



CITY OF WAXAHACHIE, TEXAS

MANUAL FOR THE DESIGN OF WATER AND SANITARY SEWER LINES

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CITY OF WAXAHACHIE, TEXAS

MANUAL FOR THE

DESIGN OF WATER AND SANITARY SEWER LINES

SECTION A - GENERAL

This manual is intended to aid and assist private engineers in the layout and design of sanitary sewers and water lines to definite standards and to obtain uniformity in the plans. It is recognized that each addition has its individual challenges and that no fixed rules will apply to all cases; therefore, final acceptance of all or any part of any plans rests with the City Engineer.

- A. Submittal: On completion of the plan and preliminary engineering of a subdivision, it will be to your advantage to bring or send two copies along with a contour map and preliminary water and sewer layout to the City, whereby a review can be made as to the general layout and availability of water and sewer. If problems arise as to the availability of water and sewer, it may be necessary to have a meeting with the developer and discuss the problems and possible solutions.
- B. Preliminary Review: When the engineering plans are complete, submit three sets of legible prints. Every attempt will be made to review plans within two weeks.
- C. Final Review: When the plans are returned to you after preliminary review, the final plans must be submitted with the marked up set. Three sets of legible prints will need to be submitted.
- D. Final Approval of Plans: Before you request approval of the plans, check the following:
- 1) The plans must be complete and correct.
 - 2) The approved plat must have been submitted.
 - 3) The street grades and storm sewer plans must have been submitted and approved.
 - 4) The plans must be signed and sealed by a Professional Engineer licensed in the State of Texas, who is responsible for the design.
 - 5) All fees and other monies due must be paid in full.

- 6) Contractor's insurance must be in correct form.
 - 7) Three sets of complete engineering plans are required for City use. There should be additional approved plans available for Contractors and Engineering Consultants use during construction of the improvements. Only those plans with the "approved" stamp will be recognized by the City Representative.
 - 8) Upon completion of construction and prior to acceptance of that construction by the City, one set of mylars and one set of prints of the record drawings must be submitted to the City.
- E. Specifications are the Standard Specifications for Public Work Construction, North Central Texas latest addition as prepared by the North Central Texas Council of Governments.
 - F. Special Provisions are City of Waxahachie Special Provisions to the Specifications.
 - G. Standard Details are as prepared by the North Central Texas Council of Governments.

SECTION B - WATER MAINS

In general, water mains are placed on the north and west sides of a street, at a distance of ten feet from the centerline of the street, or otherwise as directed by the City Engineer. Where applicable, line sizes will comply with the Water Distribution System Master Plan and be adequate to convey a fire flow. Fire flow analysis will be required on lines that are questionable. Starting pressures shall be obtained from the nearest junction node as stated in the City's Water Distribution Master Plan computer printouts.

- A. Minimum 8-inch pipe required in residential areas.
- B. Minimum 12-inch pipe required on commercial, retail and industrial areas.
- C. Dead-end mains shall not exceed 600 feet in length, a water meter service in a lockable meter box will be required at the end of the main.
- D. No water main shall be located closer than 5-feet from any tree or structure.

E. Water Main Specifications:

- 1) City mains shall have a minimum diameter of 8-inches, unless a larger line size is required by the Comprehensive Plan, Water Master Plan or to meet fire protection needs as determined by analysis. All water lines shall meet the requirements of AWWA and NCTCOG under the following specifications:

Line Size	NCTCOG Item	AWWA Standard	Description
8" thru 12"	2.12.20	C900 DR18	PVC
	2.12.26	C906 DR9 DIP Pipe O.D.	High Density Polyethylene
Greater than 12" Pipe	2.12.5	C301 & C303	Reinforced Concrete Cylinder Pipe
	2.12.20	C905 DR18	PVC
	2.12.26	C906 DR9 DIP Pipe O.D.	High Density Polyethylene
	2.12.8	C151 Class 50	Ductile Iron Pipe

- 2) All mains supplying fire sprinkler systems outside of utility easements shall be minimum 200 PSI working pressure and U.L. listed.

F. Valves 12-inch and under shall be placed on or near street property lines not over 800 feet apart in residential, duplex and apartment districts and not over 500 feet apart in all other districts: and in such a manner as to require preferably two, but not more than three valves to shut down each City block, or as may be required to prevent shutting off more than one fire hydrant. On cross-feed mains without services, a maximum of four valves shall be used to shut down each block. Also, valves shall be placed at or near the ends of mains in such manner that a shut down can be made for a future main extension without causing loss of service on the existing main. The location of valves larger than 12-inch will be as approved by the City Engineer. Valves 12-inch and under will be Gate Valves meeting requirements of AWWA C500 or AWWA C509 (NCTCOG Item 2.13.1) with non-rising stems. Valves over 12-inch will be Butterfly Valves meeting requirements of AWWA C504 (NCTCOG Item 2.13.4).

