Texas Commission on Environmental Quality
SEWAGE COLLECTION SYSTEM SUBMITTAL APPLICATION
FOR PLANS AND SPECIFICATIONS REVIEW

This application is intended as an aid in fulfilling the review requirements of 30 TAC Chapter 317, titled *Design Criteria for Sewerage Systems*, sections 317.1 and 317.2. This application may be submitted in lieu of a separate engineering report. This form will only be accepted for review if all the pages of this application, including any attachments, are permanently bound together, and the application is signed, sealed and dated on the final page by a professional engineer registered in the State of Texas, or if each page of attachments and each page of this application have the signed and dated seal of a Professional Engineer registered in the State of Texas. **Use of the application form is not mandatory except for Edwards Aquifer applications.** The intent of this application is to expedite Texas Commission on Environmental Quality (TCEQ) plan review by providing a format which ensures that the information required to complete a TCEQ review of the project is included in the submittal materials, and to assist the reviewer in locating this information. Please note that the determination of whether or not the information submitted by the applicant is sufficient to obtain TCEQ approval will be made by the TCEQ reviewer and that additional information regarding the project design may be required before the TCEQ will approve construction of the project. Except as exempted in question A23 of this application, in addition to this application, each submittal must include one set of the project specifications, permanently bound, with the signed and dated seal of a Professional Engineer registered in the State of Texas on the cover of the specifications and one set of plans, with each plan sheet containing the signed and dated seal of a Professional Engineer registered in the State of Texas. The submittal of the plans, specifications and application need to be made to the following address:

TCEQ
Wastewater Permits Section
MC 148
P.O. Box 13087
Austin, Texas 78711-3087

For answers to questions relating to wastewater plan review contact:

Louis C. Herrin, III, P.E.
Phone No. (512) 239-4552

Use the back of this page and attachments if needed for long narrative answers or engineering calculations.

ADMINISTRATIVE REVIEW

TCEQ review is intended to provide both a technical review and a historical record of wastewater construction projects. The following information is required for administrative review purposes.

A1) **Does the project include any potable water distribution or water treatment related construction? _____ If yes, a separate review by the TCEQ Water Utilities Division may be required.** Please contact Joe Strouse, PE, at (512) 239-6960 for this determination.

A2) Name and mailing address of entity submitting project for review:_____
_____

A3) Name of design engineer:_____ Phone No. :_____

A4) County in which the project is located:_____

A5) Name of project (include subdivision name, contract numbers, or any other identifying information which is relevant to this project):

_____

A6) Entity which will own and maintain the sanitary sewer collection system described in this application: _____ _____

A7) Identify the wastewater treatment plant (WWTP) which will receive and treat flows from the project.

TCEQ Permit No. :_____ Permittee:_____

Facility or plant name if different from permittee: _____

A8) If this WWTP is <u>not</u> under enforcement skip to A10. If this WWTP is currently under a TCEQ enforcement order, please provide the name and phone number of the TCEQ enforcement coordinator and the TCEQ Region Office wastewater inspector assigned to the enforcement case.

Name:_____ Phone No. :_____
Name:_____ Phone No. :_____

A9) Describe the nature of the enforcement case. If the WWTP which will receive flow from this project is under enforcement due to flow exceedance, the description should include the permitted average daily flow, information regarding average daily flows currently measured at the WWTP during both dry and wet weather conditions, and any other information which would help describe the flow exceedance problems:

Use the back of this page and attachments if needed for long narrative answers or engineering calculations.

A10) If any portion of the project is within the Edwards Aquifer Recharge Zone, **attach this form to your Edwards Aquifer protection plan**. The project must be reviewed by the appropriate TCEQ Region Office as required by 30 TAC Chapter 213. For information on the submittal requirements for projects located over the Edwards Aquifer Recharge Zone contact the appropriate Region Office for details. Are all portions of this project outside the Edwards Aquifer Recharge Zone?_____

A11) If the project is publicly funded, identify the source of funding. Please include the name and phone number of a contact person at the funding entity.

Source of Funding:_____

Name:_____ Phone No. :_____

A12) Identify entities other than TCEQ which will review the project. Please include the name and phone number of a contact person for each entity other than the TCEQ which will review this project.

Entity:_____ Name:_____ Phone No. :_____
Entity:_____ Name:_____ Phone No. :_____
Entity:_____ Name:_____ Phone No. :_____
Entity:_____ Name:_____ Phone No. :_____

A13) If this project proposes any sewage collection system (gravity sewer pipe, lift station or force main) installation or construction which would not be considered maintenance and rehabilitation work, skip to page 7 of this application and complete the applicable portions of the technical review section of this application starting with T1 on page 7. If a project consists solely of maintenance and repair of an existing sanitary sewer collection system, a waiver of review may be granted on a case by case basis in accordance with Section 317.1(a)(7) of the Design Criteria. Section 317.1(a)(7) states, "Waiver of submittal or review requirements. When minor upgrade, rehabilitation, or maintenance work is planned for existing systems a waiver of submittal or review may be granted at the discretion of the executive director…If a waiver of submittal or review is desired, written notification to the commission…shall be made and shall include

sufficient information to describe the significance of such modifications. If a waiver of submittal or review is requested, it shall be submitted by a professional engineer registered in Texas, and shall include the signed and dated seal of the engineer submitting the waiver request. The executive director…will determine whether a submittal or review of engineering plans and specifications will be required following this initial notification of the extent of the planned modifications. Replacement of equipment, piping or materials with like equipment, piping, or materials for purposes of maintenance and repair only, will not routinely require a submittal or a technical review by the executive director, and also will not routinely require a request for a waiver of submittal or a request for a waiver of review." If this project only proposes collection system maintenance and rehabilitation work, state whether the project consists of sewage collection piping rehabilitation work, lift station rehabilitation work, or both sewage collection system piping and lift station rehabilitation work:_____

_____

If this project only consists of sewage collection piping maintenance and rehabilitation work, answer items A14 through A18.

If this project only consists of maintenance and rehabilitation work for one or more lift stations, answer items A19 through A22 and continue on with A23.

If this project proposes both sewage collection system piping rehabilitation and maintenance and rehabilitation of one or more sanitary sewer lift station, answer items A14 through A22 and continue on with A23.

A14) Detail the scope of the sewer collection pipe rehabilitation project. Include details regarding linear feet of pipe which will be rehabilitated, types of pipe rehabilitation technologies which are proposed, pipe, pipe joint and pipe bedding materials which are proposed for the maintenance and rehabilitation work and any other information which may be necessary to show that the proposed project will be accomplished utilizing standard acceptable engineering practices:

A15) Are all proposed lines to be constructed in the same trench as existing lines?_____

A16) Are all proposed lines the same diameter as existing lines?_____

A17) Are all slopes the same as or greater than existing lines?_____

A18) Will flows and connections be equal to or less than current flows and connections? _____ If no lift station rehabilitation work is planned, skip to A23.

