RULE NO.: R161-17.08

NOTICE OF PROPOSED RULE **POSTING DATE: April 5, 2017**

The Director of the Department of Austin Water proposes to adopt the following rule after May 7, 2017.

Comments on the proposed rule are requested from the public. Comments should be submitted to Mr. Eric Langhout, P.E.; Austin Water, 3907 S. Industrial Dr., Suite 236, Austin, Texas 78744, 512-972-0073, or via email at Eric.Langhout@austintexas.gov . To be considered, comments must be submitted before May 7, 2017, the 32nd day after the date this notice is posted. A summary of the written comments received will be included in the notice of rule adoption that must be posted for the rule to become effective.

An affordability impact statement regarding the proposed rule has been obtained and is available for inspection or copying at the address noted in the preceding paragraph.

EFFECTIVE DATE OF PROPOSED RULE

A rule proposed in this notice may not become effective before the effective date established by a separate notice of rule adoption. A notice of rule adoption may not be posted before May 7, 2017 (the 32nd day after the date of this notice) or not after June 14, 2017 (the 70th day after the date of this notice).

If a proposed rule is not adopted on or before June 14, 2017, it is automatically withdrawn and cannot be adopted without first posting a new notice of a proposed rule.

TEXT OF PROPOSED RULE

A copy of the complete text of the proposed rule is available for public inspection and copying at the following locations. Copies may be purchased at the following locations at a cost of ten cents per page:

Austin Water, located at 3907 S. Industrial Dr., Suite 236, Austin, Texas, 78744. See Mr. Eric Langhout, P.E. and:

Office of the City Clerk, City Hall, located at 301 West 2nd Street, Austin, Texas.

BRIEF EXPLANATION OF PROPOSED RULE

R161-17.08: Proposed revision to the Utility Criteria Manual Section 2.9.4

- Section 2.9.4.A.5 – This change is being made to clarify when flow measurements may be used in designing wastewater lines.
- Section 2.9.4.B.5 – This is being added because the UCM does not allow 10" wastewater mains and we do not want the Engineer to confuse the two requirements.
- Section 2.9.4.C.4 – This is being added to specify the amount of separation distance between gas and wastewater lines. There is not state regulation regarding wastewater lines and dry utilities. This will also apply to all other dry utilities and wastewater lines.
- Section 2.9.4.C.6 – This is being added to keep Engineers from filling or cutting in excess above wastewater lines.
- Section 2.9.4.C.6.a,b,c – This change is being made to require the same minimum depth of new wastewater pipes for both proposed and existing streets at 66 inches below the ground elevation. It also replaces "of cover" with "below ground elevation to be consistent with the details.
- Section 2.9.4.D.1 – This is being added to ensure our construction crews can access all manholes and wastewater lines located outside of the pavement on all-weather surfaces.
- Section 2.9.4.D.1.g – This section is being removed because it is defined in section 2.9.4.G.1.
- Section 2.9.4.D.1.h – This is being added to ensure the manhole is placed at the main and not at another location along the service.
- Section 2.9.4.D.3 – This is being added to specify the need for bolted watertight covers in the TCEQ Edwards Aquifer Recharge Zone.
- Section 2.9.4.D.4 – This is being added since the Engineers are already required to perform a Manhole Assessment and Inspection Report from the reviewers when they are connecting to an existing manhole.
- Section 2.9.4.D.6 – This is being changed to specify that the utility does not want external drops over 15' deep where re-excavating the massive block of concrete encasement is a huge effort and cost.
- Section 2.9.4.D.7.Note 2 – This is being added to specify that large diameter manholes means "a five (5) foot or larger diameter manhole."
- Section 2.9.4.D.7.Note 3 – This is being removed because we don't want to restrict the Engineer to only junction boxes when access is 42" and larger.
- Section 2.9.4.D.7.Note 4 – This is being changed to Note 3 and added to provide the minimum separation distance for new precast manholes.
- Section 2.9.4.D.7.Note 4 – This is being added to provide working room to maintenance crews who will need to work in manholes.
- Section 2.9.4.D.8 – This is being added to differentiate between constructing a new wastewater line or water line.

- Section 2.9.4.D.9 – This is being elaborated on to let the designer know what type of base is required.
- Section 2.9.4.D.10 – This is being changed to "D.9." We are removing the 0.1 feet minimum difference between the inlet and out pipe. The minimum slope of 2.5% takes care of this requirement. The information was redundant.
- Section 2.9.4.D.10.b – This is being added to provide clarity to Engineers that all manholes located in floodplains shall be sealed.
- Section 2.9.4.F – This is being changed to discourage siphons.
- Section 2.9.4.G.4 – We are allowing the Engineer to decide on what type of sample and inspection port they want to include in their design when industrial waste monitoring is required.
- Section 2.9.4.G.5 – This section is being removed with the information being relocated to 2.9.4.D.1.h
- Section 2.9.4.J.1 – This is being changed to correct the section number.
- Section 2.9.4.J.7.c – This is being changed to correct the section number.
- Section 2.9.4.J.17.a – This is being added to include MUD's and WCID's.
- Section 2.9.4.J.17.b – This change is being made to clarify what is required for grinder pumps.
- Section 2.9.4.J.17.c – This is being added to clarify what is allowed for cleanouts regarding sizes of fittings, valves, and bends.
- All "Austin Water Utility (AWU)" names are being changed to "Austin Water (AW)". This is being done at 2.9.4.C.3, 2.9.4.H.1, 2.9.4.H.2, 2.9.4.I.1.c, 2.9.4.I.2.c, 2.9.4.J, 2.9.4.J.16, 2.9.4.J.17.a, 2.9.4.J.17.e

AUTHORITY FOR ADOPTION OF PROPOSED RULE

The authority and procedure for adoption of a rule to assist in the implementation, administration, or enforcement of a provision of the City Code is provided in Chapter 1-2 of the City Code. The authority to regulate construction requirements is established in Section 552.001 and Title 15 of the City Code.

CERTIFICATION BY CITY ATTORNEY

By signing this Notice of Proposed Rule R161-17.08, the City Attorney certifies the City Attorney has reviewed the rule and finds that adoption of the rule is a valid exercise of the Director's administrative authority.

