MONTGOMERY COUNTY PUBLIC SERVICE AUTHORITY
WATER AND SEWER DESIGN & COSTRUCTION STANDARDS
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SECTION TWO - WATER/SEWER STANDARDS

DESIGN AND CONSTRUCTION STANDARDS FOR WATER FACILITIES - Section 100.00

DESIGN AND CONSTRUCTION STANDARDS FOR SANITARY SEWER FACILITIES - Section 200.00

DESIGN AND CONSTRUCTION STANDARDS
FOR
WATER FACILITIES

100.00 GENERAL REQUIREMENTS:

All water supply systems, other than individual, including mains, valves, hydrants, and appurtenances shall be planned and constructed according to the specifications and standards set forth herein as minimum requirements. Before construction is commenced, plans, profiles, details, and specifications shall be reviewed and approved by the PSA Director as being in accord with these requirements and all construction shall be in accord with approved plans.

Water mains shall be located within public rights-of-way or dedicated public water line easements and shall be located no closer than five (5) feet from the edge of the easement or right-of-way line unless otherwise authorized by the PSA Director. Easements shall provide sufficient space for both installation and maintenance with a minimum width of 20 feet. When it is deemed necessary for proper maintenance of the facilities, additional easement width may be required by the PSA Director.

In planned developments (residential, commercial, industrial, etc.), water lines shall be placed in the road right-of-way outside of pavement and public utility easements for all other utilities (gas, electric, cable TV, telephone, etc.) shall be placed on the opposite side of the roadway to prevent conflicts of other utilities with water lines. Public water line easements shall be unencumbered by any other easements including blanket public utilities easements dedicated by reference in plats or deeds. Crossings of the public water line easements by other easements shall be as close to perpendicular as possible, but in no case shall the crossing be at an angle of less than 60 degrees to the public water line easement.

Water supply systems, as described above, shall be designed by a Professional Engineer, licensed by the Commonwealth of Virginia whose seal and signature shall be placed on each plan sheet. A Land Surveyor licensed by the Commonwealth of Virginia may design such portions of a water supply system as provided by the Code of Virginia, Title 54, Section 54-17.1, 3(b).

Systems shall be designed to provide adequate flow and pressure, both for domestic supply and fire flow, based on sound hydraulic analysis and good engineering practice. Hydraulic analysis shall be developed using readily available software. Domestic and fire flows shall be analyzed and presented separately and pipes shall be sized to meet the calculated requirements of simultaneous peak domestic and fire flow. Model output runs shall be presented in tabular form and include the following as a minimum: narrative defining various assumptions and various output runs, map showing all elements and labels easily referenced to site plans, static pressures, residual pressures, available fire flows, pipe velocities, pump conditions, control valve (PRV, etc.) conditions, storage tank conditions, and condition of any other applicable system element.

In order to properly evaluate water systems and hydraulic conditions, all submitted plans shall be based upon actual NAD 83 (horizontal) and NAVD 88 (vertical) datum.

100.01 The Design and Construction Standards Manual of Montgomery County Public Service Authority, of which these specifications are a part, approved by the Board shall be followed unless specified deviation therefore is authorized, in writing, by the PSA Director. When such deviations effect fire protection concurrent authorization by the Emergency Services Coordinator shall also be obtained. All standards referenced in this Section shall refer to the latest revision or revised edition of the referenced manual.

101.00 WATER LINE DESIGN:

101.01 The minimum size of water line shall be as follows:

A. In residential districts, eight-inch (8"); six inch (6") may be used only when it completes a good grid system, and only, in blocks six hundred feet (600') or less in length.

B. In other areas, 12-inch (12") and 8-inch (8"); 8-inch may be used only when it completes a good grid system and 12-inch for lines not interconnected.

C. Fire hydrants shall not be installed on lines less than eight inches (8") in diameter, except that fire hydrants may be installed on a six-inch (6") line that is part of good grid system. Unless specifically approved by the Emergency Services Coordinator, no plantings or erection of other obstructions shall be made within a four-foot (4') radius of any fire hydrant. The surface shall be level within this same radius.

D. For the last 450 feet of pipe located beyond last fire hydrant on streets which water line cannot be extended, 6-inch pipe may be used, when approved by PSA Director.

E. In lieu of the above, and for residential districts only, detailed design calculations may be submitted for review and concurrence by the PSA Director to substantiate line sizes other than those specified above. In any case, the minimum line size shall be six-inch (6"). For all design, the published "C" factor shall be reduced to new pipe "C" factor minus 10. This reduced "C" factor shall be used so as to reflect more accurately the future flow in aged pipe.

F. Dead-end water lines shall be eliminated wherever possible by looping of all water mains. Generally, ends of water lines within 500 feet or less shall be connected.

G. Long water service lines shall not be allowed in lieu of water main extensions, where a water main extension would serve other customers or areas. Where allowed, the water meter shall be installed at the right-of-way or easement line perpendicular to and at the shortest point from the public water main. Private water service lines shall not be located within the public right-of-way or easement parallel to the water main. The property owner shall be responsible to obtain private easement(s) for any crossing of private property.

101.02 In general, fire hydrants shall be located as follows:

A. In residential areas, at street intersections and at intermediate locations where necessary, as determined by the Emergency Services Coordinator. In no case shall the distance between fire hydrants, measured along the centerline of accessible streets, be greater than one thousand feet (1,000').

B. Within one hundred feet (100') of any standpipe or sprinkler system fire department connections, where those systems are required in buildings.

C. As required by the following schedule as given by use group, the distance shall be measured to the most remote part of the structure the hydrant will serve.

Industrial buildings	250 feet
School buildings	300 feet
Commercial, Churches & Office Buildings	350 feet
Apartments, Multi-family & Townhouses	250 feet
Single family detached dwellings	500 feet*

* Measured along centerline of street to the center of front property line for single-family detached dwellings only.

D. All hydrants shall be a minimum of fifty feet (50') away from buildings other than single-family detached dwellings. The location of all new and existing hydrants that are to serve the property shall be shown on the plans.

101.03 Water systems shall be designed to adequately supply normal and peak hour demands of all customers, while maintaining a pressure of not less than twenty-five (25) pounds per square inch at all points of delivery without reducing the service to existing customers below the foregoing requirements. Water systems shall have adequate capacity to provide not less than the below listed fire flows along with Maximum Hour Domestic Demands at all points of delivery, for a minimum of two hours, with a residual pressure of not less than twenty (20) pounds per square inch at all points within the proposed and existing water systems. The identified fire flow shall be available at a minimum of one (1) point within two hundred fifty feet (250') of each building to be served or proposed to be served by an extension. In those cases where the existing source of supply cannot deliver fire flows at adequate pressures, the developer shall design his water system based on achieving the required fire flows with an assumed residual pressure of 30 psi at point of connection to the supplying system.

