

II. Neighborhood Development Regulations: Section 9 - Utility Standards

II. Neighborhood Development Regulations

Section 9 - Utility Standards: General Requirements

A. General Requirements.

1. Intent. The intent of this article is to:
 - a. Establish and define the public utility Improvements which will be required to be constructed by the Applicant as conditions for all approvals.
 - b. Outline the procedures and responsibilities of the Applicant and the various public officials and agencies concerned with the planning design, Construction, and financing of public utilities.
 - c. Encourage efficient development by coordinating existing and proposed utility systems in the city.
 - d. Coordinate the operation and function of utility systems throughout the city, including access to and within individual Subdivisions.
 - e. Ensure that the design and operation of required utility Improvements are compatible with the street system and the resulting Block and Lot patterns.
 - f. Ensure that all new streets have access to the required utilities, or that the necessary Improvements can be efficiently constructed in coordination with future development.
2. Applicability. The standards in this article shall apply to Parcels being subdivided according to the processes outlined in I.4 Process Criteria and Application and in this Article.
3. General Requirements. The Applicant shall provide adequate water, sanitary sewer, stormwater management, and energy service to all Lots resulting from a Subdivision by connecting to existing city systems that are deemed adequate by the City Engineer to handle the additional volume resulting from the proposed Neighborhood Development.
 - a. Installation of Public Utilities. Public utilities shall be located in accordance with the rules of the City. The underground work for utilities shall be stubbed to the Property Line.
 - (1) Underground Utilities. Except as specifically authorized by this article, all public and quasi-public utilities, including gas lines, electrical lines, telephone lines, and cable transmission lines shall be located underground and, except for individual building or property services, shall be located in public Easements or dedicated public rights-of-way.
 - (2) Above-ground Utilities Screening. The Applicant shall provide adequate landscaping to screen any above-ground utilities, such as electrical transformers, pumping stations, and telephone pedestals, in accordance with IV.5 Landscape Standards.
 - (3) Overhead Utilities. Refer to the City's Overhead Utilities ordinance for standards for overhead utilities.
 - b. Water Main, Sanitary Sewer, and Storm Sewer Locations. Water mains, sanitary sewers, and storm sewers shall be located under the vehicular pavement of a street Right-of-Way. Water shall be located along the centerline of the street and storm and sanitary sewers shall be separated by a minimum of ten (10) feet. Refer to Figure 9.A-1. With Code Administrator approval, portions of utilities may be located outside the pavement area if any of the following conditions exist:
 - (1) Pavement width is not wide enough to provide defined clearances.
 - (2) Curvature of the street requires straight segments of utilities to extend beyond the pavement.
 - (3) Underground conditions prohibit locating utilities under pavement.
 - c. Water and Sewer Easement Width. Easements outside the street Rights-of-Way, containing both water and sewer mains shall be at least thirty (30) feet in width. No other utilities or related items (sprinkler systems, buildings, electric cables, etc.) shall be installed in the Easement unless approved by the City.
 - d. Required Access to Easements. Utility Easements or Rights-of-Way shall be of sufficient width and the utilities shall be installed at such locations therein as to permit open-cut installation, maintenance and repair within the confines of the Easement or Right-of-Way.
 - e. Location of Appurtenances. All utilities and appurtenances located in a vehicular Right-of-Way shall be located to minimize visual impacts. Where

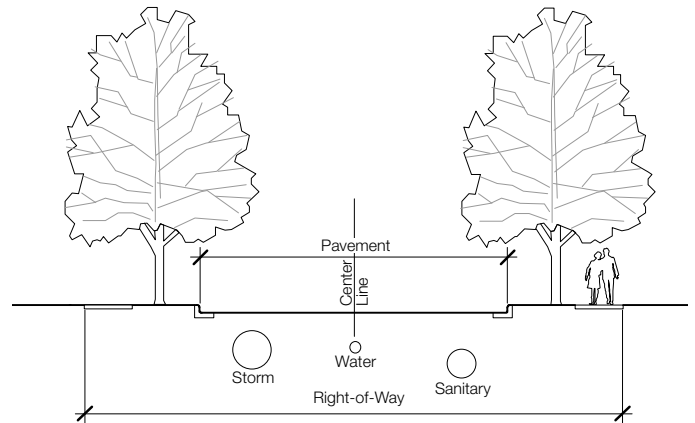


Figure 9.A-1. Diagram of Typical Utility Locations.

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possible, avoid locating multiple appurtenances on the corner and, where feasible, locate in the rear of the Lot.