A19) Detail the scope of the maintenance and rehabilitation work proposed for the lift station(s). Include the number of lift stations which will be rehabilitated, information regarding structural maintenance which is

to be performed on each lift station proposed for rehabilitation, the size of any pumps which are to be replaced in each lift station, the size of any pumps which currently exist in each lift station, the size of any pumps which are not proposed to be replaced and will remain in each lift station, details regarding any force main rehabilitation which is intended for the sewage system and any other information which may be necessary to show that the proposed project will be accomplished utilizing standard acceptable engineering practices:

A20) Will the operating characteristics of the rehabilitated lift station(s) be equivalent to the operating characteristics of the existing lift station(s) regarding pumping capacity versus total dynamic head?_____

A21) Will the force main piping either remain unchanged, or, be replaced at the same alignment and with the same diameter pipe as the existing force main piping? (yes or no)_____

A22) Will the lift station(s) and force main(s) include, at a minimum, an arrangement of valves and appurtenances which ensures that the lift station(s) operation will be equivalent to or superior to that of the lift station(s) and force main(s) being upgraded or replaced?_____

A23) **If you answered no to any of the items in A15, A16, A17, A18, A20, A21, or A22, skip to A24. If you answered yes to all the items in A15, A16, A17, A18, A20, A21, or A22,** which are relevant to the project, **STOP**. This project meets the criteria which must be met to allow the TCEQ to grant a

general waiver of review and to allow an exemption from the requirement to submit plans and specifications to the TCEQ. Submit pages 1 through 6 of this application, and any attachments associated with pages 1 through 6 of this application to the TCEQ for record keeping purposes. The submitted pages shall be properly bound and the final page shall include the signed and dated seal of a Professional Engineer registered in the State of Texas. The pages can be stapled or left loose if each page of the submittal has the signed and dated seal of a Professional Engineer registered in the State of Texas.

A24) **If you answered no to any of the items in A15, A16, A17, A18, A20, A21, or A22,** but believe that the project constitutes routine maintenance of an existing system, please provide engineering justification why TCEQ review should not be required. Please detail in what ways the rehabilitation project differs from the existing system with regard to the items in A15, A16, A17, A18, A20, A21 or A22. Submit all attachments and pages 1 through 6 of this application to the TCEQ for a determination of whether review is required for this project. The pages of the submittal shall be properly bound and the final page shall include the signed and dated seal of a Professional Engineer registered in the State of Texas. The pages can be stapled or left loose if each page of the submittal has the signed and dated seal of a Professional Engineer registered in the State of Texas. Please be aware that review may be required at the discretion of the Executive Director. If it is determined that the proposed maintenance and rehabilitation work will be reviewed by the TCEQ, in addition to pages 1 through 6 of this application, the applicant will need to submit one set of the project specifications, permanently bound, with the signed and dated seal of a Professional Engineer registered in the State of Texas on the cover of the specifications, an engineering report, permanently bound, with the signed and dated seal of a Professional Engineer registered in the State of Texas on the cover of the engineering report (For collection system submittals which contain no lift stations or force mains, this application form may substitute for the engineering report, provided the application is properly completed) and one set of plans, with each plan sheet containing the signed and dated seal of a Professional Engineer registered in the State of Texas.

TECHNICAL REVIEW

T1) Please provide a brief summary of the project scope:

T2) If a conflict exists between the various submitted documents (engineering calculations, project specifications, project plans, addendums, etc.), which document takes precedent? For instance do plans govern over

specifications or do specifications govern over plans? Do special conditions govern over technical specifications or plans? etc. Where in the submitted materials is the prioritization of documents specified? Provide answers to these items below. Please be aware that the TCEQ may require any identified discrepancies between plans and specifications to be corrected or clarified:

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T3) This application form is intended to function as a document, which when completed properly, constitutes full compliance with Sections 317.1 and 317.2 of the TCEQ's rules. All the requirements in these Sections of Chapter 317 have been restated in this application in a format which is intended to clarify what is needed to show compliance with Sections 317.1 and 317.2. ***If during the course of completing this application it is determined that the project does not comply with specific portions of the requirements in Chapter 317, as indicated by "no" answers to the items in the application, the applicant must request a variance from the rules for these items. The specifics of what requirements must be met to obtain a variance can be found on page 35 of this application. Page 35 is also the appropriate places to provide the details needed to justify any variance requests.***

Part I of the technical review portion of this application covers gravity sewer collection piping only. Part II of this application has not yet been developed. Part II, when developed, will cover lift stations and force main piping only. If this project contains gravity collection piping complete the items in Part I, beginning with T4 on page 8 of this application. Until Part II is finalized, if this project contains lift stations and force main piping, which need a TCEQ review, a separate engineering report which shows full compliance with Section 317.3 of the TCEQ's rules titled Design Criteria for Sewerage Systems, must be submitted to the TCEQ for the lift station and force main portions of the project. Conceptually similar Chapter 317 requirements have been grouped together under their relevant citations in Part I of this application. For more detailed information on these requirements, please consult the relevant rules.

PART I - GRAVITY SANITARY SEWER PIPING

Capacity Design

Flow and Capacity Analysis: 30 TAC, Sections 317.2.(a)(1), 317.2.(b)(1), 317.2.(b)(2), 317.2.(b)(3), 317.4.(a)

T4) Basis for average flow used for design of collection system (**check one or more**):

Per Capita Contributions:____Service Connections:____Land Area and Use:____Fixture Analysis:____

T5) Peaking factor used for design:____ A peaking factor of at least 4 is required for minor lines. A peaking factor greater than 4 must be used if needed to convey peak flows. Has a peaking factor greater than or equal to 4 been used in the design?_____

T6) Provide flow/capacity analysis. The capacity analysis must derive the average and peak flows to be carried by each line. Additionally, the analysis must verify that the diameters and slopes for each reach of collection line (or for the minimum capacity reach of each line) provide a capacity adequate to carry the anticipated peak flow. The analysis must include consideration of all existing upstream flow contributions, and the impact of

the project on the downstream collection system. The stated design flow must be justified on the basis of future population to be served, and must include any anticipated industrial, commercial, or institutional flow contributions. Please note that capacities must be determined using Manning's equation for pipes flowing full with an "n" value of 0.013:

General Structural Components

The Design Criteria outlined in Section 317.2 of the TCEQ's rules states, "The collection system design shall provide a minimum structural life cycle of 50 years." Section 317.2 also states, "The collection system design shall provide for the minimization of anaerobic conditions." These two TCEQ requirements can be assumed to have been met for the purposes of Plans and Specifications approval provided that the items in T7 through T104, detailed below, are met:

Materials Used and ASTM Standards Adhered To: 30 TAC 317.2(a)(2), 317.2(a)(3), 317.2(a)(5), 317.2(c)(5)(A)

T7) List all the pipe diameters proposed for this project. Specify the total linear feet of pipe proposed for each listed diameter, the pipe material proposed for each diameter, the national standard specifications (ASTM, AWWA, ANSI, etc…) which govern each proposed pipe material and the appropriate national standard specifications for joints which correspond to each of these proposed materials:

	Linear Feet	Pipe Material	National Standard Specification for Pipe Material	National Standard for Pipe Joints
Pipe Diameter 1				
Pipe Diameter 2				
Pipe Diameter 3				
Pipe Diameter 4				
Pipe Diameter 5				
Pipe Diameter 6				

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

Note: Section 317.2.(c)(1) requires a minimum pipe diameter of 6 inches for all sanitary sewer collection system piping except service laterals. The TCEQ does not currently review service laterals. The design, installation and testing of service laterals is regulated by municipal and county codes. Compliance with these codes is considered sufficient to satisfy the TCEQ.