A. Peaking Factors and Demands for Design:

1. Peak Hour Factor: 3
2. Maximum Day Factor: 2
3. Average Day Factor: 1
4. Residential Demand per ERC: 0.5 gallon per minute (GPM)
5. Maximum Hour Domestic Demand (less than 1,000 ERC): $Q=11.4 \times N^{0.544}$
   Q = total GPM N = total number of residential units

6. Industrial or commercial demands shall be based upon Best Engineering Judgment
7. Minimum fire flow: 500 GPM.

B. Fire Flow Requirements for Various Land Uses

1. Residential Areas as follows:

a. Normal residential property with over 100' between buildings - 500 GPM.

b. Normal residential property with 31'-100' between buildings - 750 GPM.

c. Normal residential property with 11'-30' between buildings - 1,000 GPM.

d. Story and one-half residential - 1,000 GPM.

e. Two-story residential, congested area - 1,500 GPM.

f. Normal residential property with 10' or less between buildings - 1,500 GPM.

2. High Value Areas:

a. Apartments, townhouses up to 2-1/2 stories -1,500 GPM.

b. Minor mercantile and congested apartments, 2 to 3 stories - 2,000 GPM.

c. High value industrial, shopping centers, and mercantile districts - 2,500 GPM.

In areas of mixed-use development, higher fire flow shall govern. Fire flows indicated above are for new development. Where size and scope of the development exceeds these requirements, additional flow shall be provided in accordance with ISO (Insurance Services Organization) requirements as reviewed by the Emergency Services Coordinator.

C. Fire Hydrant Top Bonnet and Caps Color Coding:
RED - Less than 500 gallons per minute
ORANGE - 500 to 999 gallons per minute
G**REEN** - 1,000 to 1,499 gallons per minute
BLUE – 1,500 gallons per minute and above

101.04 Valves shall be so set and adjusted such that covers shall be exposed and flush with street surface. Valves may not be installed in a roadway ditch or concrete gutter. If street surfaces are renewed or replaced by developer or owner after water system has been approved and accepted by the PSA but while such streets are still the obligation of the developer or owner, valve boxes/vaults therein shall be readjusted to proper location relative to the new street surfacing. Valve boxes/vaults located in sodded or other off-street areas shall be so set and adjusted that the covers shall be exposed and flush with finished surface elevation.

101.05 Valves shall be installed at the intersection of water lines. Generally, three (3) valves will be used at crosses and two (2) valves at tees. A valve shall also be installed at least every

one thousand feet (1,000') on distribution mains and adjacent to fire hydrant tees if practical. A valve shall be installed between the last service and the terminus of any water main that can be extended in the future.

101.06 Where a water main that can be extended is terminated beyond a gate valve on that main, the minimum length of pipeline between valve and end of the line shall be thirty-six feet (36'). Additional length shall be required to insure future extension with minimum surface destruction. In no case shall the end of a pipeline terminate in a paved area. No services or fire hydrant shall be installed between gate valve and end of line that can be extended.

101.07 No water line shall terminate under a concrete valley gutter or roadway ditch. Whenever possible to avoid, no gate valve shall be located under a concrete valley gutter. Water lines shall be laid with a minimum parallel offset of 3 feet from centerline of the pipe to either face of concrete curbing.

101.08 A blow-off at dead-end lines shall be provided as indicated in the details drawings.

101.09 All pipes shall be laid to a minimum depth of thirty-six inches (36") from established final grade to the top of the pipe. Water pipe shall not be laid at depths exceeding five (5') feet unless specifically approved by the PSA Director.

101.10 Automatic air release valves shall be placed at all high points in the system to provide for the release of trapped air. Fire hydrants may only be used at high points for release of trapped air when approved by the PSA Director. Combination (air and vacuum release) valves shall be installed when required by the PSA Director to also mitigate potential vacuum conditions.

101.11 All water mains shall be provided with blow-off valves at strategic low points in the line. Fire hydrants may be used at low points in place of blowoffs where it is demonstrated that a minimum flushing velocity of 4 feet per second is provided. The point of connection to the water main shall be rotated downward to facilitate removal of accumulated solids.

101.12 Cross connections and backflow prevention connections shall be designed and reviewed to insure compliance with the adopted cross-connection and backflow ordinance.

101.13 Main Line Pressure-Reducing Valve Assemblies (Detail Drawing W-14) shall be installed for all new water main extensions supplying residential areas which connect to an existing public water system where the static water pressure of the existing public water system is 80 psi or greater, the public water system is subject to water pump station fluctuations, or as deemed necessary by the PSA Director to mitigate pressure transients / water hammer.

101.14 Water mains may be installed on private property if a public water line easement of a minimum of twenty feet (20') in width is duly recorded. The easement width may be reduced in certain areas with written approval of the PSA Director when the twenty-foot (20') easement would constitute a significant hardship for the development.

Increased easement widths may be required by the PSA Director when determined necessary due to large mains or excessive depths which will require special trench exca-

vation in order to comply with applicable State and Federal safety regulations. Easement instruments denoting water line easements shall include a note giving water purveyor the right of access to water service connection and water meter for the purpose of maintenance and operation.

No permanent structure, including fences, trees or shrubbery, shall be placed or constructed within an easement. Additional easements shall be provided across property under the owners/developers control that may be required to extend water facilities in the future or to provide convenient access to easements for construction and maintenance purposes. Grade within existing easements shall not be changed without written approval from the PSA Director.

101.15 AWWA STANDARDS

The following AWWA Standards (latest revision) are hereby incorporated by reference. Where a conflict exists between these written standards, and the standards incorporated by reference, the PSA Director will determine which standard shall apply. In general, PSA Director will select Standard that gives a final product that is in the best interest of the PSA. Applicant shall provide PSA with manufacturer's certification that materials meet these standards.