- f. Construction Standards. All utility installations shall conform with the applicable city, state, regulatory, or accepted industry standards, whichever impose the highest and most demanding requirements for the preservation and protection of the public health, safety, and welfare.
- g. New Technology and Materials. New materials, equipment, or technology not covered by these design standards or the City's Public Works Construction and Material Specifications, may be considered on an individual basis if such a variance has the potential to initiate more cost-effective service to the citizens of Lakeland. Facilities not covered by these standards shall be reviewed and approved jointly by the City and the Department of Environment and Conservation.
- h. Record Drawings. At acceptance, record drawings shall be submitted to the City, illustrating the constructed locations of all utilities and appurtenances. The record drawings shall include, but are not limited to, the following information for utilities:
- (1) Contractors name and address.
 - (2) Construction dates.
 - (3) Distance between water or sewer mains and other utilities.
 - (4) Street names and widths.
 - (5) Mains and sizes.
 - (6) Material of mains.
 - (7) Fire hydrant locations and manufacturer, and model.
 - (8) Water valve locations, manufacturer, and model.
 - (9) Location and types of all anodes.
 - (10) Location of corrosion test stations
 - (11) Location of tracer/locator boxes
 - (12) Distances from Property Lines.
 - (13) Block and Lot numbers.
 - (14) House numbers. These may be obtained from the City Building Inspection Division.
 - (15) Measurements from sewer main to stub out end. Ends of stub outs shall be tied into permanent reference points and elevations shown.
 - (16) Measurements from water main to curb box. All curb stops shall be tied into permanent reference points.
 - (17) Sizes of water taps.
 - (18) Distance between fittings.
 - (19) All dead ends accurately tied into permanent reference points.

(20) All tapping sleeves shall be shown.

(21) All couplings shall be indicated.

(22) Location of all bends (including vertical bends).

(23) Size of sewer taps.

(24) All manhole invert and top of ring elevations.

(25) Distance between manholes or cleanouts.

(26) Orientation of north.

(27) Scales shall be the same Scale as those for construction drawings.

B. Water Supply System.

1. General Requirements. All Subdivisions shall be designed so the proposed water distribution and supply system meets the following requirements.
 - a. Plan Approval. All proposed plans shall be designed by Memphis Light Gas and Water (when applicable) or by the Applicant and a completed plan shall be provided to the City Engineer. Construction of improvements shall follow the City's Public Works Construction and Material Specifications.
 - b. Provider Requirements. Design of the water supply system shall conform to the requirements of Memphis Light, Gas, and Water or the City of Bartlett in their respective service areas.
2. Systems in Public Rights-of-Way.
 - a. Extension of Existing Lines. Water mains shall be extended through the proposed Subdivision to serve otherwise unserved abutting properties.
 - b. Service Line Connections. The Applicant shall provide water service, with separate service connections terminating not less than two (2) feet inside the property or Easement line, to each proposed Lot of record.
 - c. Capacity. The Applicant shall ensure that there is adequate capacity to serve all the Lots proposed to be served by the utility, plus any additional extensions to the main which might be made to develop property in the same pressure area with the type of Uses and to the maximum Density permitted by the existing Zoning Regulations of the City with respect to the property within the corporate limits and by the anticipated zoning for any land currently outside the corporate limits.
 - d. Configuration. Loop water mains to avoid dead ends.
 - e. Fire Hydrants. Standard fire hydrants shall be provided at each intersection of two (2) or more public streets or roadways, and additional hydrants shall be provided as necessary so that hydrants are not more than three hundred (300) feet apart in all areas. All fire hydrants shall have auxiliary valves.

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- f. Size Requirements. The minimum size water main shall be eight (8) inches in diameter; on cul-de-sac or other permanently disconnected streets, six (6) inches in diameter is acceptable.
 - g. Horizontal Distance of Main from Sewer. Water mains shall be laid at least ten (10) feet horizontally from any sanitary sewer, storm sewer, or sewer manhole, whenever possible. The distance shall be measured edge-to-edge.
 - (1) When local conditions prevent a horizontal separation of ten (10) feet, a water main may be laid closer to a storm or sanitary sewer provided that such construction is strictly in accordance with Tennessee Department of Environment and Conservation requirements.
 - h. Vertical Distance Between Mains and Sewers. Water mains crossing house sewers, storm sewers, or sanitary sewers shall be laid above the sewers to provide a separation of at least eighteen (18) inches between the bottom of the water main and the top of the sewer, whenever possible.
3. Right-of-Way Dedication. All water mains shall be installed in public Easements or dedicated public Rights-of-Way, with all associated Easements and Rights-of-Way of with a minimum width of eighteen (18) feet plus the diameter of the water main.
4. Construction Standards. All water mains shall use materials and be installed in a manner meeting or exceeding the required standards and specifications approved by the City Engineer or Memphis Light Gas and Water.
5. Oversizing. Whenever the required utilities or a portion thereof are necessary to service future growth in the vicinity of the Subdivision, or to develop property with the type of Uses and to the maximum intensity permitted by the existing Zoning Regulations of the City with respect to the property within the corporate limits and by the anticipated zoning for any land currently outside the corporate limits. The City may provide for oversizing reimbursement. The City will provide for the terms and conditions of reimbursement to the Applicant and authorized by the Board of Commissioners and as specified in the oversizing ordinance. Oversizing reimbursements will be provided to the Applicant upon acceptance of public improvements.
6. Groundwater Wells. Refer to Chapter 20 of the Code of Ordinances.