T8) Watertight, size on size resilient connectors conforming to ASTM C-923 must be specified for connecting pipe to manholes. Have such connectors been specified? _____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T9) For purposes of TCEQ review, rigid pipe materials include, but are not limited to, concrete, vitrified clay or ductile iron pipe. If the design does not include rigid pipe, skip to T11. If the design includes rigid pipe, the specified bedding must comply with ASTM C-12 class A, B, or C for materials and densification. A minimum of 4 inches of bedding is required for all pipe. Will the proposed project comply with these requirements?_____

T10) Specify the bedding class proposed for each diameter of rigid pipe and each rigid pipe material:

Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T11) For purposes of TCEQ review, flexible materials include, but are not limited to, plastics, PVC, ABS,

fiberglass, and, polyethylene. If the design does not include flexible pipe, skip to T13. If the design includes flexible pipe materials, the specified bedding must comply with ASTM D-2321 class IA, IB, II or III for materials and densification. A minimum of 4 inches of bedding is required for all pipe. Will the proposed project comply with these requirements?_____

T12) Specify the bedding class proposed for each diameter of flexible pipe and each flexible pipe material:

Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____
Pipe Diameter:_____ Pipe Material:_____ Bedding Class:_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

Note: For TCEQ review, cement stabilized bedding materials are considered to comply with ASTM D-2321 if the base material and compaction meet the minimum requirements of ASTM D-2321, class IA, IB, II or III.

T13) Brick manhole construction is not allowed. Use of brick for adjusting manhole covers to grade is also prohibited. Do the project plans and/or specifications prohibit the use of brick manholes and the use of brick to adjust manholes to grade?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T14) Are materials specified for manhole construction limited to monolithic cast in place concrete, fiberglass, precast concrete or HDPE?_____ List all materials specified for manhole construction:

1)_____ 2)_____ 3)_____ 4)_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

Minimum and Maximum Slopes: 30 TAC 317.2(c)(2), 317.2(c)(3)

T15) All pipe must be designed with a slope that will provide a velocity of at least 2 ft/s flowing full, as calculated using Manning's equation with an "n" value of 0.013. Additionally, the collection system must be designed to ensure that, with pipes flowing full, the velocities will be less than 10 feet per second. For each diameter of pipe, indicate the minimum and maximum collection line slopes which will exist in this project (see 317.2(c)(2) of the TCEQ's rules for a table of maximum and minimum slopes allowed for each diameter of pipe):

Pipe Diameter: ____ Min. Slope: ____ Max. Slope:____
Pipe Diameter: ____ Min. Slope: ____ Max. Slope:____
Pipe Diameter: ____ Min. Slope: ____ Max. Slope:____
Pipe Diameter: ____ Min. Slope: ____ Max. Slope:____
Pipe Diameter: ____ Min. Slope: ____ Max. Slope:____
Pipe Diameter: ____ Min. Slope: ____ Max. Slope:____

T16) Do these proposed slopes ensure a velocity greater than or equal to 2 feet per second and less than or equal to 10 feet per second?_____

General Trenching and Backfill: 30 TAC 317.2.(a)(5), 317.2.(a)(9), 317.2.(a)(10), 317.2.(c)(3)

T17) Describe any known soil, geologic, or hydrologic conditions on the site which may pose difficulties for construction or compromise the structural integrity of the collection system. These include but are not limited to high water table; low soil strength; high plasticity index; active faults; zones of active subsidence; and, caves, solution caverns or sinkholes. If no such conditions are known to exist in the proposed project location, skip to T19.

T18) Describe the measures which will be taken to provide for the structural integrity of the collection line and for construction safety where pipe must be installed in conditions described in T17:

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T19) **If faults, caverns, or subsidence are discovered during construction, construction should be halted to allow the features to be inspected by the design engineer or a geological or geotechnical professional.** For active faults, localized subsidence zones, or caverns, the system must be laid out to minimize the number of crossings through, and construction within, the unfavorable features. Where crossings through faults or subsidence zones are unavoidable, the design must allow for deflection due to differential settlement. Manholes should be provided on each side of such features to allow pumping in case of sewer failures. Service connections within 50 feet of such features should be avoided. These design features should be detailed in the project specifications. Will these requirements be met?_____ Please provide appropriate details:

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T20) The trench width must be minimized while still allowing adequate width for proper compaction of backfill, and while still ensuring that at least 4 inches of backfill exists on each side of the pipe. Will this be accomplished? _____

T21) For each diameter of pipe, indicate minimum and maximum trench width:

Pipe Diameter: _____ Min. Trench Width: _____ Max. Trench Width: _____
Pipe Diameter: _____ Min. Trench Width: _____ Max. Trench Width: _____
Pipe Diameter: _____ Min. Trench Width: _____ Max. Trench Width: _____
Pipe Diameter: _____ Min. Trench Width: _____ Max. Trench Width: _____
Pipe Diameter: _____ Min. Trench Width: _____ Max. Trench Width: _____
Pipe Diameter: _____ Min. Trench Width: _____ Max. Trench Width: _____

T22) Will the trench walls be vertical to at least one foot above the pipe? _____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T23) Will the backfill be free of stones greater than 6 inches in diameter and free of organic or any other unstable material? _____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

Corrosion Prevention:

T24) List any proposed collection system components (pipes, manholes, etc…) that will be susceptible to deterioration through the corrosive effects of an anaerobic sewage environment. If the collection system does not contain any components which are susceptible to deterioration through the corrosive effects of an anaerobic sewage environment, skip to T26:

T25) If the proposed wastewater collection system contains components susceptible to corrosive attack, provisions to protect these components from corrosive attack, such as coatings, liners, high alkalinity concrete, etc, are needed. If steps have been taken to protect the wastewater collection system from corrosive attack, detail these corrosion prevention measures below. Indicate that these measures are sufficient to protect the gravity sanitary sewer piping from corrosive attack for a design life of 50 years and indicate where in the plans and specifications these measures are required. If the proposed wastewater collection system contains components susceptible to corrosive attack, and if corrosion prevention measures will not be taken for this project, provide an engineering analysis demonstrating that the collection system will adequately resist corrosive attack through the 50 year design life of the project. This analysis must consider the potential for anaerobic conditions both under startup conditions and at ultimate buildout. (Refer to ASCE Manual and Reports on Engineering Practice-No. 69, Sulfide in Wastewater Collection and Treatment Systems). Have these specifics been addressed?_____

Analysis:

Manholes - General: 30 TAC Section 317.2(c)

T26) Are manholes provided at all changes in size, grade or alignment of pipe? _____

T27) Are manholes or cleanouts provided at the end of all lines? _____

T28) The maximum manhole spacings allowed by the TCEQ are as follows:

Pipe Diameter (in)	Maximum Manhole Spacing (ft)
6 - 15	500
18 - 30	800
36 - 48	1000
54 or larger	2000

Indicate what the maximum spacing in this project will be for each proposed diameter of pipe.

Pipe Diameter: _____ Max. Spacing: _____ Pipe Diameter: _____ Max. Spacing: _____
Pipe Diameter: _____ Max. Spacing: _____ Pipe Diameter: _____ Max. Spacing: _____
Pipe Diameter: _____ Max. Spacing: _____ Pipe Diameter: _____ Max. Spacing: _____

T29) Do the maximum spacings for this project comply with the TCEQ's maximum manhole spacing requirements?_____

Manholes - Ventilation: 30 TAC 317.2.(c)(5)(C)

T30) Provide the 100-year flood plain elevation for the project area(s):_____

T31) On what basis was the 100-year flood plain elevation determined?