A100 Standard for water wells.
C104 Standard for cement-mortar lined for ductile-iron and gray-iron pipe and fittings.
C110 Standard for ductile-iron and gray-iron fittings.
C111 Standard for rubber gasket joints for ductile-iron and gray-iron pipe and fittings.
C115 Standard for flanged ductile-iron and gray-iron pipe with threaded flanges.
C150 Standard for thickness design of ductile-iron pipe
(Class 52 minimum to be considered for 12" diameter or less)
C151 Standard for ductile-iron pipe
C502 Standard for dry-barrel fire hydrants
C504 Standard for rubber-seated butterfly valves (approved for 14 inch or larger)
C506 Standard for backflow prevention devices
C508 Standard for swing-check valves
C509 Standard for resilient-seated gate valves
C550 Standard for protective interior coatings for valves and hydrants
C600 Standard for installation and testing of ductile-iron water mains and appurtenances
C651 Standard for disinfecting water mains
C602 Standard for cement-mortar lining of water pipe lines
C652 Standard for disinfection of water storage facilities
C900 Polyvinyl chloride (PVC) pressure pipe, (DR-14 minimum class for water).
D100 Standard for welded steel tanks for water storage
D102 Standard for painting steel water storage tanks
D103 Standard for factory-coated bolted water storage tanks

102.00 SURFACE WATER CROSSING

Surface water crossings, both over and under water, present special problems and should be discussed with the PSA Director before final plans are prepared.

A. Above Water Crossings - The pipe above water crossings shall be:

1. Adequately supported;
2. Protected from damage from freezing;
3. Accessible for repair or replacement; and
4. Above 100 year flood level.

B. Under Water Crossing:

1. Pipe shall be of special construction, having flexible watertight joints; i.e. ball and socket, lock-joint, and shall be Class 54 or 55 DI. DR-9 HDPE may be used for under water crossings. In lieu of the above, Class 52 DI pipe may be used with a minimum of one foot on all sides being concrete encased within the one hundred (100) year flood way limits;

2. Valves shall be provided at both ends of the water crossing so that the section can be isolated for tests or repair; the valves shall be easily accessible and not subject to flooding by the 100-year storm flood level;

3. Permanent sample taps shall be installed on each end of the crossing and at reasonable distance from each side of the crossing to facilitate testing.

103.00 WATER STORAGE FACILITIES

Water storage facilities shall be designed and constructed to meet the requirements of AWWA D100 for "Welded Steel Tanks" or AWWA D103 for "Factory Coated Bolted Steel Tanks" for water storage, latest edition Standard except as hereafter specified otherwise. Water storage facilities shall be designed and constructed to meet Virginia Department of Health (VDH) standards and PSA requirements. All water storage facility design plans and specifications shall be reviewed and approved by the VDH and PSA.

Precast concrete water storage reservoirs may be required by the PSA Director under specific conditions that require below ground reservoirs. All precast concrete water storage reservoirs will be designed by PSA using applicable standards.

Water storage tanks shall be located on a dedicated water storage tank lot with an all-weather access road. Minimum lot size shall be 150 feet by 150 feet and minimum access road width shall be 15 feet.

A. Steel Standpipe, Reservoirs and Accessories

1. Supplemental Information to both AWWA D100 and AWWA D103.

a. Earthquake Design: Seismic Zone 2 using fixed percentage method of 5%.

b. Electric Power: Developer/Contractor's obligation

c. Compressed Air: Developer/Contractor's obligation

d. Concrete Work: Comply with all requirements of ACI 301.

2. Supplemental Information to AWWA D100.

a. Corrosion Allowances: 1/16-inch for parts in contact with water.

b. Submit written report certifying work inspected as set forth in AWWA D100, Sec. 11.2.1. Mill and shop inspection by commercial inspection agency is required.

c. Submit details of all welded joints referenced on design drawings in accordance with AWWA D100, Sec. 1.4.

d. Mill Scale: Completely remove by blast cleaning or pickling. (SSPC-SP10 or SSPC-SP8)

e. Butt-joint welds subject to secondary stress where thickness is greater than 3/8 inch (3/8") shall have complete joint penetration welds.

f. Radiographic tests shall be required and film shall become property of the PSA.

g. Protective Coatings:

g1. Surface preparation for both inside and outside shall be in accordance with SSPC-SP10. (Steel Structures Painting Council - Surface Preparation 10)

g2. First anniversary inspection in compliance with AWWA D102 will be required.

g3. Outside Paint System: Aliphatic Polyurethane 5.5 to 8.0 total dry mils. Outside paint shall be Tnemec 70/71-3, Pennsbury Coatings, Water Tank System No. 10 or equal as approved by PSA Director.

g4. Inside Paint System: Two-Coat Epoxy Polyamide, 7.0 to 11.0 total dry mils meeting NSF Standard 61. The inside paint shall be Tnemec 20-1 (Poto-Pox) or equal as approved by the PSA Director.

g5. Paint Color shall be as selected by the PSA Director from the manufacturers available colors.

3. Supplemental Information to AWWA D103.
   a. Tank Bottom: Concrete slab and steel base setting ring is required.

   b. Full five (5) year manufacturers warranty on factory coating is required.

4. The following accessories, in addition to those required by either AWWA D100 or AWWA D103, shall be provided and installed.

   a. Exterior safety cage, rest platform and roof ladder, handrails to accessories in conformance with OSHA. A fall prevention system, which complies with applicable OSHA regulations, is also required.

   b. Overflow to ground, 1,000 GPM minimum, located near roof opening. Provide coarse screen and concrete splash pad and erosion protected channel from overflow to drainage system or natural channel.

   c. Screen vent against insects, provide special vent to insure fail-safe operation in event insect screens frost over.

   d. Removable silt stops.

   e. Separate drain line to drainage system or natural channel with erosion protection and drainage easement as needed.

   f. Separate fill and discharge lines to provide adequate mixing and minimize short-circuiting.

   g. Exterior tank water level system with sight gauge measurements of 0.5 foot intervals of entire tank height.

B. Disinfection

1. After all painting and coating schedules have been completed and the specified drying times have elapsed; the Developer/Contractor shall proceed to disinfect the interior surfaces of the standpipe structure utilizing one of the following disinfection methods.

   a. Tank shall be filled to overflow level with potable water to which enough chlorine has been added to produce an initial chlorine concentration of 50 mg/l in the full tank. The full tank should stand for 24 hours; however, in no case, shall it stand less than 6 hours. At the end of the holding period, the highly chlorinated water shall be drained to waste after being properly de-chlorinated, the tank refilled with potable water and tested for bacteriological quality.

   b. All interior surfaces of the tank shall have applied to them a strong

chlorine solution containing at least 200 mg/l of free available chlorine. The chlorine solution shall be applied with either spray equipment or brushes. Any equipment used to apply the chlorine solution shall either be new or previously used only for disinfection purposes. Strong chlorine solution shall remain in contact with tank surfaces for at least 30 minutes. Tank shall then be filled with potable water to overflow level and tested for bacteriological quality.

c. Potable water containing a free chlorine residual 50 mg/l shall be placed in the tank to such a depth that when the tank is filled, the resulting chlorine concentration in the water will be at least 2 mg/l. The water containing 50 mg/l of chlorine shall stand in the tank for 24 hours. The tank shall then be filled with potable water and allowed to stand for 24 hours. At the end of the second 24-hour period, the chlorine residual shall be at least 2 mg/l. After bacteriological analysis of the water for quality, the tank may be placed in service without draining the water used to disinfect it.