G. Fire Hydrants

Section 1. Number and Locations

A sufficient number of fire hydrants shall be installed to provide hose stream protection for every point on the exterior wall of the building with the lengths of hose normally attached to the hydrants. There shall be sufficient hydrants to concentrate the required fire flow, as recommended by the publication "GUIDE FOR DETERMINATION OF REQUIRED FIRE FLOW" published by the Insurance Service Office, around any building with no hose line exceeding the distances hereinafter established and with an adequate flow available from the water system to meet this required flow. In addition, the following guidelines shall be met or exceeded:

- 1) **SINGLE FAMILY AND DUPLEX RESIDENTIAL** - As the property is developed, fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections at a maximum spacing of 500 feet between fire hydrants as measured along the route that fire hose is laid by a fire vehicle.
- 2) **MULTIFAMILY RESIDENTIAL** - As the property is developed, fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections at a maximum spacing of 400 feet as measured along the length of the centerline of the roadway, and the front of any structure at grade shall be no further than 500 feet from a minimum of two fire hydrants as measured along the route that a fire hose is laid by a fire vehicle.
- 3) **OTHER DISTRICTS** - As the property is developed, fire hydrants shall be located at all intersecting streets and at intermediate locations between intersections at a maximum spacing of 300 feet as measured along the length of the centerline of the roadway, and the front of any building at grade shall be no farther than 300 feet from a minimum of two fire hydrants as measured along the route that the fire hose is laid by a fire vehicle.
- 4) **PROTECTED PROPERTIES** - Fire hydrants required to provide a supplemental water supply for automatic fire protection systems shall be within 100 feet of the Fire Department connection for such system.
- 5) **BUILDINGS FIRE SPRINKLED** - An 8-inch fire line stub-out with valve shall be provided for all buildings to be sprinkled. A smaller stub-out can only be used with Fire Department approval.

- 6) Fire hydrants shall be installed along all fire lane areas as follows:
 - a) Non-Residential Property or Use
 - Within 150 feet of the main entrance.
 - Within 100 feet of any Fire Department connection.
 - At a maximum intermediate spacing of 300 feet as measured along the length of the fire lane.
 - b) Apartment, Townhouse' or Cluster Residential Property or Use
 - Within 100 feet of any Fire Department connection.
 - At maximum intermediate spacing of 400 feet as measured along the length of the fire lane.
- 7) Generally, no fire hydrant shall be located closer than 50-feet to a non-residential building or structure unless approved by the Engineering and Fire Departments.
- 8) In instances where access between the fire hydrant and the building that it is intended to serve may be blocked, extra fire hydrants shall be provided to improve the fire protection. Railroads, divided thoroughfares, expressways, blocks which are subject to buildings restricting movement, and other man-made or natural obstacles are considered as barriers.

Section 2. Restrictions

- 1) All required fire hydrants shall be of the national standard 3-way breakaway type no less than 5¼-inches in size and shall conform to the provisions of the latest AWWA Standard C502 and shall be placed upon water mains of no less than 8-inches in size. Fire hydrants shall have a bury depth of five feet.
- 2) Valves shall be placed on all fire hydrants leads. Valves shall be flanged by mechanical joint.
- 3) Required fire hydrants shall be installed so the breakaway point will be no less than 2-inches, and no greater than 6-inches above the grade surface.
- 4) Fire hydrants shall be located a minimum of 2-feet and a maximum of 6-feet behind the curb line, based on the location of the sidewalk. The fire hydrant shall not be in the sidewalk.

- 5) All required public fire hydrants placed on private property shall be adequately protected by either curb stops or concrete posts or other methods as approved by the City Engineer and Fire Chief and shall be in easements. Such stops or posts to be the responsibility of the landowner on which the said fire hydrant is placed.
- 6) All required fire hydrants shall be installed so that the steamer connection will face the fire lane or street, or as directed by the Fire Department.
- 7) Fire hydrants, when placed at intersections or access drives to parking lots, when practical, shall be placed so that no part of the fire truck will block the intersection or parking lot access when connections to the fire hydrant are made.
- 8) Fire hydrants, required by this article, and located on either public or private property, shall be accessible to the Fire Department at all times.
- 9) Fire hydrants shall be located at street or fire lane intersections, when feasible.
- 10) A Blue Stimsonite, Fire-Lite reflector (or approved equal) shall be placed in the center of the drive lane on the side of the fire hydrants.
- 11) In non-residential developments an 8-inch lead will be required on all fire hydrants that are located more than 50-feet from the looped main.
- 12) Fire hydrant bonnet shall be painted according to the capacity of the main to which it is attached. See chart below. The remainder of the hydrant above ground shall be painted aluminum.

