or any other unusual conditions may call for a special study of other infiltration and inflow and the impact of such on sewer capacity.

B. REQUIRED SEWER HYDRAULIC CAPACITY

(1) The required hydraulic capacity of sewer pipes shall be designed such that all existing and proposed sanitary sewer pipes flow at no more than 80% of the full depth at the calculated future peak flow rate, unless otherwise approved by the City Engineer. Capacity analyses for existing downstream pipes may be required by the City Engineer.

(2) For pipes exceeding eight (8) inches in diameter, the City Engineer may, on a case-by-case basis, require that the hydraulic capacity of new sewer pipes be designed such that the new sewer and the existing downstream sewer is flowing at no more than 50% of the full depth at the calculated future peak flow rate.

a. The Average Design Flow, Q_{avg}, is derived from the fourth column, "90th Percentile (2005 – 2022)", Table 4-1 on page 4.

b. The Peaking Factor (PF) is to be determined using the equation below:

$$PF = 2.6 \times Q_{avg}\ (cfs)\ ^{(-0.16)}$$

c. In no cases shall the Peaking Factor be less than 2.0 or greater than 4.0.

d. The Required Sewer Hydraulic Capacity, Q, for d/D = 0.8 is calculated as follows:

$$Q = \frac{\text{Peak Factor x Average Daily Sewer Flow}}{0.87}$$

e. The Required Sewer Hydraulic Capacity, Q, for d/D = 0.5 is calculated as follows:

$$Q = \frac{\text{Peak Factor x Average Daily Sewer Flow}}{0.70}$$

f. Example: Consider a proposed multi-family neighborhood development of 29 acres.

Step 1 - Determine Average Design Flow:

Average Daily Flow from Table 4-1: 1,651 gpd/ac

Calculate Average Design Flow, Q_{avg}, using 20% I & I: 1,651gpd/ac x 1.2 = 1,981gpd/ac

Convert to gallons per day: 1,981gpd/ac x 29 acres = 57,455gpd

Average Design Flow, Qavg (cfs): 57,455 gpd x 1.55 x $10^{(-6)}$ (cfs)/ (gal/day) = 0.0889 cfs

Step 2 – Determine the Peak Factor:

PF = 2.6 x Qavg (cfs) $^{(-0.16)}$

PF = 2.6 x (0.0889) $^{(-0.16)}$ = 3.83

Step 3 – Determine the Required Sewer Hydraulic Capacity:

Required Sewer Hydraulic Capacity, Q = (PF x Q_{avg})/0.87 (for pipes flowing at 80% full)

Required Sewer Hydraulic Capacity, Q = (3.83 x .0889)/ 0.87 = 0.39 cfs

C. SEWER SIZING

The hydraulic capacity of sanitary sewers shall be based on the Manning's Equation. The Manning's n value used shall be per the manufacturer's recommendation:

$$Q=VA=\left(\frac{1.49}{n}\right)AR^{2/3}\sqrt{S} \qquad [U.S]$$

Where:

Q = Flow Rate, (ft^3/s)

V = Velocity, (ft/s)

A = Flow Area, (ft^2)

n = Manning's Roughness Coefficient

R = Hydraulic Radius, (ft)

S = Channel Slope, (ft/ft)

400.04 DESIGN VELOCITIES AND GRADES – MAIN LINES

A. All sanitary sewers shall be designed to ensure that the peak day flow velocity within the pipe will be two (2) feet per second as a minimum and ten (10) feet per second as a maximum. The minimum and the maximum grades of the sewer lines shall be as shown in Table 4-2.

Table 4-2 Minimum and Maximum Sewer Pipe Slope

Pipe Diameter (inches)	Minimum Slope (%)	Maximum Slope (%)
8	0.40	7.5
10	0.25	5.5
12	0.20	4.5
15	0.15	3.5

B. Sanitary Sewer mains constructed under these City Standards shall be designed so as to adequately serve the entire area that is tributary to the sanitary sewer main when fully developed.

C. The minimum allowable size for a sewer main is eight (8) inches diameter.

D. The City reserves the right to require a developer to upsize any sewer main, existing or proposed, that is inadequate for the proposed use, based on these City Standards.

400.05 SERVICE LINE SIZES AND GRADES

A. Service lines shall be designed with a minimum fall of one quarter (1/4) inch per foot (2% slope) and a maximum velocity of ten (10) feet per second, regardless of service line size. Lesser slopes may be accepted in the determination of the City Engineer, depending on the circumstances at issue. The minimum allowable service line size is four (4) inches. Any building requiring larger than a four (4) inch service line shall be sized by the Design Engineer based on standard engineering practices and these City Standards. All service line sizes will be subject to review and approval of the City Engineer.