C. Sanitary Sewer System.

- 1. General Requirements. All Subdivisions shall be designed so the proposed sanitary sewers and appurtenances meet the following requirements.
 - a. Adjacent Areas. All sanitary sewers and appurtenances shall be designed to carry the design flows from all contiguous or adjacent areas that may, within a reasonable period in the future, be tributary thereto.
 - b. Plan Approval. Contiguous or adjacent areas to be included in the design, and the tributary population to be provided for, shall be subject to approval by the City. The Lakeland Board of Sewerage Commissioners shall review all public sewer connections and make a recommendation to the Board of Commissioners prior to any connection by the Applicant.
 - c. State Requirements. Design of the sanitary sewer system shall conform to the requirements contained in the Tennessee Department of Environment and Conservation Sewer Design Guidelines (addendum to the Subdivision Regulations)
 - d. Master Plan of Wastewater Facilities. All mains ten (10) inches and larger shall be sized and located in accordance with the current Master Plan of Wastewater Facilities; however, the City reserves the right to specify sizes and locations including those not delineated on the Master Plan.

Sewer Size (inches)	Minimum Slope (ft/100 ft)
4"	2.0
6"	0.80
8"	0.40
10"	0.28
12"	0.22
15"	0.15
18"	0.12
21"	0.10
24"	0.08
27"	0.067
30"	0.058
33"	0.051
36"	0.046

Table 9.C-1. Minimum Sewer Slope Requirements.

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- e. Development Limitations. No Subdivision of property shall occur if sewer does not service the property with the following exception:
- (1) Lots of two (2) acres or more and containing adequate area and soils may utilize a septic system approved by the County Health officer and the City.
 - (a) Soils Test. A soils test shall be conducted by a certified soils scientist and filed with the City.
 - (b) Proximity to Existing Sewer. If any portion of a Lot within the Subdivision is located within one quarter (1/4) mile of an existing sanitary sewer line, septic systems are not permitted and connection to the sanitary system is required.
 - f. Design to Prevent Damage. All sewers shall be designed to prevent damage from superimposed loads as well as trench loading conditions. All sewers are to be bedded as required by the City's Public Works Construction and Material Specifications.
 - g. Anchoring on Steep Grades. Sewers on twenty (20) percent slope or greater shall be anchored securely with concrete anchors, or equal, spaced as follows:
 - (1) Not over thirty six (36) feet center-to-center on Grades between twenty (20) percent and thirty five (35) percent.
 - (2) Not over twenty four feet center-to-center on Grades between thirty five percent (35) and fifty (50) percent.
 - (3) Not over sixteen (16) feet center-to-center on Grades over fifty (50) percent.
 - h. Potable Water Supply. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto which would permit the passage of any sewerage or polluted water into the potable supply.
 - i. Materials approved for sewer main and service connections shall be listed in the City's Public Works Construction and Material Specifications Manual.
2. Sewer Tap Procedures. Sewer tap procedures to be followed by plumbers and installers in connecting sanitary sewer lines from any and all buildings to sanitary sewer lines within the corporate limits of the City shall be as follows:
- a. Notification. Notify the City Engineer twenty-four (24) hours prior to any connection being made.
 - b. Uncovering the Service Line. Uncover the service line to the Lot in the presence of an authorized City representative or as directed by the City Engineer.
 - c. Tying In. Make a tie in to the service line only with an authorized City representative present. Back fill only when instructed to do so by the City representative.
 - d. Line Testing. The line will be tested immediately by the introduction of water, which will be monitored by an authorized City representative to determine the suitability of the connection. Dye or color may be required if the line is active.
 - e. Certificate of Acceptability. A Certificate of Acceptability will be given prior to allowing the normal use of lines. The City will issue the Certificate prior to allowing occupancy.
3. Sewer Easement Width. All Easements outside street Rights-of-Way containing only sewer mains shall be at least eighteen (18) feet plus the diameter of the sewer pipe in width and Graded so that every manhole will be accessible to maintenance equipment. No other utilities or related items (sprinkler systems, buildings, sidewalks, electric cables, etc.) shall be installed in the Easement unless approved by the City.
4. Design Flows.
- a. Peak Discharge. Sanitary sewers shall be designed to carry the peak discharge and to transport suspended material so that deposition in the sewer is precluded.
 - b. City Approval of Densities. The consultant shall substantiate and have City approval of population densities per acre or per unit.
 - c. Daily Per Capita Flow. New sewer systems shall be designed on the basis of an average daily per capita flow of not less than one hundred gallons (100) per day or actual sewer flows determined from the City.
 - (1) Additional Allowance. Additional allowances may be made if conditions are unfavorable to accommodate an average daily per capita flow of one hundred gallons per day.
 - (2) Peak Load Parameters. To provide for peak loads, sanitary sewers shall be designed for peak flow to average flow at 0.75 pipe diameter depth, ratios of 4:1 for lateral sewers (8-inch); 3.5:1 for collector sewers (10-inch through 15-inch); and 2.5:1 for interceptor sewers (18-inch and larger).
 - d. Additional Submittal. When deviations from the foregoing procedure are requested, a description of the design procedure used shall be submitted with the plans and specifications for approval.
 - e. Sewage Flow Guidelines. The following sewage flow parameters shall be used as a general guideline