<u>Water Main Capacity (GPM)</u>	<u>Color</u>
Less than 500	Red
500 to 999	Orange
1,000 to 1999	Green
1,500 and Greater	Blue

- H. Four-inch mains used for hydrant supply shall be replaced and dead-ends eliminated where practical. Six-inch lines shall be connected so that not more than one hydrant will be between intersecting lines and not more than two hydrants on an eight-inch main between intersecting lines.
- I. The minimum cover to the top of the pipe must vary with the valve stem. In general, the minimum cover below the top of the street subgrade should be as follows: 6-inch and smaller, 3.5 feet; 8-inch, 4.0 feet; 12-inch, 4.5 feet to 5 feet; 16-inch, 5.0 feet to 5.5 feet. Lines larger than 16-inch shall have a minimum of 6 feet of cover, which is sufficient to allow water and sewer and other utilities to go over the large main. For water lines to be constructed along county-type roads commonly built with a high crown about the surrounding property, increase the cover as required to allow for future paving grade changes.
- J. A service with a meter box is constructed from the main to a point just behind the curb line, usually in advance of paving. The location of the meter box will either be at or near the center of the front of the lot or at every other property line. The type of development will determine this location. On multiple apartments and business properties, the desired size and location is usually specified by the Owner or Architect. Minimum requirements for water service sizes are:
- 1) One-inch copper services are required to serve all residential lots including townhouse lots and patio homes. Separate services shall be provided for each of the family units.
 - 2) The size of apartment, condominium, or multi-family services will depend on the number of units served with a minimum of one meter per building.
 - 3) Fittings shall include megalugs on 3" and larger services.
- K. A domestic service connection shall not be allowed on fire hydrant leads.

SECTION C - SANITARY SEWERS

- A. Sizes and grades for sanitary sewer lines shall be based on serving the proposed development and all upstream areas in the drainage basin at full development. Design calculations for sizing lines shall be included in the plans, along with drainage area map. If feasible, sewers shall be placed in streets. Sewers are usually located in the center of the street. Each addition has its challenges, therefore, no fixed rules will apply to all cases.
- B. Minimum cover shall be 3.5 feet; exceptions authorized by the City Engineer shall have concrete protection. In general, the minimum depth for sewer to serve given property with a 4-inch lateral shall be 3-feet plus 0.02 times the length of the house lateral (the distance from the sewer to the center of the house). Thus, for a house 135 feet from the sewer, the depth would be 3-feet plus $0.02 \times 135 \text{ feet} = 3.0 \text{ plus } 2.7 = 5.7 \text{ feet}$. The depth of the flow line of the sewer should then be at least 5.7 feet below the elevation of the ground at the point where the service enters the house. Profiles of the ground line 20-feet past the building line will be required to verify that this criteria is met. On lines deeper than 12 feet, a parallel sewer line will be required when laterals are to be attached. This requirement should be discussed with the City Engineer.
- C. Sewage flow shall be computed in accordance with Appendix "A", with the exceptions, as required by the City Engineer. Pipes should be placed on such a grade that the velocity when flowing full is not less than two feet or more than 6-feet per second. Minimum grades shall be as follows:
- | | | | |
|--------------|-------------|--------------|--------------|
| 6" - 0.54%; | 8" - 0.35%; | 10" - 0.26%; | 12" - 0.22%; |
| 15" - 0.16%; | 18" - 0.12% | 21" - 0.095% | 27" - 0.065% |
- D. All grades shall be shown to the nearest 0.01-foot. Grades shall be evenly divisible by 4, and if practical, they should be even, such as: 0.20%, 0.40%, 0.60%, and 1.00%, etc., in order to facilitate field computations. When the slope of a sewer changes, a manhole will be required. No vertical curves will be allowed. Horizontal curves (pulling pipe not joints) with a min. 200 foot Radius to match change in street direction will be allowed as approved by the City Engineer, but will not be allowed across residential single family and duplex lots.
- E. The sizes and locations of manholes, wyes, bends, tap connections, cleanouts, etc., shall be approved by the City Engineer. In general, manholes shall be placed at all four-way

connections and three-way connections. The diameter of a manhole constructed over the center of a sewer should vary with the size of the sewer. For 6", 8", and 10" sewers, the manhole shall be 4.0-foot minimum diameter; for 12", 15", 18", 21", 24" and 27" - 5.0 foot minimum diameter; 30" and 36" - 6-foot minimum diameter. In Flood Plains, sealed manholes are to be used to prevent the entrance of storm water. Manholes in flood plains shall be vented as required by TNRCC. Clean-outs shall be placed on the ends of all lines. Drop manholes shall be required when the inflow elevation is more than 18-inches above the outflow elevation. Construct manholes at each end of lines that are installed by other than open cut and at each end of aerial crossing lines. Sewer mains and water mains shall be not less than nine feet apart, edge to edge of pipe.