B. The owner of the property that a service line serves is responsible for the ownership and maintenance of the sanitary sewer service line from the sanitary sewer main to the structure, excluding the tap fitting at the main, in compliance with the Code.

400.06 DEPTH

A. Unless otherwise approved by the City Engineer due to site specific conditions, sanitary sewer mains should be designed deep enough to accommodate service line installations, with a maximum cover of 15 feet. If greater depth is required, the exception request in accordance with Section 100.08 shall include structural calculations for the manhole base and adequate area at the final surface shall be provided to accommodate special equipment during installation and future replacements. Without exceeding maximum flow velocities, service lines shall be a maximum of ten (10) feet deep at the back of sidewalk. Minimum pipe cover shall be three (3) feet unless otherwise approved by the City Engineer.

B. Refer to Section 100 of these City Standards for minimum allowable vertical clearance to other utilities.

400.07 ALIGNMENT

A. Unless otherwise approved by the City Engineer, sewer mains shall be laid whenever possible at the center line of the street. Sewer mains shall be located a minimum of ten (10) feet horizontally from existing or

proposed water mains and storm sewer mains (edge to edge distance) and shall be located a minimum of five (5) feet horizontally from curb, gutter, flowline and manholes. Installation of curved sewer pipe is not allowed.

B. Sewer mains shall not be installed within 15 feet of any structure unless approved by the City Engineer. No structure or retaining wall shall be constructed within a minimum of 15 feet from any sewer main unless approved by the City Engineer.

400.08 FUTURE EXTENSION OF MAINS

A. When a sewer line under construction is anticipated to be extended at a future date, the end of the line shall have a manhole and a plugged stub-out installed in the direction(s) of future extension. Sanitary sewers must be extended to the far edge of the property to be serviced, or to the edge of the platted subdivision, or as directed by the City Engineer. All extension lengths shall be subject to the approval of the City Engineer.

B. Dead-end main lines, with no plans for future extension, shall extend to the edge of existing easement or right-of-way boundary, and a manhole shall be installed at the end of the line.

400.09 MANHOLE GUIDELINES

A. Manholes shall be located at all changes in grade, pipe size, and alignment. At all manholes, the drop across the manhole between incoming and outgoing inverts shall be a minimum of 0.2 feet. A one tenth (0.1) foot drop between the incoming and outgoing inverts may be used when there is no change in bearing from incoming pipe to outgoing pipe.

B. The minimum angle between any pipe entering the manhole and the pipe exiting the manhole shall be 90°.

C. Manholes shall be located at street intersections whenever possible.

D. Manholes shall be four (4) feet in diameter for pipes up to and including 15 inches. Larger pipes or multiple large pipes shall require manholes with a five (5) foot diameter or larger. See Detail 400-01 “Standard Sanitary Manhole”.

E. When multiple pipes connect into a manhole with an angle between the pipes that is less than 90°, the manhole shall maintain a minimum clearance of one (1) foot between outside of pipe to outside of pipe at the exterior wall of the manhole. Manhole diameter shall be increased, as needed, to accommodate this standard.

F. Inside drop manholes shall be a minimum five (5) feet in diameter and shall use an inside drop bowl. See Detail 400-05 “Inside Drop Manhole”.

G. Manholes shall be spaced no farther than 400 feet apart.

H. Manholes shall not be installed across differing pavement types.

I. Manholes shall not be partially or fully located within bike lanes, side paths, or sidewalks unless approved by the City Engineer.

J. Manholes shall be located in areas that are not subject to flooding from surface runoff.

K. Manholes shall not be located in areas where ponding or storm detention basins are to be used.

L. If the possibility of surface runoff cannot be avoided a solid manhole cover, having an integral O-ring type gasket and a waterproof insert that can be bolted closed, shall be used. See note for bolt pattern in Detail 400-07 “Sanitary Sewer Standard Manhole Cover”.

M. All manholes located outside of paved sections and/or within the 100-year floodplain shall be designed and constructed with a watertight, bolted-type cover, and the manhole ring shall be bolted to the manhole cone.

N. Maintenance access: Direct, all-weather, vehicular access shall be provided to manholes and valve boxes installed in areas outside of the public roadway. This shall consist of a minimum ten (10) foot wide gravel, asphalt, or concrete path or roadway constructed in accordance with the standard for all-weather-access as described in Section 200 of these City Standards.

O. Manholes shall be located a maximum distance of six (6) feet from the flowline of the roadway, or the maintenance access path.

