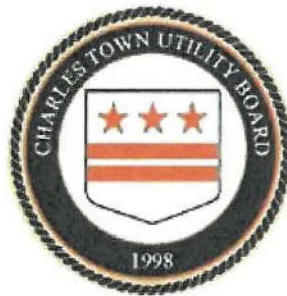


CHARLES TOWN UTILITY BOARD

**SEWER SYSTEM
DESIGN AND CONSTRUCTION STANDARDS MANUAL**

JULY 23, 2025



INTRODUCTION

The mission of the Charles Town Utility Board (CTUB) is to provide reliable water and sewer services that protect health and the environment with financial accountability, regional stewardship, and superior customer service. This Sewer System Design and Construction Standards Manual is intended to provide guidance to the development community as to the acceptable public facilities construction for CTUB. This document is meant to be a user-friendly guide in matters relating to sewer facilities within the CTUB service area and is not all inclusive. Basic policies, standards, and construction requirements of CTUB are set forth herein to aid CTUB employees, contractors and DEVELOPERS, and the general public.

CTUB reserves the right to modify these requirements or add additional requirements/conditions which may be deemed necessary by a particular project.

The goal of the CTUB Sewer System Design and Construction Standards Manual is to set forth a minimum level of quality and to not impose an undue burden on the CTUB's existing or future customers. Should other regulatory agency requirements differ from these specifications, the more stringent shall apply.

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APPLICATION PROCESS/PERMITS/INSPECTION/FEEES

APPLICATION PROCESS

PRELIMINARY APPLICATION REQUEST

The DEVELOPER shall submit a written request to the CTUB describing the project. The description shall include:

1. Owner name, title, address and contact information.
2. Location of project (include City/County Road map with project site indicated).
3. Location of proposed connection to the CTUB sewer system.
4. Number and type of dwelling(s) or facility proposed, including all phases and/or projected future growth.
5. Aerial mapping indicating overall projected growth area.
6. Terms of connection proposed, including lateral type, size and material.
7. Anticipated construction start and completion dates for all phases.
8. Letter of confirmation that DEVELOPER or their consultant has received and reviewed the CTUB DEVELOPER sewer design specifications.

Staff will issue the DEVELOPER a letter of availability, with or without, limitations based on the project location, size, type, etc. Some projects may warrant additional review and/or coordination with the Utility Board of Directors, the WVDEP, WVBPH or others as necessary.

PERMITS

DEVELOPERS requesting connection to the CTUB Infrastructure are responsible for obtaining any and all permits or approvals necessary for the intended project and any costs required for the permits. This includes, but is not limited to, the necessary permits from the West Virginia Department of Public Health (BPH); the West Virginia Department of Highways (WVDOH); West Virginia Department of Environmental Protection (WVDEP); Building Permits, Land Development; federal permits and/or railroads for pipe line crossings and longitudinal occupancies; etc.

Permits submitted to the BPH for approval must be reviewed, approved and signed by an official of CTUB, prior to their submission. The DEVELOPER is responsible for paying any permitting fees.

RIGHTS-OF-WAY AND EASEMENTS

DEVELOPERS requesting connection to the CTUB Infrastructure are responsible for obtaining the rights-of-way and easements that are necessary for the intended project and for the connection to the CTUB's sewer infrastructure, including rights-of-way and easement from private individuals as well as those from public agencies such as the WVDOH and from corporate entities such as railroads, gas, electric, and telecommunication utilities.

The rights-of-way and easements shall be written so as to facilitate transfer of same to the CTUB. Adequate easement area shall be obtained such that CTUB can make necessary repairs, perform maintenance, access, etc. The minimum permanent easement width shall be 20 feet, with proposed utility line being in the center. Where parallel sewer lines exist, the minimum permanent easement width shall be 30 feet.

INSPECTIONS

The DEVELOPER shall conduct all work in accordance with the rules and regulations of those respective agencies. Any and all inspections and/or flagmen costs incurred and deemed necessary by the governing agencies at any and all locations where work under this project is performed shall be borne by the DEVELOPER.

The use of equipment on WVDOH right-of-way and all related construction activities shall comply with the provisions of the WVDOH.

DESIGN REVIEW PROCESS

Once CTUB has approved the project application in principle, the DEVELOPER must submit detailed construction drawings for review. All projects requiring a WV BPH Construction Permit must have the plans signed by a Registered Professional Engineer in the State of West Virginia.

The DEVELOPER will be responsible for the cost of the CTUB in obtaining supplementary Engineering review, if deemed necessary, including any fees associated with Engineering review (both in-house and/or retained Engineer) of the construction drawings for all phases of design and construction.

NOTIFICATION

The CTUB shall notify the DEVELOPER within thirty (30) working days of acceptance of the design or, in writing, of review comments requiring follow-up action.

DEVELOPER'S AGREEMENT

Concurrent with the design review process, CTUB and the DEVELOPER must prepare and execute an Extension (or Project) Agreement. The agreement must satisfy the West Virginia Public Service Commission (PSC) regulations and other legal requirements. CTUB's standard practice is to utilize the Alternate Mainline Extension Agreement Form as the basic instrument to be used for all CTUB - Developer Agreements. The Alternate Mainline Extension Agreement format may be modified accordingly to fit unique projects with approval of CTUB.

- A. The DEVELOPER must bear the expense of the CTUB engineering review. Any project proposing a gravity main, a pump station or a forcemain must have an engineering review.
- B. The DEVELOPER shall bear the expense of any legal costs associated with processing the agreement and preparations of deeds, etc. necessary to transfer ownership of the project to the CTUB.
- C. The DEVELOPER shall provide, in writing or by signed extension agreement, a (2) two-year extended maintenance warranty of the project beginning at date of transfer of ownership of the project to CTUB.

D. The project's sewer infrastructure, once completed and accepted by the CTUB, shall become the property of the CTUB.

E. Inspection

1. CTUB reserves the right to inspect the project on either a full time or interim basis. When CTUB provides inspection, the cost of the inspection will be borne by the DEVELOPER. All work found not to be in compliance with state and/or CTUB rules and regulations shall be amended and paid for fully by DEVELOPER.

2. Due to CTUB's limited manpower, resources and operation schedule, CTUB and DEVELOPER may negotiate the inspection process to an extent acceptable to both parties. All third-party inspection fees shall be borne by the DEVELOPER.

3. Refer to Acceptance Testing Section for all required construction testing required for sewer infrastructure prior to CTUB acceptance.

F. Fees

CTUB's website (www.ctubwv.com) contains applicable PSC approved tariff charges for service fees, Capacity Improvement Fee, application for sewer service, security deposit, etc.

G. Bonds and Insurance

The DEVELOPER shall furnish a Performance bond of an acceptable Surety in the full amount of the final cost of work to be taken over by CTUB. The DEVELOPER and their contractors shall list CTUB as an additional insured pertaining to all applicable certificates of Liability Insurance.

ASSET TRANSFER PROCESS

REQUIRED DOCUMENTATION

At the time of phase build-out, The DEVELOPER shall provide to CTUB the following documentation for asset acceptance of the sanitary sewer system.

- Confirmation of transfer of ownership of sewer infrastructure system to CTUB.
- Construction cost for sanitary sewer system.
- Quantities for sanitary sewer system.
- Electronic PDF copy of As-built plan.
- Electronic GIS shapefile of sanitary sewer system.
- Recorded copy of easement plat conveying sanitary sewer system to CTUB.

- Confirmation that all engineers, materialman, contractors and sub-contractors have been paid for their work of the sanitary sewer system.
- Verification that there are no legal disputes, outstanding liens or known potential liens regarding the sanitary sewer system.

AS-BUILT DRAWINGS

A. The DEVELOPER shall keep one copy of all Contract Documents, including working drawings, at the site, in good order, and annotated to show all changes made during the construction process. These as-built drawings shall be available to CTUB, kept current during the project, and shall be delivered to CTUB upon completion of the project. The as-built drawings shall include the following at a minimum:

- Length, size and type of all sewer line installed, including updated pipe profiles.
- Location of all valves, manholes, vaults and meters with reference ties as needed.
- Location of all sewer lines with reference ties as needed.
- GIS shape files of the entire sewer system shall be provided to CTUB.
- Elevations of sewer manhole rim, invert of line in, and invert of line out.
- Distance from manhole to service lateral connections.
- For new systems, locations of the end of all installed lateral with reference ties as needed to assure ability to relocate.
- Distances between manholes and reference ties to manholes as needed.
- Length of service lateral installed.
- Location of clean-outs with reference ties as needed.
- Location, size, type and length of casing pipe.
- Location, size and type of pipe installed.
- Location, size, type and invert elevation of mainline clean-out with reference ties as needed.
- Pump Stations, Treatment Plants, Basins, etc.
 - All information necessary to describe location, configuration and composition of facility including utilities, equipment, drains, fencing, roadways and other related items.
- Existing Utilities Encountered
 - Location, size and type of utility encountered with reference ties as needed.
 - Note any repairs made to damaged utilities.
 - Location, size and type for any relocated utilities with reference ties as needed.
- NOTE: Location must be established by shown distances, reference ties, or co-ordinates and not by physical placement on a map alone.