- F. **LATERALS:** The sizes and locations of laterals shall be as approved by the City Engineer. In general, for single family dwellings, the lateral size shall be 4" minimum; for multiple units, apartments, local retail and commercial - 6" minimum; for manufacturing and industrial, the size should be 8" or larger as required. House laterals usually come out 10 feet downstream from the center of the lot and shall have a 10-foot lateral separation from the water service. Manholes will be required on 6-inch and larger laterals where they connect to the main line. Laterals will not be attached to sewer mains that are deeper than 12 feet. A minimum of one lateral per building shall be required. Also, a minimum of one lateral per residential lot shall be required. Duplexes shall have two laterals.
- G. Railroad, State Highway and creek crossings, etc., shall be as approved by the City Engineer. The developer is responsible for obtaining permits from the Railroad Company and from the Texas Department of Highways & Public Transportation.
- H. Line and grade stakes for construction shall be furnished by the developer's Engineer. All property lines and corners must be properly staked to insure correct alignment. The City will not be liable for improper alignment or delay of any kind caused by improper or inadequate surveys by the developer or by interference of other utilities.
- I. In order to provide access for sewer lines for cleaning, manholes and/or cleanouts shall be so located that 250 feet of sewer cleaning equipment can reach any point in the line. This means that manhole spacing shall be a maximum of 500 feet: that spacing between a manhole and an upstream cleanout shall be limited to 400 feet. Cleanouts may be located at the end of the line only.

J. No sewer line shall be located nearer than five feet from any tree or structure.

K. No sanitary sewer in alleys unless approved by the City Engineer.

L. Sewer Lines Specifications:

- 1) All sewer lines shall be PVC and meet the requirement of ASTM and NCTCOG under the following specifications:

Pipe Diameter	NCTCOG Item	ASTM Standard
6" thru 15"	2.12.14	D3034/SDR 35 D3350/PE 345434C
Lines Greater Than 12" thru 48"	2.12.13	F679 F794 F949 D3350/PE 345434C

- 2) Sewer pipe shall conform to the Specifications and/or Special Provisions.

M. Lift Stations

- 1) Lift station design shall be in full conformance to TNRCC Chapter 317 Rules, latest revision. Letter approval from the TNRCC must be provided at time of Preliminary Engineering plan submittal. Flows shall be as calculated by this manual.

- 2) The current rules can be obtained at:

www.tnrcc.state.tx.us/oprd

SECTION D - FORM OF PLANS

A. Plans shall be clear, legible, and neatly drawn on bordered sheets, size 22" x 34". Each sheet shall clearly display the Texas Professional Engineer's seal of the Engineer under whose direction the plans were designed. A title block in the lower right-hand corner shall be filled in to include: (1) project name; (2) Engineer's name, address, and telephone number.

B. The plan sheet should be drawn so that the north arrow points to the top or to the left side of the sheet. It is important that the plan show sufficient surrounding streets, lots, and property lines so the existing water and sewer may be adequately shown and so that proper consideration may be given to future extensions. Proposed water and sewer lines shall be stubbed out to the addition extremities in order that future extensions may be made with a minimum of

inconvenience. Unless it would make the plan very difficult to read, both water and sewer lines should be shown on the same sheet. The lines on the profile sheet shall be drawn in the same direction as on the plan. Lettering shall be oriented to be read upward or to the left.

- C. On large additions or layouts requiring the use of more than six sheets (total of plan & profile), key sheets may be required on a scale of 1" = 400' or 1" = 1000', as designated by the City Engineer. They shall show the overall layout with the specific project clearly indicated with reference to individual sheets.
- D. The use of "off-standard" scales will not be permitted. A plan shall be drawn to scales of 1" = 20', or 1" = 40'. Plans for water and sewer that do not involve great detail should be drawn on a scale of 1" = 50'. Plans in and along creeks, heavily wooded sections, streets with numerous utilities, or as may be required to produce a clean and legible drawing, shall be drawn on plan-profile sheets or separate plan and profile sheets on a scale 1" = 40'. If the plan is in an extremely congested area, a scale of 1" = 20' may be necessary. All profiles shall be drawn on a vertical scale (1" = 4') as required for clarity, and the horizontal scale shall be the same as for the plan unless otherwise directed by the City Engineer.