T32) Manhole covers which lie within a 100 year flood plain must be sealed and gasketed or otherwise provided with adequate protection against inflow. Such measures should also be provided to any manholes lying in drainageways or streets subject to carrying drainage flows. Will this requirement be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T33) If this project does not contain any sections of line with more than three manholes in sequence which are bolted and gasketed, or protected against inflow in some other fashion, skip to T34. Where more than three manholes in sequence are to be bolted and gasketed, every third manhole (or a maximum of every 1,500 feet) must be vented to a point above the 100 year flood plain elevation in a way that prevents stormwater inflow. Additionally, the plans should identify the nearest known flood plain elevation and indicate any manhole covers which are required to be sealed. Will these requirements be met?_____ Does this project solely protect against inflow with bolted and gasketed manholes?_____Describe ventilation provisions:

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

Manholes - Minimizing Turbulence: 30 TAC 317.2.(c)(5)(E)

T34) Where unequal sized pipes enter a manhole, the crowns of the pipes should be at equal elevation where feasible and the manhole channel should slope evenly between pipe inverts. If relevant, have these principles been incorporated into the design (If not relevant to this project skip to T35)? _____

T35) Drop inlets must be provided for pipes entering a manhole at an elevation greater than 30 inches above the manhole invert. This requirement is especially important where force mains or inverted siphons discharge into the gravity collection system. Any required drops should be detailed in the project plan sheets. If relevant, have these requirements been specified (If not relevant skip to T36)? _____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T36) Where sewer lines enter the manhole higher than 24 inches above the manhole invert, the invert shall be filleted to prevent solids deposition. A drop pipe should be provided for a sewer entering a manhole more than 30 inches above the invert. Any required fillets should be indicated in the project plans or profile drawings. If relevant, have these features been incorporated into the design (If not relevant skip to T37)? _____

T37) A U-shaped channel must be provided through the manhole base. For pipes less than 15 inches diameter, channel depth must be at least half the pipe diameter. For pipes greater than 15 inches but

less than 24 inches diameter, channel depth must be at least 3/4 the pipe diameter. For pipes greater than 24 inches diameter, channel depth must be at least equal to the pipe diameter. Has this principle been followed in the design? _____

T38) The manhole bench (base area outside the flow channel) must be sloped at least 0.5 inches per foot. Has this principle been followed in the design? _____

Inverted Siphons: 30 TAC 317.2.(c)(6)

T39) Inverted Siphons (sag pipes) can be a major source of corrosive activity due to anaerobic conditions. If the project does not include any sag pipes skip to T40. If the project includes sag pipes, have they been designed in accordance with section 317.2.(c)(6) of the Design Criteria?_____ Provide design assumptions and calculations which justify the design of the sag pipes and show that 317.2(c)(6) of the TCEQ's rules has been complied with:

Trenchless Technology: 30 TAC 317.2(a)(2)(A)

T40) If the project propose any trenchless installation of pipe (e.g. slip-lining; boring and jacking; or, microtunneling), please provide a brief description of the type of installation, design basis, and engineering justification of why the proposed method is appropriate for this project. If the project does not propose trenchless installation of pipe skip to T41:

Vertical Curvature: 30 TAC 317.2(c)(4)

T41) Vertical curvature between manholes is not allowed in gravity collection systems. Has this project been designed without the use of vertically curved gravity collection piping between manholes?_____

Horizontal Curvature: 30 TAC 317.2(c)(4)

T42) If this project does not contain any portions which include horizontally curved gravity sanitary sewer piping, skip to T57. Chapter 317 of the TCEQ's rules states "Sewers shall be laid in straight alignment with uniform grade between manholes unless slight deviations from straight alignment and uniform grade are justified to the satisfaction of the Executive Director." To clarify what constitutes justification to the satisfaction of the Executive Director, the TCEQ developed a horizontal curvature policy. The specifics

of this horizontal curvature policy are detailed in T43 through T56. If this project includes horizontally curved gravity sanitary sewer piping, complete the relevant portions of T43 through T56, then continue with T57. Has the amount of horizontal curvature which will be used in this design been minimized?_____

T43) Horizontal curvature must be either by joint deflection or pipe flexure, but not both. Indicate the method utilized:_____If horizontal curve will be provided by joint deflection skip to T46. If horizontal curvature will be provided by pipe flexure, for each type and size of pipe to be installed using pipe flexure, calculate the minimum radius of curvature which is proposed in this project and calculate a value for 300 * D_o, where D_o is the average outside diameter of the pipe in inches.

T44) For each type of pipe material and for each pipe diameter, report the minimum radius of curvature recommended by the manufacturer, the minimum radius of curvature recommended by a national reference standard (if available), the minimum radius of curvature calculated in T43 and the value for 300*D_o calculated in T43:

	Pipe Material	**Minimum Radius of Curvature Recommended by Manufacturer**	**Minimum Radius of Curvature Recommended by National Reference Standard (N/A if none)**	**Calculated Minimum Radius of Curvature**	**Value for 300*D_o**
Pipe Diameter 1					
Pipe Diameter 2					
Pipe Diameter 3					
Pipe Diameter 4					
Pipe Diameter 5					

Pipe Diameter 6					

T45) If curvature will be provided by pipe flexure, all joints must be installed fully seated. The specifications must describe how installation will be performed for curved sections. The minimum radius of curvature calculated cannot be less than the minimum radius of curvature recommended by the manufacturer or the minimum radius of curvature recommended by any applicable national reference standards. The minimum radius of curvature also should not be less than $300*D_o$. Will these requirements be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T46) If the horizontal curvature in this project will not be provided by joint deflection, skip to T52. If the horizontal curvature in this project will be provided by joint deflection, calculate the joint deflection proposed for each pipe diameter:

T47) Report the maximum proposed joint deflection for each pipe diameter:

Pipe Diameter:_____ Maximum Proposed Joint Deflection:_____
Pipe Diameter:_____ Maximum Proposed Joint Deflection:_____
Pipe Diameter:_____ Maximum Proposed Joint Deflection:_____
Pipe Diameter:_____ Maximum Proposed Joint Deflection:_____
Pipe Diameter:_____ Maximum Proposed Joint Deflection:_____
Pipe Diameter:_____ Maximum Proposed Joint Deflection:_____

T48) Indicate manufacturer's maximum recommended joint deflection for pipe to be used and/or indicate maximum joint deflection recommended by the appropriate national reference standard (ASTM, AWWA, ANSI etc…) for pipe to be used:

a) Manufacturer's maximum recommended joint deflection (degrees):

Pipe Diameter:_____ Deflection:_____ Pipe Diameter:_____ Joint Deflection:_____
Pipe Diameter:_____ Deflection:_____ Pipe Diameter:_____ Joint Deflection:_____
Pipe Diameter:_____ Deflection:_____ Pipe Diameter:_____ Joint Deflection:_____

b) National Reference Standard maximum recommended joint deflection (degrees):

Pipe Diameter:_____ Deflection:_____ Pipe Diameter:_____ Joint Deflection:_____
Pipe Diameter:_____ Deflection:_____ Pipe Diameter:_____ Joint Deflection:_____
Pipe Diameter:_____ Deflection:_____ Pipe Diameter:_____ Joint Deflection:_____