OPERATING AND MAINTENANCE MANUAL

- A. Manuals shall include operating and maintenance information on all systems and items of equipment. The data shall consist of catalogs, brochures, bulletins, charts, schedules, working drawings corrected to as-built conditions and assembly drawings and wiring diagrams describing location, operation, maintenance, lubrication, operating weight, lubrication chart showing manufacturer-recommended lubricants for each rotating or reciprocating unit, and other information necessary for the Engineer to establish an effective operating and maintenance program. The following data shall also be included:
1. Title page giving name and location of facility.
 2. Four eight-inch by ten-inch color pictures of the facility, views as directed by CTUB.
 3. Photographs (color) of each piece of equipment in place.
 4. "Name Plate" data of all equipment.
 5. Performance curves for all pumps installed, including VFD curves.
 6. Approved working drawings of each piece of equipment.
 7. Manufacturers' cuts and dimension drawings of each piece of equipment, and details of all replacement parts.
 8. Manufacturers' erection, operation, and lubrication instructions for all equipment and apparatus.
 9. Complete wiring diagrams of all individual pieces of equipment and systems including one line diagram; schematic or elementary diagrams; and interconnection and terminal board identification diagrams.
 10. Complete piping and ductwork layout and interconnecting drawings.
- B. All items noted in paragraph 1 that are of sheet size of 8-1/2 inches by 11 inches shall be bound in loose leaf 3-ring type binders with black plastic-coated or blue canvas covers. Binders shall be Vernon Line Royal Number R-6372 or Number R-372.
- C. Working drawings 24-inches by 36-inches or similar in size shall be folded such that they can be bound into the 3-ring binder, their title block is exposed, and they can be folded out without being removed from the binder. Alternatively, they may be folded as described and placed in clear pockets which are bound in the manual. Drawings descriptive of a single item of equipment shall be grouped together.

- D. The DEVELOPER shall deliver to CTUB CAD files and a pdf of all relative sewer system drawings. A shape file (used for GIS purposes) of all the sewer lines encountered or installed as part of the project shall also be provided. The digital information shall be provided on WV North NAD 83 datum (or latest version).

FINAL APPROVAL

- A. Approval for the utilization of the sanitary sewer system shall not be given until all site work and base asphalt is complete, the sewer line is tested and inspected by CCTV or other means. Final acceptance and approval will not be granted until all testing is performed and acceptance documents have been received.

SANITARY SEWER DESIGN STANDARDS

Applicability:

These Design Standards are intended as a reference for the installation of complete sewage collection systems, including public sewer mains, public sewer laterals and private sewer laterals, pump stations and force mains, which connect into the CTUB Sewage System. Specific types or brands of equipment or material are specified to intended to maintain uniformity within the CTUB's system, minimize maintenance and repair problems, and facilitate operations.

All collection system sewer pump stations and force mains will require the review and approval of CTUB prior to submission for state approval. In cases where a particular project requirement is not defined herein, the CTUB reserves the right to review and define the requirement.

During the construction phase, all project submittals pertaining to the sewer system shall be submitted electronically to CTUB for review and approval prior to ordering materials. CTUB has the right to reject any and all submittals which do not apply with their standards and/or do not meet the expected quality. Any material found which is not in compliance with CTUB standards shall be replaced by DEVELOPER at their costs.

All sanitary sewer systems shall be designed in (at a minimum) accordance with the West Virginia Division of Health "Sewage Treatment and Collection Systems Design Standards" Title 64-Series 47. Failure to specifically mention a particular requirement in this manual does not excuse DEVELOPER from meeting requirement.

Under no circumstances shall stormwater, surface water, ground water, roof runoff, subsurface drainage or untreated industrial process water be discharged into any sanitary sewerage system.

The criteria established herein are minimum requirements for design and review by CTUB. The requirements included herein are critical to ensure that CTUB maintain compliance with the West Virginia Department of Environmental Protection (WVDEP) National Pollutant Discharge Elimination System Permit authorizing the discharge of pollutants, under prescribed conditions, to State waters pursuant to the applicable regulations of the West Virginia Department of Environmental Quality.

Relocation of Public Improvements:

When a development proposes to:

1. Relocate existing public improvements.
2. Encroach upon existing public rights-of-way of easements with physical improvements.
3. Reduce the cover over existing public improvements to less than that specified by this manual.
4. Increase cover over existing public improvements to more than that specified by this manual.

The DEVELOPER shall be responsible for replacement of the public improvements on new location during development of the property. Such replacement shall be to the standards and specifications set forth in this manual, shall be approved by CTUB, and shall be at no cost to CTUB.

SEWER GRAVITY MAINS

- A. Infiltration Allowance - An infiltration allowance of 200 gallons per inch diameter per mile per day may be added to the per capita flows to arrive at the average daily flow (ADF).
- B. Peak Flows - The sewer collection system needs to be designed to carry a peak flow, when flowing full, of:
- Laterals 4 ADF
 - Trunk and Interceptor and Outfall Sewers 2.5 ADF
- C. Minimum Size - No gravity sewer (sewer) shall be less than 8" in diameter. The only exception is when there is no possibility of future expansion, no more than 10 mobile homes or 5 residences can be served by a 6" diameter gravity sewer. 4" diameter pipe will not be allowed for the CTUB's sewer collection system.
- D. Slope - All new sewers shall be so designed and constructed to give velocities, when flowing full, of not less than 2.0 feet per second based on Kutter's and Manning's formula using an "n" value of 0.013. The following table lists the minimum slopes to be provided. Slopes greater than these are desirable.

E.

Sewer Size	Minimum Slope in feet per 100 feet
6"	0.62
8"	0.40
10"	0.28
12"	0.22
14"	0.17
15"	0.15
16"	0.14
18"	0.12
21"	0.10
24"	0.08
27" and larger	0.07

- F. Slopes less than those specified shall be prohibited.
- G. Sewers shall be designed to be free-flowing with the hydraulic grade below the crown and with hydraulic slopes sufficient to provide an average velocity of not less than 2.0 feet per second (fps). Calculations shall indicate that a cleansing velocity of 2.0 fps will be maintained at the designed peak flow condition.
- H. Computations of velocity of flow shall be based on a coefficient of roughness "n" in the Manning formula of 0.013 for ductile iron pipe (DIP) or 0.010 for PVC based on actual material used.
- I. In no case shall terminal lines serving less than 8,000 gpd have a slope of less than 1 percent.
- J. The maximum permissible velocity occurring with average flow shall be 15 feet per second (before applying peak flow factor).
- K. Sewers shall be laid in straight line with uniform slope between manholes. Sewers on 20% slope or greater shall be anchored securely with concrete anchors, or approved equal, spaced as follows: (See Standard Detail No. 6)
 - a. Not over 36 feet center to center on slopes between 20% and 35%
 - b. Not over 24 feet center to center on slopes between 35% and 50%
 - c. Not over 16 feet center to center on slopes greater than 50%
- L. Alignment - Sewers shall be laid with straight alignment between manholes.
- M. Increasing Size - When a sewer joins a larger one, the invert of the larger sewer line should be lowered sufficiently to maintain the same energy gradient.
- N. Bedding - No. 8 limestone shall be used for bedding unless otherwise approved by CTUB. All mains must have a minimum of 6" of stone below and 12" above and on the sides of the pipe. (See Standard Detail No. 1)
- O. All pipe must have a born-on date within one year from pre-construction meeting or start of the project.
- P. All gravity sewer shall have a minimum of 48" of cover.
- Q. Maximum sewer line depth of cover shall be 15 feet, NO EXCEPTIONS unless otherwise approved by CTUB.

In general, the maximum allowable depths to inverts of various types and sizes of pipe are dependent on different types of bedding, earth loading, and live loading. Pipes with less than minimum cover and pipes with cover greater than 15 feet require pipe strength calculations to be submitted with the design. The maximum depth for all types of pipe shall be 15 feet. Under very unusual circumstances and with prior approval of CTUB, the depth of cover may be increased to 22 feet for short runs of ductile iron pipe. Request for a waiver of the 15-foot requirement shall be made in writing and approved by CTUB.

- R. Acceptable gravity sewer pipe types shall be: PVC SDR-35 or SDR-26 and shall conform to ASTM D3034 and ASTM F679. SDR-26 shall be utilized for pipe burial depths equal to or greater than 12 feet. Ductile iron pipe (minimum thickness Class 52) double cement lined may be used for sewers 20' or deeper, under certain circumstances.
- S. The thickness class of ductile iron pipe is minimum and shall be increased as required by individual trench loading considerations.
- T. There shall be no physical connection between a drinking water supply system and a sewer system.
- U. Joints in sewer pipe lines shall be designed to prevent infiltration and to prevent entrance of roots. The joint design shall conform to the appropriate ASTM specifications for the type of pipe and type of joint utilized. Joints for PVC pipes shall be flexible elastomeric seals ASTM D-3212, gaskets ASTM F477. Joints for ductile iron pipe shall be single rubber gasket, AWWA C111.
- V. In general, sewers shall be located within legally established public streets or rights-of-way along the centerline of the street, and shall be equidistant from property lines or curb lines wherever possible.
- In order to reduce the number of manholes in curvilinear streets, manholes must be located within the pavement area but beyond the spread of stormwater gutter flow and a minimum of ten feet from the water lines (outside edge to outside edge).
- W. Horizontal Separation - A minimum of 10 feet separation between sewer lines and water lines must be maintained. The distance shall be measured edge-to-edge. In cases where the 10 feet minimum cannot be maintained, the sewer line shall be 18" lower than the water line and constructed of a pressure type pipe. When the lines are placed within 5 feet of each other, permanent identification tape must be buried directly above the lines denoting "Sewer Line" or "Potable Water Line".
- X. Vertical Separation - A minimum of 18" of separation between the top of the sewer lines and the bottom of the water lines must be maintained. When local conditions prohibit this vertical separation, the sanitary sewer shall be constructed of AWWA specified water pipe and pressure tested in place without leakage prior to backfilling. The hydrostatic test shall be conducted in accordance with the most recent edition of the AWWA Standard, with a minimum test pressure of 30 psi. Sewers crossing over watermains shall:
- Be laid to provide a separation of at least 18 inches between the bottom of the sanitary sewer and the top of the watermain.
 - Be constructed of AWWA approved water pipe and pressure tested in place without leakage prior to backfilling, in accordance with the provisions of the most recent edition of the AWWA Standard, with a minimum test pressure of 30 psi.
 - Have adequate structural support to prevent damage to the watermain.