P. All manholes shall be designed to prevent floatation.

400.10 ABANDONMENT OF EXISTING SEWER LINES OR “STUBS”

A. All sewer service lines that were installed and will not be used shall be abandoned at the main. This shall include excavating the service line, installing a plug in the sewer main, and pavement removal and restoration. In new construction, abandonment of an existing sewer service line shall occur prior to final lift of paving. A sewer tap or wye in a non-PVC sewer main shall be removed per direction of the City Inspector after the service tap or wye has been exposed. All other abandonments shall require further direction from the City Engineer.

B. All sewer lines that tie directly into a manhole, either main lines or service lines, shall be abandoned at the manhole by plugging the inside wall of the manhole with concrete.

C. All abandonments of service lines shall be inspected by the City Inspector.

400.11 GREASE INTERCEPTORS, OIL SEPARATORS, AND SAND INTERCEPTORS

If required, grease interceptors, oil separators, and sand interceptors shall conform to the provisions outlined in the corresponding section in the City Code.

401.00 MATERIALS

For a specific list of materials accepted by the City, see the Approved Materials List, which can be found in the Appendices.

401.01 POLYVINYL CHLORIDE PIPE (PVC)

A. DESCRIPTION OF PIPE

(1) All PVC pipe sizes four (4) inches through 15 inches, including the sanitary sewer service line up to the coupling adapter at the clean out nearest to the building, shall meet the requirements of ASTM D3034 "Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings"; sizes larger than 15 inches shall meet the requirements of ASTM F-679.

(2) All PVC pipe used for sanitary sewer mains shall be “green” in color.

B. CLASS AND TYPE

All sizes of PVC pipe shall be SDR 35, Pipe Stiffness 46 psi, and shall have the ASTM Specification, nominal diameter, and name or trademark of the manufacturer imprinted on the outside of the pipe. Any pipe installed deeper than the maximum allowed depth shall be approved by the City Engineer.

C. PIPE LENGTHS

Pipe shall be furnished in maximum lengths of 14.5 feet, except service tees and closure pieces.

D. JOINT TYPE

(1) Pipe joint assemblies shall be bell and spigot push-on joints using elastomeric gaskets with an O-ring rubber gasket conforming to ASTM F477. Joints shall conform to ASTM D 3212.

(2) Solvent cement joints are strictly prohibited.

E. PIPE BARREL DIAMETER DEFLECTION

(1) The diameter indicated on the Approved Plans shall mean the inside diameter of the pipe.

(2) Each sewer pipe section between manholes shall be tested for vertical ring deflection after completing backfill.

(3) Pipe shall be constructed so that the maximum initial vertical diameter does not decrease by more than five percent (5%) of the base internal diameter.

(4) The maximum allowable deflection of the line shall be five percent (5%) of the base internal diameter.

(5) Mandrel outside diameters in inches shall be as outlined in table 4-3:

Table 4-3 Mandrel Outside Diameters and Deflections

PIPE SIZE, inches	BASE I.D., inches	5% DEFLECTION
6	5.742	5.455
8	7.665	7.282
10	9.563	9.085
12	11.361	10.793
15	13.898	13.203

(6) The Contractor shall uncover all pipe sections exceeding the above maximum allowable deflections and replace the bedding and backfill to prevent excessive deflection, then retest repaired sections.

F. PIPE QUALITY

PVC having any of the following visual defects will not be accepted:

(1) Straight pipe, measured from the concave side, shall not deviate from straight greater than one-sixteenth (1/16) inch per foot of length.
(2) Pipe that is sufficiently out-of-round to prohibit proper jointing.
(3) Improperly formed bell and spigot ends.
(4) Fractured, cracked, chipped, or otherwise damaged pipe.
(5) Pipe discolored due to sun fading that is two (2) years old or older.
(6) Pipe that has been damaged during shipment or handling. Acceptance of the pipe at point of delivery will not relieve the Contractor of full responsibility for any defects in material of the completed pipeline.

401.02 HDPE

HDPE shall not be allowed for gravity installation but may be approved by the City Engineer on a case-by-case basis for other applications.

401.03 FUSIBLE PVC

A. Fusible PVC shall not be allowed for gravity installation but may be approved by the City Engineer on a case-by-case basis for other applications.

B. The pipe supplier shall fully qualify a Fusion Technician to install Fusible PVC of the type(s) and size(s) used. Qualifications shall be current as of the project's actual date of fusion performance. Fusible PVC pipe lengths shall be assembled in the field with butt-fused joints unless otherwise specified. Contractor shall follow the pipe supplier's written guidelines for this procedure. All fusion joints shall be completed as described in these specifications.

401.04 DUCTILE IRON PIPE

A. DESCRIPTION

Pipe shall be Class 50 ductile iron designed in accordance with AWWA C-151, C-150. Ductile iron pipe shall be ceramic epoxy lined. Cement mortar lining shall not be allowed. Fittings shall be cast iron. When allowed, the ductile iron pipe shall be lined with an epoxy lining type as approved by the City Engineer.