T49) The maximum allowable joint deflection allowed by the TCEQ's horizontal curvature policy is equal to the lesser of 5 degrees, **or** 80% of T48(a) **or** 80% of T48(b). Indicate the maximum allowable joint deflection for each pipe diameter:

Pipe Diameter:_____ Max. Allowable Joint Deflection:_____ Max. Joint Deflection for Project:_____
Pipe Diameter:_____Max. Allowable Joint Deflection:_____Max. Joint Deflection for Project:_____
Pipe Diameter:_____Max. Allowable Joint Deflection:_____Max. Joint Deflection for Project:_____
Pipe Diameter:_____Max. Allowable Joint Deflection:_____Max. Joint Deflection for Project:_____
Pipe Diameter:_____Max. Allowable Joint Deflection:_____Max. Joint Deflection for Project:_____
Pipe Diameter:_____Max. Allowable Joint Deflection:_____Max. Joint Deflection for Project:_____

T50) If the proposed joint deflection, for any individual portion of pipe, as calculated in T46 is greater than the maximum allowable joint deflection as determined in T49 for that same portion of pipe, the proposed curvature will not be approved by TCEQ. Does the proposed horizontal curvature comply with TCEQ policy as outlined in T43 through T49 above?_____

T51) Curved lines constructed using joint deflection must be tested for deflection with a mandrel sized to verify that the design maximum joint deflection is not exceeded. Has this test been specified?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T52) For each size of pipe which will be installed with horizontal curvature, indicate the minimum slope.

Pipe Diameter:_____ Min. Slope:_____ Pipe Diameter:_____ Min. Slope:_____
Pipe Diameter:_____ Min. Slope:_____ Pipe Diameter:_____ Min. Slope:_____
Pipe Diameter:_____ Min. Slope:_____ Pipe Diameter:_____ Min. Slope:_____

T53) All curved sections of gravity line must be installed at a minimum slope at least 3% greater than the corresponding minimum slope for straight lines. Do the slopes in T52 comply with this requirement?
_____

T54) Maximum allowable manhole spacing for sections of pipe with horizontal curvature is 300 feet. Has this requirement been met in the design? _____

T55) Manholes should be provided at PC and PT of horizontal curves. Does the design include such provisions? _____

T56) Trench excavation must match the radius of curvature of the installed pipe, with the pipe laid in the center of the trench. Has this requirement been incorporated into the design and detailed in the specifications? _____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

Reduction of Inflow: 30 TAC 317.2(a)(8)

T57) TCEQ rules do not allow combined sewers. Has the project been designed to preclude or eliminate any connections of storm drains, roof drains, etc… to the sanitary sewer? _____

T58) If storm drainage facilities are proposed for construction in conjunction with this project, were these designed to prevent storm water from entering the sanitary sewer? _____

T59) Please indicate the design storm return period for the storm sewer, if applicable: _____

Rigid Pipe Design

General Requirements: 30 TAC 317.2(a)(2)(B)

T60) If the project does not specify an option to use rigid pipe, skip to T61. If the project specifies an option to use rigid pipe, please provide an engineering analysis which shows that the rigid pipe design will be adequate to withstand the applied loads expected from the proposed installation. Consideration should be given to trench width, depth of cover, effect of water table elevation on the rigid pipe, etc. Please indicate the maximum burial depth or applied load for each diameter and type of pipe material and the corresponding minimum strength properties or allowable depth of installation as specified in the appropriate national reference standard, or as specified by the pipe manufacturer.

Flexible Pipe Design

T61) If the project specifies an option to use flexible pipe materials, complete T62 through T87. If the project does not specify an option to use flexible pipe materials, skip to T89.

Live Load Analysis: 30 TAC 317.2(a)(2)(A)

T62) For the purposes of this application, the minimum depth of burial for gravity sanitary sewer pipe, from the ground surface to the crown of the pipe (H) is 2 feet. Does the submitted design comply with this minimum H?_____

T63) If all pipe proposed for this project will be installed at a burial depth of greater than or equal to 3.0 feet and the pipe will not be subjected to live loads greater than 18 kip axle, assume that the pressure due to live load (L_l) = 0 and skip to T68. If a value of H greater than or equal to 2 feet and less than 3 feet is proposed for any portions of the gravity sanitary sewer pipeline or if the pipe will be subjected to live loads greater than 18 kip axle, calculations which quantify what the L_l on the pipe will be must be provided:

T64) Indicate minimum H: _____

T65) Indicate maximum anticipated L_l as determined in T63: _____

T66) Are all proposed flexible pipe materials capable of supporting this L_l?_____

T67) Indicate source of maximum L_l:_____

Buckling Analysis: 30 TAC 317.2(a)(2)(A)

T68) Calculate allowable and predicted buckling pressure. Predicted and allowable buckling pressures must be calculated for each size of pipe and type of flexible pipe material. For the purposes of this application form, the buckling analysis must be performed using the method outlined below. The method of calculating allowable buckling pressure provided below is only valid for lines which are installed at depths of 2 ft $\leq$ H $\leq$ 80 feet.

a) Calculate allowable bucking pressure as follows:

$$q_a = 0.4 * \sqrt[2]{32 * R_w * B' * E_b * (E * I / D^3)}$$ **Equation (1)**

$$R_w = 1 - 0.33 * (h_w / h)$$ **Equation (2)**

Use the back of this page and attachments if needed for long narrative answers or engineering calculations.

$$B' = \frac{1}{1 + 4 * e^{-0.065H}}$$ **Equation (3)**

$$I = (t^3/12) * (inches^4/Linch)$$ **Equation (4)**

q_a = allowable buckling pressure, pounds per square inch (psi)

h = height of soil surface above top of pipe in inches (in)

h_w = height of water surface above top of pipe in inches (in) (groundwater elevation)

R_w = Water buoyancy factor. If $h_w = 0$, $R_w = 1$. If $0 \leq h_w \leq h$ (groundwater elevation is between the top of the pipe and the ground surface), calculate R_w with Equation 2

H = Depth of burial in feet (ft) from ground surface to crown of pipe.

B' = Empirical coefficient of elastic support

E_b = modulus of soil reaction for the bedding material (psi)

E = modulus of elasticity of the pipe material (psi)

I = moment of inertia of the pipe wall cross section per linear inch of pipe, $inch^4$/lineal inch = $inch^3$. For solid wall pipe, I can be calculated with equation 4. If the pipe used is not solid wall pipe (for example a pipe with a ribbed cross section), the proper moment of inertia formula must be obtained from the manufacturer.

t = pipe structural wall thickness (in)

D = mean pipe diameter (in)

b) Calculate pressure applied to pipe under installed conditions:

$$q_p = \gamma_w * h_w * R_w * (W_c/D) * L_f$$ **Equation (5)**

$$W_c = \gamma_s * H * (D + t)/144$$ **Equation (6)**

q_p = pressure applied to pipe under installed conditions (psi)

γ_w = 0.0361 pounds per cubic inch (pci), specific weight of water

γ_s = specific weight of soil in pounds per cubic foot (pcf)

W_c = vertical soil load on the pipe per unit length in pounds per linear inch (lb/in)

L_l = Live load as determined in T63

T69) Report q_a and q_p for each pipe diameter proposed and for each type of pipe material proposed:

Pipe Diameter:_____	Pipe Material:_____	q_a:_____	q_p:_____
Pipe Diameter:_____	Pipe Material:_____	q_a:_____	q_p:_____
Pipe Diameter:_____	Pipe Material:_____	q_a:_____	q_p:_____
Pipe Diameter:_____	Pipe Material:_____	q_a:_____	q_p:_____
Pipe Diameter:_____	Pipe Material:_____	q_a:_____	q_p:_____
Pipe Diameter:_____	Pipe Material:_____	q_a:_____	q_p_____

T70) If $q_a \geq q_p$, specified pipe is acceptable for the proposed installation. If $q_a \leq q_p$, the wall thickness of the pipe must be increased and/or a pipe with a larger modulus of elasticity (E) must be used. Make the appropriate modifications and repeat the buckling analysis, showing that for the upgraded pipe, $q_a \geq q_p$. Does all the pipe proposed for this project meet these requirements?_____

Wall Crushing: 30 TAC 317.2(a)(2)(A)

T71) If no concrete encased flexible pipe is proposed for the submitted project, skip to T73. If any flexible pipe will be installed in rigid encasement (e.g. concrete), calculate the maximum depth that the pipe can be buried before wall crushing (or failure by ring compression) will occur using the method outlined below. It should be noted that cement stabilized sand or soil is not considered a rigid encasement for purposes of TCEQ review:

$$H=(24*P_c*A)/(\gamma_s*D_o)$$ **Equation (7)**

D_o = outside pipe diameter, in.

P_c = compressive stress or hydrostatic design basis (HDB). For typical PVC pipe assume 4,000 psi. For any other pipe material the HDB must be supplied by the pipe manufacturer.

A = surface area of the pipe wall, $in.^2/ft$

γ_s = specific weight of soil in pounds per cubic foot (pcf)

H = Depth of burial in feet (ft) from ground surface to crown of pipe.

24 = conversions and coefficients

T72) Will all pipe installations proposed for this project have an H less than or equal to the maximum allowable H calculated in T71 and greater than or equal to 2 feet?_____ Report maximum allowable H, (H_a), and the maximum H which is proposed, (H_p), for each proposed pipe diameter and each type of flexible pipe material.

Pipe Diameter:_____ Pipe Material:_____ H_a:_____ H_p:_____
Pipe Diameter:_____ Pipe Material:_____ H_a:_____ H_p:_____
Pipe Diameter:_____ Pipe Material:_____ H_a:_____ H_p:_____
Pipe Diameter:_____ Pipe Material:_____ H_a:_____ H_p:_____
Pipe Diameter:_____ Pipe Material:_____ H_a:_____ H_p:_____
Pipe Diameter:_____ Pipe Material:_____ H_a:_____ H_p:_____

Installation Temperature Effects: 30 TAC 317.2(a)(2)(A)

T73) If flexible pipe will be installed under favorable ambient temperature conditions, skip to T74. If flexible pipe will be installed under very high or low ambient temperature conditions, please indicate provisions

for handling which will protect the pipe and ensure an adequate installation:

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

Tensile Strength: 30 TAC Sections 317.2.(a)(2)(A), 317.2.(a)(5)

T74) The project specifications need to indicate minimum allowable tensile **strength** in psi for each flexible pipe material. If PVC pipe is proposed, specify cell class:

Pipe Material:_____ Tensile Strength:_____ Cell Class (PVC only):_____
Pipe Material:_____ Tensile Strength:_____ Cell Class (PVC only):_____
Pipe Material:_____ Tensile Strength:_____ Cell Class (PVC only):_____
Pipe Material:_____ Tensile Strength:_____ Cell Class (PVC only):_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

Strain: TAC 30 Section 317.2.(a)(2)(A)

T75) Are the conditions of this installation such that strain-related failure will not be a problem?_____ If any proposed flexible pipe material is considered to be susceptible to strain-related failure at less than 5% long-term deflection provide analysis for predicted strain due to hoop stress and bending strain. If strain-related failure will not be a problem for the pipe installation proposed in this project, skip to T76.:

Deflection Analysis: 30 TAC 317.2(a)(2)(A)

T76) Indicate E_b (modulus of soil reaction for the bedding material) in psi. If E_b is greater than 750 psi, justification must be provided.: _____

How was E_b determined or estimated?

T77) Indicate E'_n (modulus of soil reaction for the in-situ soil) in psi: _____

How was E'_n determined or estimated?

T78) Based on T76 and T77, above, calculate the ratio of bedding modulus to soil modulus:

E_b/E'_n = _____.

If this ratio is greater than 1.25, a zeta factor must be calculated by completing T79 and T80, where zeta is a factor which corrects for the effect of in-situ soil on pipe stability. If the ratio of bedding modulus to soil modulus is less than or equal to 1.25, assume zeta = 1.0 and skip to T80.

T79) Where native soil is significantly weaker than bedding material, or where predicted deflection approaches 5%, the effect of native soil must be quantified using Leonhardt's Zeta factor. Zeta must be determined for each diameter of pipe and corresponding trench width. Zeta may be estimated graphically or calculated directly. If zeta is estimated graphically, identify the source for tables, figures, etc…(including page numbers and table numbers or figure numbers for each source) which were used to estimate zeta. To calculate zeta directly use the formulas in T79(b), below. The calculations which are done to determine the zeta factors for the different pipe diameters must be included with this submittal.

(a) Sources:

(b) Calculations:

$$zeta = \frac{1.44}{f + (1.44 - f) * (E_b / E_n')} \qquad \textbf{Equation (8)}$$

$$f = \frac{b/d_a - 1}{1.154 + 0.444 * (b/d_a - 1)} \qquad \textbf{Equation (9)}$$

f = pipe/trench width coefficient

b = trench width

d_a = pipe diameter

E_b = modulus of soil reaction for the bedding material (psi)

E'_n = modulus of soil reaction for the in-situ soil (psi)

T80) For each size of pipe, report zeta factor determined in T78 or T79:

Pipe Diameter: _____	Trench Width: _____	Zeta: _____
Pipe Diameter: _____	Trench Width: _____	Zeta: _____
Pipe Diameter: _____	Trench Width: _____	Zeta: _____
Pipe Diameter: _____	Trench Width: _____	Zeta: _____
Pipe Diameter: _____	Trench Width: _____	Zeta: _____
Pipe Diameter: _____	Trench Width: _____	Zeta: _____

T81) Determine pipe stiffness (P_s) in psi. P_s can be determined either by parallel plate test at 5% deflection, based on manufacturer's data or national reference standards; or, calculated using either equation 10 or equation 11. As an example, the minimum pipe stiffness at 5% deflection for PVC pipe less than 15 inches in diameter meeting ASTM D 3034, is 46 psi for SDR-35 and 115 psi for SDR 26. If equation 11 is used, the ring stiffness constant (RSC) is provided by the pipe manufacturer. Show calculations, or provide proper references, for each size of pipe and for each flexible pipe material.

$$P_s = \frac{EI}{0.149 * r^3}$$ **Equation (10)**

or

$$P_s = 0.80 * RSC * (8.337/D)$$ **Equation (11)**

Use the back of this page and attachments if needed for long narrative answers or engineering calculations.

E = modulus of elasticity of the pipe material (psi)

I = moment of inertia of the pipe wall cross section per linear inch of pipe, $inch^4$/lineal inch = $inch^3$. For solid wall pipe, I can be calculated with equation 4. If the pipe used is not solid wall pipe (for example a pipe with a ribbed cross section), the proper moment of inertia formula must be obtained from the manufacturer.