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for minimum estimated average flows generated from nonresidential land Use:

- (1) Commercial Areas 2,000 gal./acre/day
- (2) Infiltration-Inflow Allowance 500 gal./acre/day

5. Depth of Cover. In no case shall sanitary sewers be designed for a depth of cover less than thirty six inches over the top of the pipe or sewer.
 - a. Where shallower depths are unavoidable, consideration may be given to the construction of epoxy lined or polyurethane lined ductile iron, or similarly protected sewer, with or without insulation as circumstance may direct. Proper allowance for loads on the sewer shall be made because of width and depth of trench.
 - b. Minimum Factor of Safety. Rigid pipe shall have a minimum factor of safety of 1.5. Flexible pipe shall have a minimum factor of safety of 1.25. Where necessary, special construction will be required.
6. Velocity of Flow. All sewers shall be designed and constructed with hydraulic slopes sufficient to give mean velocities, when flowing full, of not less than 2.0 feet per second, based on Manning's formula, using a value for "n" of 0.013. The minimum slopes to be provided for shall be as specified by Tennessee Department of Environment and Conservation.
 - a. The engineer shall furnish computations for velocities and depth of flow for Grades in excess of 8% and for extremely low flow situations.
 - b. Where velocities greater than ten (10) feet per second are attained, special provision shall be made to protect against displacement by erosion and shock.
7. Minimum Size. No public sanitary sewer shall be less than eight (8) inches in diameter. The minimum size of house connections shall be four (4) inches in diameter.
8. Alignment.
 - a. General Sewer Alignment. In general, sewers shall be designed for uniform slope and alignment between manholes, and shall be located parallel to and with a minimum of ten (10) feet separation from water lines.
 - b. Curvilinear Sewers. Curvilinear sewers will be permitted only for sewers fifteen (15) inches in diameter and larger.
 - c. Energy Gradient Line. The energy gradient line shall be maintained whenever a smaller sewer joins a larger sewer. This can be approximated by placing the 0.8 depth of both sewers at the same elevation (not considering head loss through the manhole).
9. Manholes.
 - a. Locations. Manholes shall be installed at the end of each line, at all changes in Grade, size, or alignment, at all sewer main intersections, and at distances not greater than four hundred feet apart for sewers fifteen (15) inches in diameter or less, and not greater than four hundred fifty feet (150) apart for sewers eighteen (18) inches in diameter or larger.
 - b. Manhole Diameter. Four (4) foot diameter manholes may be used for pipes up to 18-inch diameter. Five (5) foot diameter manholes shall be used for pipes twenty one (21) inches in diameter and larger.
 - c. Lamp Holes. Lamp holes will not be acceptable as a substitute for manholes.
 - d. Drop Manholes. Drop manholes shall be provided for a lateral sewer entering a manhole at an elevation of eighteen (18) inches or more above the manhole invert. Drop manholes shall be avoided whenever it is feasible to do so. The upper pipe at drop inlets shall extend into the manhole twelve (12) inches with the top half cut out.
 - e. Floor Troughs. Floor troughs shall be furnished for all sewers entering manholes. A larger diameter manhole may be needed in order to properly construct floor troughs where the incoming sewer inverts are substantially higher than the outgoing sewer invert. At all manholes with a change of direction, a drop from entrance to outlet of at least 0.1 ft. shall be provided to account for head loss through the manhole. More drop may be required for sewer mains twelve inch and larger. Inverts shall be U-shaped to the pipe crown before sloping at a 1 to 12 slope to the manhole walls.
 - f. Public Works Construction and Material Specifications. All manholes shall conform to the dimensions, construction details, materials, and testing requirements detailed in the City's Public Works Construction and Material Specifications.
 - g. Corrosion Protection. When directed by the city, manholes shall be internally coated for corrosion protection in accordance with the standard construction specifications.
 - h. All manholes located in floodplains shall be flat top manholes. All manhole ring and covers shall be water tight and meet specifications outlined by the City's Public Works Construction and Material Specifications.
10. Service Connections.