- Have the sewer joints placed equidistant and as far as possible from the watermain joints and encase in concrete.
 - Sewer shall cross under watermains such that the top of the sewer is at least 18 inches below the bottom of the watermain.
- Y. Sewer shall be designed as gravity type to the maximum extent practical. Pump stations shall be a last resort and number of pump stations shall be limited.
- Z. DEVELOPER may be asked by CTUB to upsize their proposed sewer system to accommodate future growth and/or eliminate existing or proposed pump stations. DEVELOPER shall submit cost increase backup information to CTUB for review and approval.
- AA. Sewers shall not be located in the rear of lots unless no other location will provide the sewer depth and slope requirements herein. Sewers so located must provide access for an AASHTO SU vehicle to all manholes.
- BB. Proposed sewers to be publicly maintained shall not be located within the plane of influence of the building footing and in no case closer than one-half the required easement width from an existing or proposed building.
- CC. Sewers shall be designed such that they do not create skewed crossings with other utilities with an acute angle of less than 45 degrees, 90 degrees is preferred. Where skewed crossings are unavoidable due to existing utilities and/or where the crossing angle is greater than 45 degrees and involves a pipe larger than 48 inches in diameter, the crossing must be specifically designed and construction details provided.
- DD. Sewer lines shall not be located within stormwater management impoundment areas, within stormwater management embankment dams, or closer than 15 feet to the point of discharge for any outfall structure or spillway. In all cases, the sewer shall be located such that excavation on a 1:1 side slope, from the sewer invert to the proposed finished grade, will not disturb the impoundment area (defined as the 100-year water surface elevation), the embankment dam, the outfall structure, or the spillway. This requirement shall include wet and dry ponds.
- EE. When abandoning existing sewers (mains or laterals), they shall be capped at the active main.
- FF. When an entire run of a sewer line is constructed in a fill, the pipe shall be a continuous ductile iron run from manhole to manhole (i.e., no adapter). Fill material directly beneath pipe shall be select material compacted to 95 percent density at optimum moisture (ASTM Proctor Test).
- GG. All newly installed sewers shall be plugged at their outfall and the plug removed only when the lines have been tested, flushed, and vacuumed. The plug shall be placed on the invert out of the manhole. All debris must be vacuumed from the manhole before the plug is removed.

HH. Stream Crossings

1. Sewers adjacent to or crossing streams, estuaries, lakes and reservoirs shall conform to conditions set forth in the WV Public Lands Corporation permit. (See Standard Detail No. 9).
 2. The connection of main sewer lines (not laterals) shall be made only at manholes. The use of adapters for a change in pipe type shall not be permitted. Connection to existing manholes shall be made by core borings.
 3. Sewer lines crossing streams shall be ductile iron pipe and provided with a minimum cover where the stream is located in rock and three feet of cover where the stream is located in other materials.
 4. Sewers located in areas of unstable soil conditions or other special circumstances may need to be encased in concrete or relocated as required by CTUB.
- II. The minimum permanent easement width shall be 20 feet, with proposed utility line being in the center. Where parallel sewer lines exist, the minimum permanent easement width shall be 30 feet. Increased public easement widths may be requested by CTUB.
1. No privately owned permanent structure or landscaping other than shrubs shall be permitted within a public easement.
- JJ. If an existing copper or galvanized pipe, brass or bronze fittings, are encountered during sewer utility excavation, they shall be bedded in silica sand (not limestone).

MANHOLES

- A. Location - Manholes shall be provided at the following locations (See Standard Detail Nos. 10 & 10A):
1. At all intersections or connections of differing or same size sanitary sewer mains.
 2. At all points of change in alignment.
 3. At all points of change in grade.
 4. At points of industrial discharge as required by CTUB.
 5. At the terminal ends of the sanitary sewer line.
 6. At intervals not exceeding 300 feet on all sanitary sewers 15 inches in diameter or less, and not exceeding 400 feet on all sanitary sewers larger than 15 inches in diameter.
- B. Depth
1. Maximum Depth - Maximum manhole depth shall be 15', NO EXCEPTIONS unless otherwise approved by CTUB.

2. Flow Channel - The inside base of the manhole shall be filled with concrete to form a bench sloping toward the flow channel. Both the flow channel and the bench shall be welled to a smooth surface. Typical invert in to out drop shall be 0.1 feet.
3. Special Lining of Force Main Discharge Manholes – The entire interior of all manholes where force main discharges, including first two (2) manholes downstream shall be spray lined per Standard Detail No. 10A. This includes existing CTUB manholes.
4. Combined Manhole - A combined flow manhole shall be provided inside of the fence at pump station and prior to wet well in the event that wet well would need bypassed.
5. Inside Drop Manholes - An inside drop connection shall be installed when the pipe inverts into the manhole are 2'-0" or more above invert out of the manhole. Outside drop manholes are prohibited. (See Standard Detail No. 12).
6. All manholes shall be vacuum tested after backfill per ASTM C1244. All 48" diameter manholes are expected to hold a vacuum of 10 inches/mg or -9.5 psi for 1 minute. The vacuum may fall to 9 inches/mg or -9.0 psi during the 1 minute and still be approved.
7. Doghouse manholes will be permitted on a case-by-case basis and as approved by CTUB. (See Standard Detail No. 10B)
8. When the incoming (new or existing) sewer line into a manhole is smaller than the sewer line out, the invert of the smaller pipe shall match the centerline of the larger pipe. If the diameter of the smaller pipe is equal to or greater than one-half of the diameter of the larger pipe, then the crowns must match.
9. All sewer manholes shall be precast concrete in accordance with ASTM-C478 consisting of precast reinforced sections, an eccentric conical section or sections, and a base section conforming with the typical manhole.
10. All manholes shall have reinforced plastic steps.
11. No water pipe shall pass through or come into contact with any part of a sanitary sewer manhole. Manholes shall be placed at least 10 feet horizontally from a watermain whenever possible. The distance shall be measured edge-to-edge of the pipes or structures (widest part of a manhole). When local conditions prohibit this horizontal separation, the manhole shall be of watertight construction and tested in place.
12. Nothing herein shall modify BPH requirements for lines and horizontal and vertical separation between waterlines and sanitary sewer manholes.
13. Manholes for sewers up to 21 inches in diameter shall not be less than four feet, inside diameter. Manholes for sewers 24 inches and up to 36 inches shall have an inside diameter of not less than five feet. If the angle of deflection does not permit use of a four-foot inside diameter manhole, then a five-foot manhole or special manhole detail must be provided.

14. For all new construction, line connection to the manhole shall be made with an approved flexible sleeve.
15. When designing new sewers to tie into existing manholes, the bench of the existing manhole must be considered so that the invert of the new tie-in is not established lower than the existing bench.

C. Control of Infiltration and Inflow

1. All sanitary sewer manholes shall be provided with an approved chimney seal installed to cover the joints at the frame adjusting rings and cone section. The chimney seal may be omitted only upon specific approval of CTUB in isolated locations when infiltration is highly unlikely.
2. All sanitary sewer manholes or appurtenances subject to inflow of ponded surface water and those with top elevations below the 100- year flood elevation shall be provided with watertight manhole frame and cover. (See Standard Detail No. 11)
3. Nothing in this paragraph shall be construed to permit the location of sanitary sewer manholes within the spread of stormwater gutter flow in paved areas.
4. Manhole tops outside paved areas and or developed lawns shall be raised at least one foot above the finished grade.
5. The bottom of manholes located in fill shall be extended to undisturbed earth unless otherwise approved by CTUB with compaction requirements. Inside of manhole filled with non-shrink grout and provided with appropriate shaping.

SANITARY SEWER LATERALS

- A. For all subdivisions and development plans, the DEVELOPER, as part of the required public improvements, shall extend the sanitary sewer lateral from the main to the property line. (See Standard Detail Nos. 16 & 17).
- B. Minimum lateral size shall be 4" in diameter for single family residences or 6" diameter whenever a double lateral is proposed.
- C. All plastic pipelines (i.e., laterals) must be provided with a tracer wire and warning tape. The tracer wire shall be attached to the top of the pipe.
- D. The sewer lateral pipe material shall be SDR 35 or SDR 26 installed at 2% minimum slope.
- E. DEVELOPER is responsible for installing and maintaining all sewer piping and appurtenances located on private property.
- F. Laterals shall require a minimum of 3.5 feet of cover unless otherwise approved by CTUB.
- G. The extension of the lateral 5 feet beyond the sidewalk will allow the building plumber to install the sewer without undermining the sidewalk or curb and gutter.