D = mean pipe diameter (in)

r = mean radius (in)

T82) Report P_s for each pipe size and each type of flexible pipe material as determined in T81.

Pipe Diameter:_____ Pipe Material:_____ P_s:_____
Pipe Diameter:_____ Pipe Material:_____ P_s:_____
Pipe Diameter:_____ Pipe Material:_____ P_s:_____
Pipe Diameter:_____ Pipe Material:_____ P_s:_____
Pipe Diameter:_____ Pipe Material:_____ P_s:_____
Pipe Diameter:_____ Pipe Material:_____ P_s:_____

T83) Because the terms in the denominator of the modified Iowa formula (Equation 13) are added, it is theoretically possible to have zero pipe stiffness ($P_s = 0$) and still predict flexible pipe deflections less than 5%. In order to ensure that the stiffness being provided to the installation has a reasonable contribution from pipe stiffness, and does not rely solely on the stiffness provided by the soil stiffness factor (SSF), the ratio of P_s/SSF must be calculated. If P_s/SSF < 0.15, T81 and T82 must be repeated such that a higher stiffness pipe is chosen for each portion of the project where P_s/SSF < 0.15. The P_s/SSF ratio(s) must then be recalculated for the new higher stiffness pipe. This process must be repeated until P_s/SSF ≥ 0.15 exists for all proposed pipe sizes and for all types of flexible pipe materials.

$$\frac{P_s}{SSF} = \frac{P_s}{0.061 * zeta * E_b} \geq 0.15 \qquad \textbf{Equation (12)}$$

P_s = Pipe stiffness (psi) [from T82]

E_b = modulus of soil reaction for the bedding material (psi) [from T76]

zeta = 1.0, or a value calculated with the method in T79

SSF = soil stiffness factor ($0.061*zeta*E_b$)

T84) Indicate the final values calculated for P_s/SSF for each diameter of pipe and for each pipe material:

Pipe Diameter:_____	Pipe Material:_____	P_s/SSF:_____
Pipe Diameter:_____	Pipe Material:_____	P_s/SSF:_____
Pipe Diameter:_____	Pipe Material:_____	P_s/SSF:_____
Pipe Diameter:_____	Pipe Material:_____	P_s/SSF:_____
Pipe Diameter:_____	Pipe Material:_____	P_s/SSF:_____
Pipe Diameter:_____	Pipe Material:_____	P_s/SSF:_____

T85) Do all proposed pipe sizes and flexible pipe materials have a pipe stiffness to soil stiffness factor ratio of greater than or equal to 0.15?_____

T86) Calculate and report predicted deflection. Predicted deflection must be calculated for each size of pipe and type of flexible pipe material. For the purposes of this application form, predicted deflection must be calculated using the method outlined below. Show calculations and report calculated maximum deflection for each size of pipe and type of flexible pipe material. Maximum allowable deflection in installed lines is 5%, as determined by the deflection analysis and verified by a mandrel test conforming to T89. Some conservatism should be employed in determining allowable predicted deflections. This conservatism is necessary to allow for variability in the quality of installation.

$$\Delta Y/D(\%) = \frac{K*(L_p+L_l)*100}{(0.149*P_s)+(0.061*zeta*E_b)}$$ **Equation (13)**

$$L_p = \frac{\gamma_s*H}{144}$$ **Equation (14)**

%ΔY/D = Predicted % vertical deflection under load.

ΔY = Change in vertical pipe diameter under load

D = Undeflected mean pipe diameter (in)

K = Bedding angle constant. Assumed to be 0.110 unless otherwise justified.

γ_s = Unit weight of soil (pcf). γ_s less than 120 pcf must be justified.

H = Depth of burial (ft) from ground surface to crown of pipe.

L_p = Prism load (psi). If prism load is calculated using Marston's load formula, or other formulas less conservative than the one provided above, the load should be multiplied by a deflection lag factor D_L = 1.5 to account for long-term deflection of the pipe as the bedding consolidates.

(P_s from T82; *zeta* from T80; and E_b from T76)

★ If the predicted %ΔY/D for any proposed pipe size or material is over 5%, the proposed flexible pipe design cannot be approved by the TCEQ. Appropriate design modifications must be made and the analysis must be repeated until a deflection of less than or equal to 5% is predicted.

★ If a zeta value of 1.0 was assumed as a result of T78, and the predicted deflection for any size or type of pipe is determined to be between 4% and 5%, the deflection analysis must be repeated. Repeat the deflection analysis by performing all the same calculations. The difference will be that instead of using an assumed zeta factor of 1.0, the zeta factor must be calculated as outlined in T79. If the predicted deflection is determined to be above 5% after the deflection analysis is repeated, this flexible pipe design cannot be approved by the TCEQ. Appropriate design modifications must be made and the analysis must be repeated until a deflection of less than or equal to 5% is predicted.

★ If the predicted deflection, for a particular pipe, using the deflection analysis method detailed above, is less than or equal to 4%, and a zeta factor of 1.0 was assumed as a result of T78, that particular pipe is assumed to comply with the TCEQ's requirements for deflection analysis and can therefore be approved.

★ If the predicted deflection, for a particular pipe, using the deflection analysis method detailed above, is between 4% and 5%, and the zeta factor which was used in the analysis was determined using the method in T79, that particular pipe is assumed to comply with the TCEQ's requirements for deflection analysis and can therefore be approved.

T87) Report the final pipe diameters, types of pipe material proposed for each diameter, type of pipe material, pipe stiffness for each pipe material (P_s), zeta factors assumed or calculated for each pipe diameter, modulus of the pipe bedding material (E_b) and % deflection predicted for each pipe size and type of pipe material.

	Type of Pipe Material	**P_s (psi) [T82]**	**Zeta Factor Assumed or Calculated [T80]**	**E_b (psi) [T76]**	**% Deflection [T86]**
Pipe Diameter 1					
Pipe Diameter 2					
Pipe Diameter 3					

Pipe Diameter 4					
Pipe Diameter 5					
Pipe Diameter 6					

T88) Do all pipes proposed for this project have a maximum predicted deflection of 5.0%?_____

Miscellaneous Requirements

Testing, Inspection, and Certification: 30 TAC Sections 317.2.(a)(1), 317.2.(a)(4)(A)&(B), 317.2(a)(4)(C), 317.2.(c)(5)(H)

T89) All gravity lines utilizing flexible pipe must be tested for deflection by pulling a rigid mandrel through the installed pipe. The test must be conducted at least 30 days after placement and compaction of final backfill. No pipe shall exceed a deflection of 5%. A rigid mandrel shall be used to measure deflection. The test must be performed without mechanical pulling devices. The mandrel's minimum outside diameter is 95% of the pipe inside diameter. The mandrel must have an odd number of runners, totaling nine or more. The barrel section of the mandrel must have a length at least 75% of the pipe inside diameter. A TV test cannot substitute for the deflection test. Will these requirements be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T90) A professional engineer registered in the State of Texas must certify that the entire installation passed the required deflection test. This certification may be made in conjunction with the notice of completion required in section 317.1.(e)(1). Will these requirements be met?_____