REVIEWED AND APPROVED

Greg Meszaros, Director
Austin Water

Date: 3/15/17

Anne L. Morgan
City Attorney

Date: 3/23/17

Austin Water 2nd Quarter 2017 Backup Material

For Proposed Changes to UCM Sect. 2.9.4

2.9.4 - Wastewater Systems

A. Determination of Wastewater Flow

1. Residential single-family units shall be assumed to produce an average wastewater flow of 245 gallons/day.

2. Industrial wastewater flows will be evaluated on a case-by-case basis.

3. Inflow/Infiltration.

   In sizing sewers, external contributions are accounted for by including 750 gallons per day per acre served for inflow and infiltration. For sewers in the Edwards Aquifer Zone refer to the Texas Commission on Environmental Quality (TCEQ) requirements. Strict attention shall be given to minimizing inflow and infiltration.

4. Peak Dry Weather Flow.

   The peak dry weather flow is derived from the formula:

   $Qpd = [(18+(0.0206 \times F)0.5)/(4+(0.0206 \times F)\ 0.5)] \times F$

   where: F = 70 gal./person/day x population/1440 = average dry-weather flow in gpm

5. Peak Wet Weather Flow.

   The peak wet weather flow is obtained by adding inflow and infiltration to the peak dry weather flow. In designing for an existing facility, flow measurement ~~shall~~ ***may*** be used ***when available*** in lieu of calculations for the preexisting developed area.

B. Determination of Pipe Size

1. Minimum Size.

   The minimum diameter of all gravity sewer mains shall be eight (8) inches. For service line sizes, refer to the City of Austin Standard Details.

2. Design Requirements.

   For sewer mains, fifteen (15) inches in diameter or smaller, use the larger size as determined below:

   a. The main shall be designed such that the Peak Dry Weather Flow shall not exceed 65% of the capacity of the pipe flowing full.

   b. The main shall be designed such that the Peak Wet Weather Flow shall not exceed 85% of the capacity of the pipe flowing full.

   c. For sewer mains, eighteen (18) inches in diameter or larger, the main shall be designed such that the peak Wet Weather Flow shall not exceed 80% of the capacity of the pipe flowing full.

3. Design Velocities.

   The minimum design velocity calculated using the Peak Dry Weather Flow shall not be less than two (2) feet per second (fps). The maximum design velocity calculated using the Peak

Wet Weather Flow should not exceed ten (10) fps. Velocities in excess of 10 fps may be considered under special conditions where no other options are available. In such cases, proper consideration shall be given to pipe material, abrasive characteristics of the wastewater flows, turbulence and displacement by erosion or shock.

4. Minimum Slope.

   The minimum allowable slope for eight (8) inches mains within the service area of the City of Austin shall be 0.005 ft./ft (0.5 percent grade).

5. Allowable pipe sizes.

   The following sizes will be the only sizes allowed for use in the gravity system: 6″ (for services only), 8″, 12″, 15″, 18″, 21″, 24″, 30″, 36″, 42″. Larger sizes may be approved on a case by case basis. ***These pipe sizes do not apply to force mains.***

C. Design Considerations

1. Materials and Standards.

   All materials and appurtenances shall conform to the City of Austin Standard Products List.

2. Protecting Public Water Supply.

   No physical connection shall be made between a drinking water supply and a sewer or any appurtenance thereof. An air gap of a minimum of two inlet pipe diameters between the potable water supply and the overflow level connected to the sewer shall be provided.

3. Location.

   The location of the wastewater main shall be in conformance with the City of Austin Standard Details Manual. Alternative assignments must be approved by Pipeline Engineering. Outside the City Limits, the design engineer shall coordinate utility assignments with both ~~the~~ Austin Water ~~Utility~~ and the appropriate county authority.

4. Separation Distance.

   The separation between wastewater mains and other utilities shall be in accordance with the Rules adopted by the Texas Commission on Environmental Quality. ***A minimum horizontal separation of five (5) feet, measured from OD of pipe to OD of pipe, shall be maintained between existing or proposed wastewater mains and all other non-water utilities and/or conduits in order to maintain trench integrity.***

5. Steep grades.

   Where the pipe grade exceeds 12% and the construction is outside of any pavement, concrete retards conforming to the City standards will be required at intervals of no more than twenty-five (25) feet (preferably at joint locations).

6. Depth of Cover.

   If fill or embankment placed over existing wastewater mains exceeds four (4) feet above the existing ground, AW approval is required. If cuts exceed the minimum depth of cover stated below, AW approval is required. The minimum depth of cover over the upper-most projection of the main shall be as follows:

   a. Wastewater piping installed in natural ground in easements or other undeveloped areas which are not within existing or planned streets, roads or other traffic areas, shall be laid ~~with~~ at least 42 inches ~~of cover~~ ***below ground elevation***.

b. Wastewater piping installed in ***proposed streets,*** existing streets, roads or other traffic areas shall be laid ~~with~~ at least 66 inches ~~of cover~~ ***below proposed ground elevation***.

~~c. Wastewater piping installed in proposed streets shall be laid with at least 48 inches of cover below the actual subgrade. The maximum depth shall be as approved by the Utility for the specific material, application, and conditions.~~

7. Turbulence.

   Wastewater lines shall be designed to minimize turbulence to prevent release of sulfide gases and subsequent corrosion.

8. Wastewater lines are prohibited in a critical water quality zone, except for a necessary crossing. (see the Code of the City of Austin, 25-8-361).

9. Curved wastewater mains are prohibited.

D. Manholes

1. Location.

   Manholes shall be located and spaced so as to facilitate inspection and maintenance of the wastewater main. All manholes must be accessible to maintenance equipment, including 2½ ton straight trucks, dump trucks, vacuum trucks, and standard (not compact) sizes of backhoes and loaders. ***Construction of all-weather access roads may be necessary for manhole and/or wastewater line access.*** Manholes shall be placed at the following locations:

   a. Intersections of mains.

   b. Horizontal alignment changes.

   c. Vertical grade changes.

   d. Change of pipe size.

   e. Change of pipe material.

   f. The point of discharge of a force main into a gravity wastewater main.

   ~~g. Intersection of service lines to main lines 24 inches and larger.~~

   ~~h.~~***g.*** ~~A manhole is required at the point of connection of a building service line to the public wastewater service stub f~~ ***F***or multi-family projects exceeding fifteen (15) dwelling units and for commercial developments ~~(~~containing more than 4,000 square feet~~)~~ ***of air condition space and*** requiring a water meter greater than 2"***, a manhole is required on the main at the point of connection to the wastewater service***.

   ~~i.~~***h.*** At the upstream end of mains.

   ~~j.~~***i.*** At other locations as required by Chapter 15-10 (Wastewater Regulations) of the Austin City Code.