- H. Each lateral shall contain two cleanouts located at 18 to 36 inches from any building and at the property line. The cleanout shall be installed on the private side of the sidewalk, as applicable. (See Standard Detail Nos. 16A & 17A)
- I. The sanitary sewer easement for the lateral and the CTUB responsibility for maintenance shall extend to the property line only.
- J. The lateral table shall specifically list, for each lot, the length of the lateral, from the main to the end of lateral extension specified above, and the plan view shall agree with the lateral table.
- K. Sanitary lateral connections tying to the public sanitary sewer main shall have a minimum spacing of five (5) feet at the main.
- L. Sanitary laterals shall have a minimum clearance of five feet from water service lines or other laterals. Connection of private lateral to public lateral shall be by fitting of same type as pipe. Where grade change precludes use of standard fitting, a Fernco type (or CTUB approved alternate) fitting may be used.
- M. In general, each building must have its own dedicated lateral connection, unless a 6" double wye connection is provided and is approved by CTUB. (See Standard Detail No. 17) Building laterals, from multi-family buildings (condominiums and apartments only), may upon approval by CTUB connect to a single collector submain serving a single building before discharging into a public sewer. A sanitary sewer lateral shall be provided to all lots or individual buildings and shall be extended by the DEVELOPER to each lot or building in accordance with the provisions of this article unless further extension of service is required by CTUB. A sanitary sewer easement running to CTUB for this lateral extension shall be platted and recorded if the line is outside the public right-of-way. If authorized by CTUB a lateral extension servicing a single residential unit may extend from the sewer main easement or road right-of-way across lands of another to the serviced property. In this specific case, CTUB's easement and maintenance responsibilities shall end at the limits of the sewer main easement or road right-of-way, and a private easement, running to the benefit of the serviced property, shall extend from the end of the CTUB maintenance to the serviced property. A project's lateral sizes shall be tabulated in a lateral table and included on the approved construction drawings.
- N. CTUB makes no guarantee of providing gravity basement sewer service. DEVELOPERS are fully responsible for providing "Hung Sewer" and/or providing and maintaining ejector/grinder pumps, pits, piping, etc., to achieve a hung sewer. Any floor level below existing grade is considered basement sewer service.
- O. Laterals shall be installed with minimum of 6" bedding below pipe and 12" over and on the sides of pipe. Bedding shall be No. 8 limestone or other material as approved by CTUB.

GREASE, OIL/WATER AND SAND INTERCEPTORS AND SEPARATORS

In accordance Section 921.14 of the City of Charles Town Codified Ordinances, the following are the requirements for grease, oil/water/sand separators:

GENERAL

- A. Installation Requirements: All existing, proposed, or newly remodeled Food Service facilities shall be required to install, at the user's expense an approved, properly operated and maintained grease trap.
- B. Sanitary Sewer Flows: Sanitary sewer flows from toilets, urinals, lavatories, etc. shall not be discharged into the grease trap. These flows shall be conveyed separately to the sanitary sewer service lateral.
- C. Floor Drains: Only floor drains which discharge or have the potential to discharge grease shall be connected to a grease trap.
- D. Garbage Grinders/Disposers: It is recommended that solid food waste products be disposed of through normal solid waste/garbage disposal means. If a grinder/disposal is used it must be connected to the grease trap. The use of grinders is discouraged since it decreases the operational capacity of the grease trap and will require an increased pumping frequency to ensure continuous and effective operation.
- E. Dishwashers: Commercial dishwashers must be connected to the grease trap. Dishwashers discharge soap and hot water which can melt grease and allow it to pass through an undersized grease trap. Traps must be sized accordingly to allow enough detention time to allow water to cool and grease to solidify and float to the top of the trap.
- F. Location: Grease trap shall be installed outside the building upstream from the sanitary sewer service lateral connection. This will allow easy access for inspection, cleaning, and removal of the intercepted grease at any time. A grease trap may not be installed inside any part of a building without written approval by the City of Charles Town Utility Board.
- G. Pass Through Limits: No User shall allow wastewater discharge concentration from grease trap to exceed 100 Mg/L (milligrams per liter) as identified by EPA Method 413.

DESIGN

- A. Construction: Grease traps shall be constructed in accordance with CTUB's standards and shall have a minimum of two compartments with fittings designed for grease retention. All grease removal devices or technologies shall be subject to the written approval of the CTUB. Such approval shall be based on demonstrated removal efficiencies of the proposed technology. The volume-based grease interceptor shall carry an IAPMO Certification.
- B. Access: Access to grease traps shall be available at all times, to allow for their maintenance and inspection. Access to trap shall be provided by two manholes (one on each compartment) terminating at finished grade with cast iron frame and cover.

- C. Load-Bearing Capacity: In areas where additional weight loads may exist, the grease trap shall be designed to have adequate load-bearing capacity. (Example: vehicular traffic in driving or parking areas).
- D. Inlet and Outlet Piping: Wastewater discharging to a grease trap shall enter only through the inlet pipe of the trap. Each grease trap shall have only one inlet and one outlet pipe.
- E. Grease Trap Sizing: The required size of the grease trap shall be calculated using EPA-2 model. All grease traps shall have a capacity of not less than 1,000 gal. nor exceed a capacity of 3,000 gal. If the calculated capacity exceeds 3,000 gal., multiple units plumbed in series shall be installed.
- F. Central Business District: The Central Business District (CBD) shall be exempt to the sizing requirements of 921.14 and subject to the following requirements:
 - 1. Compliance with the WV State Building Code.
 - 2. If sized by gallon capacity the tank shall have a liquid volume of not less than 150 gals. (ref: WVDHHR manual of Environmental Health Procedures - Procedure WW13).
 - 3. If sized by standard PDI-G101 method the tank shall have a minimum of 50 lbs. of grease capacity.
 - 4. All calculations shall be using maximum occupancy numbers established by the State Fire Marshall or the Code Official. All plans are subject to Fire Marshall and Health Department review as part of building plan review.

MAINTENANCE

- A. Cleaning/Pumping: The user at the user's expense shall maintain all grease traps to assure proper operation and efficiency and maintain compliance with the City's Pass-Through Limits. Maintenance of grease trap shall include the complete removal of all contents, including floating materials, wastewater, and bottom sludge and solids. This work shall be performed by a qualified and licensed hauler. Decanting or discharging of removed waste back into the trap from which it was removed or any other grease trap, for the purpose of reducing the volume to be disposed, is prohibited. This service shall also include a thorough inspection of the trap and its components. Any needed repairs shall be noted. Repairs shall be made at user's expense.
- B. Cleaning/Pumping frequency: The grease trap must be pumped out completely a minimum of once every four months, or more frequently, as determined by the City of Charles Town Utility Board, as needed to prevent carry over of grease into the sanitary sewer system.
- C. Disposal: All waste removed from each grease trap must be disposed of at a facility approved to receive such waste in accordance with the provisions of this program. In no way shall the pumpage be returned to any private or public portion of the City's sanitary sewer collection system. All pumpage from

grease traps must be tracked by a manifest, which confirms pumping, hauling, and disposal of waste. The customer must obtain and retain a copy of the original manifest from the hauler.

- D. Maintenance Log: A grease trap cleaning/maintenance log indicating each pumping for the previous 24 months shall be maintained by each Food Service Facility. This log shall include the date, time, amount pumped, hauler, and disposal site.
- E. Submittal of Records: Each user shall submit all cleaning and maintenance records to CTUB on a biannual basis (twice per year). Records shall be submitted by March 1st and September 1st of each year. The records shall be submitted to:

**Attn. CTUB Utility Manager
661 South George Street, Suite 101
Charles Town, WV 25414**

CTUB may perform periodic inspections of these facilities.

1. Additives: Any biological additive(s) placed into the grease trap or building discharge line including but not limited to, enzymes, commercially available bacteria, or other additives designed to absorb, purge, consume, treat, or otherwise eliminate fats, oils, and grease shall require written approval by CTUB prior to use. The use of such additives shall in no way be considered as a substitution to the maintenance procedures required herein.
2. Chemical Treatment: Chemical treatments such as drain cleaners, acid, or other chemical solvents designed to dissolve or remove grease shall not be allowed to enter the grease trap.
3. Sand, Soil, and Oil Interceptors: All car washes, truck washes, garages, service stations, car and truck maintenance facilities, fabricators, utility equipment shops, and other facilities (as determined by CTUB) that have sources of sand, soil, and oil shall install effective sand, soil and oil traps, interceptors, and/or oil/water separators. These systems shall be sized to effectively remove sand, soil, and oil at the expected flow rates. These systems shall be, at the user's expense, cleaned or pumped on a regular basis to prevent impact upon the wastewater collection and treatment systems.
4. Laundries: Commercial laundries shall be equipped with an interceptor with a wire basket or similar device, removable for cleaning, that prevents passage (into the wastewater collection system) of solids ½" or larger in size such as rags, strings, buttons, or other solids detrimental to the system.
5. Control Equipment: The equipment or facilities installed to control FOG, food waste, sand, soil, oil, and lint must be designed in accordance with the Southern Plumbing Code, the WVDEP guidelines, most current engineering standards, or other applicable guidelines approved by CTUB. Underground equipment shall be tightly sealed to

prevent inflow of rainwater and shall be easily accessible to allow regular maintenance and inspection. Control equipment shall be maintained by the owner and/or operator of the facility as to prevent a stoppage of the wastewater collection system, and the accumulation of FOG, food waste, sand, soil, and lint in the collection lines, pump stations, and wastewater treatment plant. If CTUB is required to clean out the wastewater collection lines, as a result of a stoppage resulting from poorly maintained control equipment (or lack thereof) the owner or operator shall be required to refund the labor, equipment, materials, and any overhead costs to CTUB including any fines incurred due to any sanitary sewer overflow due directly to the stoppage. CTUB retains the right to inspect and approve any and all installations of control equipment.

6. Alteration of Control Methods: CTUB reserves the right to request additional control measures if existing control equipment is shown to be insufficient to protect the wastewater collection system and wastewater treatment plant from interference due to the discharge of FOG, sand, soil, lint, or any other undesirable materials.

