KNOXVILLE UTILITIES BOARD

DESIGN GUIDE FOR AS-BUILT APPROVAL FOR WASTEWATER GRAVITY SYSTEMS

2nd EDITION
October 2008

Knoxville Utilities Board

Introduction to Design Guide for Wastewater As-builts

The purpose of this document is to assist developers and design firms with successfully completing wastewater as-built for proposed developments. This guide offers a standard set of templates that are proposed for wastewater system designs and outlines the minimum submittal information considered to be required by KUB for new systems such as subdivisions, extensions, upgrades, etc. The purpose of this guide is to improve the efficiency of reviews by reducing the number of re-submittals by the developer's design firm.

As a general rule, the first submittal should include only two paper copies of the as-built to KUB. One copy will be marked and kept by KUB, and the second will be returned to the designer with comments for revisions. Once the plans are ready for approval, KUB will notify the developer in a letter accepting the system.

Documents contained in the Sections

Several items located in this package can help assist designers in document submittal requirements when preparing proposed wastewater as-builts. This guide is divided into several sections. The sections include parts A through E, focusing on required checklists that are used to approve general wastewater as-built projects, Sections F though I focusing on required checklists that are used to approve wastewater as-built submittals, and the latter sections give various wastewater design examples that relate to the previous checklist requirements mentioned.

<u>Proposed As-built Approval for Wastewater Gravity Drawing Requirements (Sections A-H)</u>
There are sets of wastewater as-built checklists that are used to review the plans in order to improve the efficiency of the review process. It is important that the designer view the checklist items before project submittal to KUB. If an item on the checklist is not identified in the project submittals, the plans will not be approved and will have to be corrected. Note that Sections A-H should be used for gravity wastewater sewer designs. The "Required Documents for Wastewater Submittals" page outlines all the required checklist items relevant to the type of design.

<u>Additional Resources for Construction Approval of Wastewater Gravity Systems</u>
KUB has provided numerous hyperlinks through our webpage to further assist is receiving approved plans. These additional resources include example as-builts, electronic KUB Border, electronic version of required construction notes, etc. Contact Engineering New Service for additional details of accessing this information.

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CHART A-1: Review Process -General Wastewater

Comment Number	First Date: _____	Second Date: _____	Review Criteria
1			If submitted design plans are of a project with multiple phases, all prior phases and their respective easements and final subdivision plans must already be approved, accepted, and recorded if this phase will connect to an earlier phase.
2			Design plans are 24" x 36" (D Size) drawings
3			Provided KUB border is used.
4			Title Block at the bottom of each sheet must include:
5			- Project name (Public or Private)
6			- Engineer's company, address and phone number
7			- Engineer's stamp (signed and dated)
8			- Developer's name, address, and phone number
9			North Arrow on all sheets
10			Vicinity Map (Upper right-hand corner)
11			Property units for the whole project are summarized in table format.
12			Print out LandViewer drawing showing all utilities (i.e., water, sewer, gas, electric, storm, etc.). Date and initial in the printout and include in the project file.

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CHART B-1: Review Process -General Wastewater (Plan View)

Comment Number	First Date:	Second Date:	Review Criteria
13			Plan & profile can be any scale used from a standard engineering scale, such as 1"=5' (profile), 1"=20', 1"=50', 1"=100', etc.
14			All existing public utilities and associated easements are shown where appropriate (i.e. water, sewer, gas, electric, storm, etc.)
15			Bold all proposed wastewater utilities and features and reduce line weight for other utilities in order to clarify the project's items of interest.
16			Represent existing wastewater mains by dashed lines. (Refer to provided drawing legend.)
17			Represent proposed wastewater mains by solid continuous lines (Refer to provided drawing legend.)
18			Station 0+00 is located at the downstream end of the wastewater main and is on the left side of each drawing sheet.
19			Location where project/phase completion will occur is clearly shown (i.e. E.O.L..)
20			Clearly label line designations throughout proposed project
21			Clearly indicate the location and station number of all important appurtenances. Manholes (existing and proposed) are described by the line stationing (i.e., MH STATION 0+50) and the KUB MH number for existing manholes.
22			Clearly label each proposed pipe's material and size. Include pipe length on profile view.
23			Minimum pipe size shall be 8 inch diameter for gravity wastewater mains
24			Clearly indicate locations of storm water mains, catch basins and detention ponds (existing and proposed).
25			All stormwater mains not running parallel to sewer mains are shown in profile view.