B. JOINT TYPE

Joints shall be mechanical joint or push-on joint unless otherwise authorized by the City Engineer.

C. CORROSION PROTECTION

Refer to Section 500 – Water Distribution of these City Standards for corrosion protection requirements.

D. PIPE QUALITY

Ductile iron pipe having any of the following visual defects will not be accepted:

(1) Pipe that is sufficiently out-of-round to prohibit proper jointing.
(2) Improperly formed bell and spigot ends.

(3) Fractured, cracked, chipped, or otherwise damaged pipe.
(4) Pipe that has been damaged during shipment or handling. Acceptance of the pipe at point of delivery will not relieve the Contractor of full responsibility for any defects in material of the completed pipeline.

401.05 VITRIFIED CLAY PIPE

The installation of vitrified clay pipe shall not be permitted.

401.06 ASBESTOS CEMENT PIPE (ACP)

The installation of asbestos cement pipe shall not be permitted.

401.07 FITTINGS FOR SEWER PIPE

A. Fittings used in new sewer construction, unless authorized by the City Engineer, shall be of the same material and class as the pipe to which it is attached.

B. Connections between dissimilar pipe materials are subject to the City Engineer's approval.

401.08 CLEAN-OUTS IN SERVICE LINES

All clean-outs shall be PVC. Clean-outs shall be placed two (2) feet outside of the structure, spaced at a maximum of 100 feet apart, and shall be installed at each change in direction of greater than 45° as per the International Plumbing Code. If the clean-out conflicts with structures, it can be placed in alternate locations conforming to specific site conditions. Clean-outs in traffic areas shall be protected by traffic-rated covers or boxes and shall be designed to carry the appropriate weight loads without damage to the pipe or clean-out.

401.09 UNDERDRAINS

A. Refer to Section 300 for underdrain requirements.

B. Underdrains are not a part of the sanitary sewer system and they shall not connect to the system at any time.

401.10 MANHOLES

A. DESCRIPTION
(1) All manholes shall be constructed using precast concrete sections fabricated from Type II cement and otherwise conforming to ASTM C-478.
(2) Cast-in-place manhole bases installed to connect new sanitary sewer mains may be allowed by the City Engineer on a case-by-case basis. Cast-in-place manhole bases installed to connect to existing sanitary sewer mains may be required by the City Engineer.
(3) An approved water stop gasket shall be required at each pipe penetration, as specified in the Approved Materials List located in the Appendices.
(4) Manhole cones shall be of the eccentric type. See Detail 400-01 "Standard Sanitary Manhole".
(5) Corrosion resistance measures may be required on a case-by-case basis as determined by the City Engineer based on soil type or expected effluent composition.
a. Interior manhole coating may be required on a case-by-case basis at the determination of the City Engineer.
b. Manhole steps shall be polypropylene meeting the following requirements: they shall be Grade 60 steel-reinforced, corrosion-resistant, polypropylene plastic conforming to ASTM

C478; they shall be fabricated with a positive-friction lock system for being hammer hand-driven into preformed holes.

B. MISCELLANEOUS MATERIALS

Use of mortar, non-shrink, non-metallic grout, and preformed plastic gaskets shall be in accordance with the Approved Materials List, located in the Appendices of these City Standards.

C. CASTINGS

(1) All castings for manhole covers, frames, and other purposes shall be of rough, gray iron and have a workmanlike finish free from blow-holes. The manhole frames and risers shall be designed for H-20 minimum traffic loading.

(2) Manhole covers shall have the words "Sanitary Sewer, Confined Space, Entry Permit Required" cast thereon. Manhole covers shall be sized for 24-inch diameter openings, one (1) inch thick, and designed for traffic loading. Manhole covers shall be located above the pipelines so the City's jetting equipment can access the pipelines.

(3) Manhole frames and covers shall be as indicated on the Approved Materials List, located in the Appendices to these City Standards.

401.11 CONCRETE AND REINFORCING STEEL

All concrete, unless otherwise specified on the Approved Plans, shall use Type II cement and have a minimum compressive strength of 4,000 p.s.i. at 28 days. The concrete design mix will be subject to the City Engineer’s approval. An air entraining agent shall be used in all concrete. Metal reinforcement shall be deformed steel bars sized according to their application by the Design Engineer, subject to the approval of the City Engineer. All steel reinforcement shall conform to ASTM A615, Grade 60.

402.00 INSTALLATION OF SEWER MAINS AND APPURTANCES

402.01 PLUGS OR STOPPERS

A. Water-tight PVC mechanical plugs or stoppers shall be furnished for all permanent stub-outs and all unused branch pipes. The size of the stopper shall be determined by the size of the pipe in which it is installed.