SANITARY SEWER FORCE MAINS

- A. All force mains shall have a minimum of 42" of cover. Acceptable force main pipe types shall be Class 52 (min.) ductile iron double cement lined, PVC SDR-21, C900 PVC or HDPE (DR9/DR11). Maximum force main depth shall be 14 feet (with certain exceptions for stream, road and railroad crossings).
- B. In general, force mains 3" in diameter or smaller should be PVC SDR-21 minimum thickness and contain concrete thrust blocks at all joints and fittings. Force mains 4" in diameter or larger should be C900 PVC, HDPE (fused fittings) or ductile iron pipe with double cement lined, ductile iron, restrained joints.
- C. 90-degree bends are prohibited on sewer force mains. Two (2) 45-degree bends shall be provided.
- D. Bell restraints are required on force mains 6" and larger. Bell restraints to be placed on the 3 joints prior to and 3 joints after any bend fittings.
- E. Concrete thrust blocks are required at each buried fitting for all lines 4" in diameter or smaller. (See Standard Detail No. 7)
- F. All force main to force main tie-ins shall feature a Wye fitting with cleanout. Tees are not acceptable.
- G. Air release valves/pits shall be located along force main at all system high points. Profiles of force mains shall be such that they avoid excessive changes in elevation. In such instances, the pipes shall be installed deeper to flatten out the pipe system. (See Standard Detail No. 24)
- H. A pressure cleanout shall be located along force main at all system low points. (See Standard Detail Nos. 21 & 22)

- I. All force main pipes crossing state routes, railroads and streams shall be installed in a steel casing pipe. Certain exceptions apply for fused HDPE as permitted by the applicable agencies and CTUB.
- J. All manholes (including doghouse) which force mains discharge into, including at least 2 manholes downstream shall be provided with an interior coating system.
- K. CTUB has the authority to shift and/or alter force main alignment to accommodate future developments and planning.
- L. All force main lines shall be pressure tested for a minimum of 1 hour at 1.5 times the normal working pressure or equal to the shutoff head of the pumps. The force main discharge pipe shall be temporarily extended into the discharge manhole where a DIMJ cap (or other appropriately pressure rated cap) with pressure gauge can be installed. Once the line passes pressure testing, the pipe can be cut flush with the manhole.
- M. At pumping capacity, a minimum line velocity of two feet per second shall be maintained.
- N. The maximum line velocity shall be eight feet per second.
- O. Force main shall terminate in manhole with its centerline elevation set as to ensure a smooth transition to gravity flow. The design shall be such as to prevent turbulence. (See Standard Detail No. 13)
- P. All pipe used for force mains shall be pressure type with pressure type restrained joints.

SEWAGE PUMP STATIONS

GENERAL

- A. All previous specifications still apply. This section is intended to expand upon certain portions of the design of sewer systems by DEVELOPER.
- B. Design of the sewer pump station shall be such that it is a complete and fully functioning system prior to CTUB acceptance. Design of wet wells shall be such that they are not excessively deep. In general, the maximum wet well depth shall be 30 feet unless otherwise approved by CTUB. DEVELOPER shall layout proposed sewer system such that it minimizes the number of Pump Stations. If the subject site can accommodate one pump station, DEVELOPER'S engineer shall design it as such. All drawing/design review, redesign and/or changes stemming from CTUB or its Consulting Engineers comments shall be paid for by the DEVELOPER. CTUB nor its consulting engineer claim any responsibility in the design of the sewer pump station. If it is determined by CTUB that the pump station is either over or undersized, it shall be redesigned and re-constructed by DEVELOPER.
- C. Tops of all wet wells, vaults and electrical equipment shall be such that they are at least 1-foot above the 500-year flood per the latest FEMA Maps. All 100- and 500-year floodplains shall be clearly denoted on drawings. If H&H modeling is required to properly and adequately determine flood elevations, this shall be done so by DEVELOPER. Horizontal datum shall be based on NAD 83, vertical datum shall be based on NAD 88 (or latest versions). Pump stations shall not be located in or installed within 50 feet of any delineated wetlands or streams.

- D. All temporary and permanent stormwater and E&S facilities that are designed and constructed for purposes of the pump stations are solely the responsibility of the DEVELOPER to install and maintain.
- E. DEVELOPER/contractor is solely responsible for all construction means, methods, techniques, temporary controls, sequences, schedules, procedures and safety protocol.
- F. All pump station design calculations including pump and wet well sizing, buoyancy, headloss, EDU counts, etc. shall be submitted to CTUB for review. All calculations and drawings shall be signed and sealed by a licensed WV professional engineer.
- G. All fees such as but not limited to legal, administrative, land, easements/ ROWs, permits, utility, state, county, taxes, insurance, professional, review, inspection, etc. associated with the project shall be fully paid by the DEVELOPER. All such documents shall be turned over to CTUB prior to takeover.
- H. During the construction phase, all project submittals pertaining to the sewer system shall be submitted electronically to CTUB for review and approval prior to ordering materials. CTUB has the right to reject any and all submittals which do not apply with their standards and/or do not meet the expected quality. Any material found which is not in compliance with CTUB standards shall be replaced by DEVELOPER at their costs.
- I. Industrial Users (IU's) shall be responsible for all required pretreatment prior to discharging to CTUB including but not limited to screening, grit removal, solids reduction, removal of volatiles, FOG, PFOA/PFAS, etc. These specifications do not include industrial type facilities. These would require additional permitting and requirements per WVDEP and CTUB.
- J. The Sanitary sewer system shall be for sanitary sewer flow only. Any and all storm lines, French drains, gutters/downspouts, sump pumps, etc., shall NOT be tied into the sewer system. If any of these instances are ever found to be present by CTUB, they shall be properly fixed by the DEVELOPER within 30 days.
- K. Burying and/or paving over of manhole covers, valve box covers, vaults, etc., is strictly prohibited. DEVELOPER shall be fully responsible for assuring that this does not happen at any time during construction and/or following turnover to CTUB. If future development or grade changes, DEVELOPER is responsible for installing all necessary risers and/or extensions.

DESIGN

- A. Design flows in gallons per day shall be taken from the Usage Equivalents for Multiple Residential or Non-residential Capacity Impact Fees table. Refer to Table 64-47-B. - Minimum Design Loadings for Sewage Treatment per the DHHR Design Standards. Consult with CTUB prior to design for any design flow assumptions.

- B. Pump Stations shall be sized accordingly for all flows both current projected and future. Pumps shall NOT be oversized for future flows if they cannot be turned down (via VFDs) to meet the minimum or average daily demands. In this case, sufficient wet well volume, physical space in the wet well, larger or spare conduits, etc., shall be provided to allow installation of future additional pumps or larger pumps. The minimum force main design pipe velocity shall be 2.0 feet per second in all discharge lines. An infiltration allowance of 200 gallons per inch diameter per mile per day should be added to the pump station flow. The peaking factor used shall be 2.5-3 times the average daily flow.
- C. DEVELOPERS engineer shall submit pump VFD curves for each flow condition at various speeds to confirm proper pump turndown at low flows and adequate flows with multiple pumps running simultaneously.

Drawing Requirements

- 1. All construction documents for sewer extensions/pump stations shall be prepared and submitted in accordance with the applicable State regulations and CTUB standards. The requirements outlined herein are to supplement the applicable State regulations (WV Health 64 CSR 3 and 64 CSR 77), and the more stringent shall govern.
- 2. DEVELOPER shall submit one electronic set of the construction documents and one copy of the pump station computations for review. A review will be made and the comments transmitted directly to the DEVELOPER and/or the Project Designer. Project Designer shall address all review comments, make the necessary modifications and return revised copies of the documents to CTUB for additional review. If necessary, a meeting will be scheduled at the CTUB office to discuss the construction documents.
- 3. Original drawings and their reproducibles shall be accurate, explicit, clear and legible to provide an accurate basis for review and construction. Drawing size shall be 24" x 36".
- 4. Drawings shall include a location map, a site map showing the extent of the project, an index of the sheets in the set of drawings, bench mark and control point descriptions and locations and description with plane of datum, and a legend.
- 5. A suitable north arrow shall be provided on all plan views. Graphic scales (both horizontal and vertical when applicable) shall be shown on each sheet.
- 6. Plan drawings shall consist of and/or show:
 - a. The area to be developed with all property lines, all lot lines, all easements and all street rights-of-way, complete with property monuments and pins.
 - b. Existing and proposed contours, features and utilities.

- c. Sewer extension and appurtenances (shown as symbols). Sewer extension shall be stationed continuously from point of connection to the existing system or point of origin.
 - d. Reference data to be shown on each drawing shall include: (1) the center-line stationing of all streets with tick mark and station label at 100 ft. intervals; (2) station equations at each street intersection; (3) referenced benchmark and description located within 500 ft. of the sheet limits; and (4) 1–2-foot contour intervals labeled at the ten-foot interval. Where the sewer extension, appurtenances and easements are referenced to a survey baseline, this baseline must be shown and stationed.
 - e. Easements shall be provided for sewer extensions and shall be located to maximize current and future utilization of the adjoining property. Easements shall show survey and alignment data and shall be dimensioned. Minimum easement width shall be 20 feet with the sewer main and/or appurtenance located in the center of said easement (30 feet for parallel lines). For dead-end mains, manholes, blow-offs, and similar appurtenances, the easement shall extend full width perpendicular to the centerline of the mainline extension and shall extend a minimum of 10 feet beyond the limits of the appurtenance.
 - f. Service connections to buildings shall be located water up-grade and sewer down-grade from the building.
 - g. Proposed, typical street cross-section showing the location of all utilities to be installed in the project.
 - h. Provide landscape plan drawings. No trees or shrubs shall be planted within ten (10) feet of any force main or gravity sewer line.
7. Profile drawings shall consist of and/or show:
- a. Existing and proposed features and utilities.
 - b. A continuous profile of the proposed sewer extension showing existing ground surface and finished roadway center-line grade for a proposed sewer main extension to be installed parallel to and within 15 feet of the center-line of the street. All other proposed sewer line extensions shall have the finished grade shown at the center-line of the sewer line extension.
 - c. All pipes (gravity and force main) shall be profiled showing all existing and proposed intersecting utilities along with existing and proposed grade elevations. Show utility clearances on the profiles. The linear feet distance of pipe to each manhole shall be indicated on profiles along with proper stationing.