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- a. Wyes. Service connections to any sanitary sewer shall be made only to a wye installed at the time of the sewer main installation or by machine tap and approved saddle appropriate to the main line sewer material. All connections to existing public sewers shall be made by a licensed plumber and approved by the City. All wyes and service connections shall be made at the 10:00 or 2:00 position on the sewer main.
 - b. Water Tight. All connections and service lines shall be water tight.
 - c. Uniform Plumbing Code. All service connections shall be sized in accordance with the Uniform Plumbing Code.
 - d. One Building Limit. Only one residence, structure, or building shall be served by each lateral connected to the public or private main, unless as approved by the City.
 - e. Commercial and Industrial Wastes. Attention is directed to City's Municipal Code relative to the use of public sewers and the requirements for discharge of certain materials (pretreatment).
 - (1) Inspection Manhole. An inspection manhole or other suitable structure shall be required on the service line for any use other than normal domestic use.
 - (2) Grease Interceptors. In addition to the above, acceptable grease interceptors will be required of all restaurants, food preparation centers, or for any other discharge containing oil and grease.
 - (3) Sand and Oil Interceptors. Acceptable sand and oil interceptors shall be provided for all car washes and similar facilities which may discharge sand or dirt to the sewer.
11. Roof or Foundation Drains. Under no circumstance shall roof drains, foundation drains, storm drains, or sub-drains be connected to the sanitary sewer system.
12. Townhouse Manifolds. Townhouse developments may elect to use a "manifold" sewage collection system for service to individual properties, if a valid Homeowner's Association exists among all property owners. The "manifold" system is restricted to townhouse developments and shall conform to the following requirements:
- a. Homeowner's Association. The "manifold" system shall be owned and maintained by a viable Homeowner's Association. The Homeowner's Association will be responsible for the manifold to the point of connection with the sewer main.
 - b. Four Unit Limit. No more than four (4) privately-owned units may be placed on any "manifold."
 - c. Location. The "manifold" shall be located at the back side of the front Lot utility Easement.
 - d. Header Pipe. The common header pipe to the main shall be six (6) inches in size and shall be provided with cleanouts at the ends and at all bends.
 - e. Uniform Plumbing Code. The "manifold" shall meet all requirements of the Uniform Plumbing Code as adopted by the City. The inspection of the "manifold" beyond the sewer main shall be accomplished by the Plumbing Inspector.
- D. Storm Sewer System.**
- 1. General Requirements. All Subdivisions proposed storm sewers and appurtenances shall meet the following requirements.
 - a. Adjacent Areas. All storm sewers and appurtenances shall be designed to carry the design flows from all contiguous or adjacent areas that may within a reasonable period in the future, be tributary thereto. Contiguous or adjacent areas to be included in the design, and the tributary population to be provided for, shall be subject to approval by the City.
 - b. State Requirements. Design of the storm sewer system shall conform to the requirements contained in the Tennessee Department of Environment and Conservation Storm Sewer Design Guidelines (addendum to the Subdivision Regulations).
 - c. Design to Prevent Damage. All storm sewers shall be designed to prevent damage from superimposed loads as well as trench loading conditions. All sewers are to be bedded as required by the City's Public Works Construction and Material Specifications.
 - d. Anchoring on Steep Grades. Sewers on twenty (20) percent slope or greater shall be anchored securely with concrete anchors, or equal, spaced as follows:
 - (1) Not over thirty six (36) feet center-to-center on Grades between twenty (20) percent and thirty five (35) percent.
 - (2) Not over twenty four (24) feet center-to-center on Grades between thirty five percent (35) and fifty (50) percent.
 - (3) Not over sixteen (16) feet center-to-center on Grades over fifty (50) percent.
 - e. Potable Water Supply. There shall be no physical connection between a public or private potable water supply system and a storm sewer or appurtenance thereto which would permit the passage of any polluted water into the potable supply.