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CHART B-2: Review Process -General Wastewater (Profile View)

Comment Number	First Date: _____	Second Date: _____	Review Criteria
26			Plan & profile can be any scale used from a standard engineering scale, such as 1"=5' (profile), 1"=20', 1"=50', 1"=100', etc.
27			All existing public utilities and associated easements are shown where appropriate (i.e. water, sewer, gas, electric, storm, etc.)
28			Bold all proposed wastewater utilities and features and reduce line weight for other utilities in order to clarify the project's items of interest.
29			Represent existing wastewater mains by dashed lines. (Refer to provided drawing legend.)
30			Represent proposed wastewater mains by solid continuous lines (Refer to provided drawing legend.)
31			Station 0+00 is located at the downstream end of the wastewater main and is on the left side of each drawing sheet.
32			Location where project/phase completion will occur is clearly shown (i.e. E.O.L..)
33			Clearly label line designations throughout proposed project
34			Clearly indicate the location and station number of all important appurtenances. Manholes (existing and proposed) are described by the line stationing (i.e., MH STATION 0+50) and the KUB MH number for existing manholes.
35			Clearly label each proposed pipe's material and size. Include pipe length on profile view.
36			Minimum pipe size shall be 8 inch diameter for gravity wastewater mains
37			Clearly indicate locations of storm water mains, catch basins and detention ponds (existing and proposed).
38			All stormwater mains not running parallel to sewer mains are shown in profile view.

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CHART C-1: Review Process - Site Plan View

Comment Number	First Date: _____	Second Date: _____	Review Criteria
Plan View General:			
39			Rights-of-way (ROW), edges of pavement, driveways and property lines are shown and labeled.
40			Existing and proposed streets and street names are shown (actual street names used) if known.
41			Future development in adjacent parcels is addressed in the design by either providing easements for future extensions or extending utilities to allow immediate access for future phases.
42			Show all building footprints and other proposed structures such as pool, garage, clubhouse, etc., on drawing plan that impact the design.
Main & Lateral Locations:			
Comment Number	**First** Date: _____	**Second** Date: _____	**DO INSTALL**
43			Street right-of-ways
44			Easements
			DO NOT INSTALL
45			Paved areas
46			Berms or any crossing detention basins
47			Wastewater mains shall not be installed in the same trench with other utilities unless approved by KUB Engineering in writing prior to the preparation of design plans
Horizontal Separation:			
48			Horizontal separation between water and wastewater mains is at least 10 feet
49			Minimum horizontal separation shall be greater than or equal to 3 feet between the sanitary sewer and storm water sewer mains measured from the outside of the pipes.
50			When horizontal separations are less than 3 feet, the sanitary sewer pipe material specifications shall be C900 or C905 (SDR 18) PVC Pipe, or Class 150 Ductile Iron Pipe with Protecto 401. Pipe sections between manholes shall be the same material.

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CHART C-2: Review Process - Site Plan View (continued)

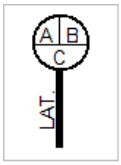
Comment Number	First Date: _____	Second Date: _____	Review Criteria
Manholes:			
51			Clearly indicate the delta angles at each manhole to indicate direction of the up-stream sewer main (Delta angles shall be 90 degrees or less)
52			Clearly indicate stub out elevations and locations for <u>future</u> laterals and wastewater mains at manholes.
Laterals:			
53			Clearly present the proposed locations of all proposed laterals
54			Each customer (lot or unit) shall have its own sewer lateral connection.
55			All typical gravity laterals shall have a minimum diameter of 6 inches PVC (SDR 26). Show cleanout locations.
56			Each customer's (lot or unit) sewer lateral length from the main, depth at the main, and distance from the nearest downstream manhole are shown  WHERE: A = FT length of the lateral from the main to the property line B = FT of depth where the lateral taps into the sewer main C = FT from the nearest downstream manhole

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CHART D-1: Review Process - Profile View