- d. Pipe size, specification, material and pressure class: EXAMPLE: 8" PVC SDR 35 Gravity, shall be shown on both plan and profile.
 - e. Main sewer line extension appurtenances shall be shown using a vertical leader at the station of location. Vertical lettering along the leader shall give the station and type of appurtenance.
 - f. The limiting pipe deflection where pipe joints are deflected.
 - g. Waterline, storm sewer, electrical and gas crossings and clearance from water main at water main crossings. A minimum of 18" of vertical separation is required between top of the sewer lines and bottom of the water lines. In no instance shall a sewer line be constructed overtop of a water line. A minimum of 10' of horizontal separation is required between parallel water and sewer lines.
8. Supplemental construction specifications shall stipulate and describe any construction material, special structure, equipment, or any other work not covered by the Construction Standards.
9. All proposed sewer line extension projects shall be referenced to the West Virginia State Coordinate System. A minimum of 2 reference points will be required for each project or 1,000 feet of sewer line extension.
- West Virginia State Coordinates shall be given for each reference point. The reference point shall be a significant point on the sewer line extension or the intersection of streets within a subdivision or land development.
10. All laterals and lateral connections shall be indicated on the plan drawings and profiles. All cleanouts shall be indicated on the plan drawings and profiles. All manholes shall be labeled/identified on the plan and profile sheets. Identify which manhole frames and covers are to be watertight on both plan and profile.
11. All applicable CTUB standard details and notes shall be included on the contract drawings.

Pump Station Site Layout (See Standard Detail No. 33)

- 1. A minimum 12' wide stabilized or paved access roadway to the pump station shall be provided with appropriate drainage and stormwater. All culvert pipes used shall be either HDPE or concrete, galvanized steel pipes are strictly prohibited.
- 2. Landscaping shall be planted as necessary or determined by CTUB or the DEVELOPER. Maintenance of any landscaping shall not be the responsibility of CTUB.

3. Site shall be surrounded by an 8' high black vinyl coated chain link fence topped with three strands of barbed wire in a V-shape. Chain link fence shall have plastic slats installed from the same side of the fence to provide 80% opacity. A double swing manually locked entrance gate shall be provided that is equal to the access road width. At least one (1) lockable 3' man gate shall also be provided. (See Standard Detail No. 35)
4. Minimum distance from fence to any equipment pad, building, or structure shall be 5 feet with sufficient space left for an emergency generator and/or bypass pump configuration. Entire inside area of fence, including a 1-foot-wide mow strip around fence shall feature geotextile fabric and a minimum 6" of crushed stone subbase or pavement. Entire inside area of fence shall be graded level. Top of wet well, valve/meter vaults and concrete pads/buildings shall be at least 6" above finished grade.
5. A non-freeze yard hydrant shall be provided near wet well where potable water line is in the site vicinity. A backflow preventer with isolation shutoff valves in a precast concrete vault is required on the line leading to the hydrant. (See Standard Detail No. 34)
6. All pump stations 150 GPM or less shall have an automatic transfer switch and a permanent emergency generator located on a concrete pad. Generator shall be sized to run all pumps at 100% speed.
7. In lieu of an emergency generator, all pump stations greater than 150 GPM shall feature installation of a permanent Godwin (Xylem) DBS Dri-Prime Backup Pump Station in lieu of a permanent generator. Station shall come with its own independent submersible pressure transducer and automatic pump VFD controller. Station shall consist of a fully enclosed single dry-prime pump/motor that is diesel powered with belly fuel tank. Contact Tom Vance with Xylem at 301-332-6457 for sizing, selection and startup services. Station shall include a permanent DI or SS suction line that is installed approximately 2' off wet well floor and tied into pump. A 10–20-foot piece of removable flexible hose shall connect the suction line to the pump above grade. Discharge line shall be permanently tied into force main with a check and plug valve prior to the flow meter. Standby station shall be installed on a reinforced concrete equipment pad. Fuel tank shall be filled by DEVELOPER/Contractor prior to turn-over to CTUB including copy of receipt.
8. A combined influent flow manhole shall be provided within the fence just prior to the wet well. This shall be used for any bypass pumping associated with the wet well.
9. DEVELOPER will be responsible for obtaining all temporary or permanent easements, driveway permits, DOH, stormwater/E&S permits, etc., as needed and they shall be transferred over to CTUB.

Wet Wells (See Standard Detail Nos. 29, 30, 31 & 32)

1. Wet wells shall either be constructed of precast concrete or FRP. Wet wells constructed of FRP are limited to 10' deep and 48" diameter.
2. All wet wells shall be designed and constructed for anti-flotation and calculations shall be included in the submission that include a minimum 1.2 FOS.
3. Minimum wet well diameter is 48 inches and shall include either an attached or separate valve vault. Bottom of wet well shall be grout sloped to pumps.
4. The minimum distance from the lowest pipe invert elevation to the high-level alarm float is 1.0 foot.
5. The wet well shall include a submerged pressure transducer with lightning arrestor located inside a 6" diameter PVC stilling well as the primary means of level control. A minimum of six (6) backup floats shall also be provided (high high-level alarm, high level alarm, lag pump on, lead pump on, both pumps off and low-level alarm). An independent float shall be tied into the pump controller. Floats shall be Roto-Float signal-duty float switches, SPST, normally open with internal weight.
6. The designer shall consider the minimum required submergence depth of the submersible pumps to set the low-level alarm. The volume below this low-level alarm shall not be included in the overall wet well usable volume calculations.
7. All supports and accessories shall be type 304 or 316 stainless steel and sized appropriately.
8. All wet wells shall feature passive vents with odor control system (Wager Company Model 2050-50) or approved equal.
9. Wet well shall feature lockable aluminum access hatches with safety grates.
10. Gravity drains with check valves from valve/meter vaults shall enter wet well.
11. A float hanger/support system shall be easily accessible and mounted just below the access hatches.
12. All piping entering wet well shall be sealed with stainless steel pipe sleeves and link seals.
13. Wet well inlet flows shall be designed to minimize pump cavitation to the maximum extent practical.
14. Inside drops shall be provided in wet well when applicable.

15. In some instances, stainless steel removable trash racks may be required as directed by CTUB.
16. Removable lifting cranes, hoists, and/or monorails, utilized to facilitate pump/trash rack removal are required. Lifting hoist shall be stainless steel with stainless steel hardware.
17. All pumps in excess of 25 HP shall be equipped with an onsite electric motorized overhead lifting jib crane to facilitate pump removal.
18. The entire interior concrete surface of all wet wells shall be lined with a special three (3) layer aromatic polyurea coating system. Coating system shall be two (2) coats of OBIC 1000 with 1306 middle layer or equal. Total minimum system dry film thickness shall be 500 mils (1/2 inch).

Protection Against Clogging

1. Larger pump stations, which CTUB deems to have a potential for clogging, shall have a comminutor vault (or manhole) directly after the inlet manhole for the station. The comminutor will be sized for the estimated peak hourly flow into the station. This is to prevent clogging issues associated with pumps and check valves which are prone to clogging. Consult with CTUB during the design phase to see if a comminutor is necessary.
2. The comminutor shall be designed to be easily removed from the flow channel without disturbing any piping connections.
3. The comminutor channel shall be designed to settle out grit upstream of the screening area.
4. Comminutors shall be designed for continuous operations and shall automatically restart after power failures.
5. The vault shall also be equipped with a stainless-steel bar screen (inline or as a bypass), so that the comminutor can be taken out of service for repair and maintenance. The clear openings on the bar screen will not exceed 2.0 inches. In the event the comminutor must be taken out of service, stainless steel slide gates shall be provided to direct comminutor vault influent flow to a bypass bar screen.
6. The comminutor vault may be a precast concrete manhole provided it is large enough for equipment access and maintenance.
7. All lighting and electrical equipment shall be explosion proof inside the comminutor vault.
8. All lighting shall be LED and on a switch near the entrance.
9. An emergency stop button shall be provided in the comminutor vault for the comminutor.

10. When a generator is provided, the comminutor shall be connected to the generator.

Pumps and Discharge Lines

1. All pumps shall be submersible type with explosion proof motors. A minimum of two (2) pumps shall be provide with one (1) pump being fully redundant. For sewage pump stations with more than two pumps, with the largest pump out of service, the remaining pumps must be able to pump the design peak flow.
2. Pumps 2.0-10 HP (typically pumps 125 GPM or less) and smaller shall be grinder pumps as manufactured by FE Meyers and be the VS or WG Series or latest edition as approved by CTUB. At a minimum, pump stations are required to have one (1) primary pump to be sized to handle peak flow, and one (1) fully redundant pump with separate discharge line. Triplex pump stations are discouraged. Fiberglass basins are approved for pump stations 2.0 HP or smaller. Pumps shall pass a minimum of a 2" sphere.
3. Pumps greater than 10.0 HP shall be Grundfos SL/SE/S Series or latest edition as approved by CTUB. These stations shall be precast concrete construction. Minimum wet well volume is 210 gallons per vertical foot for designs with less than 300 GPM pumps and 376 gallons per vertical foot for pumps over 300 GPM, and 587 gallons per foot minimum for pumps greater than 700 GPM.
4. All pumps greater than 2.0 HP shall be placed on variable frequency drives sized appropriately for the maximum amperage draws. Input and output filters may be required as directed by CTUB.
5. All pumps shall contain stainless steel guiderails, stainless steel top rail brackets, stainless steel intermediate guide rail brackets, stainless steel lifting chains and ANSI flanged base assemblies of adequate size for the pump.
6. All pump discharge piping inside wet well and vaults shall either be Schedule 40 stainless steel or minimum Class 52 double cement lined ductile iron unless otherwise approved by CTUB.
7. Pressure gauge assemblies are required on the discharge line of each pump. The assembly shall be equipped with a ½"-1" process connection, SS isolation ball valve, SS diaphragm seal, 4.5" gauge and an aluminum wall support with SS connection hardware.
8. Sewerage air release valve assemblies are required on all individual pump discharge lines.