SECTION E - DATA TO BE INCLUDED IN PLANS

- A. Sewer Data to be Included on Plan Sheet: The plan shall show the existing and proposed water and sewer lines and all appurtenances thereto. The plan should also have the storm sewer system dashed in. All lines shall be numbered, lettered or otherwise designated on both plan and profile sheets. All lines shall show sizes and direction of flow on both plan and profile sheets. Stationing shall be shown to the nearest 0.1 foot and each new line shall begin at 0+00 at the outlet and increase up the sewer. Station pluses at all junctions of sewers, horizontal P.C.'s, and P.T.'s, bends, angle points, wyes, cleanouts, manholes, the centerlines of all cross streets and railroads, and all crossing utilities, etc., shall be shown on both plan and profile. The degree of angles and horizontal curve data shall be shown on the plan only. Minimum Radius for sanitary sewer mains is 200 feet by pulling pipe not joints. Sewer laterals shall be shown at a location most convenient to serve the property.

Sewer laterals will usually be near the center of the lot, either at the street or alley. If the lateral is to be adjacent to the water service, then show the lateral 10 feet downstream. The location shall be designated on the plans.

- B. Sewer Data to be Included on the Profile Sheet: The data for the profile sheet shall be obtained by running a line of levels along the actual route and by taking any other necessary observations. Profiles shall show the elevations to the nearest 0.1 foot of the ground at the centerline of the sewer, and to the right and left of the centerline of the sewer at the location of the approximate center of the proposed houses or buildings to be served, and the approved street or alley grade. Profiles shall also show the sewer pipe, manholes, cleanouts, etc. The size of the sewer, the direction of the flow, and the grade to the nearest 0.01 foot shall be indicated just over the "pipe" and the total linear footage of line, size, kind of pipe, and type of embedment or encasement shown below the "pipe". The design flow, pipe capacity and velocity must be shown in the profile. All of the information pertaining to the horizontal data, station pluses, appurtenances to be built, etc., is usually shown just above the ground line, whereas, the flow line (invert) elevations are shown below the pipe. Elevations of crossing and parallel utilities shall be shown. All invert elevations shall be shown to the nearest 0.01-foot. Invert elevations shall be recorded at all junctions (all lines-in and out), at grade breaks, the ends of lines, or other points as requested by the City Engineer. Benchmarks used shall also be clearly shown, giving the descriptive locations and elevations. Elevations must be from sea level datum, not assumed. Bench level circuits should begin at a USGS monument and benchmark of second order accuracy established at least every one-half mile through the project. All existing water, sewer, gas, storm sewer, telephone, power, and other utilities parallel to or crossing the proposed sewer or water line shall be adequately designated as to size, type, and location.
- C. Data to be Included for Water Plan and Profile: Indicate the location of any existing valves required for shutdown purposes and of any tees, ends, etc., to be tied into. Indicate clearly the sizes of the lines to be installed, and all proposed valves, fire hydrants, tees, crosses, bends, reducers, plugs, sleeves, wet connections, tap connections, creek, railroad or highway crossings, tunnels, meter boxes, valve vaults, and other appurtenances at each intersection or as required. Where the pipe is to be laid around a curve, the curve data must be provided. The size and type of services and the material, type of joint, and class of pipe may be indicated by adequate notation in the lower left or right hand corners of the plan sheet. Water services and meter boxes shall be indicated and shall be located at or near the center of the front of each lot. Waterline profiles are required on lines 12-inches and larger, follow the general procedures as outlined for sewers, except that the grades and elevations of the proposed water line usually need not be shown closer than the nearest 0.1-foot.

APPENDIX "A"

SANITARY SEWER DAILY FLOW CALCULATIONS

Apartment Sanitary Sewer Flow

95 gal. x .75 = 71.25 gal. per day per person

22 units per acre with 3 persons per unit

Calculations (71.25) (22) (3) = 4,702 or 4,700 gallons per day per acre.

Office Sanitary Sewer Flow

3100 parking spaces for 34.7 acres

One person per parking space

20 gallons per person per day

3100 = 89.33 persons per acre (20 gal) = 1,786.7 or 1,790 gal. per day per acre.