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- f. Materials approved for storm sewer main and service connections shall be listed in the City's Public Works Construction and Material Specifications Manual.
2. Storm Sewer Tap Procedures. Storm Sewer tap procedures to be followed by contractors and installers in connecting drains lines from any and all buildings or properties to storm sewer lines within the corporate limits of the City shall be as follows:
 - a. Notification. Notify the City Engineer twenty-four (24) hours prior to any connection being made.
 - b. Uncovering the Service Line. Uncover the service line to the Lot in the presence of an authorized City representative or as directed by the City Engineer.
 - c. Tying In. Make a tie in to the storm sewer pipeline only with an authorized City representative present. Back fill only when instructed to do so by the City representative.
 - d. Line Testing. The line may be tested immediately by the introduction of water, which will be monitored by an authorized City representative to determine the suitability of the connection.
3. Storm Sewer Easement Width. All Easements containing only storm sewer mains shall be at least eighteen (18) feet plus the diameter of the sewer pipe in width and Graded so that every manhole will be accessible to maintenance equipment. No other utilities or related items (sprinkler systems, buildings, sidewalks, electric cables, etc.) shall be installed in the Easement unless approved by the City.
4. Design Flows. Storm Sewer Hydraulic Design. Storm sewers shall be designed In accordance with the City of Memphis/Shelby County Storm Water Design Manual.
5. Depth of Cover.
 - a. Minimum Depth of Cover. In no case shall storm sewers be designed for a depth of cover less than thirty six (36) inches over the top of the pipe. Where shallower depths are unavoidable, consideration may be given to different bedding conditions. Proper allowance for loads on the sewer shall be made because of width and depth of trench.
 - b. Minimum Factor of Safety. Rigid pipe shall have a minimum factor of safety of 1.5. Flexible pipe shall have a minimum factor of safety of 1.25. Where necessary special construction and bedding will be required.
6. Velocity of Flow. All sewers shall be designed and constructed with hydraulic slopes sufficient to give mean velocities, when flowing full, of not less than 3.0 feet per second based on Manning's formula, using a value for "n" of 0.013. Curb and Gutter shall be designed with a manning coefficient of 0.017.
7. Minimum Size. No public storm sewer shall be less than twelve (12) inches in diameter.
8. Alignment.
 - a. General Sewer Alignment. In general, sewers shall be designed for uniform slope and alignment between manholes, and shall be located parallel to and with a minimum of ten (10) feet separation from water lines.
 - b. Curvilinear Sewers. Curvilinear sewers will be permitted only for sewers thirty six (36) inches in diameter and larger.
 - c. Energy Gradient Line. The energy gradient line shall be maintained whenever a smaller sewer joins a larger sewer. This can be approximated by placing the 0.8 depth of both sewers at the same elevation (not considering head loss through the manhole).
9. Manholes.
 - a. Locations. Manholes shall be installed at the end of each line, at all changes in Grade, size, or alignment, at all sewer main intersections, and at distances not greater than four hundred feet apart for sewers fifteen (15) inches in diameter or less, and not greater than four hundred fifty feet (450) apart for sewers eighteen (18) inches in diameter or larger.
 - b. Manhole Diameter. Manhole diameters shall be as described in the City's Public Works and Material Specifications.
 - c. Lamp Holes. Lamp holes will not be acceptable as a substitute for manholes.
 - d. Drop Manholes. Drop manholes shall be provided for a lateral sewer entering a manhole at an elevation of twenty-one (21) inches or more above the manhole invert. Drop manholes shall be avoided whenever it is feasible to do so.
 - e. Floor Troughs. Floor troughs shall be furnished for all sewers entering manholes. A larger diameter manhole may be needed in order to properly construct floor troughs where the incoming sewer inverts are substantially higher than the outgoing sewer invert. At all manholes with a change of direction, a drop from entrance to outlet of at least 0.1 ft. shall be provided to account for head loss through the manhole. More drop may be required for sewer mains twelve (12) inch and larger. Inverts shall be U-shaped to the pipe crown before sloping at a 1 to 12 slope to the manhole walls.

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- f. Public Works Construction and Material Specifications. All manholes shall conform to the dimensions, construction details, materials, and testing requirements detailed in the City's Public Works Construction and Material Specifications.
 - g. Corrosion Protection. When directed by the City, manholes shall be internally coated for corrosion protection in accordance with the standard construction specifications.
 - h. All manholes located in floodplains shall be flat top manholes. All manhole ring and covers shall be water tight.
10. Inlets
- a. Storm Water inlets shall be precast or cast in place. Brick inlets are not permitted.
 - b. Storm sewer inlet grates shall be as specified in the City's Public Works Manual and Material Specifications.
11. Service Connections.
- a. Wyes. Service connections to any storm sewer shall be made only upon permission of the City. All connections to existing public sewers shall be made by a licensed plumber and approved by the City. All wyes and service connections shall be made at the 10:00 or 2:00 position on the sewer main.
 - b. Water Tight. All connections shall be water tight.
- E. Sewage Lift Stations and Sewer Force Mains**
1. General Requirements. All Sewage Lift Stations shall be designed to meet the following requirements.
- a. Adjacent Areas. All sewage lift stations shall be designed to carry the design flows from all contiguous or adjacent areas that may within a reasonable period in the future be tributary thereto. Contiguous or adjacent areas to be included in the design, and the tributary population to be provided for shall be subject to approval by the City.
 - b. State Requirements. Design of the sewage lift station shall conform to the requirements contained in the Tennessee Department of Environment and Conservation Sewer Design Guidelines (addendum to the Subdivision Regulations).
 - c. Sewage lift stations and Sewer Force mains shall be installed in public rights of way or in dedicated public easements. These facilities shall not be located in any OS zoning district. Sewage Lift Stations areas shall be the footprint of the lift station plus twenty feet (20) on all sides.
- d. Sewage Lift Stations shall be placed on reinforced concrete pads designed to withstand the weight and operational characteristics of the pumps.
 - e. Sewage Lift Stations shall be fenced on all sides with eight (8) foot high fencing. A gate suitable for vehicular traffic shall be installed on one side of the lift station. Fencing shall be of a durable exterior coating of neutral colors. Wood fencing is not permitted.
2. Sewage Lift Stations.
- a. Total Dynamic Head. The total dynamic head rating of pumping units shall be based on pipe friction, pressure losses from piping entrances, exits, appurtenances (bends, valves, etc.), and static head at the rated flow.
 - b. Design Conditions.
 - (1) Grit. Where no grit removal is provided ahead of the pumping station, equipment and piping design shall minimize the deleterious effects of grit in the sewage.
 - (2) Screening. Screens or comminutors shall be provided ahead of pumps where the average daily flow is in excess of 1.0 mgd (3,784 m³/d) to prevent solids larger than 2 ½ inches (6.4 cm) from entering the pump.
 - (3) Minimum Pump Opening. Except for grinder pumps, raw sewage pumps shall be capable of passing spheres of at least three (3) inches (7.6 cm) in diameter. Pump suction and discharge piping in all sewage and sludge services shall be no smaller than four (4) inches in diameter (10 cm).
 - (4) Pump Cycle Time. Intermittently operated pumps shall be designed to start no more often than once every ten (10) minutes at the minimum operating interval.
 - (5) Removal of Equipment. Pumping stations shall be designed to permit removal of all items of equipment including pumps, valves, electrical, and control equipment. Equipment located in wetwells shall be removable without entering the wetwell.
 - (6) Surge Control. Piping systems shall be designed to withstand the maximum possible surge (water hammer) from the pumping station, or adequate surge control provided to protect the piping. Pressure relief valves are not acceptable surge control.
 - (7) Net Positive Suction head. Pumps shall be selected so that the net positive suction head required at maximum flow (NPSHR) is less than the NPSH available minus four (4) feet