2. Spacing.

   Manhole spacing for lines smaller than 24 inches should not exceed 500 ft.; for larger mains, spacing may be increased, subject to approval by the Utility.

3. Covers.

   All manholes ~~not~~ located in ***un***paved areas ***or in the TCEQ Edwards Aquifer Recharge Zone (EARZ)*** shall have bolted, watertight covers.

4. Corrosion Prevention.

Manholes shall be constructed of or lined with a corrosion resistant material. Where new construction ties into an existing manhole, the existing manholes must be lined, coated, or replaced with a corrosion resistant material. ***The Design Engineer shall provide an AWU Manhole Inspection report for Wastewater Manhole replacement or rehabilitation for both CIP and non-CIP projects.***

5. All lines into manholes, including drop connections, shall match crown-to-crown where feasible. Any deviation must be approved in advance by Pipeline Engineering.

6. Drop manholes ~~will have a maximum of 8 foot of drop and~~ are not allowed where the ~~main~~ size ***of the incoming main requiring the drop*** exceeds 15 inches ***diameter***. ***External drops will be limited to a depth of fifteen (15) feet from the lid of the manhole to the base. Drop manholes in excess of fifteen (15) feet deep must be designed with an internal drop and must be a minimum size of five (5) foot diameter.***

7. Minimum inside manhole diameters shall be as indicated in the following table:

	Depth		
Main Size	Less than 20′	20′—30′	Greater than 30′
Up to 15″	48″	60″	72″
18″—24″	60″	60″	72″
30″ & 36″	72″	72″	72″

Note 1: In the event a structure is utilized inside a manhole, the clear space between the structure and the manhole wall shall be a minimum of 48″.

Note 2: If more than two ~~pipes~~ ***mains*** connect to a manhole, or if two ~~pipes~~ ***mains*** connect to a manhole at an angle other than 180 degrees from each other, ~~larger diameters~~ ***a larger diameter manhole*** may be required in order to accommodate mandrel insertion and hydraulically efficient flow.

~~Note 3: Access to mains 42″ and larger shall be by junction boxes designed by a structural engineer.~~

Note ***3***~~4~~: New pipe connections to existing manholes shall provide a minimum of 12″ clearance between the existing pipe ID and the new core hole ID measured on the inside surface of the manhole, regardless of the orientation of the pipes with respect to one another. New precast manholes shall have holes for pipe penetrations separated ***by a minimum of seven (7) inches as measured from the inside diameter of the cored holes on the inside wall of the manhole*** ~~far enough apart~~ to ensure the structural integrity of the manhole wall.

Note 4: The vertical distance between the highest point of the invert shelf and the bottom of any horizontal or near-horizontal surface protruding into a manhole or junction box, shall be at least six (6) feet, when the depth of the main is sufficient.

8. Where a separation of nine feet between a water main and a manhole cannot be achieved~~,~~ ***during construction of a new wastewater main,*** ~~as approved by the Austin Water Utility,~~ the joints in the wastewater manhole shall be made watertight using externally applied joint wraps. ***Where a separation of nine (9) feet between a water main and a manhole cannot be achieved during construction of a new water main, then the manhole shall be assessed as per Section 2.9.4.D.4. to determine if the manhole is watertight and if not, shall require the manhole to be made watertight.***

9. ~~All manhole bases, for manholes to be constructed on existing lines, shall be cast in place.~~ ***Manholes constructed on existing wastewater mains may have a cast-in-place base. All other manholes shall have a precast base.***

10. Manhole and junction box inverts shall have a minimum slope of 2.5% between the inlet and outlet pipe inverts ~~or have a minimum difference of 0.10 feet between the inlet and out pipe inverts, whichever provides the maximum difference in invert elevation between the inlet and outlet pipes~~.

11. Manholes and junction boxes located below ground water

    a. When the interior surface of a concrete manhole or junction box is coated with a urethane, polyurethane, or epoxy liner, the exterior surface of that portion of a manhole or junction box located below ground water level shall be water proofed using a flexible system applied to the exterior surface. The drawings shall indicate which structures must be water proofed and the elevation to which water proofing must be applied (2 feet above ground water level).

    b. Manhole joints below the ground water level ***and/or located in the 100 year floodplain*** shall be sealed by installing a joint wrap material over the joint on the manhole exterior.

    c. Construction joints in cast-in-place junction boxes shall be water proofed using water stops.

~~8. Where a separation of nine feet between a water main and a manhole cannot be achieved, as approved by the Austin Water Utility, the joints in the wastewater manhole shall be made watertight using externally applied joint wraps.~~

E. Ventilation

Ventilation shall be provided as required by TCEQ Rules and Regulations.

F. Inverted Siphons

The use of siphons is discouraged. When no feasible option exists, the following criteria apply. Siphons shall have a minimum of two barrels. The minimum pipe size shall be six (6) inches with a minimum flow velocity of 3.0 fps at peak dry weather flow. The minimum dry weather flow shall be used to size the smallest barrel. Three-barrel siphons shall be designed to carry the capacity of the incoming gravity wastewater mains(s) with one barrel out of service.

An additional corrosion resistant pipe shall be designed to allow for the free flow of air between the inlet and outlet siphon boxes. The diameter of this air jumper shall not be smaller than one-half the diameter of the upstream sewer. Air jumper pipe design shall provide for removal of condensate water that will collect in the pipe.

Siphons shall be designed to allow draining, cleaning, and diversion of flow from individual barrels and inspection. Siphon inlet and outlet structures shall be manufactured with ***polymer concrete.*** ~~approved corrosion resistant material and shall provide for siphon cleaning and maintenance requirements~~.

G. Service Lines

1. Wastewater service lines, between the main and property line, shall have an inside diameter not less than six (6) inches. The minimum grade allowed for service lines is one (1) percent. In all new systems, grade breaks exceeding allowable joint deflection must be made with approved fittings and shall not exceed a cumulative total of 45 degrees. No service connections shall be made to mains larger than 15 inches in diameter.

2. Usually wastewater services are placed along the common property line between two lots where there is no conflict with other utilities' services. All other Utility service is usually located at the other lot corner. Wastewater service should be placed four (4) feet on the low (or right, if on a level ground) side of the lot, nine (9) feet from the water service (located on the other side of the lot line). Services to lots without a water/wastewater easement will terminate at the property line with a cleanout; service to lots having a five (5) foot by five (5) foot water/wastewater easement will terminate within the easement. For details, see the City of Austin Standard Details.