34.7 acres

Residential Sanitary Sewer Flow

95 gallons per person per day

4 units per acre

3.5 persons per unit

(95) (4) (3.5) = 1330 gallons per acre per day

Nursing Home Sanitary Sewer Flow

150 beds -heritage Manor

90 gallons per day per bed

90 x 150 = 13,500 gallons per day

Patio Home Sanitary Sewer Flow

95 gallons per person per day

10 units per acre

3.5 persons per unit

(95) (10) (3.5) = 3,325 gallons per day/acre

Add 750 gallon per acre per day for inflow and infiltration. Peaking factor shall be applied to daily flow calculations. Peak factors shall be in accordance with ASCE Manual and Reports on Engineering Practice No. 60/WPCF Manual of Practice No. FD-5. Generally the following factors applies:

<u>Acres</u>	<u>Peaking Factor</u>
0 – 65	5
70	4.9
80	4.8
85	4.78
90	4.72
100	4.66
110	4.62
120	4.50
130	4.35
140	4.25
150	4.20

APPENDIX “B”

TNRCC RULES FOR LIFT STATIONS

<<Prev Rule

Texas Administrative Code

Next Rule>>

TITLE 30

ENVIRONMENTAL QUALITY

PART 1

TEXAS NATURAL RESOURCE CONSERVATION
COMMISSION

CHAPTER 317

DESIGN CRITERIA FOR SEWERAGE SYSTEMS

RULE §317.3

Lift Stations

(a) Site selection. In the selection of a site for a lift station, consideration shall be given to accessibility and potential nuisance aspects. The station shall be protected from the 100-year flood and shall be accessible during a 25-year flood. All lift stations shall be intruder-resistant with a controlled access. Lift stations should be located as remotely as possible from populated areas.

(b) Design.

(1) Small lift stations. Lift stations designed for a discharge capacity of less than 100 gallons per minute will be reviewed on a case-by-case basis by the commission and shall be used only for institutional use or other locations where it is necessary to pump the sewage from a single building, school, or other measurable source establishment into the sanitary sewer lines. If the location of the discharge does not provide a positive head due to elevation, then a positive pressure control valve shall be provided. Ejectors may be used for this type of lift station. Whenever a lift station handles waste from two or more residential housing units, or from any public establishment, standby pumps shall be provided. In the case of ejectors or eductors, two air compressors shall be provided. Grinder pumps should be used for all small installations.

(2) Dry well sump pump. The following design considerations shall be addressed in providing dry well sump pumps.

(A) Two separate sump pumps should be provided for removal of leakage or water from the dry well floor.

(B) The discharge pipe level from the sump pumps shall be above the maximum liquid level of the wet well. A check valve should be installed on the discharge side of each sump pump.

(C) All floor and walkway surfaces shall have an adequate slope to a point of drainage with sufficient measures taken to maximize traction and safety.

(D) Motors to drive sump pumps shall be located above the height of the maximum liquid level in the wet well. As an alternate, sump pumps may be of the submersible type.

(3) Pump controls. All lift stations shall have automatically operated pump control mechanisms. Pump control mechanisms shall be located so that they will not be affected by flow currents in the wet well. Provisions shall be made to prevent grease and other floating materials and rags in the wet well from interfering with the operation of the controls. When a float tube is located in the dry well, its height shall be such as to prevent overflow of the sewage into the dry well. Pump control mechanisms which depend on a bubbler in the wet well shall be equipped with a backup air supply system. All connections to level controls in the wet well shall be accessible at all times. The circuit breakers, indicator lights, pump control switches, and other electrical equipment should be located on a control panel at least three feet above ground surface elevation. If controls are located in a dry well, the dry well shall be protected from flooding.

(4) Wet wells.

(A) Wet wells and dry wells, including their superstructure, shall be separated by at least a watertight and gastight wall with separate lockable entrances provided to each. Equipment requiring regular or routine inspection and maintenance shall not be located in the wet well, unless the maintenance can be accomplished without entering the wet well.

(B) Based on design flow, wet well capacity should provide a pump cycle time of not less than six minutes for those lift stations using submersible pumps and not less than 10 minutes for other nonsubmersible pump lift stations.

(C) All influent gravity lines into a wet well shall be located where the invert is above the "off" setting liquid level of the pumps, and preferably should be located above the lead pump "on" setting.

(5) Stairways. Stairways with non-slip steps shall be provided in all underground dry wells. Removable ladders may be provided in small stations where it is impractical to install stairways.

(6) Ventilation. Ventilation shall be provided for lift stations, including both wet and dry wells.

(A) Passive ventilation such as gooseneck type or turbine ventilators designed to prevent possible entry of insects or birds shall be provided in all wet wells if mechanical ventilation is not provided. All mechanical and electrical equipment in wet wells should be explosion-proof and spark-proof construction if mechanical ventilation is not provided.