2. Two consecutive bacteriological samples collected at 24-hour intervals shall be obtained from the standpipe structure before the tank is placed into service. The bacteriological test form shall be marked "CONSTRUCTION SAMPLE". Analysis of the samples shall be performed by a laboratory certified by the VA State Health Department. If contamination is indicated in the bacteriological samples, the disinfection procedure shall be repeated at the Developer/Contractor's expense.

104.00 WATER PUMP STATIONS

Water pump stations shall be designed and constructed to meet Virginia Department of Health (VDH) standards and PSA requirements. All water pump station design plans and specifications shall be reviewed and approved by the VDH and PSA. In addition the following requirements shall apply:

A. All pump stations shall be designed with three pumps, each capable of pumping 50% of the peak hour design flow. Hydraulic or electrically actuated pump control valves shall be provided for each pump unless otherwise approved by the PSA Director.

B. Pumps shall be selected for maximum operating efficiency. The pump operating design point (system curve intersect) shall be between 75 to 120 percent of the gallon per minute (GPM) flowrate (Q) of the pump rate (GPM) at the point of maximum operating efficiency (n) on the manufacturer's pump curve.

C. Pump stations shall be controlled by pressure devices installed on a separate sensing line at the point of storage. For pump stations not located at storage facilities, pump control information shall be transmitted to pump station via dedicated telephone lines or radio transmission.

D. Pump controllers shall include provisions for alternating plus backup control of pumps.

E. Low suction pressure cut-off switches shall be provided to prevent/shut down pump operation when suction pressure drops to a preset value to prevent pump damage.

F. Electrical Requirements:

1. Pumps 5 horsepower and above shall be 3 phase. Where 3 phase is available, pumps larger than 3 horsepower shall be 3 phase. Variable Frequency Drives (VFD) shall be provided for all pumps 5 horsepower or greater where 3 phase power is not available. Three-phase power will be considered available if the supply is within 2,000 feet for overhead service or 1,500 feet for underground service of the sewage pump station.

2. Three phase pumps shall have phase protection on individual phases which also protect when running, as manufactured by Square D, Allen-Bradley or equal as approved by the PSA Director.

3. Three phase pumps shall each have an individual poly-phase starter.

4. All pumps shall be controlled by starters with individual HOA switches.

5. Starters shall be sized one size larger than horsepower required. Heaters shall be sized for actual current load.

6. All control circuits shall be 120 volt.

7. Electrical service shall be provided with lightning arresters.

8. Electrical panel shall have a minimum of 20 circuits.

9. All electrical wiring shall be placed in conduit.

10. Water pump stations shall be considered a wet location for interpretation of the National Electric Code requirements.

11. All receptacles and switches shall have a minimum 20-amp rating.

12. At least one 20-amp circuit equipped with GFI protection shall be provided.

13. All electrical equipment and panels shall be manufactured units with UL listing and shall include the manufacturer's warranty.

14. A non-automatic transfer switch shall be installed on load side of service disconnect with connection for auxiliary generator. Switch shall be rated same as or higher than service disconnect. Connector for the auxiliary generator shall

be Crouse Hinds catalog number APJ10477.

15. On-site standby generators shall be provided for all pump stations. Generators shall be powered by natural gas (where available) or propane and sized to provide adequate service to start and operate all pumps. Propane storage tanks shall be sized to provide a minimum of three (3) days of operation.

G. Hour run meters shall be required for each pump motor.

H. Master water meters shall be provided and located to provide maximum accuracy.

I. All pump stations installed above ground shall be of masonry construction with masonry or frame roof. Exterior shall be brick faced or washed pebble and shall have prefinished fascia, soffit and trim. Pre-hung insulated steel doors with minimum size 3-0 x 6-8 shall be used.

J. Pump houses shall have adequate insulation to protect equipment and reduce heating cost.

K. Adequate lighting, heating, ventilation, and drainage shall be provided for pump stations.

L. Below or in-ground pump stations may be approved by the PSA Director for special application on an individual basis. Such approval will only be given when such design meets all the above requirements and adequate provisions are provided for the prevention of flooding, safe working conditions, efficient access system and adequate area for maintenance and operation of the pump station.

M. Minimum size structures to house a pump station shall be 8 foot x 10 foot x 8 foot high.

N. All pump stations shall comply with applicable Building Codes and applicable Montgomery County permits shall be secured.

O. All pump station piping and fittings shall be flanged copper or ductile iron unless otherwise approved by the PSA Director.

P. Isolation valves shall be required between the connection to the piping and all gauges and all other smaller diameter taps.

Q. Bleeder valves (petcocks) shall be provided on all pump discharge lines.

R. Pump shutoff controls (high level pressure switch) with manual reset is required for each pump when discharge pressure exceeds 85 psi unless otherwise approved by the PSA Director.

S. Automatic air release valves shall be installed at all high points on pump discharge piping.

T. A minimum of one automatic air/vacuum valve shall be installed on the pump suction piping.

U. A spare (not installed) pump shall be provided with each pump station.

V. Water pump stations shall be located on a dedicated water pump station lot with all-weather access road. Minimum lot size shall be 100 feet by 100 feet.

- END OF SECTION -

DESIGN AND CONSTRUCTION STANDARDS
FOR
SANITARY SEWER FACILITIES

SECTION 200.00 APPLICABILITY

A. If public sewer is located within 300 feet of the proposed dwelling/dwellings, the owner is required to extend the public sewer and connect onto the public system.

B. If public sewer is not available, the owner is required to acquire necessary Health Department approval prior to a building permit being issued by Montgomery County.

C. Sanitary sewers shall be designed to serve all lots, including lateral connections between the trunk sewer and the property line being served.

D. Plan approval of any outside jurisdiction involved shall be obtained by the developer prior to plan approval by the PSA.

E. The Virginia Department of Environmental Quality (DEQ) approval may be required for projects involving any non-single family home sewer pump station discharging into a gravity collector or interceptor sewer line. Virginia Sewage Collection and Treatment (SCAT) Regulations are to be used in conjunction with PSA standards with the more stringent of the two having precedence. SCAT Regulations can be found at ***http://www.deq.virginia.gov***.