3. Wastewater clean-outs are not allowed in sidewalks or driveways.

4. ~~Large Diameter Cleanouts~~ ***Sample and inspection ports*** are required for service lines ~~that are 8" in diameter and~~ when industrial waste monitoring is required. They shall be located at the property line within the public right-of-way (ROW) or utility easement line to indicate the line of responsibility of the utility. They shall not be located in traffic areas, paved parking areas or sidewalks.

5. ~~Manholes are required for services larger than 8" in diameter. They shall be located within the public ROW or utility easement line to indicate the line of responsibility of the utility.~~

H. Easements

1. Easements for wastewater mains shall be a minimum of 15 feet wide, or twice the depth of the main, measured from finished grade to pipe flowline, whichever is greater. Mains shall be centered on the easement. Narrower easements will be considered where the Engineer provides evidence, to the satisfaction of AW~~U~~, that maintenance activities will not be hindered by the reduced width.

2. Easement documents and the metes and bounds shall be reviewed and approved by AW~~U~~ Pipeline Engineering prior to recordation in the real property records of the appropriate county. Easement recordation in the real property records of the appropriate county is required prior to AW~~U~~ approval of construction plans.

I. Requirements for Existing and Proposed Wastewater Infrastructure beneath Circular Intersections or Other Geometric Street Features

1. Installation of Circular Intersections or Other Geometric Street Features over existing wastewater infrastructure.

   a. Existing wastewater infrastructure may be allowed to exist beneath circular intersections or other geometric street features such as, but not limited to, modern roundabouts, medians, bulb-outs, splitter islands, channelization islands, and other types of physical roadway features. These features may contain hardscaping, landscaping, water quality features, public art, permanent structures, street furniture, or other similar amenities.

   b. The planning and design of these features and their amenities shall include consideration for access, maintenance, protection, testing, cleaning, and operations of the wastewater infrastructure. Where existing wastewater facilities are to remain, trees with root zones of 18 inches in depth or greater at maturity may be considered for inclusion provided the drip lines at maturity of the proposed trees are not located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure. Public art, permanent structures, and other similar amenities may be considered for inclusion provided they are not located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure. The drip lines at maturity of ornamental trees

with root zones at maturity of less than 18 inches in depth, grasses, woody or herbaceous shrubs, and street furniture may be located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure.

c. The need for relocating, replacing or protecting in place existing wastewater infrastructure beneath these features and their amenities shall be determined on a case-by-case basis by AW~~U~~.

2. Installation of Circular Intersections or Other Geometric Street Features in new areas of development with no existing wastewater infrastructure.

a. Proposed wastewater infrastructure may be placed beneath proposed circular intersections or other geometric street features such as, but not limited to, modern roundabouts, medians, bulb-outs, splitter islands, channelization islands, and other types of physical roadway features. These features may contain hardscaping, landscaping, water quality features, public art, permanent structures, street furniture, or other similar amenities.

b. The planning and design of these features and their amenities shall include consideration for access, maintenance, protection, testing, cleaning, and operations of utility infrastructures. Trees with root zones of 18 inches in depth or greater at maturity may be considered for inclusion provided the drip lines at maturity of the proposed trees are not located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure. Public art, permanent structures, and other similar amenities may be considered for inclusion provided they are not located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure. The drip lines at maturity of ornamental trees with root zones at maturity of less than 18 inches in depth, grasses, woody or herbaceous shrubs, and street furniture may be located within a minimum horizontal separation of 7.5 feet from any wastewater infrastructure.

c. The need for alternative alignments or the inclusion of protective systems for the proposed wastewater infrastructure beneath these features and their amenities shall be determined on a case-by-case basis by AW~~U~~.

J. Lift Stations (Excluding low pressure systems)

Lift stations are discouraged and will be allowed only where conventional gravity service is not feasible (Lift Station installation cost plus 30 years O&M expense is less than installation cost for gravity system). This subsection details the specific design criteria for wastewater lift stations proposed for immediate or future City operation and maintenance within the City of Austin or its ETJ. Additional requirements for individual lift stations may be imposed by the Director of the Austin Water Utility or his designee as conditions warrant.

In addition to these criteria, all lift stations must meet the Texas Commission on Environmental Quality Chapter 317.3 rules and the Austin Water ~~Utility~~ Submersible Wastewater Lift Station General Specifications.

1. Flow Development

Calculation of wastewater flow shall be done in accordance with Section 2.9.3~~3~~*4*.A. The following calculations shall be included.

a. Maximum Wet Weather Flow (Design Flow)

This flow is used to determine the lift station design capacity. All lift stations shall be designed to handle the maximum wet weather flow for its service area

Equation:

(Population of service area x 70 gallons per capita per day (gpcd) x maximum flow peaking factor) + (750 gallons per acre served).

b. Maximum Dry Weather Flow

This flow is used to determine pipe size in the collection system.

Equation:

(Population of service area) x (70 gpcd) x (maximum flow peaking factor)

c. Average Dry Weather Flow

This is the flow developed without the maximum flow peaking factor. This flow is used to determine the average detention time in the wet well.

Equation:

(Population of service area) x (70 gpcd)

d. Minimum Dry Weather Flow

This is used to determine the maximum detention time in the wet well.

Equation:

(Population of service area) × (70 gpcd) × (minimum flow peaking factor)

e. A minimum of two (2) pumps shall be required for all lift station. The capacity of the pumps shall be such that the maximum wet weather flow can be handled with the largest pump out of service.

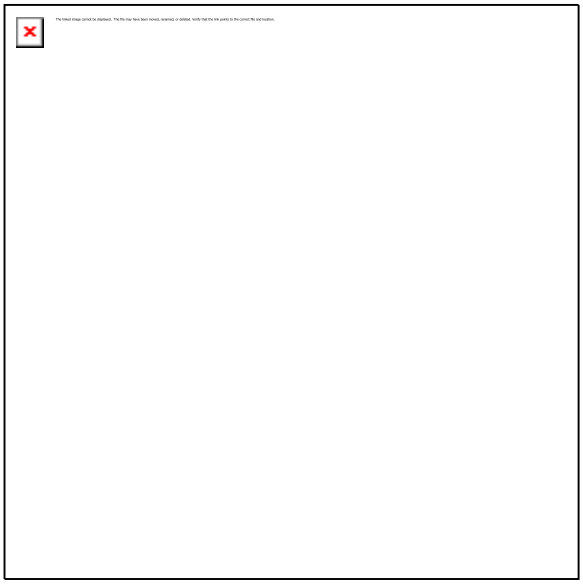
2. Wet Well Design

a. The bottom of the wet well shall have a minimum slope to the intake of two (2) vertical to one (1) horizontal. There shall be no projections in the wet well, which would allow deposition of solids.