B. Plugs or stoppers with air balls shall be used for temporary plugs.

402.02 CONNECTION TO THE EXISTING SYSTEM

A. DESCRIPTION

The physical connection to the existing sewer system shall be plugged until Construction Acceptance has been issued for the project. If improper construction methods or materials are used, or excess infiltration occurs, the City may require the sewer be plugged until satisfactory corrections are made. A minimum of 48-hours notice must be given to the City Inspector prior to any connection to the existing system.

B. MAINLINE INTERRUPTION

Sewer mainline flow shall not be interrupted. The Contractor shall take the necessary steps to ensure the appropriate temporary means are taken to convey sanitary flow. The means of conveyance (i.e. bypassing) shall be approved by City Engineer and supplied or provided by the Contractor.

C. DEWATERING

(1) All pipe trenches or structure excavation shall be kept free from water during laying of pipe and other related work. The Contractor shall design, furnish, install, maintain, and operate a dewatering system that prevents loss of fines, boiling, quick conditions, or softening of foundation strata and maintain stability of bottom of excavations so that every phase of the work can be performed in a dry, safe, and stable environment. Dewatering systems shall be operated such that excavation bottoms are firm, suitably dry, and free from standing water at all times.

(2) Pipe shall not be installed with water present at or in the bell.

(3) The Contractor shall be responsible for obtaining a permit for ground water discharge.

(4) Discharge of ground water into any sewer line shall not be permitted.

(5) Dewatering shall be maintained until the trench is completely backfilled and until such time it is safe to allow the water table to return to its natural state.

402.03 TAPPING

A. Taps to the existing sewer main shall only be completed by City staff or by a City Representative with City Inspector present. Where tapping is necessary, the Contractor shall apply for the tap and pay the associated material tapping fee. The only service line size that shall be allowed to connect directly to a sanitary sewer main is four (4) inches in accordance with the City Code. Any service line size larger than four (4) inches shall connect into the sewer system through a manhole.

B. Six (6) inch service line taps shall not be allowed.

C. When performing a tap on live sewer, the system shall be protected from construction debris.

D. Contractors shall be required to schedule taps on existing sewer mains with the City by calling 303-651-8416. No tap will be scheduled less than 48 hours, or two (2) working days, in advance of desired tapping

and all requests are subject to approval based on available resources. No tap shall be scheduled until all fees have been paid.

E. The Contractor shall be responsible for excavating the sewer main and maintaining acceptable trench safety requirements following current OSHA standards.

F. The pipe shall be sufficiently exposed to accommodate the tapping equipment.

G. When all conditions are deemed safe at the determination of City personnel, and as described in Section 402.03, City personnel will physically make the tap(s). If the conditions of this section are not satisfied, City personnel will not perform the tap and a new time will need to be scheduled. If rescheduling is necessary due to the fault of the Contractor, all costs for time lost on the originally scheduled tap will be billed to the Contractor.

H. Taps are only made Monday through Thursday. Taps will not be performed on Fridays, except for emergency taps.

402.04 GENERAL PIPE INSTALLATION

A. LOWERING OF PIPE, FITTINGS, AND ACCESSORIES INTO TRENCH

All pipe, fittings, and accessories shall be carefully lowered into the trench with suitable equipment in a manner that will prevent damage to pipe and fittings. Under no circumstances shall pipe, fittings, or accessories be dropped or dumped into the trench. Pipe, fittings, and accessories shall be inspected for defects prior to being lowered into the trench. All foreign matter or dirt shall be removed from the interior and machined ends of pipe, fittings, and accessories before they are lowered into position in the trench. Pipe shall be kept clean by means approved by the City Inspector during and after installation.

B. INSTALLATION OF PIPE

(1) Every precaution shall be taken to prevent foreign material from entering the pipe while it is being placed in line. The end of the pipe shall be plugged or capped with approved materials when work stops. Pipe shall be installed working from downstream to upstream with the bell end facing up-grade. All pipe installed shall be to the required line and grade and checked to ensure there is no variation from that line and grade. No pipe shall be laid when, in the determination of the City Inspector, trench conditions are unsuitable, such as in the case of unstable bedding, pipe subgrade, or trench walls or the presence of contaminated soil or liquids.

(2) Pipe shall be installed using a pipe laser in accordance with pipe manufacturer's specifications.

(3) Refer to Section 100 of these City Standards for tracing wire and additional trenching requirements.

C. CUTTING OF PIPE

The cutting of pipe for inserting into fittings shall be done in a neat and workmanlike manner without damage to the pipe or lining, and so as to leave a smooth end with beveled edges recut to match the original pipe. Flame cutting of ductile pipe shall not be allowed. Asbestos cement pipe shall not be cut: an entire section of pipe shall be removed and replaced with a non-asbestos type pipe.