F. A preconstruction conference shall be held on all sewer projects by Montgomery County Public Service Authority (PSA) at least one day prior to any construction work being performed. The contractor's superintendent/foreman shall also attend this meeting. If superintendent/foreman cannot attend, then the developer or contractor's representative shall submit a letter to the PSA that the superintendent/foreman has been informed of items discussed at this meeting.

SECTION 200.01 GENERAL

A. Type of Sewers

1. The PSA Sewage System is designed to provide conveyance with total containment. New sewers, extensions, or replacements, not designed to provide total containment for the design period shall not be permitted.

2. Under no circumstances shall storm water, surface water, ground water, roof runoff, subsurface drainage or untreated industrial process water be discharged into any public sanitary sewer system.

B. Compliance with Design Criteria

The criteria established herein are minimum requirements for design and review under the Montgomery County Subdivision and Land Development Ordinance. This criteria is required in order for the County to comply with the Virginia National Pollutant Discharge Elimination System Permit authorizing the discharge of pollutants, under prescribed conditions, to State waters pursuant to the Virginia Department of Environmental Quality Regulations.

SECTION 200.02 DESIGN CRITERIA

A. All sanitary sewer designs shall comply with the approved Montgomery County Comprehensive Water and Wastewater Study, and Commonwealth of Virginia Sewer Regulations as applicable.

All sanitary sewer designs shall be prepared and properly certified by a professional engineer licensed in the State of Virginia.

B. The adequacy of the existing sanitary sewer system receiving flows from the proposed project shall be determined at the preliminary stage to preclude unnecessary revisions to construction plans.

The designer shall provide calculations for the sanitary sewer system (on-site and off-site for both existing and proposed conditions as required) to the points of connection to the PSA sanitary sewer system when requested.

C. Tributary Population

Sewerage facilities shall be designed for the estimated ultimate tributary population. Consideration shall be given to domestic, commercial, institutional, and industrial wastes in determining the capacity of the system. The design shall be based on approved estimates of anticipated populations and flows for a period of 50 years hence, or the entire watershed shall be assumed to be completely developed according to the Comprehensive Plan and/or sewer master plan, whichever provides the greater sewerage flow, unless the PSA Director approves otherwise.

D. Sewage Flow

1. Determining the average design flow shall be the first step in the sizing of sanitary sewerage systems. Actual design quantities may be substituted for the average design flows, provided supporting data is furnished to and approved by the PSA Director.

2. Sewers shall be designed to carry a peak flow when full as determined by applying the appropriate peak flow factor to the average design flow.

3. Ventilation of gravity sewer systems shall be provided where continuous watertight sections greater than 1,000 feet in length occur.

E. Location of Sewers and Manholes

1. In general, sewer lines and manholes shall be located within public sanitary sewer easements wherever possible. Sewers shall only be located in public road right-of-way with written approval of the PSA Director.

   a. If approved, manholes should be located along the centerline of streets when possible but always beyond the spread of stormwater gutter flow.

   b. Sanitary sewer pipe and manholes shall not be located within the paved portion of privately owned and maintained streets or common driveways without the prior written approval of the PSA Director. This provision does not preclude the crossing of these driveways at generally 90 degrees with a sanitary sewer pipe.

   c. The horizontal and vertical separation between sewers and waterlines shall be in accordance with the requirements of PSA Design and Construction Standards for Water facilities.

   d. Sanitary 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 involves any pipe larger than 24 inches in diameter, the crossing must be specifically designed and construction details provided.

   e. A table of bearings and distances shall be provided on all construction drawings for sanitary sewer construction, in order to accurately locate the utility. The table of bearings and distances is not required on early submissions, but is required prior to final plan approval. The engineer or surveyor will supply cut-sheets for the installation of all sewer systems.

   f. Plan and profile of the sanitary sewer system is required.

   g. The deflection angle from the inflow pipe to the outflow pipe at any junction shall not be less than 90 degrees unless a drop connection is provided.

   h. A table of lateral elevations at cleanout invert and minimum building sewer elevations shall be included in plans. Building sewer elevation shall be a minimum of two feet above cleanout invert elevation.

   i. Long sewer service laterals shall not be allowed in lieu of sewer main extensions, where a sewer main extension would serve other customers or areas. Where allowed, the sewer cleanout shall be

installed at the right-of-way or easement line perpendicular to and at the shortest point from the public sewer main. Private sewer service laterals shall not be located within the public right-of-way or easement parallel to the sewer main. The property owner shall be responsible to obtain private easement(s) for any crossing of private property.

2. Proposed sanitary 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.

3. Manholes for access to sewer lines shall be provided at:

   a. At all intersections of differing size sewers that are 27 inches in diameter or smaller.

   b. At all points of change in alignment.

   c. At all points of change in grade.

   d. At the terminal end of the sanitary sewer line.

   e. At intervals not exceeding 400 feet on all sewers 15 inches in diameter or less and not exceeding 600 feet on all sewers larger than 15 inches in diameter.

   f. A sampling manhole will be required for all non-residential users. The sampling manhole may be used in lieu of the required cleanout at the property/easement line.

4. When it is necessary, due to steep slopes, increased velocity or invert elevation differences equal to or greater than 24 inches, an inside or outside drop connection shall be employed. The maximum difference in elevation between the influent and effluent pipe inverts within the manhole itself shall be one inch. The minimum diameter manhole for use with an inside drop connection shall be five feet. Only one inside drop shall be installed per five-foot diameter manhole. Two inside drop connections may be made in a six-foot diameter manhole. These provisions apply for both sewer main and lateral connections. Refer to Detail Drawings.

5. Outside drop manhole connections are acceptable for use in Montgomery County. Refer to Detail Drawings.

6. Manholes for sewers up to 15 inches in diameter shall not be less than four feet inside diameter. Manholes over fifteen feet (15') in total depth (lowest invert to top of cover) shall be five-foot in diameter. Manholes over 20 feet in depth shall have safety slabs installed every 10 feet. Manholes for sewers

up to 36 inches shall have an inside diameter of not less than five feet. If hydraulic characteristics do not permit use of a four-foot inside diameter manhole, then a five-foot diameter manhole or special manhole detail must be provided.