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- (1.2 m) based on the hydraulic conditions and altitude of the lift station.
- (8) Uplift. The pumping station chambers shall resist hydrostatic uplift pressures.
- c. Siting requirements.
- (1) Access. Pumping stations shall be located so that they are readily accessible to operating and maintenance personnel at all times of day or night, and under all weather conditions. Pumping stations shall be located off of traffic ways.
- (2) Flood Protection. Pumping stations shall be designed so there is no equipment or structural damage in the one hundred (100) year flood, and so the pumping station's operation is uninterrupted by the twenty-five (25) year flood.
- (3) Security. The pumping station shall be designed to discourage unauthorized entry.
- d. Pumping Station Types.
- (1) Dry wells.
- (a) Access. Pumping station dry wells and equipment rooms shall be accessible for equipment inspection, operation, and maintenance. Ladder and stair dimensions, locations of landings, and structural design shall comply with the Tennessee OHSA. Equipment shall be removable from pumping stations without making structural changes to the station.
- (b) Separation from Wetwell. Dry wells and equipment rooms shall be completely separated from wetwells with no hatches, untrapped drains, or other connecting accessways.
- (c) Dewatering. Dry pits and below-grade equipment rooms shall be provided with sump pumps sized to remove infiltration of water during normal seepage and leakage.
- (2) Wetwell Design. Wetwells shall be designed to prevent vortexing and unstable pump operation. Pumps shall be located below the minimum water level, except suction lift pumps. Suction intakes shall be bell-mouthed. Provisions shall be made for isolating, bypassing and/or dewatering portions of the wetwell for maintenance. Hopper walls of wetwells shall be sloped at no less than 1.75 vertical to 1 horizontal.
- (3) Submersible pumping stations. Submersible pumping stations shall be designed specifically for totally submerged operation and so that pumps may be readily removed from the wetwell without dewatering the wetwell or disconnecting piping in the wetwell. Submersible pumps shall have an adequate means of indicating motor seal failure. Electrical equipment shall be suitable for Class 1, Division 1, Groups C and D hazardous environments, as defined in the National Electrical Code
- (4) Suction Lift. Pumping stations utilizing suction lift pumps shall have adequate priming means to prime the pumps quickly and shall be designed for priming the pumps when the water level in the wetwell is one (1) foot (0.3 m) below the lead pump starting elevation in the suction wetwell, and for maintaining prime when the wetwell level is one (1) foot (0.3 m) below the lead pump stopping level. Valving shall not be located in the wetwell.
- (5) Pneumatic Ejectors. Pneumatic ejectors shall not be permitted by the City unless authorized by the Board of Sewerage Commissioners.
- (6) Bypass Valves shall be installed for all pumps along with a spare parts kit.
- e. Air Release. Air release valves shall be provided at the high points in piping whenever the pipe crown elevation falls below the pipe invert elevation. On sewage lines, air or air and vacuum release valves shall be specifically designed for sewage service.
- f. Reliability.
- (1) Multiple units. Every pumping station shall have not less than two (2) pumping units. The number of units and their size shall be sufficient to permit pumping the maximum design flow with the largest pumping unit out of service.
- (2) One of the following shall be provided:
- (a) Alternative power source. Where the pumping station serves more than one hundred fifty (150) residential units (or equivalence), permanently installed or portable engine driven pumps or a separate, independent utility source provided. Where annual starting is required, sufficient storage shall be provided to allow notifying the operator and performing whatever tasks are necessary to get the pumping station in service. Where permanently installed engine driven equipment is provided, sufficient fuel shall be provided for at least eight hours operation under the maximum flow condition. Where more than one pumping station is affected by a power outage and portable equipment is planned for alternative power source, sufficient portable equipment shall be provided to provide

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alternative power to all pumping stations under maximum flow conditions.