Valves/Meters and Vaults (See Standard Detail Nos. 28, 29, 30, 31 & 32)

1. Above grade valve vaults are strictly prohibited. All valve vaults shall be below grade. Valve vaults shall either be FRP or precast concrete construction depending on type and size.

2. All valve vaults and wet wells shall have a minimum of a 36" x 36" aluminum watertight hatch with safety grating. Designer shall ensure that all proposed pumps and future larger pumps will fit through proposed hatch openings. FRP or aluminum ladders with safety up-posts are required for all valve/meter vaults. Manhole steps are prohibited.
3. All valve vaults shall feature an eccentric flanged plug valved and Bauer type fitting emergency bypass line.
4. All pump stations in excess of 30 gpm shall feature a combined magnetic flow meter with digital transmitter as manufactured by Krohne Enviromag 2000 flowtube with IFC 050 or 100 converter. Flow tube shall be installed inside a vault with appropriate number of straight run pipe diameters upstream and downstream. Remote mounted flow converter is generally installed inside pump control panel. Flow meter shall have 4-20mA and pulse output.
5. A buried plug valve with valve box is required immediately downstream of the flow meter for isolation purposes.
6. Each pump discharge line shall have a check valve. All check valves 3" in diameter and larger shall be American Flow Control 2100 Series with flushing connection, resilient seated type. Weighted check valves are strictly prohibited.
7. All valves 3" and larger shall be ductile iron body, full-port, flanged, eccentric gear operated plug valves with operating wheels as manufactured by Dezurik or equal. A plug valve is required after the check valve on each discharge line.
8. Pressure gauges with SS isolation valves shall be provided on each pump discharge line.
9. A pump station bypass/emergency connection is required at each station either after valve vault or within valve vault. Connection to include plug valves, fittings and a stainless-steel female Bauer type camlock fitting with cap (same line size as pump discharge lines in vault).
10. Restrained flanged coupling adapters are required at all valves and meters to facilitate replacement.
11. All hardware shall be Type 304 or 316 stainless steel including pipe supports.
12. All exposed ductile iron piping and fittings shall be primed and painted with 8 mils minimum of epoxy with direction of flow arrows.
13. Meter and valve vaults shall be grout sloped to a gravity drain. In cases where no gravity drain is possible, a recessed sump pit is required.

14. Restrained type couplings are required within 5 feet of all meter and valve vaults on all lines to account for differential settlement.
15. Meters and vaults shall be placed on a minimum 6" of compacted crushed stone.

Electrical

1. DEVELOPER is fully responsible for providing power to pump station site.
2. All power to the pump stations shall be 3 Phase, 208, 240 or 480 Volt unless otherwise approved by CTUB. If 3 Phase power is not available, DEVELOPER shall be responsible for providing VFDs and transformers to achieve 3 Phase power for pumps. Single phase pumps are strictly prohibited, except for instances using a 2 HP or smaller grinder pump station where 3-Phase power is not readily available. Engineer/DEVELOPER must verify voltage availability with utility provider prior to submission.
3. Local pump disconnects shall be provided independently for all pumps.
4. Conduit/wireways shall be designed such that sewer gases do not enter electrical enclosures. This involves stainless steel screened/caged air gaps.
5. A means of disconnecting the pump cables at the wet well shall be provided in all cases to facilitate pump removal. The junction box shall be freestanding and mounted on a stainless steel Kindorf assembly. CHICO type conduit packing is strictly prohibited. (See Standard Detail No. 37)
6. All wooden backboards, sheathing, framing, posts, etc. shall be pressure treated.
7. Electrical support structures shall be stainless steel, aluminum or FRP. Galvanized or carbon steel items are prohibited.
8. In general, all electrical panels/equipment shall be covered by a minimum 3 feet on all sides with an aluminum standing seam metal roof structure with aluminum gutters and downspout. (See Standard Detail Nos. 40, 41 & 42)
9. A minimum 4" thick reinforced concrete pad shall be provided beneath the canopy/pavilion.
10. Under canopy/roof LED lights and weatherproof GFCI service receptacles are required.
11. Minimum conduit size shall be ¾". In general, all conduit from control panel to junction box shall be oversized by a factor of 2 to allow for larger future cables. Spare conduits are also required.

12. All enclosures and control panels shall be NEMA 4X stainless steel construction.
13. The transfer switch will be fully automatic with the ability to sense a -phase loss condition and switch to the generator power system with a minimum time delay. When a phase loss condition occurs., the transfer switch will move to the neutral position to check for emergency or commercial power voltage.
14. The station's power supply shall be protected from power surges. The surge protector for the station shall be adequately sized to protect all equipment and have at least a 250kA rating.

Controls

1. Pump stations with 25 HP pumps and smaller shall use the Primex View Controller. Pump stations with pumps 25 HP or larger shall be controlled by means of a Programmable Logic Controller (PLC) which monitors a level transducer. The PLC can be included in the HMI. The PLC shall be programmed to turn the pumps on or off at various levels in the wet well. The secondary method of level control will be floats. CTUB will require six (6) Roto-floats that report the following alarms through the remote monitoring system:
 - a. High High-level wet well
 - b. High-level wet well
 - c. Low-level wet well
 - d. Lag Pump on
 - e. Lead Pump on
 - f. Both Pumps off

The level transducer shall be hydrostatic submersible type as manufactured by ProSense model number NFLT-015-L60 with protective spacer accessory or equal. It shall be installed inside of a stilling well to limit the agitation to the level transducer. A stilling well shall be 6" diameter SCH 40 PVC pipe with 4-1" diameter holes drilled around the top of the well (to stop a vacuum from occurring), and 4-2.5" diameter holes drilled every 6" of length from 3" off the bottom of the pipe to the "pump on" elevation to allow for liquid to enter the well. The stilling well shall run from the top of the wet well to 6" off of the bottom of the wet well.

2. Check valve limit switch telemetry shall be used for pump failure logic.
3. A local elapsed run time indicator will be provided for each pump.
4. A press-to-test circuit will be provided for the control panel indicator lights.
5. All stations shall be equipped with a remote monitoring and telemetry system shall be OMNISITE Crystal Ball Remote Telemetry Unit capable of alarming via text message, email and phone call. Duplex and triplex configurations shall be thoroughly incorporated into the pump controls and monitoring equipment.

6. All stations shall have the following alarms connected to the remote monitoring system:
 - a. Commercial power failed
 - b. Generator/Emergency pump power failure
 - c. Check valve failed
 - d. Generator/Emergency pump running
 - e. Generator/Emergency pump fuel low
 - f. Backup controller running
 - g. UPS alarm
7. Controller shall be View Series Dedicated Pump Controller by PRIMEX.
8. The following minimum electrical components are required in the pump station controllers: Transformers, terminal blocks, incoming power surge suppression system, circuit breakers, power supply, control relays, selector switches, push buttons, variable speed pump controller, backup float controller, pilot lights, elapsed time meters, anti-condensation heater, cooling fans and thermostat, pump seal and thermal failures and relay alarms, voltage/phase monitoring relays, 5.7" minimum touch screen HMI, auxiliary contacts and VFD bypass around each pump. VFDs with line reactors shall be provided for each pump greater than 2.0 HP and shall be installed inside pump control panel or other NEMA 4X enclosure or temperature-controlled building.
9. All monitoring points shall have digital and analog outputs on a terminal strip within the control panel.

Lighting

1. Adequate lighting will be provided throughout the station.
2. All lighting fixtures shall be LED, at least 400K color.
3. All lighting fixtures shall be rated for the environment in which they are installed.
4. There shall be no lights in the wet well in submersible pump stations.
5. At least one LED flood light installed on a 15' tall post shall be installed in the parking area of the pump station to shine light on the hatches. The light shall automatically come on at dusk and automatically shut off at dawn. In dense residential neighborhoods, CTUB may approve a motion sensor with an on/off switch for time when actual work is taking place.

Pump Station Startup/Testing

1. A representative from the pump, controls, generator and dry-prime pump system manufacturers shall all be present concurrently in the presence of CTUB for startup and testing of the system. The pumps shall be tested and documented for rotation, voltage and amp current draw. The pumps shall be operated at various speeds with documented

flow rates in GPM. Both or all pumps shall also be tested simultaneously to confirm proper working condition and to verify the flow rate with both/all pumps running. The VFDs shall be started up and adjusted accordingly for proper acceleration/deceleration, ramp up speed, alarms, etc. The pumps shall run to maintain a level in the wet well. The pump station shall be tested for loss of incoming power with all standby equipment automatically turning on and maintaining pumping operations. All level sensors and flow meters shall be calibrated and scaled correctly. A written startup report shall be provided to CTUB. CTUB shall be properly trained on all new equipment, controls and instrumentation, including maintenance activities.