D. JOINING OF PIPE

Push on and mechanical joints shall be installed in accordance with the manufacturer's recommendations.

E. JOINT DEFLECTION

Sewer pipes shall not have any deflections. All pipes shall be laid and maintained to the required lines and grades. No deviation shall be made from the required line or grade except with the written consent of the City. Manholes and other necessary appurtenances shall be installed at the required locations. All pipes shall be laid to the depth shown on the Approved Plans or as directed by the City Engineer in writing.

F. PIPE SAGS AND BELLIES

(1) Any sag in a gravity sanitary sewer main measuring more than ten percent (10%) at any point along a segment shall not be accepted.
(2) The allowable tolerance for sags or bellies in a newly-installed pipe shall be 0.375 inches or less.
(3) Multiple sags or any sag measuring more than five (5) feet in length shall not be accepted for allowable sags and bellies.

402.05 SERVICE LINES

A. Each structure and each subdivided lot shall be served by a separate service line. Compound taps are not allowed per Section 14.08.230, City Code.

B. No taps shall be allowed on pipes 12 inches in diameter or greater without the approval of the City Engineer.

C. It is the responsibility of the owner of the premises to service and maintain the sanitary sewer service line from the structure to the connection at the main, per the Code.

D. Sewer service lines shall not be installed in trenches containing conduits that carry potable water without written permission of the City Engineer. Service lines shall be separated laterally from conduits that contain potable water by a minimum of ten (10) feet, edge to edge.

(1) Exception: For water and sanitary sewer services, where it is not possible to achieve a ten (10) foot separation of the water and sewer services due to the size, location, or other physical restraints of the lot, the City Engineer may allow deviation on a case-by-case basis if supported by data from the Design Engineer. Such deviation may allow installation of the water service closer to the sanitary sewer, provided the water service is laid in a separate trench or on an undisturbed earth bench located on one side of the trench at such an elevation that the bottom of the water service is at least 18 inches above the top of the sewer.

E. All service lines shall be extended 15 feet into the lot at the time of initial construction for future building connection.

F. Location of all service lines shall be marked with an “S” stamped in curb head or sidewalk.

G. All service lines shall be inspected by the City Inspector.

H. Sanitary sewer service line rehabilitation work shall require a building permit be issued and that a 48-hour notification be given to the City prior to commencing. All rehabilitation work on sanitary sewer services shall require inspection by the City.

I. All six (6) inch or larger sewer service lines shall connect into manholes. The connection shall channel their influent to flow with the main stream at no greater angle than 45 degrees with a minimum drop of two-tenths (0.2) foot and a maximum drop of 18 inches without a drop manhole.

J. All services smaller than six (6) inches must connect into a sewer main with a wye connection unless otherwise approved by the City Engineer.

K. Service line bedding, trench backfill, and compaction shall be the same as for the mainline sewer.

402.06 SETTINGS OF MANHOLES AND FITTINGS

A. GENERAL

(1) Manholes shall be constructed in accordance with Standard Detail 400-01 “Standard Sanitary Manhole”. The materials, operations, excavation, and backfilling shall conform to the applicable sections of these City Standards. If manholes are located in open fields, they shall be installed to have positive drainage.

B. MANHOLE BASES

(1) The Contractor may provide manhole inverts at Contractor's option. In case of any change in alignment or elevation of manholes, the Contractor is responsible for making all changes with the approval of the City Engineer.

(2) Bases shall be constructed such that they are level conforming to the dimensions as shown on the standard detail.

(3) When permitted, all cast-in-place concrete manholes shall conform to the following:

a. Invert channels shall be smooth and semi-circular in shape conforming to the inside of the adjacent sewer section. These must be formed directly in the concrete of the base. Class "B” 4,000 psi concrete with a minimum thickness of eight (8) inches below the flow line of the pipe and four (4) inches above the crown shall be required. For a straight-through manhole with no other inlets, the channel may be constructed by laying a full section of sewer pipe through the manhole and by cutting out the top half of the pipe after the surrounding concrete has hardened.

b. The first barrel section on the base shall have one and one half (1-1/2) inches preformed, bitumastic joint sealant or larger and grouted around the outside of the barrel section and manhole base. Changes in direction of flow shall be made with a smooth curve having as large a radius as the manhole will permit. Manhole bases shall be thoroughly bonded to the barrel of the pipe.

c. The manufacturer shall cut openings of sufficient size to receive entering pipes, providing three quarter (3/4) inch annular space around the pipe, or as required by the manufacturer of penetration gaskets. Inverts within the precast base shall have the same requirements as the inverts for the cast-in-place manhole bases.