- (b) Generators. Generators shall be sized to permit starting the largest pump in the pumping station with all other pumps except one running. If the generator is not capable of starting all pumps simultaneously, suitable controls shall be provided to stagger the pump starts to remain within the capabilities of the equipment. Generators shall be diesel-fired, natural gas-fired or bottled gas-fired. The use of gasoline or digester gas-fired generators for permanently installed standby service is unacceptable. Gasoline-fired or diesel portable generators are acceptable.
- (c) Engine driving pumps. Engine driven pumps shall be sized for maximum design flow. Diesel, natural gas, and bottled gas are acceptable fuels for portable engines only. Digester gas is unacceptable for standby fuel. Quick connecting couplings shall be provided for portable engine driven pumps.
- (d) Storage. Wastewater storage may be provided in the form of underground storage or surface ponds or tanks in lieu of alternative power supplies. Storage shall be sized for the maximum anticipated power outage, but not less than twenty-four (24) hours at average design flow. Storage shall be water tight and arranged to drain back to the pumping station wetwell.

g. Electrical.

- (1) Equipment Location. All electrical equipment, including motors, motor starters, and controls shall be located so as to be undamaged by the one hundred (100) year flood.
- (2) Controls. Controls shall include a separate start/stop device for each pump or for each pumping position in the control sequence. Controls shall be arranged so that the failure of any one control system component will affect only the operation of one pumping unit. Manual override shall be provided for normal pump operating control.
- (3) Code requirements. All electrical work shall comply with the National Electrical Code as adopted and amended by the local codes.
- (4) Alarms. An alarm system shall be provided for each pumping station. As a minimum, alarms shall include high wetwell level and high water level in the dry well. The alarm system shall be compatible with the existing alarm system installed by the City of Lakeland.

h. Safety.

- (1) Ventilation. All accessible pumping station areas shall be ventilated. Ventilation may be continuous or intermittent. If intermittent, ventilation in areas normally visited by operating personnel shall be started automatically at not greater than thirty (30) minute intervals. Permanently installed dry well ventilation shall provide at least six air changes per hour if continuous, and twelve (12) air changes per hour if intermittent. Permanently installed wetwell ventilation shall provide twelve (12) complete air changes per hour if continuous, and thirty (30) complete air changes per hour if intermittent. Wetwell ventilation shall be positive pressure, forcing air into the wetwell rather than exhaustion from it. All ventilation equipment shall be of a non-sparking design. Intermittent ventilating equipment shall insure starting upon entry of operating personnel. Wetwells may be ventilated by gravity means if normal access by operating personnel is unnecessary. Wetwells that are accessed infrequently shall be designed to permit the use of portable blowers that will exhaust the space and continue to supply fresh air during access periods.
 - (2) Hoists. Where required for removing equipment, hoists shall be rated for not less than fifty (50) percent more than the weight of the heaviest single item to be lifted by the hoist.
 - (3) Lighting. Lighting levels shall be sufficient to permit safe operation and maintenance of all equipment within the pumping station, but not less than thirty (30) foot candles. All areas shall be lit in such a manner that the failure of one lighting fixture or lamp will not cause the area to be completely dark.
 - (4) Equipment Guards. Provide shields to protect from rotating or moving machinery.
 - (5) Warning Signs. Provide warning signs for nonpotable water, electrical hazards, chemical hazards, or other unsafe features. Warning signs shall be permanently attached to the structure or appropriate equipment.
3. Force Mains
- a. Depth. Force mains shall be located a minimum of thirty six inches to the top of the pipe.
 - b. Size. Force mains shall be four (4) inches (10 cm) diameter or greater.
 - c. Velocity. Minimum velocity shall be 2.5 fps. Maximum velocity shall be ten (10) feet per second

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- d. Air Release. Air release facilities shall be provided at the high point in the piping whenever the pipe crown elevation falls below the pipe invert elevation. Access to air release manholes shall not be in traffic-ways.
- e. Pipe Materials to be used for force mains shall be approved by the City.
- f. Force Main Easement Width. All Easements containing force mains shall be at least eighteen (18) feet plus the diameter of the sewer pipe in width and will be accessible to maintenance equipment. No other utilities or related items (sprinkler systems, buildings, sidewalks, electric cables, etc.) shall be installed in the Easement unless approved by the City.

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