(B) Mechanical ventilation shall be provided for all dry wells below the ground surface. The ventilation equipment shall have a minimum capacity of six air changes per hour under continuous operations. At least a capacity of 30 air changes per hour shall be required where the operation is intermittent. All intermittently operated venting equipment shall be interconnected with the stations lighting system.

(7) Wet well slopes. The bottom of wet wells shall have a minimum slope of 10% to the pump intakes and shall have a smooth finish. There shall be no projections in the wet well which will allow deposition of solids under ordinary operating conditions. Antivortex baffling should be considered for the pump suction in all large sewage pumping stations (greater than five mgd firm pumping capacity).

(8) Hoisting equipment. Hoisting equipment or access by hoisting equipment for the removal of pumps, motors, valves, etc., shall be incorporated in the station design.

(9) Dry wells and valve vault drains. Drains from dry wells or valve vaults to the wet well shall be equipped with suitable devices to prevent entry of potentially hazardous gases.

(c) Pumps.

(1) General. All raw sewage pumps shall be of a non-clog design, capable of passing 2 1/2 inch diameter spheres, and shall have no less than three-inch diameter suction and discharge openings. Inspection and cleanout plates, located both on the suction and discharge sides of each pumping unit, are suggested for all nonsubmersible pumps so as to facilitate locating and removing blockage-causing materials. Where such openings are not provided on the pumps, a hand hole in the first fitting connected to the suction of each pump shall be provided. All pumps shall be securely supported so as to prevent movement during operation. For submersible pumps, rail-type pump support systems incorporating manufacturer-approved mechanisms designed to allow the operator to remove and replace any single pump without first entering or dewatering the wet well should be provided.

(2) Lift station pumping capacity. The firm pumping capacity of all lift stations shall be such that the expected peak flow can be pumped to its desired destination. Firm pumping capacity is defined as total station maximum pumping capacity with the largest pumping unit out of service.

(3) Variable capacity pumps. Lift stations or transfer pumping facilities at a wastewater treatment plant or those discharging directly to the treatment plant where the plant's permitted daily average flow is equal to or greater than 100,000 gallons per day shall be provided with three or more pumps or with duplex automatically controlled variable capacity pumps or other automatic flow control devices. The pumps or other devices shall be adjusted for actual flow conditions and controlled to operate so as to minimize surges in the treatment units. No single pumping unit shall have a capacity greater than the design peak flow of the wastewater treatment plant unless flow splitting/equalization is provided.

(4) Pump head calculations. The engineering design report accompanying the plans shall include system curves, pump curves, and head calculations. Calculations and pump curves at both minimum (all pumps off) and maximum (last normal operating pump on) static heads and for a C value of both 100 and 140 must be provided for each pump and for the combination of pumps (modified pump curves). Where a suction lift is required, the report shall include a calculation of the available net positive suction head (NPSH) and a comparison of that value to the required NPSH for the pump as furnished by the pump manufacturer.

(5) Self-priming pumps. Only self-priming pumps or pumps with acceptable priming systems, as demonstrated by a reliable record of satisfactory operation, shall be used where the suction head is negative. All self-priming pumps shall include a means for venting the air back to the wet well when the pump is priming.

(6) Pump positioning. All raw sewage pumps, other than submersible pumps without "suction" piping and self-priming units capable of satisfactory operation under any negative suction heads anticipated for the lift station under consideration, shall be positioned such that the pumps always experience, during their normal on-off cycling, a positive static suction head.

(7) Grinder pumps. See §317.2(d) of this title (relating to Sewage Collection System).

(d) Piping.

(1) Pump suctions. Each pump shall have a separate suction pipe. Cavitation may be avoided by using eccentric reducers in lieu of typical reducers in order to prevent air pockets from forming in the suction line.

(2) Valves. Full closing valves shall be installed on the discharge piping of each pump and on the suction of all dry pit pumps. A check valve shall be installed on the discharge side of each pump, preceding the full closing valve. Check valves should be of a swing check type with external levers. Rubberball check valves may be used for grinder pump installations in lieu of the swing check type. Butterfly valves, tilting disc check valves, or other valves with a pivoted disc in the flow line are not allowed. The design shall consider surge effects and provide protection where necessary. Surge relief shall be contained in the system.

(3) Valve position indicators. Gate valves should be rising-stem valves. If other than rising-stem gate valves and check valves with external levers are used, the valves shall include a position indicator to show their open and closed positions.