d. Inlet and outlet pipes shall be joined to the manhole by a gasketed, flexible, watertight connection. Connections with pipes shall be made without projections or voids. The pipe shall not penetrate more than two (2) inches beyond the interior wall. Flowlines shall extend through the length of the base. See Standard Detail 400-01 “Standard Sanitary Manhole”. Inverts shall meet the requirements of the City.

e. Pipe size changes shall be accomplished by matching pipe crowns and forming the channel to accommodate the pipe size differential. The floor of the manhole outside of the channels shall be smooth and shall slope toward the channels at not less than one (1) inch per foot.

f. All manholes shall be installed to prevent floatation.

C. PIPE CONNECTIONS

Manholes shall be thoroughly bonded to the barrel of the pipe. Where shown on the Approved Plans, a piece of pipe of the proper size shall be built into the manhole where future services may be connected. This pipe shall be sealed with a plug at its outer end and an invert shall be built into each manhole for such service connections. For sewer pipe connections to existing manholes where there is no existing pipe stubbed out, the Contractor shall core drill the existing manhole as necessary to insert an approved gasket and new sewer pipe. The existing concrete foundation bench shall be ground 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. Portland cement non-shrink grout shall be used as necessary to smoothly finish the new invert.

D. DROP MANHOLES

Outside drop manholes are not allowed. Inside drop manholes, if necessary, shall be constructed in accordance with Detail 400-05 “Inside Drop Manhole”. A minimum five (5) foot diameter manhole shall be required for inside drops and must utilize an inside drop bowl.

E. MANHOLE LIDS AND STEPS

(1) Manholes shall be provided with polypropylene-coated, reinforced steps not less than 15 inches in width, built into, or thoroughly anchored in, the walls of the manhole at the time of fabrication or installation. No steps shall be installed in the grade rings. These steps shall be positioned as shown on Standard Detail 400-01 “Standard Sanitary Manhole”. Steps or rungs shall not be required unless the depth of manhole from ring to invert exceeds three (3) feet. Steps shall be installed centered with the manhole cover.

(2) Manhole lids shall be installed to be located out of the wheel-path of the flow of traffic, but oriented to be centered over the flowline of the outflow pipe if possible, as directed by the City Inspector.

F. PRECAST MANHOLES

(1) Precast sections shall be placed on the manhole base after it has reached sufficient compressive strength per Section 401.11. No modification of precast sections shall be permitted on the job site; all such fabrication shall be accomplished at the point of manufacture.

(2) The manhole base shall be thoroughly cleaned prior to installing.

(3) The manhole barrels shall be sealed watertight at all joints and riser sections using a preformed, bitumastic joint sealant from the Approved Materials List, located in the Appendices of these City Standards. Two rings of preformed, bitumastic joint sealant per joint shall be used, one (1) inch thick. The first precast section shall be carefully lowered onto the base so that the preformed plastic gaskets or mortar is evenly seated on all sides. The interior side of the first and, if deemed necessary by the City Inspector, other joints, shall be grouted with a non-shrink grout. Each succeeding precast section shall be jointed in a similar manner.

(4) In areas where the manhole will be exposed to groundwater, an approved waterproofing shall be applied to the thicknesses and recommendations of the manufacturer. The waterproofing shall only be applied to clean surfaces free of oils, greases, and foreign matters and shall not be placed on surfaces when the ambient air temperature is less than 50 degrees Fahrenheit, unless approved by the manufacturer.

G. MANHOLE RISERS

(1) Manhole frames shall be raised using precast, reinforced concrete rings or cast-in-place concrete; no other material shall be allowed. The first step shall be no lower than 24 inches from the finished grade of the street.

(2) Drop-in type risers are not allowed for new construction. Drop-in type risers may be used on overlay projects, but only one riser shall be allowed to be used in each manhole and the riser shall not exceed four (4) inches in height.

(3) All risers shall have a minimum of three (3) set screws per riser.

(4) No steps shall be allowed on the riser section. See Detail 400-02 “Manhole Adjustment”.

402.07 UTILITY MARKER SIGNS

Utility marker signs shall be installed by the Contractor next to manholes located in open fields or unpaved areas. See Detail 100-11 “Marker Post” for more information.

402.08 LIFT STATIONS

A. Lift stations directly connected to the public sanitary sewer shall not be allowed unless approved through a Design Exception Request process per Section 100 in these City Standards.

B. If a private lift station or grinder pump is installed, the sewer shall return to a gravity condition prior to connecting to the public sanitary sewer system.