7. When designing new sewers to tie into existing sewers, the connection shall be made by one of the following methods:

   a. Connection to an existing manhole. Connection to the existing manhole must be configured so that the invert of the new tie-in is not established lower than the existing bench. Existing manhole shall be cored through the manhole base (bench) on adequate slope and 0.2' higher than the existing invert at the point of intersection. The pipe connection shall be made using a manufactured flexible manhole boot.

   b. New in-line manhole. The new manhole shall be set after removal of the existing pipe and installation of proper bedding material. Refer to Detail Drawings. The invert of the base section shall match the slope of the removed pipe. Outlet pipe shall be connected to the manhole boot. Inlet connection shall be made with a 6-foot pipe stub connected to the manhole boot and to the existing pipe by a Fernco coupling or approved equal as per Detail Drawings. This method will require pumping of existing flows during installation. Testing shall be by the vacuum test method.

   c. Straddle manhole. Straddle manholes may be used for installations not suitable to the above two methods and approved on an individual basis by the PSA Director. Refer to Detail Drawings. Special care shall be taken to make the manhole watertight and to protect the integrity of the existing pipe. Outside of existing pipe shall be thoroughly cleaned and waterstops installed prior to placing of concrete. All concrete for invert shaping, bench, and base shall be of a single pour. Risers and other sections shall not be installed for a minimum of 24 hours after placing concrete. All existing concrete that comes in contact with new concrete shall be etched and have a bonding agent applied. A PSA inspector must be present during installation of all straddle manholes. Testing shall be by the vacuum test method.

8. All new sanitary sewer manholes shall be precast concrete in accordance with ASTM-C478 consisting of precast concentric riser reinforced sections, an eccentric conical section, and a base section conforming with the typical manhole as shown in Detail Drawings. Field installation of manhole flow trough (invert) using concrete will not be allowed.

9. Sewers adjacent to or crossing streams, estuaries, lakes and reservoirs shall be designed, constructed and protected in accordance with requirements of

the Virginia Department of Environmental Quality Sewerage Regulations, except that:

a. The connection of sanitary sewer lines shall be made only at manholes. The type of material shall be the same from manhole to manhole. Connections to existing manholes shall be made under direct supervision of Montgomery County PSA personnel.

b. Sewer lines crossing streams shall be Class 52 Ductile Iron pipe with sanitary sewer specific lining material, HDPE SDR-9, C900-DR 14 PVC or equivalent and concrete encased. Reference Detail Drawings. Pipe shall be provided with a minimum of one foot of cover over the concrete encasement where the stream is located in rock and three feet minimum cover where the stream is located in other materials. The cover requirements may be lessened with the approval of the PSA Director in an area that will not interfere with future improvements to the channel bottom.

c. Sewer lines shall not be located within stormwater management impoundment areas unless there is no alternative. The PSA Director may approve sewer lines within a stormwater management impoundment area only if such sewer lines are designed and constructed to site specific conditions that will protect the sewer line for a period of 100 years. If allowed, sewers shall be configured so that repairs can be made without dewatering the impoundment.

d. Inverted siphon (sag pipes) shall be approved on an individual basis by the PSA Director. Inverted siphons shall not be less than two (2) barrels, with a minimum pipe size of six inches (6) and shall be provided with necessary appurtenances for convenient flushing and maintenance; the manholes shall be designed to facilitate cleaning; and, in general, sufficient head shall be provided and pipe sizes selected to secure velocities of at least 3.0 feet per second for average flows. The inlet and outlet details shall be arranged so that normal flow is diverted to one (1) barrel so that either barrel may be removed for service or cleaning.

e. Aerial sewer crossings shall be approved on an individual basis by the PSA Director. Pipe shall be restraint joint ductile iron on concrete piers with specifically designed pipe supports/anchors. Aerial sewers shall be protected against water borne debris if crossing a stream, ditch, gully, etc. Exit/entrance points of pipe shall be protected against erosion by grouted riprap or concrete section.

10. Sewer located in areas of unstable soil conditions or other special circumstances may need to be encased in concrete, relocated or re-designed as required by the PSA Director.

F. Sanitary Sewer Lateral Cleanouts

1. Sanitary sewer cleanouts will be:

   a. Located at the property line or sanitary sewer easement line contiguous to the property. Refer to Detail Drawings.

   b. A traffic bearing type cleanout box is required if located in pavement areas. Refer to Detail Drawings.

   c. Minimum slope for service lateral shall be 2.08 percent (1/4": 1'). Maximum slope of service lateral shall be 45 degrees within public easements or right-of-ways.

   d. The offset angle of the lateral to run of the sewer main shall not exceed 45 degrees.

G. Minimum Sewer Size

No public sanitary sewer main shall be less than eight inches in diameter except for sewer force mains.

H. Hydraulic Criteria

The design and determination of sewer size shall be based on the following conditions.

1. Sewers shall have a uniform slope and alignment between manholes.

2. At all manholes where a smaller diameter sewer discharges into a larger one, the invert of the larger sewer shall be lowered so that the energy gradients of sewers at junction are at the same level. Generally, this condition will be met by placing the 0.8 depth of flow or diameter in each sewer at the same elevation.

3. Sewer 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 when running full to maintain cleansing flow. Computations of velocity of flow shall be based on a PVC pipe coefficient of roughness "n" in the Manning formula of n = 0.015.

4. In no case shall terminal lines with less than 20 residential connections have a slope of less than one percent unless approved by the PSA Director.

5. The maximum permissible velocity occurring with average flow shall be 10 feet per second (before applying peak flow factor).

6. Where due to steep grades, velocity exceeds 10 feet per second, and/or where drop manholes are impractical for reduction of velocity, the sewer shall be designed with an abrasion resistant material meeting ASTM or AWWA specifications approved by the PSA Director and shall be anchored where appropriate.

7. In general, the following are minimum slopes in feet per hundred feet to be provided for pipes flowing at full depth to one-half of full depth:

Sewer Size	Minimum Slope in Feet per 100 Feet
8 Inch	0.40
10 Inch	0.28
12 Inch	0.22
14 Inch	0.17
15 Inch	0.15
16 Inch	0.14
18 Inch	0.12
21 Inch	0.10
24 Inch	0.08
27 Inch	0.067
30 Inch	0.058
36 Inch	0.046

8. Benches in terminal manholes shall be built at a slope of not less than one inch per foot.

9. Minimum Permissible Depth

   All sewer mains and service laterals shall have a minimum cover of three feet (See Construction, Section 201.04 Pipe Installation for more information).

10. a. Maximum depth of sewers shall be 14 feet unless approved in writing by the PSA Director.

    b. 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 deeper than 14 feet require pipe strength calculations to be submitted with the design. The maximum depth for all types of pipe shall be in accordance with manufacturer's specifications and recommendations for Standard Pipe Laying Conditions - Type 3 Trench.

11. Slope Anchorage

    Concrete anchors shall be placed on sanitary sewer lines with grades of 20

percent or greater. Minimum anchorage shall be provided such that anchors are not located over 36 feet center to center on grades from 20 to 35 percent. The maximum grade for sanitary sewers shall be 35 percent with anchorage unless otherwise approved in writing by the PSA Director. Refer to Detail Drawings.