b. The wet well volume shall be sized to provide adequate storage volume at peak design flows and a pump cycle time of sufficient duration to prevent pump short cycling and consequential motor damage. Pump cycle time, defined as the sum of "pump off" time plus "pump on" time, shall be as follows:

Motor H.P.	θ Min (Minimum Cycle Time in Minutes)
2 to 50	10
51 to 75	15
76 to 250	30
251 to 1500	45

Volume between "pump on" and "pump off" elevation (of the pump cycle) shall be determined by the following criteria:



$$V = \frac{\theta q}{4}$$

Where: q = pump capacity in gpm and θ is the minimum cycle time in minutes

c. All "pump on" levels shall have a minimum separation of one (1) foot between levels. All "pump off" levels shall be at least six (6) inches above the top of the pump casing. For more than two (2) pumps, the "pump off" levels shall be staged with a minimum separation of one (1) foot between levels.

d. An example of a two (2) pump staging sequence follows:

High-level alarm

Lag pump on

Lead pump on

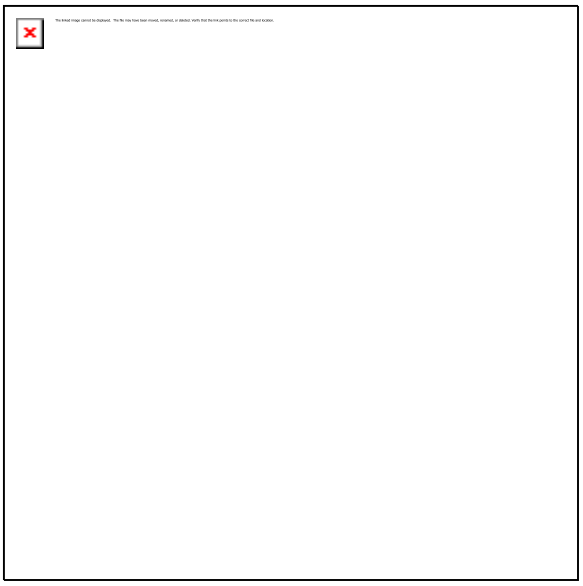
Lag pump off

Lead pump off

Low-level alarm

The high level alarm shall be at least one foot above the last (highest) "pump on" level in the wet well and also at least one (1) foot below the flow line of the lowest influent line into the wet well.

e. For lift stations with three pumps or more, the following method for calculating the wet well volume may be used:



$$V = \frac{\theta \times q_1}{4}$$

and $K = (q_1 - q_2) + q_1$

$V2 = V' \times N \times V_1$

Where:

V_1 = working volume for the first pump in gallons

θ = minimum cycle time in minutes

Q_1 = capacity of the first pump in gpm

Q_2 = capacity of the second pump in gpm

K = the ratio of the discharge increment to the discharge of the first pump, dimensionless

V_2 = working volume for the second pump gallons

V′ = the ratio of additional draw down volume to the volume for one pump, dimensionless

N = number of pumps.

1) Calculate V1 and K.
2) Locate K on Table 1 and read the corresponding value for V');
3) then calculate V2.

f. An example of a three (3) pump starting sequence is as follows:

High-level alarm

Third pump on

Second pump on

First pump on

Third pump off

Second pump off

First pump off

Low Level alarm

For the location of the high level alarm, refer to the example of a two pump starting sequence.

TABLE 1: V′ values Corresponding to various K Values

K	V′	K	V′	K	V′
0.00	0.00	2.10	1.36	3.49	2.63
0.33	0.00	2.13	1.39	3.53	2.67
0.44	0.01	2.17	1.42	3.57	2.70
0.53	0.04	2.20	1.45	3.61	2.74
0.62	0.08	2.23	1.49	3.65	2.77
0.70	0.12	2.27	1.52	3.69	2.81
0.77	0.16	2.30	1.55	3.73	2.85
0.84	0.21	2.34	1.58	3.77	2.88
0.90	0.25	2.37	1.62	3.81	2.92
0.96	0.29	2.41	1.65	3.85	2.96
1.02	0.34	2.45	1.68	3.89	3.00
1.07	0.38	2.48	1.71	3.93	3.03
1.12	0.42	2.52	1.75	3.97	3.07
1.17	0.46	2.55	1.78	4.01	3.11

1.22	0.51	2.59	1.81	4.05	3.15
1.26	0.55	2.62	1.84	4.09	3.18
1.30	0.59	2.66	1.88	4.13	3.22
1.34	0.63	2.70	1.91	4.17	3.26
1.38	0.66	2.73	1.94	4.21	3.30
1.42	0.70	2.77	1.97	4.25	3.34
1.46	0.74	2.81	2.01	4.29	3.38
1.50	0.78	2.84	2.04	4.33	3.42
1.54	0.81	2.88	2.07	4.38	3.45
1.57	0.85	2.92	2.11	4.42	3.49
1.61	0.89	2.95	2.14	4.46	3.53
1.65	0.92	2.99	2.18	4.50	3.57
1.68	0.96	3.03	2.21	4.54	3.61
1.72	0.99	3.07	2.24	4.58	3.65
1.75	1.03	3.10	2.28	4.63	3.69
1.79	1.06	3.14	2.31	4.67	3.73
1.82	1.09	3.18	2.35	4.71	3.77
1.86	1.13	3.22	2.38	4.75	3.81
1.89	1.16	3.26	2.42	4.79	3.85
1.92	1.19	3.29	2.45	4.84	3.89

1.96	1.23	3.33	2.49	4.88	3.93
1.99	1.26	3.37	2.52	4.92	3.97
2.03	1.29	3.41	2.56	4.96	4.01
2.06	1.33	3.45	2.59	5.01	4.05

K = Pump discharge (Dimensionless) V′ = Volume (Dimensionless) Source: ALBERT PINCINE

3. Wet Well Detention Time

   a. Calculate the detention time (Td) in the wet well for the maximum wet weather flow, maximum dry weather flow and average dry weather flow using the following equation:

      $T_d = t_f + t_e$

      Where:

      $T_f = (v) \div (i)$ = time to fill the wet well in minutes

      $T_e = (v) + (q - i)$ = time to empty the wet well in minutes

      V = Volume of wet well between "pump on" and "pump off" elevations in gallons

      q = Pump capacity in gpm

      i = flow into the station corresponding to the maximum wet weather flow, maximum dry weather flow or average dry weather flow in gpm.

   b. Maximum detention time shall be calculated with i = minimum dry weather flow.

   c. Odor control shall be provided for the wet well if the total detention time in the wet well and force main system exceeds 180 minutes.

4. Static Head

   The static head shall be calculated for "pump on" and "pump off" elevations in the wet well.

5. Net Positive Suction Head

   The net positive suction head (NPSH) required by the pump selected shall be compared with the NPSH available in the system at the eye of the impeller. The engineer shall consult the pump manufacturer for the NPSH required values for that pump and compare them with calculated values for the NPSH available. The NPSH available should be greater than the NPSH required for a flooded suction pump. The following equation may be used for calculating the NPSH available:

   $NPSH_A = P_B + H_s - P_v - Hf_s$

   Where:

P_B = barometric pressure in feet absolute,

H_s = minimum static suction head in feet,

P_v = vapor pressure of liquid in feet absolute,

Hf_s = friction loss in suction in feet.

For lift stations in Austin's service area a barometric pressure of 33.4 feet may be used and a vapor pressure of one and four-tenths (1.4) feet may be used. These value are based on the following assumptions: an altitude of 500 feet above sea level, a water temperature of 85ºF and a specific gravity of water of 0.996 at 85ºF.

6. Suction Piping Design

   a. All suction piping shall be flanged ductile iron and have a minimum diameter of four (4) inches. Each pump shall have a separate suction pipe.

   b. Suction piping shall have a velocity of three (3) to five (5) fps.

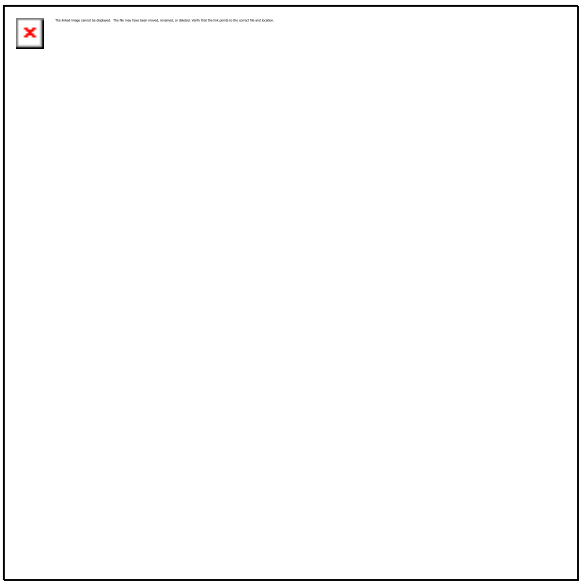
   c. All suction pipes inside the wet well shall be equipped with a flare type, down-turned intake. The distance between the bottom of the flare and the floor of the wet well shall be between D/3 and D/2 where D is the diameter of the flare inlet.

7. Force Main Design

   a. All force mains shall be ductile iron with non-corrosive lining or an approved HDPE with a minimum diameter of four (4) inches. Force main pipe within the station shall be flanged. Flexible fittings shall be provided at the exit wall.

   b. Force mains shall be sized so that the flow velocity is between three (3.0) and six (6.0) feet per second at ultimate development. During initial development phases, flow velocities may be as low as two and one-half (2.5) feet per second.

   c. The maximum time required to flush the force main shall be calculated on the basis of average dry weather flow. Flush time shall be calculated for average dry weather flow using the following equations:



$$T_{flush} = (t_f + t_e) \times \frac{\text{(Force Main Length)}}{(\theta/2)\,(V_{fm})\,(60\ \text{sec/min})}$$

Where:

T_e = Time to empty wet well in minutes

T_f = Time to fill wet well in minutes

V_{fm} = Flow velocity in the force main in feet per second

θ = Pump cycle time in minutes

*t_e = V / q - i

*t_f = ;frac;V

i = average dry weather flow in gpm.

*See Section 2.9.~~3.H~~*4.J*.3.a, "Wet Well Detention Time", for an explanation of V and q.

d. Odor and corrosion control shall be provided for the force main if the force main detention time exceeds 30 minutes if dual force mains are not feasible.

e. Location and size of all air release valves shall be evaluated for odor or nuisance potential to adjacent property by the design engineer.

The use of air release valves shall be restricted to installations where there are not possible alternatives.

f. Sulfide Generation Potential.

Lift station/force main systems shall be evaluated for their sulfide generation potential and their ability to achieve scouring velocities during average dry weather flow periods. If the evaluation indicates that sulfide concentration of greater than 2 ppm and solids deposition are likely, the design shall:

1) define a workable sulfide control technique that will minimize sulfide formation in the force main,

2) include "pig" launching stations and recovery points to allow cleaning of the force main, and

3) protect the gravity main and manholes downstream of the force main from corrosion. The length of pipe to be protected shall be determined on a case-by-case basis.

g. The force main shall discharge into it's own distinct manhole. (i.e. multiple force mains shall not discharge into a single manhole.)

h. Thrust restraint when required shall be shown on the plan view.

8. Head Loss Curves

a. Data points for the system capacity curve shall be provided in tabular form and graphed with pump head capacity curve on the same graph. Two system capacity curves shall be plotted using the Hazen Williams coefficient values of C = 100 and C= 140.

b. Pump output in gpm at maximum and minimum head shall be clearly shown on the system curve for each pump and combination of pumps.

c. For stations with two (2) or more pumps operating in parallel, multiple and single operation points shall be plotted on the system curve.

d. Pumps with the highest efficiencies at all operating points shall be used.

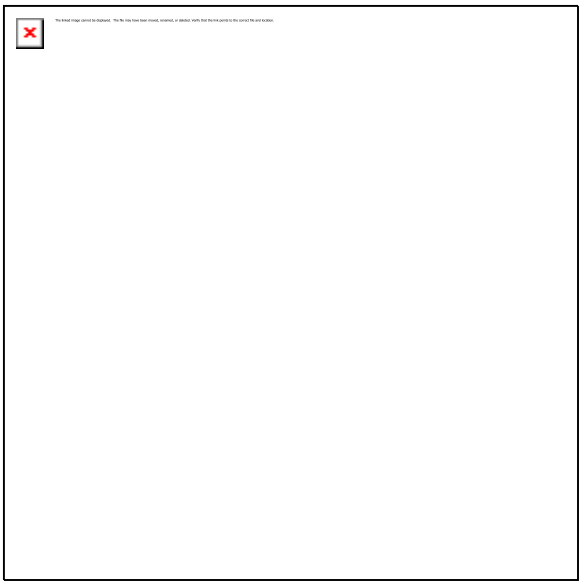
e. If pumps are equipped with smaller impellers during start up to handle lower than design flows, impellers sized to handle the design flow shall also be provided.

9. Buoyancy Calculations

The lift station design shall include a complete analysis of buoyant forces on the entire lift station structure.

10. Water Hammer

a. Calculations for water hammer showing maximum pressures, which would occur upon total power failure while pumping, shall be provided using the following equations.



$$p = \frac{(a)(V)}{(2.31)(g)} + \text{operating pressure of pipe (psi)}$$

$$a = 12 \div \left\{ \frac{w}{g} \left[\frac{1}{k} + \frac{d}{Et} \right] \right\}^{0.5}$$

Where:

p = water hammer pressure (psi)

a = pressure wave velocity (ft/s)

w = specific weight of water (62.4 lb/ft^3)

g = acceleration of gravity (32.2 ft/s^2)

k = bulk modulus of water (300,000 psi)

d = inside diameter of pipe (in)

E = Young's modulus of pipe (psi)

t = pipe wall thickness (in)

v = flow velocity in pipe (ft/s)

Surge control measures shall be provided when pressures, including those due to water hammer, exceed the pressure rating of the pipe.

11. Suction Specific Speed

Suction specific speed of the pumps shall be calculated using the following formula:

$SSS = \Omega(Q)^{.5}/(H)^{.75}$

Where:

SSS = suction specific speed (rpm)

Q = flow at the best efficiency point, gallons per minute (gpm)

H = net positive suction head required at maximum impeller speed (feet)

Ω = speed of pump and motor in rpm

Suction specific speed should be below 9,000 rpm to ensure that the pump will not cavitate because of internal recirculation.

12. Stiffness Ratio

In order to ensure that the pump shaft does not bend an excessive amount, the engineer shall calculate the stiffness ratio of the shaft using the following equation:

Stiffness Ratio = L^3/D^4

where:

L = distance from impeller centerline to the centerline of the inboard bearing (inches)

D = diameter of shaft (inches)

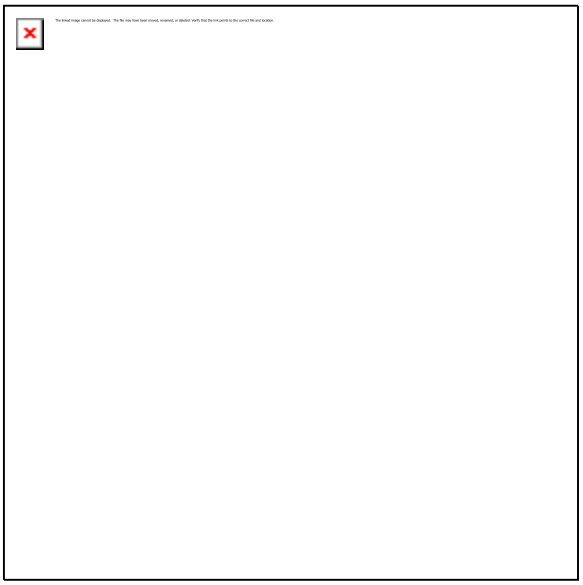
The stiffness ratio shall not exceed 60.

13. Energy Calculations

For lift stations with flows exceeding 75 gpm but less than 1,000 gpm, and if the engineer is considering a submersible type lift station as an option then the engineer shall submit cost comparisons for submersible stations versus wet well/dry well stations. These cost comparisons should include the initial station costs, installation costs and power costs for the life of the station.

Energy costs for each type station shall be calculated using the following equations:

a. Calculate the water horsepower required.



$$P = \frac{(Q)(h)(8.34\ lb/gal)}{33{,}000\ ft\text{-}lb\ min/hp}$$

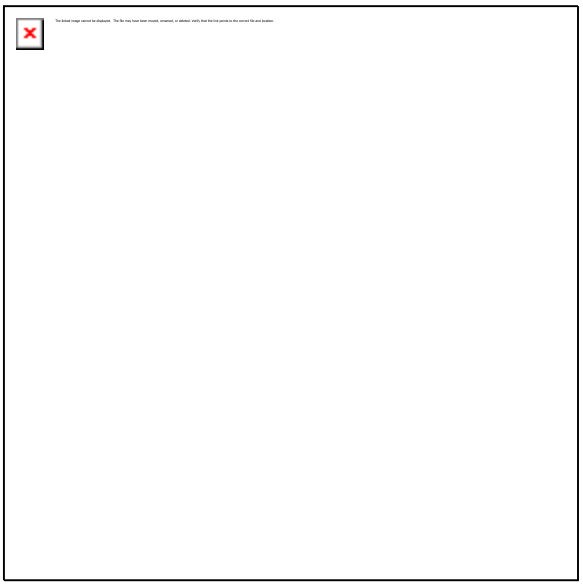
where:

P = water horsepower (hp)

Q = flow, gallons per minute (gpm)

h = head, feet (ft)

b. Calculate the brake horsepower required.

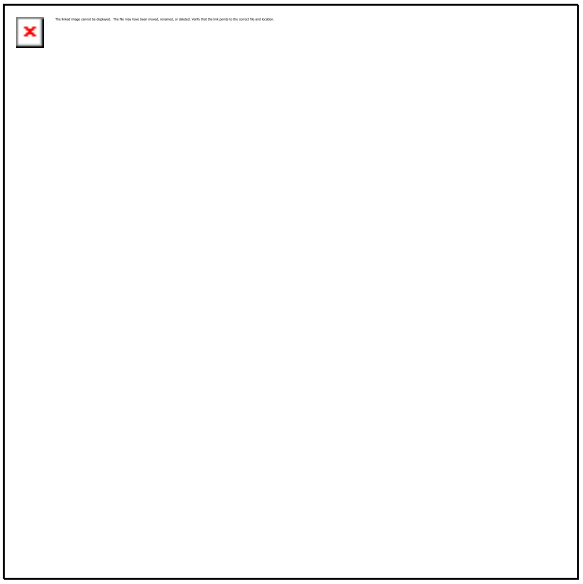


$$Bhp = \frac{P}{\text{pump efficiency*}}$$

where: Bhp = brake horsepower (hp)
P = water horsepower (hp)

* Use the most efficient pumps for the application.

c. Calculate the electrical horsepower required



$$Ehp = \frac{Bhp}{\text{motor efficiency}}$$

where: Ehp = electrical horsepower (hp)
Bhp = brake horsepower (hp)

Use the most efficient motors for the application

d. Calculate the power required in kilowatts.