(4) Lift station piping. Flanged pipe and fitting or welded pipe shall be used for exposed piping inside of lift stations. A flexible or flanged connection shall be installed in the piping to each pump

so that the pump may be removed easily for repairs. Provisions shall be made in the design to permit flexure where pipes pass through walls of the station. Piping should normally be sized so that the maximum suction velocity does not exceed five feet per second and the maximum discharge velocity does not exceed eight feet per second.

(5) Force main pipe selection. Force mains shall be a minimum of four inches in diameter, unless justified, as with the use of grinder pumps. In no case shall the velocity be less than two feet per second with only the smallest pump operating, unless special facilities are provided for cleaning the line at specified intervals or it can be shown that a flushing velocity of five feet per second or greater will occur one or more times per day. Pipe specified for force mains shall be of a type having an expected life at least as long as that of the lift station and shall be suitable for the material being pumped and the operating pressures to which it will be subjected. All pipe shall be identified in the technical specifications with appropriate ASTM, ANSI, or AWWA specifications numbers for both quality control (dimensions, tolerances, etc.) and installation (bedding, backfill, etc.). All pipe and fittings shall have a minimum working pressure rating of 150 pounds per square inch.

(6) Force main tests. Final plans and specifications shall describe and require pressure testing for all installed force mains. Minimum test pressure shall be 1.5 times the maximum design pressure.

(7) Air release valves. Air release valves or combination air release/vacuum valves suitable for sewage service shall be provided at all peaks in elevation. The final engineering drawings must depict all proposed force mains in both plan and profile.

(e) Emergency provisions. Lift stations shall be designed such that there is not a substantial hazard of stream pollution from overflow or surcharge onto public or private property with sewage from the lift station. Options for a reliable power source may include the following.

(1) Power supply. The commission will determine the reliability of the existing commercial power service. Such determinations shall be based on power outage records obtained from the appropriate power company and presented to the commission. When requesting outage records for submittal to the commission, it is important to note that the records be in writing, bear the signature of an authorized utility employee, identify the location of the wastewater facilities being served, list the total number of outages that have occurred during the past 24 months, and indicate the duration of each recorded outage. The facility will be deemed reliable if the demonstrated wastewater retention capacity, in the station's wet well, spill retention facility, and incoming gravity sewer lines, is sufficient to insure that no discharge of untreated wastewater will occur for a length of time equal to the longest electrical outage recorded in the past 24 months. If records for the service area cannot be obtained, a 120 minute worst case outage duration will be assumed. Provisions for a minimum wastewater retention period of 20 minutes should be considered even in those cases where power company records indicate no actual outages of more than 20 minutes occurred during the past 24 months.

(2) Alternative power supply. If the existing power supply is found to be unreliable, an emergency power supply or detention facility shall be provided. Options include:

(A) electrical service from two separate commercial power companies, provided automatic switchover capabilities are in effect;

(B) electrical service from two independent feeder lines or substations of the same electric utility, provided automatic switchover capabilities are in effect;

(C) on-site automatic starting electrical generators;

(D) reliance on portable generators or pumps. Proposals for the utilization of portable units shall be accompanied by a detailed report showing conclusively the ability of such a system to function

satisfactorily. Portable units will be approved only in those cases where the station is equipped with an auto-dialer, telemetry device, or other acceptable operator notification device, operators knowledgeable in acquisition and startup of the portable units are on 24-hour call, the station is accessible in all weather conditions, reasonable assurances exist as to the timely availability and accessibility of the proper portable equipment, and the station is equipped with properly designed and tested quick connection facilities. This option is usually acceptable only for smaller lift stations.

(3) Restoration of lift station. Provisions should be made to restore the lift station to service within four hours of outage.

(4) Spill containment structures. A spill containment structure should be considered together with in-system retention in determining a total wastewater retention time. Because separate spill retention facilities are not suitable for all locations, engineers should check with the commission prior to designing such structures. The design shall provide:

(A) a minimum storage volume of average design flow from the contributing area and the longest power outage during the most recent consecutive 24-month period or, if power records are not available, an assumed 24-hour outage;

(B) an impermeable liner (such as concrete or synthetic fabric (20 mil thickness)) and should have an energy dissipator at the point of overflow from the lift station to prevent scour;

(C) a fence with a controlled access; and

(D) a plan for routine cleaning and inspection.

(5) Alarm system. An audiovisual alarm system (red flashing light and horn) shall be provided for all lift stations. These alarm systems should be telemetered to a facility where 24-hour attendance is available. The alarm system shall be activated in case of power outage, pump failure, or a specified high water level.

Source Note: The provisions of this §317.3 adopted to be effective April 16, 1990, 15 TexReg 1801.

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