12. In general, the pipe diameter of sewers shall increase continually with increase in tributary flow. Where steep slopes would permit the use of reduced pipe size and construction cost savings can be derived, the pipe size may be reduced one size at a manhole; however, appropriate hydraulic allowances shall be made for head loss of entry, increased velocity, and the effect of velocity retardation at the lower end where the flow will be on a flatter slope. Prior written approval of the PSA Director is required for reduction in line sizes.

I. Sanitary Sewer Force Mains

1. The minimum size for force mains shall be four inches except when using grinder pumps.

2. At pumping capacity, a minimum velocity of two feet per second shall be maintained.

3. Automatic air relief valves or Combination (air/vacuum) relief valves shall be placed at the necessary high points in the force main to release trapped air and mitigate vacuum conditions.

4. Maximum velocity shall be eight feet per second.

5. All force mains shall connect to a cleanout with a drop stack connection at the right-of-way or easement line. From there the flow shall be gravity into the public system. See Detail Drawings.

6. All pipe used for force mains shall be pressure type with pressure type joints. (PVC SDR 21, CL 200 minimal)

7. Anchorage shall be provided where deemed necessary by the PSA Director, refer to the Commonwealth of Virginia Sewerage Regulations for testing and anchorage guidelines of force main sewers.

8. Receiving gravity flow sewage system shall be analyzed for adequacy to handle peak force main discharges.

9. Locator wire shall be installed with all force main PVC and HDPE pipe. Refer to Detail Drawings. Minimum U.S. standard gauge 12 solid copper. PSA Director may require heavier gauge wire in depths of greater than 6'.

10. Public force mains for use with private individual sewer grinder pumps shall

be acceptable. Design shall provide means to prevent excessive holding time and septic conditions. It shall be clearly noted on the deed or other title document that the sewer pump maintenance is the property owner's responsibility.

11. Public sanitary sewer force mains shall not be installed at depths exceeding five (5') feet.

J. Sewage Pump Stations

1. Private sewage pump stations (i.e., those stations not accepted into the PSA sewer inventory and privately maintained) may be approved by the PSA Director under the following conditions.

a. Private sewer pump stations shall meet the construction requirements of the applicable building codes and may only accept flows from private sewer systems limited to:

a1. Building laterals

a2. Collector laterals

a3. Private sewer systems entirely on a single lot of record

b. Only sewer grinder pumps shall be acceptable.

c. Private sewer pump stations which connect to a public sewer force main shall be designed by a professional engineer licensed in the State of Virginia.

2. Public sewage pump stations shall be required whenever the pump station accepts flow from more than one lot of record or as required to be reviewed under the Virginia Sewage Regulations. Public sewage pump stations must conform to the following:

a. All public pump stations shall be designed using submersible pumps.

b. The design criteria and equipment specifications must meet the requirements of the PSA and the Virginia Department of Environmental Quality (DEQ). The design engineer shall apply to DEQ for the Certificate to Construct (CTO) and Certificate to Operate (CTO). Construction shall not begin prior to receipt of the CTC and PSA acceptance of the pump station shall not take place prior to receipt of the CTO.

c. The design calculations for the sewage pump station and force main shall be submitted for review. This design shall address:

c1. Design flows from the subdivision and ultimate sewershed
c2. Force main TDH and velocities for new and aged pipes (new pipe "C" factor minus 20)
c3. Pump curve
c4. Wetwell size
c5. Holding times in wetwell and force main relative to septicity
c6. Piping configuration
c7. Specifications including electrical
c8. Operating conditions and setting of pump station between initial and ultimate flows.

d. The entire facility, to include the building lot on which the station is located, must be dedicated at no cost to the PSA. Minimum lot size shall be 100 feet by 100 feet.

e. All public sewage pump stations shall have an all-weather access road with a minimum width of 15 feet.

f. Public sewage pumping stations shall be protected using standard poly-coated security fence unless otherwise approved by the PSA Director. Refer to Detail Drawings.

g. Potable water shall be provided to pump station unless otherwise approved by PSA Director. Potable water systems shall be properly protected against backflow by an approved device.

h. All materials must be new and unused.

i. Due to the excessive operation and maintenance costs of public sewer pump stations, these stations will only be accepted under a waiver request. Each request must identify all alternatives to the pump station including the cost to provide gravity sewer service to the property. The cost for off-site gravity sewer extension must exceed the cost of the pump station by a factor of three (3). The inability to obtain off-site public easements for a gravity sewer extension will not in itself be justification to install a pump station.

j. All public sewer pump stations shall be designed by a professional engineer licensed in the state of Virginia and submitted to the PSA for review and approval. The PSA review and approval may include requirements not enclosed herein.

k. Four sets of operations and maintenance manuals and shop drawings shall be submitted for all electrical and mechanical equipment including complete manufacturer's parts lists and wiring diagrams.

3. Wet Well and Valve Vault Requirements for public sewage pump stations:

a. Minimum of 2 hours of storage at average flow must be provided above high-level alarm set point to allow time to respond to a pump station failure.

b. A connection for an auxiliary pump shall be provided at each pump station consisting of a valved suction line in the wet well and valved discharge line in the valve vault. The connections on both lines shall be by "cam-lock quick couplings." These pipes and fittings shall be fully restrained and pressure tested.

c. Wet well through wall penetrations shall be by wall sleeves with flexible seals for pressure piping and flexible boots for all other piping or conduits.

d. Wet wells shall be tested for watertightness by a 24 hour exfiltration test. No loss shall be allowed. A 24 hour presoak may be performed.

e. Buoyancy of the wet well shall be calculated. Anti-floatation rings shall be provided if the upward force exceed the downward force when the wet well is empty.

f. Pressure gauges with gauge guards shall be installed on each pump discharge line inside the valve vault.

g. Gate valves and check valves shall be installed on force main outside of pump station in square concrete vaults with "Bilco" hatch or approved equal. Gate and check valves shall not be installed in a vertical position. Ductile iron pipe with sanitary sewer specific lining shall be installed between the pump connection and gate valves.

h. Submersible pumps shall have provisions for pumps to slide freely on stainless steel guide rails (two per pump) to allow for easy removal and installation. Guide rail bracing shall be provided at the midpoint of each ten-foot length of guide rails.

i. Wet well platforms may be required for submersible systems 10 feet deep or greater. Wet wells shall not be greater than 25 feet deep.

j. Stations shall not utilize long stem valves.

k. A gate valve shall be installed on the sewer force main immediately upstream of the sewer pump station valve vault to allow accessing the valve vault appurtenances without having to drain the sewer force main.