CONSTRUCTION INSPECTION

ACCEPTANCE TESTS

- A. An acceptance test shall be specified for all gravity sewer lines by the contractor and test schedule communicated with CTUB's Utility Inspector. The test may be either a water test or an air test.
- B. The contractor shall schedule all acceptance tests with the assigned CTUB Utility Inspector at least 48 hours in advance of testing.
 - 1. Each section of completed sewer shall be tested.
 - 2. Generally, the sewers shall be tested from manhole to manhole.
 - 3. No sewers or building spur connections shall be excluded from this testing procedure.
- C. All sanitary sewers, including manholes, shall be inspected prior to acceptance testing using visual, television test, light test or other approved methods. Prior to this inspection, any trench dewatering pumps shall be disconnected and any noticeable trickle or leakage shall be corrected and eliminated prior to undertaking the acceptance test.
- D. Acceptance tests shall not be made until the sanitary sewer, manholes and required building spurs, as shown on approved construction plans, have been installed, the sewer trenches backfilled to finish grade and compacted within easement areas and base paved in right of ways and easement areas.
- E. Inspection approval will not be issued for any newly constructed sewer line until the sewer line and the lateral have undergone and successfully completed acceptance testing as required by this Manual and as required by State regulations. Acceptance testing shall insure that the sewer construction conforms to all applicable criteria and specifications.
- F. Television inspection shall not be used in lieu of specified acceptance testing. Television inspection will be utilized at the conclusion of acceptance testing to locate deficient areas of construction. Base pavement must be in place prior to TV inspection.

- G. Structural repairs to pipe (i.e., holes, bellies, or slipped joints), required as a result of acceptance tests, shall be made in accordance with the industry standards and guidelines of this manual.
- H. The contractor shall furnish all equipment and materials necessary to perform these tests. All acceptance tests shall be conducted by the contractor in the presence of the CTUB's Utility Inspector.

AIR TESTING (Preferred Method)

1. Air test methods and acceptability criteria shall be in accordance with the appropriate ASTM specifications. Air testing shall generally be acceptable for all types of pipe materials.
2. The contractor shall thoroughly clean and remove all debris, silt, earth, or other material from the sewer prior to acceptance testing. The pipe may be flushed or sprayed with water to facilitate this process. This water, including debris, shall be pumped and disposed of properly. Under no circumstances shall it be allowed to enter the existing sewer.
3. Test plugs shall be supplied and installed by the contractor within the pipe at each manhole or at suitable locations to test a section of the pipe. Each plug shall be securely braced.
4. If the pipe to be tested is expected to be below the ground water table, the contractor shall either:
 - a. Install a small diameter perforated vertical pipe from the invert elevation of the sewer to the surface prior to backfilling, or
 - b. Insert a pipe probe by boring or driving into the backfill material adjacent to the invert elevation of the pipe, and determine the depth of the ground water level above the pipe invert immediately prior to acceptance testing the sewer.
5. All gauge pressures in the test shall be increased by the amount of this back pressure due to ground water submergence over the end of the probe. In no case shall the starting test pressure exceed nine pounds per square inch.
6. The contractor shall add air slowly to the portion of the pipe under test until the internal air pressure is raised to four pounds per square inch greater than the average back pressure of any ground water above the invert of the pipe.
7. The contractor shall allow the air temperature to stabilize for at least two minutes to ensure accurate gauge pressure reading, thereafter adding only the amount of air required to maintain the four (4) psi pressure.
8. Pipe which fails to maintain the stipulated pressure for a minimum of four (4) minutes shall be deemed to have failed to pass the low-pressure air test and is unsatisfactory for acceptance by CTUB. Any

sewer or house connection that fails to pass this test shall be repaired by the contractor. Following corrections, the sanitary sewer shall be retested in accordance with the above procedures.

9. As a safety precaution, no one shall be allowed in a manhole after the air pressure is increased in the sewer line. If the CTUB Utility Inspector suspects that the test plug may be leaking, the pressure first shall be relieved before any adjustments are made to eliminate air leakage at the plug. The contractor may precoat the plug with a soap solution to check the plugs for leakage.
10. For accuracy and safety precautions, air tests shall be limited to the diameters of pipe and lengths of pipe indicated in the previously referenced air test timetable.
11. Pressure gauges used in the air test procedure shall have a minimum four- inch diameter face, a range of zero to ten psi, shall be calibrated in divisions of 0.10 pounds per square inch, and have an accuracy of plus or minus one percent.
12. For air testing pipes of larger diameter than 36 inches, a thorough visual inspection shall be required and all joints shall be tested with a special joint testing device such as the Cherge "Joint tester" System, or approved equal. Testing procedure shall be as recommended by the manufacturer.
13. If air testing is employed, the manholes shall be tested by exfiltration.
 - a. Inflatable stoppers shall be used to plug all lines into and out of the manhole being tested.
 - b. The stoppers shall be positioned in the lines far enough from the manhole to ensure testing to those portions of the lines not air tested.
 - c. The manhole shall then be filled with water to a level four feet above the top of the pipe. A 24-hour soak shall be allowed.
 - d. Leakage shall not exceed one-half gallon per hour. Manholes determined to be or suspected of poor-quality jointing or construction practices by CTUB, shall be tested to the top of the manhole and repaired as necessary.

WATER TESTING (Only Used if/when preapproved by CTUB)

1. Where water testing is specified (infiltration or exfiltration), the leakage inward or outward shall not exceed 100 gallons per inch of nominal pipe diameter per mile per day (2,400 gpd/mi maximum) for any section of the system including manholes.
 - a. The exfiltration test may be permitted by CTUB. When permitted, the line shall be subjected to a minimum of four feet of head, or head based on filling to the top of the manhole with water, whichever is the lesser, above the crown of the pipe at the upstream manhole of the section being tested.

- b. All service laterals, stubs and fittings into the sewer lines being tested should be properly capped or plugged, and carefully braced to resist the thrust actions developed by the internal water pressure.
2. The upper manhole standpipe must be capable of handling from five to ten feet of water head to determine the tightness and soundness of the sewer line, as specified and directed by the CTUB Utility Inspector.
3. Water shall be introduced into the line at the downstream manhole until the standpipe in the upstream manhole has been completely filled. Care must be taken to minimize entrapped air by filling the pipe slowly.
4. After filling with water, the line must be allowed to stand for a minimum of 12 hours before beginning the test. After the water absorption has stabilized, the water level in the standpipe must be checked and water added if necessary.
5. After assuring stabilization, the drop in the standpipe shall be measured and recorded over a ten-minute period. The measured drop must be converted to leakage in terms of gallons per inch diameter per mile per day.
6. Caution shall be taken conducting exfiltration tests on sewer lines laid on steep grades. Consideration must be given to the downstream portion of the system to prevent excessive pressure in these lower lines.

VACUUM TESTING OF MANHOLES

1. In those specific instances where a manhole is constructed or reconstructed astride an existing and active sewer line, and where conventional exfiltration would require pumping of the existing sewage flows around the newly constructed manhole, vacuum testing of the manhole may be authorized by CTUB.
 - a. This test method is only applicable to precast concrete manholes.
 - b. Manholes should be tested from the frame down after the base course is placed.
 - c. Stub outs, manhole boots, and pipe plugs shall be secured to prevent movement while the vacuum is drawn.
 - d. Installation and operation of vacuum equipment and indicating devices shall be in accordance with equipment specifications for which performance information has been provided by the manufacturer.
 - e. A measured vacuum of 10 inches of mercury shall be established in the manhole. The time for the vacuum to drop to nine inches of mercury shall be recorded.

- f. Acceptance standards for leakage shall be established from the elapsed time for negative pressure change from ten inches to nine inches of mercury. The maximum allowable leakage rate for a four-foot diameter manhole shall be in accordance with the following:

<u>Manhole Depth</u>	<u>Minimum Elapsed Time for a Pressure Change of 1 inch Hg</u>
10 feet or less	60 seconds
> 10 feet but < 15 feet	75 seconds
> 15 feet but < 25 feet	90 seconds

- g. For manholes five feet in diameter, add an additional 15 seconds and for manholes six feet in diameter, add an additional 30 seconds to the time requirements for four-foot diameter manholes.
- h. If the manhole fails the test, necessary repairs shall be made and the vacuum test and repairs shall be repeated until the manhole passes the test or the manhole shall be tested in accordance with the standard exfiltration test and rated accordingly.
- i. If a manhole joint mastic is completely pulled out during the vacuum test, the manhole shall be disassembled and the mastic replaced.

DEFLECTION TESTING OF PVC PIPES

- 1. Prior to acceptance of a PVC sanitary sewer line, the pipe shall be thoroughly flushed and cleaned. The deflection testing shall be conducted by using a closed-circuit television (CCTV) camera truck provided by the DEVELOPER. If the CCTV shows standing water due to sags, the contractor will be required to correct the problem. At times, a mandrel test may also be required if the CCTV indicates excessive pipe deflection.

CTUB APPROVED MATERIAL LIST

The design engineer shall follow the Approved Materials List when specifying materials and equipment with the following additions and exceptions:

Suction Lift Pump:	Gorman-Rupp Co.
Submersible Pumps:	Grundfos (large) F.E. Myers (small)
Comminutor:	Franklin Miller or JWC
Magnetic Flow Meter:	Krohne Enviromag 2000 flowtube with IFC 050 or 100 converter.
Swing Check Valve:	American Flow Control 2100 Series

Generator:	Cummins, Cat or Kohler
Submersible Level Transducer:	ProSense NFLT-015-L60 with protective spacer
Backup Floats:	Roto-Float, SPST, normally open with internal weight
Wet Well Lining System:	OBIC 1000 with 1306
Automatic Air Release Valve:	Val-Matic or DeZurik
Surge Relief Valve:	GA or DeZurik
Hatches:	Halliday or Bilco