C. All Design Exception Requests shall be evaluated on a case-by-case basis.

403.00 TESTING

403.01 INFILTRATION TESTING

A. After the compaction of fill material has been completed, tested, and approved, the Contractor shall check for infiltration in the main. This check shall begin at the furthest up-grade end of the system and proceed down-grade in the main from section to section. A section shall be defined as any portion of installed sewer line between two adjacent manholes.

B. Visible infiltration shall not be allowed.

403.02 AIR TESTING

A. The air test shall be made when the sewer is clean. The line shall be plugged at each manhole with pneumatic plugs. Low pressure air shall be introduced into the plugged line until the internal pressure reaches four (4.0) p.s.i.g. greater than the average back pressure of any ground water pressure that may submerge the pipe. At least two (2) minutes shall be allowed for the air temperature to stabilize before readings are taken and the time is started.

B. The portion being tested shall pass if it does not lose air at a rate to cause the pressure to drop from three and six tenths (3.6) to three (3.0) p.s.i.g. in less than the time listed in Table 4-4 below. If failure of the test occurs in any section, that section shall be repaired and retested until satisfactory results are achieved.

C. In instances with submerged pipelines, the back pressure of any groundwater shall be calculated by dividing the average vertical height in feet of groundwater above the invert of the sewer pipe to be tested by 2.31 and added to the 4.0 p.s.i.g. normal test starting pressure to determine the starting test pressure, not to exceed 9 p.s.i.g., as follows:

Example: Consider a ten (10) foot deep sanitary main where groundwater is encountered at eight (8) feet below the surface

Step 1 – Determine the Starting Test Pressure, P_t:

Normal Starting Test Pressure, P_n : 4psig

Feet of Groundwater Above Invert of Sewer Pipe: 10 feet – 8 feet = 2 feet

P_t = 4 psig + (2 feet/2.31 psig/ft) = 4.87 psig

Table 4-4 Air Testing

Pipe Diameter in inches	Minimum Allowable Minutes 3.6 – 3.0 psig Pressure
6	3.0
8	4.0
10	5.0
12	6.0
15	7.5

D. All service plugs shall be secured in place to prevent displacement during testing operations.

403.03 MANHOLE LEAKAGE TEST

A. Manholes shall be tested by vacuum testing. Vacuum test shall occur after assembly and backfilling, but prior to paving. Care shall be taken to affect a seal between the vacuum base and the manhole rim. Pipe plugs shall be secured to prevent movement while the vacuum is drawn. A vacuum of ten (10) inches of mercury shall be drawn. The time for the vacuum to drop one (1) inch of mercury shall be recorded. If preformed, plastic gaskets are pulled out during the vacuum test, then the manhole shall be disassembled and the gaskets shall be replaced. Acceptance shall be defined as when the time to drop one (1) inch meets or exceeds the following:

Table 4-5 Manhole Leakage Test

Diameter	Time to Drop One Inch (1") Hg
4 ft.	60 seconds
5 ft.	75 seconds

B. Manholes shall not be accepted if there is any visible infiltration when empty.

C. All installed manholes shall be tested. Any manhole with an unsatisfactory test shall be repaired and retested until satisfactory results are obtained.

D. Failure of any test shall be considered failure of the manhole involved. If the manhole fails the test after repair options have been exhausted, the manhole shall be replaced.

403.04 VISUAL INSPECTION

A. All new sewer lines shall be subject to inspection by lamping or other visual means by the City Inpsector. All new PVC pipe shall be subject to mandrel testing in accordance with section 401.01.E.

B. All newly constructed sanitary sewer lines shall be completely jetted by the Contractor to remove dirt and debris prior to Construction Acceptance. The Contractor shall be responsible for removing all dirt and debris from the lines during the jetting operation and shall not allow any debris into any active City sewer line. Jetting shall be done after first lift of asphalt is completed.

C. The Contractor/Developer shall, at their expense, hire an independent firm to video inspect the sewer line. A designated City employee will be assigned to observe the camera footage. The Contractor shall provide videos of camera inspections to the City Inspector prior to Construction Acceptance.
   (1) Manholes and sewer lines shall be clean prior to scheduling video inspection. If rescheduling is necessary due to the fault of the Contractor, all costs for time lost on the originally scheduled camera inspection will be billed to the Contractor.

D. Prior to final lift of asphalt at Final Acceptance, all installed sanitary sewer lines shall be video inspected by the City. All defects found in the lines at the time of the camera operations shall be repaired prior to the City granting Final Acceptance. The following items must be included in the camera inspection video:
   (1) Street Name
   (2) Starting and ending manhole Identification
   (3) Size and type of pipe
   (4) Distance from starting manhole in feet
   (5) Inclination

(6) Date
(7) Identify any unusual characteristics including but not limited to sags, rolled gaskets, dimples, etc.