Comment Number	First Date: _____	Second Date: _____	Review Criteria
Vertical Separation:			
57			Vertical separation must be labeled between wastewater mains and all utilities to include water and stormwater lines.
58			Wastewater and water mains have at least 18 inches of vertical separation measured from outside pipe to outside pipe.
59			Minimum vertical separation shall be greater than or equal to 24 inches between the outside of sanitary sewer mains and the outside of storm water sewer mains.
60			When vertical separations are less than 2 feet between wastewater and stormwater, the sewer pipe shall be constructed with Class 150 Ductile Iron Pipe with Protecto 401, and the lower pipe shall be exposed down to the spring and encased in concrete.
Line Slopes:			
61			Minimum slopes based on the size of the main are illustrated in KUB Standards and Specifications section 02532. Strongly recommend slopes greater than minimum required slope.
62			If gravity sewer main exceeds a slope of 10%, Z-lock gaskets are required and labeled.
63			In gravity sewer where the slope of a sewer line is in excess of 20%, the line shall be constructed of mechanical joint ductile iron pipe with concrete anchors and the pipe joint must be completely encased in concrete
64			Slopes over 30% are not permitted.
Wastewater Main Depth:			
65			Minimum depth of cover for gravity wastewater lines in roadways and other traffic-bearing areas is 48 inches for PVC, HDPE, and CCFMP and 30 inches for Ductile Iron. In non-traffic-bearing areas (easements), the minimum cover is 30 inches no matter the pipe material.
66			Investigate options to shallow deep mains.
67			Wastewater carried in PVC pipe shall not have more than 17 feet of **cover**. If over 17 feet, ductile iron piping with Protecto 401 coating should be utilized.

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CHART D-2: Review Process - Profile View (continued)

Comment Number	First Date: _____	Second Date: _____	Review Criteria
Material:			
68			When ductile iron pipe must be used on a portion of a new sewer line segment, the entire length of sewer must be installed with Ductile Iron pipe. No flexible couplings will be permitted on new construction to convert to PVC between manholes.
69			Polyvinyl chloride (PVC) pipes and fittings shall meet or exceed an SDR 26 for pipe from 4 inches to 15 inches in diameter for gravity sewer excluding clean-outs until they are available in SDR 26.
70			HDPE pipes and fittings shall be a minimum of SDR 17 with DIP outside pipe diameters, external green stripe, and heat fusion welded joints for gravity sewer excluding clean-outs until they are available in SDR 26.
Manholes:			
71			Clearly indicate the location of clay water stops (upstream of all manholes) to prevent water from draining through the gravel bedding.
72			Maximum spacing for manholes shall be 400 feet for pipe diameters of 21 inches and smaller and 500 feet spacing for connecting pipes larger than 21 inches
73			Manhole rim / surface elevations with correct numerical stationing is shown
74			All manhole invert (IN and OUT) elevations are clearly shown.
75			Difference in the invert elevations of two sewers intersecting in a manhole is 2 feet or more, a drop manhole is required.
76			Each tap into an existing manhole must be mechanically cored
77			Verify that the appropriate A- or Z-lock gasket is used for the particular pipe material.

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CHART E-1: Review Process - Easements

Comment Number	First Date: _____	Second Date: _____	Review Criteria
78			All required easements and/or subdivision plats shall be submitted, approved, and recorded before the new wastewater system will be accepted.
79			For existing easements, the deed instrument number shall be clearly indicated on the plans. If multiple instrument numbers exist for the development, then each instrument number shall be listed.
80			Easements are indicated on plans for sewer laterals which cross private property to serve another lot.
81			With project easements, a 15-foot wide permanent utility easement exists 7.5 feet on either side of all water & wastewater mains as installed, plus an additional 10 foot utility construction & maintenance easement as required, necessary to install and maintain mains.
82			If a joint permanent easement (JPE) with utilities is used rather than public Right of Way then the JPE must include "with utilities" to remove the requirement for a utility easement.

CHART F-1: Review Process - Road & Water Crossings

Comment Number	First Date: _____	Second Date: _____	Review Criteria
83			Clearly indicate road bores (casing, carrier pipe sizes, and materials) on both the plan and profile view.
84			Ductile iron pipe with concrete encasement at all joints or HDPE is used for wastewater transport beneath waterways that have a continuous flow of water or as described in the approved ARAP permit.

CHART G-1: Review Process - Abandonments & Removals

Comment Number	First Date: _____	Second Date: _____	Review Criteria
85			Abandoned lines are clearly labeled throughout the project.
86			Abandoned sewer pipes 12 inches and larger shall be filled with flowable fill if not completely removed from the ground
87			Abandoned sewer pipes located under existing/new buildings are filled with flowable fill if not removed completely from the ground no matter the size of the pipe.
88			When manholes are abandoned, a note indicates that Part 3.09, Section 02530 of KUB Standards and Specifications have been met for manhole abandonment

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