EkW=(Ehp)(0.746 Kw/hp)

e. Calculate daily power consumption in kilowatt-hours.

$E = [(EKW_1)(t_1) + (EKW_2)(t_2) + (E\ KW_3)(t_3)...]$

where: E = total power consumption, kilowatt hours (kWh) per day
EkW^n = power required, kilowatts for pumps 1,2,...,n
t^n = estimated pump run time in hours per day for pumps 1,2,...,n

f. Calculate the estimated cost for power consumption over the life of the station.

C = (E)($0.06/kWh)(T)

where:

C = cost of power over the life of the station (dollars)

E = power consumption (kilowatt-hour per day - kWh/day)

T = time the station is expected to be in service (days)

g. Stress and thrust calculations for internal station piping and bends shall be provided for stations with flows over 1000 gpm.

14. Sump Design

The following items apply for lift station dry well sump pumps:

a. Dual submersible sump pumps, each with a minimum capacity of 1000 gallons per hour (gph), shall be provided.

b. The design head of the sump pumps should be the static head from the sump to one foot above the hundred-year flood level plus allowances for pipe friction both inside and outside the pump chamber.

c. Sump piping shall be galvanized steel with a minimum diameter of two (2) inches.

d. Sump discharge from the dry well shall be installed through the wall of the wet well at a point not less than 12 inches above the top of the influent pipe and grouted in place with a water tight seal.

e. The dry well floor shall slope toward the sump pit.

15. Specific Station Requirements

a. All stations will be required to have an equipment-lifting device.

b. Engineering calculations are required showing that temperatures inside the dry well do not exceed 85°F, while the pumps are operating.

c. Stations with motors greater than 100 hp shall use a horizontal pump/motor configuration.

d. Stations with motors 75 hp and larger shall have reduced voltage starters of the auto transformer or solid-state soft start type. Part winding starters and motors are not acceptable. Motors larger than 75 hp shall be designed with a maximum temperature rise not to exceed 80°C over a 40°C ambient temperature. Motors larger than 300 hp may require a higher temperature rise and may be specifically approved with such.

e. Motors 75 hp and smaller shall be provided with high efficiency frames. Maximum temperature rise shall not exceed 90°C over a 40°C ambient temperature.

f. Stations deeper than 30 feet, measured from the finished floor to the top of the entrance tube, shall require an electrically powered personnel lift.

g. Entrance hatches larger than 40 inches in diameter shall be spring loaded.

h. Valves higher than six (6) feet above the floor shall have chain operators.

i. Any potable water supply below the overflow elevation of the wet well shall be protected by an air gap.

j. All lift stations must have a back-up power source. Looped service from two (2) different substations is adequate backup power. If a back-up electric system is not feasible, a diesel generator may be located on the lift station site instead. Generator shall be equipped with noise and air pollution control devices.

k. Flow monitoring will be provided for all lift stations.

16. Wastewater Lift Station Specifications

In addition to the design criteria presented in this document, the Austin Water ~~Utility~~ has "Wastewater Lift Station General Specifications and Drawings". These documents delineate minimum City requirements as they relate to the construction and installation of wastewater lift stations. Copies of these documents are available and can be obtained from the Austin Water ~~Utility~~.

17. Alternate Wastewater Systems

a. General

Low-pressure wastewater systems are discouraged and will be allowed only where conventional gravity service is not possible. For the purpose of these criteria, low-pressure sewer service is defined as private grinder pump facilities or private septic tank effluent pump facilities that do not convert to gravity flow at or prior to the property line. There shall be no more than one grinder pump facility per single family or duplex residential lot. Each grinder pump shall discharge to a gravity flow system. Grinder pump facilities for commercial establishments, Public Utility Districts (PUD)***, Municipal Utility Districts (MUD), Water Control and Improvement Districts (WCID)*** or condominiums will be considered on a case-by-case basis.

The distance for each grinder pump from the property line to the gravity main shall not exceed 200 feet.

Flows may be calculated using the Lift Station Design Criteria disregarding the Infiltration/Inflow flow component.

If the above criteria are applicable and a low-pressure wastewater service is necessary, the Austin Water ~~Utility~~ will be responsible for maintaining the portion within the right-of-way only.

Design and installation of the property owner's pumping system, as well as all associated plumbing shall be reviewed, approved and inspected by the City of Austin. The system shall be designed as a complete system including all connections, pumps, etc. for lots being served by the system. If the above criteria are not applicable, refer to Lift Station design criteria.

b. Connection to Gravity Main.

Each grinder pump facility shall be individually tied into a manhole on ~~an~~ ***the*** existing gravity ***sewer or an existing force*** main. If a manhole does not exist, one shall be constructed. Construction costs and all other associated costs shall be the responsibility of the property owner.

The connection to the gravity main shall be designed to minimize turbulence and the release of hydrogen sulfide. The discharge point shall be at or below the springline of the gravity main.

c. Cleanout and Valve Assemblies.

A cleanout and corrosion resistant eccentric plug valve shall be placed just inside of the right-of-way where City maintenance begins and private maintenance ends. This cleanout will allow the property owner's system to be isolated and the City's portion of the system to be pressurized, flushed or rodded.

Cleanouts and corrosion resistant eccentric plug valves shall also be installed at bends of 45 degrees and greater. ***All fittings, valves and bends shall be at least two (2) inches in diameter and all bends, tees, and wyes with a change of direction of 45 degrees or greater shall be made up of sweeping or long radius components. Force Mains shall not include any pipe with a diameter smaller than 1-1/2 inches.***

Refer to applicable standard Detail(s) in the City of Austin Standards Manual.

d. Separation Requirements.

The separation between low-pressure sewer lines and waterlines shall comply with City of Austin Standard Specifications and all other applicable rules and regulations.

e. Grinder Pump System General Specifications and Drawings.

In addition to the design criteria presented in this document, the Austin Water ~~Utility~~ maintains 'Grinder Pump System General Specifications and Drawings." These documents delineate minimum City requirements as they relate to the construction and installation of grinder pump systems. Copies of these documents are available and can be obtained from Austin Water ~~Utility~~.