4. Pump requirements for public sewage pump stations:

a. Pumps shall be selected for maximum operating efficiency.

b. The pump operating design point (system curve intersect) shall be between 75 to 120 percent of the gallon per minute (GPM) flowrate (Q) of the pump rate (GPM) at the point of maximum operating efficiency (n) on the manufacturer's pump curve.

d. Pumps shall not be provided with trimmed impellors.

e. Pumps shall be provided with a minimum five (5) year non-prorated warranty.

f. A complete spare (not installed) pump with motor and guiderail connector shall be provided with each pump station.

10. Electrical requirements for public sewage pump stations:

a. Three-phase power should be provided for all sewage pump stations. All pumps shall be three-phase where three-phase power is available. Pumps 3 horsepower and above shall be 3 phase. Variable Frequency Drives (VFD) shall be provided for all pumps 3 horsepower and greater where three phase power is not available. Three-phase power shall be considered available and provided if the supply is within 2,000 feet for overhead service or 1,500 feet for underground service of the sewage pump station.

b. All pump stations shall be designed with two pumps and be controlled by submersible level transducers. Pump controllers shall include provisions for automatic alternation plus backup control of pumps. Transducers shall be installed inside a minimum 2" diameter conduit to the top of the wet well with a "wye" fitting at top with hose bib connection on branch for flushing.

c. Three phase pumps shall have phase protection on individual phases. Three phase pumps shall have an individual poly-phase starter.

d. Pumping stations shall have an alarm system on separate circuit from pump control circuit with light and battery backup. The alarm system shall monitor power failure, high wet well level and low level alarm. An automatic dialing mechanism is also required.

e. All pumps shall be controlled by starters and have individual HOA switches with test and run lights.

f. Starters shall be sized one size larger than horsepower required. Heaters shall be sized for actual current load.

g. Leakage sensors for indication and protection of fluids in stator

housing shall be installed.

h. An hour run meter shall be provided for each pump motor.

i. All control circuits shall be a maximum of 120 volts.

j. Electrical service shall be provided with secondary surge arresters.

k. All electrical wiring shall be copper, placed in conduit, and have markers at all wire terminations.

l. Electrical panel shall have a minimum of 12 circuits.

m. At least one 20 amp GFI circuit shall be provided.

n. Dusk to dawn high-pressure sodium or approved equal light with the initial lamp rating of at least 5000 lumens shall be provided 10' above the ground at all outdoor electrical equipment.

o. A non-automatic transfer switch shall be installed on load side of service disconnect with connection for auxiliary generator. Switch shall be rated same as or higher than service disconnect. Connector for the auxiliary generator shall be Crouse Hinds catalog number APJ10477.

p. All wiring, electrical equipment and installation shall meet requirements of current National Electrical Code. All areas to be considered wet locations.

q. Electrical junction boxes and other accessories shall be easily accessible.

r. Pump motors shall be of "explosion proof" construction meeting National Electric Code (NEC) Article 500 Class 1 Division 1 Group D classification.

s. Pump motors shall be air-filled.

t. A minimum of 3 thermal sensors shall be provided imbedded in the pump motor winding, wired in series and incorporated in the external motor overload protection.

u. On-site standby generators with automatic transfer switch shall be provided for all pump stations. Generators shall be natural gas (if available) or propane and sized to provide adequate service to start and operate both pumps. Fuel storage tanks shall be provided on site sized to provide a minimum of three (3) days of continuous operations.

v. A properly sized flow meter specifically designed for sewer pump stations shall be provided.

K. Public Easements

1. Sanitary sewer mains may be constructed on private property provided that the owner has duly recorded a public sanitary sewer easement adequate for the proper installation, maintenance, operation or removal of the sewage facilities. The owner shall have recorded easements from all parties possessing or having legal interest in the property.

a. Public easement width shall be determined based on a one-to-one side slope measured from outside edge of pipe extending from invert of the pipe at its lowest point below proposed grade between manholes and rounded up to nearest foot. See Detail Drawings.

b. Minimum public easement width for sanitary sewers shall be 20 feet.

c. Increased/decreased public easement widths may be required by PSA Director for unusual situations or circumstances.

d. Public sanitary sewer easements shall be unencumbered by any other easements including blanket public utilities easements dedicated by reference in plats or deeds. Crossings of the public sanitary sewer easements by other easements shall be as close to perpendicular as possible, but in no case shall the crossing be at an angle of less than 60 degrees to the public sanitary sewer easement.

2. No privately owned permanent structure or landscaping other than shrubs shall be permitted within a public easement. Any damage to shrubs that are located within the easement that may be caused by the legal use of the easement by the PSA shall remain with the property owner.

3. Where deemed necessary by PSA Director, and in order to ensure maximum utilization of public sanitary sewer systems, it will be required that appropriate public easements be provided to adjacent properties for access or extension of said public sewer system.

4. Grade within existing public easements shall not be changed without written approval of the PSA Director.

SECTION 200.03 Repair Guidelines

A. Prior approval of the PSA Director is required for repairing damaged concrete sanitary sewer pipe.

1. Maximum repairable size hole above the spring line shall be three inches in

diameter. It shall be repaired using a repair coupling. Coupling shall extend a minimum of six inches beyond the edge of damage. Only one repair coupling is allowed between new manholes.

2. All other damage (i.e., cracks, holes in pipe line, or crushed pipe) shall be repaired by replacement of the damaged section. To repair this type of damage, vertical plane cuts shall be made a minimum of one foot beyond the extremity of the damaged section. A replacement section shall then be installed such that the joint gap at either end shall be no more than one-eighth of an inch. Replacement section will then be clamped. If damage is in joint at manhole, then the entire joint shall be replaced.

3. All clamps shall be full circle and made of stainless steel and have a minimum width of 12 inches.

4. All excavation shall be performed to afford proper protection to line while repair is made.

5. Location of sanitary sewer pipe repairs will be made part of the as-built records.

6. Location of each repair will be measured from the manhole on each side of repair.

7. Type of repair situation will be noted.

8. When pipe is required to be removed and replaced, the location of the repair clamps used will be noted on the as-built plans.

9. PSA shall be notified 48 hours in advance of making repairs so an inspector can be scheduled. Corrections made without notification will not be accepted.

B. PSA shall be responsible for informing owner/developer as to the approved method of repair.

SECTION 200.04 STRUCTURAL

A. General

Structural design of sewers shall conform to methods set forth in the ASCE Manual of Practice 60, Gravity Sanitary Sewer Design and Construction, except as modified hereafter.

- END OF SECTION -