T91) A leakage test is required for all gravity lines. For line that is not horizontally curved, a hydrostatic test and/or a low pressure air test must be performed on all proposed gravity sanitary sewer collection piping. These tests must comply with Section 317.2(a)(4) of the TCEQ's rules. All sections of horizontally curved line must be subjected to a hydrostatic leakage test conforming to the requirements of Section 317.2.(a)(4)(A) of the Design Criteria, with a maximum allowable leakage of 10 gallons/inch diameter/mile/day. Do all leakage tests proposed for this project comply with these leakage test requirements of 317.2(a)(4)?_____ Which leakage test will be used?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T92) Manholes must be tested for leakage. If manholes will be tested with a hydrostatic test, answer T93, then skip to T102. If manholes will be tested with a vacuum test, answer T94 through T101 and continue with T102. If project specifications allow either a hydrostatic test and/or a vacuum test, answer T93 through T101 and continue with T102. How will manholes be tested?_____

T93) Does the hydrostatic manhole test proposed for the manholes in this project comply with the test requirements detailed in Section 317.2(c)(5)(H) of the TCEQ's rules?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T94) Each manhole shall be tested immediately after assembly and prior to backfilling. Manholes which have been backfilled shall either be excavated to expose the entire exterior prior to vacuum testing or the manhole shall be tested for leakage by means of a hydrostatic test. Will this requirement be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T95) All lift holes and exterior joints shall be plugged with an approved non-shrink grout. Will this requirement be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T96) No grout shall be placed in horizontal joints before testing. Will this requirement be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T97) All pipes entering the manhole shall be plugged, taking care to securely brace the plugs from being drawn into the manhole. Will this requirement be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T98) Stubouts, manhole boots and pipe plugs shall be secured to prevent movement while the vacuum is drawn. Will this requirement be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T99) A minimum 60-inch/lb torque wrench shall be used to tighten the external clamps that secure the test cover to the top of the manhole. Will this requirement be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T100) The test head shall be placed at the inside of the top of the cone section and the seal inflated in accordance with the manufacturer's recommendation. Will this requirement be met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T101) A vacuum of 10 inches of mercury shall be drawn and the vacuum pump shut off. With the valves closed, the time shall be measured for the vacuum to drop to 9 inches of mercury. The manhole shall pass if the time is greater than 2 minutes. If the manhole fails the initial test, necessary repairs shall be made with a non-shrink grout while the vacuum is still being drawn. If the manhole fails a second time, repairs should again be made and the manhole shall be tested by means of a hydrostatic test which complies with Section 317.2(c)(5)(H) of the TCEQ's rules. If any manhole fails the hydrostatic test, after failing the vacuum test twice, the contractor should consider replacing that manhole. If the contractor chooses to attempt to repair that manhole, the manhole must be retested by means of the hydrostatic test outlined in Section 317.2(c)(5)(H) of the TCEQ's rules, until it passes. Will these requirements be satisfied?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T102) Inspection must be provided during critical phases of construction by a qualified inspector under the direction of a P.E. Critical phases of construction are deemed at a minimum to include testing of pipe and manholes for leakage, and testing of flexible pipe for installed deflection. Do the project plans or specifications define the scope of inspection, and indicate who (owner, design engineer, project manager, etc…) will assume this responsibility?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T103) TCEQ approval letters for plans and specifications review contain the requirement that once the project is completed, a P.E. registered in the state of Texas must certify that the construction was performed substantially in accordance with the approved plans and specifications. If flexible pipe was installed, a P.E. must also certify that all pipe was subjected to and passed the required deflection test. Will these requirements be met?_____

T104) Indicate who (owner, design engineer, project manager, etc…) will certify the installation:

Name:_____ Project Relation:_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

Occupational Safety, Public Health, and Environmental Protection: TAC 30 317.2.(a)(7), 317.13, 317.2.(a)(8) 317.2.(c)(5)(D), 317.2(c)(5)(E), 317.2(c)(F)

T105) The project plans and specifications must ensure that the pipe installation will adhere to the minimum separation distances allowed by 317.13, Appendix E of the TCEQ's rules. Additionally, the project plans or specifications should include language (preferably an exact reproduction of the separation distance wording detailed in Section 317.13 (Appendix E) of the Design Criteria) which ensures that the separation distance between any unknown water lines which are discovered during the installation phase of the project, and, the gravity sanitary sewer pipe which will be installed, will be sufficient to comply with the minimum separation distances allowed by 317.13, Appendix E, of the TCEQ's rules. Will the requirements of 317.13, Appendix E, been met?_____

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T106) Briefly describe provisions to control erosion or sedimentation due to runoff during construction of the project. Additional information may be required by the TCEQ on a case by case basis:

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T107) If the project site does not contain any water wells, springs, surface water sources of potable water, or potable water storage facilities, skip to T108. If the project site does contain any water wells, springs,

surface water sources of potable water, or potable water storage facilities, does the design conform to and include any applicable sections of 30 TAC Chapter 290, Rules and Regulations for Public Water Systems?_____

T108) If an air gap is required for the project, is the project designed with a minimum 18 inch air gap between the elevation of all potable water outlets and the maximum water surface elevation of any nearby sewer appurtenances? _____ If no air gap is required for this project, skip to T109.

Occupational Safety: 30 TAC Sections

T109) Are all manhole base sections at least 48 inches in diameter? _____

T110) Are all manhole covers at least 24 inches nominal diameter? _____

T111) For purposes of this application, **the use of manhole steps to access manholes for maintenance purposes will not be approved by the TCEQ!** Please indicate how manholes will be accessed if a manhole is in need of maintenance.

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T112) Personal gas detectors are required for wear by all personnel whose jobs require entering enclosed spaces (such as manholes and lift stations) capable of having accumulations of hydrogen sulfide or other harmful gases. Please indicate who is responsible for ensuring that these detectors are provided to the appropriate personnel.

Location in submittal: Plan sheet _____ Specifications page _____ Item No. _____

T113) If you answered no to any of the items in this application you may need to obtain a variance from those items in accordance with Section 317.1(f) of the TCEQ's rules. Section 317.1(f) of the TCEQ's rules states, "Variance. A variance from the design criteria herein may be granted by the commission if the variance would not result in an unreasonable risk to treatment plant performance, public health or the waters in the state. Requests for variances must be submitted in writing by the design engineer and must, for each affected item, include a detailed engineering justification." List each item to which you answered no below. For each item which had a no answer, provide an engineering justification which addresses the requirements of 317.1(f). The TCEQ review engineer will determine whether or not a variance is needed. If a variance is needed, the TCEQ review engineer will determine whether or not sufficient engineering justification to comply with 317.1(f) has been provided to warrant granting a variance.

In order for this document to be valid, the professional engineer responsible for the completion of this application form must certify that all the information provided in this application and in the accompanying set of plans and specifications show full compliance with the requirements of Chapter 317 of the TCEQ's rules, unless a variance from Chapter 317 is being requested, and the professional engineer responsible for this application form provides the needed justification for the

variance. Additionally, the professional engineer responsible for completing this application must certify that all portions of the application, which were relevant to the project, were filled out as completely as possible, and that all supporting calculations and engineering analyses requested in this application were performed. These calculations shall show that the proposed design complies with Chapter 317. By affixing a Texas registered professional engineer's seal to this document, below, that professional engineer certifies the compliance requirements described in this item (item T113) have been met.

Signature, Seal and Date of the Texas Professional Engineer who is certifying that item T113 has been complied with:
